(12) STANDARD PATENT (11) Application No. **AU 2017342543 B2**
(19) AUSTRALIAN PATENT OFFICE

(54) Title
AAV delivery of nucleobase editors

(51) International Patent Classification(s)
C12N 7/00 (2006.01) ***C12N 15/10*** (2006.01)
A61K 48/00 (2006.01) ***C12N 15/79*** (2006.01)
C12N 5/10 (2006.01) ***C12N 15/864*** (2006.01)
C12N 9/22 (2006.01)

(21) Application No: **2017342543** (22) Date of Filing: **2017.10.13**

(87) WIPO No: **WO18/071868**

(30) Priority Data

(31) Number	(32) Date	(33) Country
62/408,575	**2016.10.14**	**US**
62/475,780	**2017.03.23**	**US**

(43) Publication Date: **2018.04.19**
(44) Accepted Journal Date: **2024.06.27**

(71) Applicant(s)
President and Fellows of Harvard College

(72) Inventor(s)
Liu, David R.;Levy, Jonathan Ma;Yeh, Wei Hsi

(74) Agent / Attorney
Pizzeys Patent and Trade Mark Attorneys Pty Ltd, GPO Box 1374, Brisbane, QLD, 4001, AU

(56) Related Art
ELI J. FINE ET AL: "Trans-spliced Cas9 allows cleavage of HBB and CCR5 genes in human cells using compact expression cassettes", SCIENTIFIC REPORTS, vol. 5, no. 1, 1 July 2015 (2015-07-01), XP055432264, DOI: 10.1038/srep10777
DONG-JIUNN JEFFERY TRUONG ET AL: "Development of an intein-mediated split-Cas9 system for gene therapy", NUCLEIC ACIDS RESEARCH, vol. 43, no. 13, 27 July 2015, pages 6450 - 6458, XP002758945, ISSN: 0305-1048, DOI: 10.1093/NAR/GKV601
GERALD SCHWANK ET AL: "Functional Repair of CFTR by CRISPR/Cas9 in Intestinal Stem Cell Organoids of Cystic Fibrosis Patients", CELL STEM CELL, vol. 13, no. 6, 1 December 2013, pages 653 - 658, XP055102691, DOI: 10.1016/j.stem.2013.11.002
ALEXIS C. KOMOR ET AL: "Programmable editing of a target base in genomic DNA without double-stranded DNA cleavage", NATURE, vol. 533, 20 April 2016, pages 420 - 424, ISSN: 0004621430
WEI LEONG CHEW ET AL: "A multifunctional AAV-CRISPR-Cas9 and its host response", NATURE METHODS, vol. 13, no. 10, 5 September 2016 (2016-09-05), pages 868 - 874, XP055339896, ISSN: 1548-7091, DOI: 10.1038/nmeth.3993
WO 2016/112242 A1

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 April 2018 (19.04.2018)

WIPO | PCT

(10) International Publication Number
WO 2018/071868 A1

(51) International Patent Classification:
C12N 7/00 (2006.01) *A61K 48/00* (2006.01)
C12N 15/864 (2006.01) *C12N 15/10* (2006.01)
C12N 9/22 (2006.01) *C12N 15/79* (2006.01)
C12N 5/10 (2006.01)

(21) International Application Number:
PCT/US2017/056671

(22) International Filing Date:
13 October 2017 (13.10.2017)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
62/408,575 14 October 2016 (14.10.2016) US
62/475,780 23 March 2017 (23.03.2017) US

(71) Applicant: **PRESIDENT AND FELLOWS OF HARVARD COLLEGE** [US/US]; 17 Quincy Street, Cambridge, MA 02138 (US).

(72) Inventors: **LIU, David, R.**; 3 Whitman Circle, Lexington, MA 02420 (US). **LEVY, Jonathan, Ma**; 20 Sachem Street, Boston, MA 02120 (US). **YEH, Wei, Hsi**; 5 Cowperthwaite Street, Cambridge, MA 02138 (US).

(74) Agent: **BAKER, C., Hunter**; Wolf, Greenfield & Sacks, P.C., 600 Atlantic Avenue, Boston, MA 02210-2206 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH,

(54) Title: AAV DELIVERY OF NUCLEOBASE EDITORS

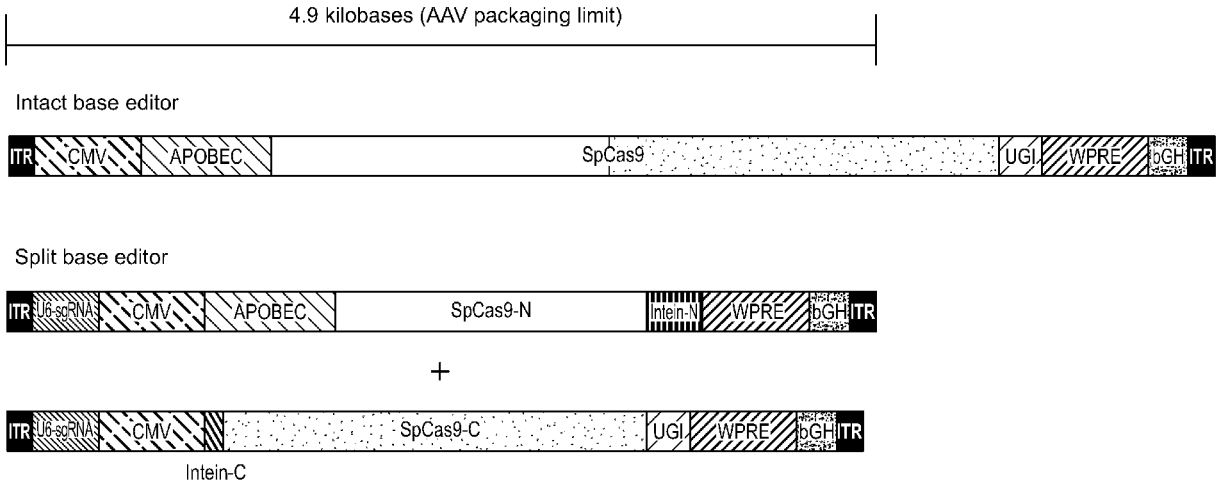


Figure 1A

(57) Abstract: Provided herein are methods of delivering "split" Cas9 protein or nucleobase editors into a cell, *e.g.*, via a recombinant adeno-associated virus (rAAV), to form a complete and functional Cas9 protein or nucleobase editor. The Cas9 protein or the nucleobase editor is split into two sections, each fused with one part of an intein system (e.g., intein-N and intein-C encoded by dnaEn and dnaEc, respectively). Upon co-expression, the two sections of the Cas9 protein or nucleobase editor are ligated together via intein-mediated protein splicing. Recombinant AAV vectors and particles for the delivery of the split Cas9 protein or nucleobase editor, and methods of using such AAV vectors and particles are also provided.

WO 2018/071868 A1

[Continued on next page]

GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report (Art. 21(3))*
— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*
— *with sequence listing part of description (Rule 5.2(a))*

AAV DELIVERY OF NUCLEOBASE EDITORS

RELATED APPLICATIONS

[0001] This application claims priority under 35 U.S.C. § 119(e) to U.S. provisional applications, U.S.S.N. 62/408,575, filed October 14, 2016, and U.S.S.N. 62/475,780, filed March 23, 2017, each of which is incorporated herein by reference.

GOVERNMENT SUPPORT

[0002] This invention was made with government support under grant number R35 GM118062 and R01 EB022376 awarded by the National Institutes of Health. The government has certain rights in the invention.

BACKGROUND

[0003] Precise genome targeting technologies using the CRISPR/Cas9 system have recently been explored in a wide range of applications, including gene therapy. A major limitation to the application of Cas9 and Cas9-based genome-editing agents in gene therapy is the size of Cas9 (>4 kb), impeding its efficient delivery via recombinant adeno-associated virus (rAAV).

SUMMARY

[0004] Described herein are systems, compositions, kits, and methods for delivering a Cas9 protein or a nucleobase editor to cells, *e.g.*, via recombinant adeno-associated virus vectors. Typically a Cas9 protein or a nucleobase editor is "split" into an N-terminal portion and a C-terminal portion. The N-terminal portion or C-terminal portion of a Cas9 protein or a nucleobase editor may be fused to one member of the intein system, respectively. The resulting fusion proteins, when delivered on separate vectors (*e.g.*, separate rAAV vectors) into one cell and co-expressed, may be joined to form a complete and functional Cas9 protein or nucleobase editor (*e.g.*, via intein-mediated protein splicing). Further provided herein are empirical testing of regulatory elements in the delivery vectors for high expression levels of the split Cas9 protein or the nucleobase editor.

[0005] Some aspects of the present disclosure provide compositions comprising: (i) a first nucleotide sequence encoding a N-terminal portion of a Cas9 protein fused at its C-terminus to an intein-N; and (ii) a second nucleotide sequence encoding an intein-C fused to the N-terminus

of a C-terminal portion of the Cas9 protein, wherein the first nucleotide sequence or second nucleotide sequence is operably linked to a nucleotide sequence encoding at least one bipartite nuclear localization signal.

[0006] In some embodiments, the N-terminal portion of the Cas9 protein comprises a portion of any one of SEQ ID NOs: 1-275 and 394-397 that corresponds to amino acids 1-573 or 1-637 of SEQ ID NO: 1. In some embodiments, the C-terminal portion of the Cas9 protein comprises a portion of any one of SEQ ID NOs: 1-275 and 394-397 that corresponds to amino acids 574-1368 or 638-1368 of SEQ ID NO: 1. In some embodiments, the intein-N comprises the amino acid sequence as set forth in SEQ ID NO: 350-351 and 354-355. In some embodiments, the intein-C comprises the amino acid sequence as set forth in SEQ ID NO: 352-353 and 356-357.

[0007] In some embodiments, the first nucleotide sequence or the second nucleotide sequence further comprises a nucleotide encoding a guide RNA (gRNA) operably linked to a promoter.

[0008] In some embodiments, the first nucleotide sequence or the second nucleotide sequence further comprises a transcriptional terminator. In some embodiments, the transcriptional terminator is the transcriptional terminator from a bGH gene, hGH gene, or SV40 gene. In some embodiments, the transcriptional terminator is the transcriptional terminator from a bGH gene.

[0009] In some embodiments, the first nucleotide sequence or the second nucleotide sequence further comprises a woodchuck hepatitis posttranscriptional regulatory element (WPRE) inserted 5´ of the transcriptional terminator.

[0010] In some embodiments, the bipartite nuclear localization signal comprises an amino acid sequence selected from the group consisting of: KRPAATKKAGQAKKKK (SEQ ID NO: 344), KKTELQTTNAENKTKKL(SEQ ID NO: 345), KRGINDRNFWRGENGRKTR(SEQ ID NO: 346), and RKSGKIAAIVVKRPRK(SEQ ID NO: 347). In some embodiments, the bipartite nuclear localization signal comprises the amino acid sequence as set forth in SEQ ID NO: 344.

[0011] In some embodiments, the Cas9 protein is a catalytically inactive Cas9 (dCas9) or a Cas9 nickase (nCas9), and wherein the first nucleotide sequence of (i) further comprises a nucleotide sequence encoding a nucleobase modifying enzyme fused to the N-terminus of the N-terminal portion of the Cas9 protein.

[0012] In some embodiments, the Cas9 protein is a catalytically inactive Cas9 (dCas9) or a Cas9 nickase (nCas9), and wherein the second nucleotide sequence of (ii) further comprises a

nucleotide sequence encoding a nucleobase modifying enzyme fused to the C-terminus of the C-terminal portion of the Cas9 protein.

[0013] In some embodiments, the nucleobase modifying enzyme is a deaminase. In some embodiments, the deaminase is a cytosine deaminase. In some embodiments, the deaminase is an adenosine deaminase. In some embodiments, the second nucleotide sequence of (ii) further comprises a nucleotide sequence encoding a uracil glycosylase inhibitor (UGI) fused at the 3′ end of the second nucleotide sequence. In some embodiments, the first nucleotide sequence of (i) further comprises a nucleotide sequence encoding a uracil glycosylase inhibitor (UGI) at the 5′ end of the first nucleotide sequence. In some embodiments, the UGI comprises the amino acids sequence of SEQ ID NOs: 299-302.

[0014] In some embodiments, the first nucleotide sequence and the second nucleotide sequence are on different vectors. In some embodiments, the each of the different vectors is a genome of a recombinant adeno-associated virus (rAAV). In some embodiments, each vector is packaged in a rAAV particle.

[0015] Other aspects of the present disclosure provide compositions comprising: (i) a first recombinant adeno associated virus (rAAV) particle comprising a first nucleotide sequence encoding a N-terminal portion of a Cas9 protein fused at its C-terminus to an intein-N; and (ii) a second recombinant adeno associated virus (rAAV) particle comprising a second nucleotide sequence encoding an intein-C fused to the N-terminus of a C-terminal portion of the Cas9 protein, wherein the first nucleotide sequence or second nucleotide sequence is operably linked to a nucleotide sequence encoding at least one bipartite nuclear localization sign.

[0016] Cells comprising the compositions described herein are provided. In some embodiments, the N-terminal portion of the Cas9 protein and the C-terminal portion of the Cas9 protein are joined together to form the Cas9 protein. In some embodiments, the cell is a prokaryotic cell. In some embodiments, the cell is a bacterial cell. In some embodiments, the cell is a eukaryotic cell. In some embodiments, the cell is a yeast cell, a plant cell, or a mammalian cell. In some embodiments, the cell is a human cell.

[0017] Further provided herein are kits comprising the any of the compositions described herein.

[0018] Some aspects of the present disclosure provide compositions comprising: (i) a first nucleotide sequence encoding a N-terminal portion of a nucleobase editor fused at its C-terminus

to an intein-N; and (ii) a second nucleotide sequence encoding an intein-C fused to the N-terminus of a C-terminal portion of the nucleobase editor.

[0019] In some embodiments, the intein-N comprises the amino acid sequence as set forth in SEQ ID NO: 350-351 and 354-355. In some embodiments, the intein-C comprises the amino acid sequence as set forth in SEQ ID NO: 352-353 and 356-357. In some embodiments, the first nucleotide sequence or the second nucleotide sequence further comprises a nucleotide encoding a guide RNA (gRNA) operably linked to a promoter.

[0020] In some embodiments, the first nucleotide sequence or the second nucleotide sequence further comprises a transcriptional terminator. In some embodiments, the transcriptional terminator is a transcriptional terminator from a bGH gene, hGH gene, or SV40 gene. In some embodiments, the transcriptional terminal is from a bGH gene.

[0021] In some embodiments, the first nucleotide sequence or the second nucleotide sequence further comprises a woodchuck hepatitis posttranscriptional regulatory element (WPRE) inserted 5´ of the transcriptional terminator.

[0022] In some embodiments, the first nucleotide sequence or second nucleotide sequence are operably linked to a nucleotide sequence encoding at least one bipartite nuclear localization signal. In some embodiments, the bipartite nuclear localization signal comprises an amino acid sequence selected from the group consisting of: KRPAATKKAGQAKKKK (SEQ ID NO: 344), KKTELQTTNAENKTKKL(SEQ ID NO: 345), KRGINDRNFWRGENGRKTR(SEQ ID NO: 346), and RKSGKIAAIVVKRPRK(SEQ ID NO: 347). In some embodiments, the bipartite nuclear localization signal comprises the amino acid sequence as set forth in SEQ ID NO: 344.

[0023] In some embodiments, the nucleobase editor comprises a cytosine deaminase fused to the N-terminus of a catalytically inactive Cas9 or a Cas9 nickase. In some embodiments, the cytosine deaminase is selected from the group consisting of: APOBEC1, APOBEC3, AID, and pmCDA1. In some embodiments, the nucleobase editor further comprises a uracil glycosylase inhibitor (UGI). In some embodiments, the UGI comprises the amino acids sequence of SEQ ID NOs: 299-302.

[0024] In some embodiments, the first nucleotide sequence and the second nucleotide sequence are on different vectors. In some embodiments, each of the different vectors is a genome of a recombinant adeno-associated virus (rAAV). In some embodiments, the vector is packaged in a rAAV particle.

[0025] Other aspects of the present disclosure provide compositions comprising: (i) a first recombinant adeno associated virus (rAAV) particle comprising a first nucleotide sequence encoding a N-terminal portion of a nucleobase editor fused at its C-terminus to an intein-N; and (ii) a second recombinant adeno associated virus (rAAV) particle comprising a second nuclei acid encoding an intein-C fused to the N-terminus of a C-terminal portion of the nucleobase editor.

[0026] Cells comprising any of the compositions described herein are provided. In some embodiments, the N-terminal portion of the nucleobase editor and the C-terminal portion of the nucleobase editor are joined together to form the nucleobase editor. In some embodiments, the cell is a prokaryotic cell. In some embodiments, the cell is a bacterial cell. In some embodiments, the cell is an eukaryotic cell. In some embodiments, the cell is a yeast cell, a plant cell, or a mammalian cell. In some embodiments, the cell is a human cell.

[0027] Further provided herein are kits comprising any of the compositions described herein.

[0028] Yet other aspects of the present disclosure provide methods comprising: contacting a cell with any of the compositions described herein, wherein the contacting results in the delivery of the first nucleotide sequence and the second nucleotide sequence into the cell, and wherein the N-terminal portion of the nucleobase editor and the C-terminal portion of the nucleobase editor are joined to form a nucleobase editor.

[0029] Yet other aspects of the present disclosure provide methods comprising: administering to a subject in need there of a therapeutically effective amount of any of the compositions described herein. In some embodiments, the subject has a disease or disorder.

[0030] In some embodiments, the disease or disorder is selected from the group consisting of: cystic fibrosis, phenylketonuria, epidermolytic hyperkeratosis (EHK), chronic obstructive pulmonary disease (COPD), Charcot-Marie-Toot disease type 4J. , neuroblastoma (NB), von Willebrand disease (vWD), myotonia congenital, hereditary renal amyloidosis, dilated cardiomyopathy, hereditary lymphedema, familial Alzheimer's disease, prion disease, chronic infantile neurologic cutaneous articular syndrome (CINCA), and desmin-related myopathy (DRM).

[0031] The details of certain embodiments of the invention are set forth in the Detailed Description of Certain Embodiments, as described below. Other features, objects, and

advantages of the invention will be apparent from the Definitions, Examples, Figures, and Claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] The accompanying drawings, which constitute a part of this Application, illustrate several embodiments of the invention and together with the description, serve to explain the principles of the invention.

[0033] *Figures 1A-1C* are graphs showing a "split nucleobase editor" for delivery into cells using recombinant adeno associated virus (rAAV) vectors. *Figure 1A* is a schematic representation of how the nucleobase editor is split into two portions. *Figure 1B* shows that AAV-delivered split nucleobase editor can undergo protein splicing upon expression of the two halves in cells to form a complete nucleobase editor that has comparable activity to a nucleobase editor expressed as a whole. *Figure 1C* shows the formation of a complete nucleobase editor from the two halves via protein splicing mediated by DnaE intein.

[0034] *Figure 2* shows that U1118 cells were efficiently transfected by AAV2 containing nucleic acids encoding mCherry. Different viral titers were tested (2.5-10 µl at 4.5 x 10^{11} vg/ml*) and all resulted in efficient transfection of U118 cells. *vg/ml means viral genome-containing particles per microliter.

[0035] *Figures 3A-3B* are graphs showing high throughput sequence (HTS) results of nucleobase editing by rAAV-delivered split nucleobase editor in U118 and HEK cells. Lipid-transfected nucleobase editor was used as a control. A sgRNA targeting R37 in the PRNP gene was used, and the PRNP gene locus was sequenced. *Figure 3A* shows the HTS reads, and *Figure 3B* summarizes the base editing results.

[0036] *Figure 4* is a graph showing the optimization of the transcriptional terminator used in the AAV constructs encoding the split nucleobase editor. Transcriptional terminators of different sizes and origins were tested. bGH transcriptional terminator is relatively short and efficiently terminates transcription comparably to longer terminator sequences. It was therefore chosen to be used in the downstream experiments.

[0037] *Figures 5A-5B* are graphs showing the results of nucleobase editing with long term (up to 15 days) transduction of AAV encoding the split nucleobase editor in mouse astrocytes expressing human ApoE4 cDNA. The target base is in the codon for arginine 112 and arginine

158 in ApoE4, which is converted to a cysteine upon base editing. *Figure 5A* shows that the editing of arginine 158 increases overtime when the mouse astrocytes were transduced at 10^{10} vg, while editing of arginine 112 remained minimal. The nucleotide sequence 3´ of the codon for arginine 158 sequence features a flanking NGG PAM allowing for high activity by SpCas9 (with guide sequence GAAGCGCCTGGCAGTGTACC, SEQ ID NO: 348), while the nucleotide sequence 3´ of the codon for arginine 112 contains a flanking NAG PAM which does not allow for high activity (with guide sequence GACGTGCGCGGCCGCCTGGTG, SEQ ID NO: 349). *Figure 5B* shows cells transduced with rAAV encoding mCherry at 10^{10} vg (control).

[0038] *Figure 6* is a schematic representation of the optimization of the nuclear localization signal in AAV constructs encoding the split nucleobase editor. The nuclear localization signal controls nuclear import, which must occur for reconstituted nucleobase editor to associate with genomic DNA as a prerequisite for editing, and is a potential rate-limiting step in the process. This schematic shows that the NLS (and NLS optimization) is critical for the nucleobase editor to be imported into the nucleus.

[0039] *Figure 7* is a graph showing the results of base editing using different rAAV split nucleobase editor constructs containing different nuclear localization signals (NLS).

[0040] *Figures 8A-8B* are graphs showing the editing of DNMT1 gene in dissociated mouse cortical neurons using an AAV encoded split nucleobase editor.

[0041] *Figure 9A-9B* are graphs showing the editing of DNMT1 gene in mouse Neuro-2a cell line using either an AAV encoded split nucleobase editor, or a lipid transfected DNA encoded nucleobase editor.

DEFINITIONS

[0042] As used herein and in the claims, the singular forms "a," "an," and "the" include the singular and the plural reference unless the context clearly indicates otherwise. Thus, for example, a reference to "an agent" includes a single agent and a plurality of such agents.

[0043] As used herein, the term "Cas9," "Cas9 protein," or "Cas9 nuclease" refers to an RNA-guided nuclease comprising a Cas9 protein (*e.g.*, Cas9 nucleases from a variety of bacterial species), a fragment, a variant (*e.g.*, a catalytically inactive Cas9 or a Cas9 nickase), or a fusion protein (*e.g.*, a Cas9 fused to another protein domain) thereof. A Cas9 nuclease is also referred to sometimes as a casn1 nuclease or a CRISPR (clustered regularly interspaced short palindromic

repeat)-associated nuclease. CRISPR is an adaptive immune system that provides protection against mobile genetic elements (viruses, transposable elements, and conjugative plasmids). CRISPR clusters contain spacers, sequences complementary to antecedent mobile elements, and target invading nucleic acids. CRISPR clusters are transcribed and processed into CRISPR RNA (crRNA). In type II CRISPR systems correct processing of pre-crRNA requires a trans-encoded small RNA (tracrRNA), endogenous ribonuclease 3 (rnc) and a Cas9 protein. The tracrRNA serves as a guide for ribonuclease 3-aided processing of pre-crRNA. Subsequently, Cas9/crRNA/tracrRNA endonucleolytically cleaves linear or circular dsDNA target complementary to the spacer. In nature, DNA-binding and cleavage typically requires protein and both RNAs. However, single guide RNAs ("sgRNA", or simply "gNRA") can be engineered so as to incorporate aspects of both the crRNA and tracrRNA into a single RNA species. Non-limiting examples of Cas9 proteins and their respective amino acid sequence are provided in Example 1.

[0044] A nuclease-inactive Cas9 protein may interchangeably be referred to as a "dCas9" protein (for nuclease-"dead" Cas9). Methods for generating a Cas9 protein (or a fragment thereof) having an inactive DNA cleavage domain are known (See, *e.g.*, Jinek *et al.*, *Science*. 337:816-821(2012); Qi *et al.*, (2013) *Cell*. 28;152(5):1173-83, incorporated herein by reference). For example, the DNA cleavage domain of Cas9 is known to include two subdomains, the HNH nuclease subdomain and the RuvC1 subdomain. The HNH subdomain cleaves the strand complementary to the gRNA, whereas the RuvC1 subdomain cleaves the non-complementary strand. Mutations within these subdomains can silence the nuclease activity of Cas9. For example, the mutations D10A and H840A completely inactivate the nuclease activity of *S. pyogenes* Cas9 (Jinek *et al.*, *Science*. 337:816-821(2012); Qi *et al.*, *Cell*. 28;152(5):1173-83 (2013). Additional suitable nuclease-inactive dCas9 domains will be apparent to those of skill in the art based on this disclosure and knowledge in the field, and are within the scope of this disclosure. Such additional exemplary suitable nuclease-inactive Cas9 domains include, but are not limited to, D10A/H840A, D10A/D839A/H840A, and D10A/D839A/H840A/N863A mutant domains (See, *e.g.*, Prashant *et al.*, *Nature Biotechnology*. 2013; 31(9):833-838, incorporated herein by reference).

[0045] In some embodiments, a Cas9 nickase is used as part of the nucleobase editor. A Cas9 nickase is able to cleave one strand of the double strand DNA. A Cas9 nickase may be generated

by introducing an inactivating mutation into either the HNH domain or the RuvC1 domain. For example, an inactivating mutation (D10A) may be introduced in the RuvC1 domain of the *S. pyogenes* Cas9, while the HNH domain remains active, *i.e.*, the residue at position 840 remains a histidine. Such Cas9 variants are able to generate a single-strand DNA break (nick) at a specific location based on the gRNA-defined target sequence. One skilled in the art is able to identify the catalytic residues in the RuvC1 and HNH domains of any known Cas9 proteins and introduce inactivating mutations to generate a corresponding dCas9 or nCas9.

[0046] A "split Cas9 protein" or "split Cas9" refers to a Cas9 protein that is provided as an N-terminal portion (also referred to as an N-terminal half) and a C-terminal portion (also referred to as a C-terminal half) encoded by two separate nucleotide sequences. The polypeptides corresponding to the N-terminal portion and the C-terminal portion of the Cas9 protein may be combined (joined) to form a complete Cas9 protein. A Cas9 protein is known to consist of a bi-lobed structure linked by a disordered linker (*e.g.*, as described in Nishimasu *et al.*, *Cell*, Volume 156, Issue 5, pp. 935–949, 2014, incorporated herein by reference). In some embodiments, the "split" occurs between the two lobes, generating two portions of a Cas9 protein, each containing one lobe.

[0047] An "intein" is a segment of a protein that is able to excise itself and join the remaining portions (the exteins) with a peptide bond in a process known as protein splicing. Inteins are also referred to as "protein introns." The process of an intein excising itself and joining the remaining portions of the protein is herein termed "protein splicing" or "intein-mediated protein splicing." In some embodiments, an intein of a precursor protein (an intein containing protein prior to intein-mediated protein splicing) comes from two genes. Such intein is referred to herein as a split intein. For example, in cyanobacteria, DnaE, the catalytic subunit α of DNA polymerase III, is encoded by two separate genes, dnaE-n and dnaE-c. The intein encoded by the dnaE-n gene is herein referred as "intein-N." The intein encoded by the dnaE-c gene is herein referred as "intein-C."

[0048] Other intein systems may also be used. For example, a synthetic intein based on the dnaE intein, the Cfa-N and Cfa-C intein pair, has been described (*e.g.*, in Stevens *et al.*, J Am Chem Soc. 2016 Feb 24;138(7):2162-5, incorporated herein by reference). Non-limiting examples of intein pairs that may be used in accordance with the present disclosure include: Cfa DnaE intein,

Ssp GyrB intein, Ssp DnaX intein, Ter DnaE3 intein, Ter ThyX intein, Rma DnaB intein and Cne Prp8 intein (*e.g.*, as described in US Patent 8,394,604, incorporated herein by reference.

[0049] Exemplary nucleotide and amino acid sequences of inteins are provided.

DnaE Intein-N DNA:
TGCCTGTCATACGAAACCGAGATACTGACAGTAGAATATGGCCTTCTGCCAATCGGG
AAGATTGTGGAGAAACGGATAGAATGCACAGTTTACTCTGTCGATAACAATGGTAA
CATTTATACTCAGCCAGTTGCCCAGTGGCACGACCGGGGAGAGCAGGAAGTATTCG
AATACTGTCTGGAGGATGGAAGTCTCATTAGGGCCACTAAGGACCACAAATTTATG
ACAGTCGATGGCCAGATGCTGCCTATAGACGAAATCTTTGAGCGAGAGTTGGACCTC
ATGCGAGTTGACAACCTTCCTAAT (SEQ ID NO: 350)

DnaE Intein-N Protein:
CLSYETEILTVEYGLLPIGKIVEKRIECTVYSVDNNGNIYTQPVAQWHDRGEQEVFEYCL
EDGSLIRATKDHKFMTVDGQMLPIDEIFERELDLMRVDNLPN (SEQ ID NO: 351)

DnaE Intein-C DNA:
ATGATCAAGATAGCTACAAGGAAGTATCTTGGCAAACAAAACGTTTATGATATTGG
AGTCGAAAGAGATCACAACTTTGCTCTGAAGAACGGATTCATAGCTTCTAAT (SEQ
ID NO: 352)
Intein-C:
MIKIATRKYLGKQNVYDIGVERDHNFALKNGFIASN (SEQ ID NO: 353)

Cfa-N DNA:
TGCCTGTCTTATGATACCGAGATACTTACCGTTGAATATGGCTTCTTGCCTATTGGAA
AGATTGTCGAAGAGAGAATTGAATGCACAGTATATACTGTAGACAAGAATGGTTTC
GTTTACACACAGCCCATTGCTCAATGGCACAATCGCGGCGAACAAGAAGTATTTGA
GTACTGTCTCGAGGATGGAAGCATCATACGAGCAACTAAAGATCATAAATTCATGA
CCACTGACGGGCAGATGTTGCCAATAGATGAGATATTCGAGCGGGGCTTGGATCTC
AAACAAGTGGATGGATTGCCA (SEQ ID NO: 354)

Cfa-N Protein:
CLSYDTEILTVEYGFLPIGKIVEERIECTVYTVDKNGFVYTQPIAQWHNRGEQEVFEYCL
EDGSIIRATKDHKFMTTDGQMLPIDEIFERGLDLKQVDGLP (SEQ ID NO: 355)

Cfa-C DNA:
ATGAAGAGGACTGCCGATGGATCAGAGTTTGAATCTCCCAAGAAGAAGAGGAAAGT
AAAGATAATATCTCGAAAAAGTCTTGGTACCCAAAATGTCTATGATATTGGAGTGGA
GAAAGATCACAACTTCCTTCTCAAGAACGGTCTCGTAGCCAGCAAC (SEQ ID NO:
356)

Cfa-C Protein:
MKRTADGSEFESPKKKRKVKIISRKSLGTQNVYDIGVEKDHNFLLKNGLVASN (SEQ ID
NO: 357)

[0050] Intein-N and intein-C may be fused to the N-terminal portion of the split Cas9 and the C-terminal portion of the split Cas9, respectively, for the joining of the N-terminal portion of the split Cas9 and the C-terminal portion of the split Cas9. For example, in some embodiments, an intein-N is fused to the C-terminus of the N-terminal portion of the split Cas9, *i.e.*, to form a structure of N-[N-terminal portion of the split Cas9]-[intein-N]-C. In some embodiments, an intein-C is fused to the N-terminus of the C-terminal portion of the split Cas9, *i.e.*, to form a structure of N-[intein-C]-[C-terminal portion of the split Cas9]-C. The mechanism of intein-mediated protein splicing for joining the proteins the inteins are fused to (*e.g.*, split Cas9) is known in the art, *e.g.*, as described in Shah *et al.*, *Chem Sci.* 2014; 5(1):446–461, incorporated herein by reference.

[0051] Herein, a "nucleobase editor" refers to a protein that edits a nucleotide base. "Edit" refers to the conversion of one nucleobase to another (*e.g.*, A to G, A to C, A to T, C to T, C to G, C to A, G to A, G to C, G to T, T to A, T to C, T to G). In some embodiments, a nucleobase editor is a macromolecule or macromolecular complex that results primarily (*e.g.*, more than 80%, more than 85%, more than 90%, more than 95%, more than 99%, more than 99.9%, or 100%) in the conversion of a nucleobase in a polynucleic acid sequence into another nucleobase (i.e., a transition or transversion) using a combination of 1) a nucleotide-, nucleoside-, or nucleobase-modifying enzyme and 2) a nucleic acid binding protein that can be programmed to bind to a specific nucleic acid sequence.

[0052] In some embodiments, the nucleobase editor comprises a DNA binding domain (*e.g.*, a programmable DNA binding domain such as a dCas9 or nCas9) that directs it to a target sequence. In some embodiments, the nucleobase editor comprises a nucleobase modifying enzyme fused to a programmable DNA binding domain (*e.g.*, a dCas9 or nCas9). A "nucleobase modifying enzyme" is an enzyme that can modify a nucleobase and convert one nucleobase to another (*e.g.*, a deaminase such as a cytosine deaminase or a adenosine deaminase). In some embodiments, the nucleobase editor may target cytosine (C) bases in a nucleic acid sequence and convert the C to thymine (T) base. In some embodiments, the C to T editing is carried out by a deaminase, *e.g.*, a cytosine deaminase. Base editors that can carry out other types of base conversions (*e.g.*, adenosine (A) to guanine (G), C to G) are also contemplated.

[0053] Nucleobase editors that convert a C to T, in some embodiments, comprise a cytosine deaminase. A "cytosine deaminase" refers to an enzyme that catalyzes the chemical reaction

"cytosine + H_2O → uracil + NH_3" or "5-methyl-cytosine + H_2O → thymine + NH_3." As it may be apparent from the reaction formula, such chemical reactions result in a C to U/T nucleobase change. In the context of a gene, such a nucleotide change, or mutation, may in turn lead to an amino acid change in the protein, which may affect the protein's function, *e.g.*, loss-of-function or gain-of-function. In some embodiments, the C to T nucleobase editor comprises a dCas9 or nCas9 fused to a cytosine deaminase. In some embodiments, the cytosine deaminase domain is fused to the N-terminus of the dCas9 or nCas9. In some embodiments, the nucleobase editor further comprises a domain that inhibits uracil glycosylase, and/or a nuclear localization signal. Such nucleobase editors have been described in the art, *e.g.*, in US Patent 9,068,179, US Patent Application Publications US 2015/0166980, published June 18, 2015; US 2015/0166981, published June 18, 2015; US 2015/0166982, published June 18, 2015; US 2015/0166984, published June 18, 2015; and US2015/0165054, published June 18, 2015; and US Provisional Applications, U.S.S.N. 62/245,828, filed October 23, 2015; U.S.S.N. 62/279,346, filed January 15, 2016; U.S.S.N. 62/311,763, filed March 22, 2016; U.S.S.N. 62/322,178, filed April 13, 2016; U.S.S.N. 62/357,352, filed June 30, 2016; U.S.S.N. 62,370,700, filed August 3, 2016; U.S.S.N. 62/398,490, filed September 22, 2016; and U.S.S.N. 62/408,686, filed October 14, 2016; PCT Application PCT/US2016/058344, filed October 22, 2016, US Patent Application, U.S.S.N. 15/311,852, filed October 22, 2016; and in Komor *et al.*, *Nature*, Programmable editing of a target base in genomic DNA without double-stranded DNA cleavage, 533, 420–424 (2016), the entire contents of each of which is incorporated herein by reference.

[0054] In some embodiments, a nucleobase editor converts an A to G. In some embodiments, the nucleobase editor comprises an adenosine deaminase. An "adenosine deaminase" is an enzyme involved in purine metabolism. It is needed for the breakdown of adenosine from food and for the turnover of nucleic acids in tissues. Its primary function in humans is the development and maintenance of the immune system. An adenosine deaminase catalyzes hydrolytic deamination of adenosine (forming inosine, which base pairs as G) in the context of DNA. There are no known adenosine deaminases that act on DNA. Instead, known adenosine deaminase enzymes only act on RNA (tRNA or mRNA). Evolved deoxyadenosine deaminase enzymes that accept DNA substrates and deaminate dA to deoxyinosine and here use in adenosine nucleobase editos have been described, *e.g.*, in US provisional application, U.S.S.N. 62/370,684, filed August 3, 2016; US provisional application, U.S.S.N. 62/370,684, filed February 3, 2017, US provisional

application, U.S.S.N. 62/473,714, filed March 20, 2017, and PCT Application PCT/US2017/045381, filed August 3, 2017; each of which is incorporated herein by reference. Non-limiting examples of evolved adenosine deaminases that accept DNA as substrates are provided in Example 1.

[0055] In some embodiments, the adenosine deaminase is *E. coli* TadA (SEQ ID NO: 314). The possible mutations in ecTadA and constructs expressing nucleobase editors comprising the modified ecTadA are provided in Table 2. The sequences of exemplary EcTadA mutants and nucleotibase editors comprising such mutants are provided in Example 1.

Table 2. EcTadA mutants for A to G nucleobase editor

Name	Construct Architecture	Mutations in TadA
pNMG-142	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	wild-type
pNMG-143	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	D108N
pNMG-144	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	A106V_D108N
pNMG-145	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	D108G
pNMG-146	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	R107C_D108N
pNMG-147	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	D108V
pNMG-155	pCMV_ecTadA_XTEN_dead Cas9_SGGS_UGI_NLS	D108N
pNMG-156	pCMV_ecTadA_XTEN_nCas9_SGGS_UGI_SGGS_NLS	D108N
pNMG-157	pCMV_ecTadA_XTEN_dead Cas9_SGGS_UGI_SGGS_NLS	D108G
pNMG-158	pCMV_ecTadA_XTEN_nCas9_SGGS_UGI_SGGS_NLS	D108G
pNMG-160	pCMV_ecTadA_XTEN_nCas9_SGGS_AAG*(E125Q)_SGGS_NLS	D108N
pNMG-161	pCMV_ecTadA_XTEN_Cas9n_SGGS_EndoV*(D35A)_NLS	D108N
pNMG-162	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	H8Y_D108N_S127S_D147Y_Q154H
pNMG-163	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	H8Y_R24W_D108N_N127S_D147Y_E155V
pNMG-164	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	D108N_D147Y_E155V
pNMG-165	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	H8Y_D108N_S127S
pNMG-171	pCMV_Cas9n_XTEN_ecTadA_SGGS_NLS	wild-type
pNMG-172	pCMV_Cas9n_XTEN_ecTadA_SGGS_NLS	D108N
pNMG-173	pCMV_Cas9n_XTEN_ecTadA_SGGS_NLS	H8Y_D108N_N127S_D147Y_Q154H

pNMG-174	pCMV_Cas9n_XTEN_ecTadA_SGGS_NLS	H8Y_R24W_D108N_N127S_D147Y_E155V
pNMG-175	pCMV_Cas9n_XTEN_ecTadA_SGGS_NLS	D108N_D147Y_E155V
pNMG-176	pCMV_Cas9n_XTEN_ecTadA_SGGS_NLS	H8Y_D108N_S127S
pNMG-177	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-178	pCMV_ecTadA_XTEN_Cas9n_SGGS_UGI_SGGS_NLS	D108N_D147Y_E155V
pNMG-179	pCMV_ecTadA_XTEN_Cas9n_SGGS_AAG*(E125Q)_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-180	pCMV_ecTadA_XTEN_Cas9n_SGGS_UGI_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-181	pCMV_ecTadA_XTEN_Cas9n_SGGS_AAG*(E125Q)_SGGS_NLS	D108N_D147Y_E155V
pNMG-182	pCMV_ecTadA_SGGS_nCas9_SGGS_NLS	D108N_D147Y_E155V
pNMG-183	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	D108N_D147Y_E155V
pNMG-235	pCMV_ecTadA_XTEN_Cas9n_XTEN_AAG*(E125A)_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-236	pCMV_ecTadA_XTEN_Cas9n_XTEN_AAG*(E125Q)_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-237	pCMV_ecTadA_XTEN_Cas9n_XTEN_AAG*(wt)_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-238	pCMV_AAG*(E125A)_XTEN_ecTadA_XTEN_Cas9n_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-239	pCMV_AAG*(wt)_XTEN_ecTadA_XTEN_Cas9n_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-240	pCMV_ecTadA_XTEN_Cas9n_XTEN_EndoV*(D35A)_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-241	pCMV_ecTadA_XTEN_Cas9n_XTEN_EndoV*(wt)_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-242	pCMV_EndoV*(D35A)_XTEN_ecTadA_XTEN_Cas9n_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-243	pCMV_EndoV*(wt)_XTEN_ecTadA_XTEN_Cas9n_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-247	pCMV_ecTadA_XTEN_Cas9 (wild-type)_SGGS_NLS	wild-type
pNMG-248	pCMV_ecTadA_XTEN_Cas9 (wild-type)_SGGS_NLS	D108N_D147Y_E155V
pNMG-249	pCMV_ecTadA_XTEN_Cas9 (wild-type)_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-250	pCMV_ecTadA_XTEN_Cas9 (wild-type)_SGGS_UGI_SGGS_NLS	D108N_D147Y_E155V
pNMG-251	pCMV_ecTadA_XTEN_Cas9 (wild-type)_SGGS_AAG*(E125Q)_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-274	pCMV_ecTadA_SGGS_NLS (no Cas9 fusion)	wild-type
pNMG-275	pCMV_ecTadA_SGGS_NLS (no Cas9 fusion)	A106V_D108N_D147Y_E155V
pNMG-276	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_XTEN_nCas9_SGGS_NLS	(wild-type) + (wild-type)

pNMG-277	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_XTEN_nCas9_SGGS_NLS	(A106V_D108N_D147Y_E155V) + (A106V_D108N_D147Y_E155V)
pNMG-278	pCMV_ecTadA_XTEN_nCas9_SGGS_NLS	D108Q_D147Y_E155V
pNMG-279	pCMV_ecTadA_XTEN_nCas9_SGGS_NLS	D108M_D147Y_E155V
pNMG-280	pCMV_ecTadA_XTEN_nCas9_SGGS_NLS	D108L_D147Y_E155V
pNMG-281	pCMV_ecTadA_XTEN_nCas9_SGGS_NLS	D108K_D147Y_E155V
pNMG-282	pCMV_ecTadA_XTEN_nCas9_SGGS_NLS	D108I_D147Y_E155V
pNMG-283	pCMV_ecTadA_XTEN_nCas9_SGGS_NLS	D108F_D147Y_E155V
pNMG-284	pCMV_ecTadA_LONGER LINKER (92 a.a.)_ecTadA_XTEN_nCas9_SGGS_NLS	(wild-type) + (A106V_D108N_D147Y_E155V)
pNMG-285	pCMV_ecTadA_LONGER LINKER (92 a.a.)_ecTadA_XTEN_nCas9_SGGS_NLS	(A106V_D108N_D147Y_E155V) + (A106V_D108N_D147Y)
pNMG-285b	pCMV_ecTadA_LONGER LINKER (92 a.a.)_ecTadA_XTEN_nCas9_SGGS_NLS	(A106V_D108N_D147Y_E155V) + (A106V_D108N_D147Y_E155V)
pNMG-286	pCMV_ecTadA_XTEN_nCas9_SGGS_NLS	A106V_D108M_D147Y_E155V
pNMG-287	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_XTEN-nCas9 (*S. aureus*)_SGGS_NLS	(A106V_D108N_D147Y_E155V) + (A106V_D108N_D147Y_E155V)
pNMG-289	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_XTEN_nCas9_SGGS_UGI_NLS	(A106V_D108N_D147Y_E155V) + (A106V_D108N_D147Y_E155V)
pNMG-290	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_UGI_NLS	(A106V_D108N_D147Y_E155V) + (A106V_D108N_D147Y_E155V)
pNMG-293	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	E59A_A106V_D108N_D147Y_E155V
pNMG-294	pCMV_ecTadA_XTEN_Cas9n_SGGS_NLS	E59A
pNMG-295	pCMV_ecTadA_SGGS_NLS (no Cas9 fusion)	E59A
pNMG-296	pCMV_ecTadA_SGGS_NLS (no Cas9 fusion)	E59A cat dead_A106V_D108N_D147Y_E155V
pNMG-297	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_XTEN_nCas9_SGGS_NLS	(A106V_D108N_D147Y_E155V) + (wild-type)
pNMG-298	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_XTEN_nCas9_SGGS_NLS	(D108M_D147Y_E155V) + (D108M_D147Y_E155V)
pNMG-320	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_XTEN_nCas9_SGGS_NLS	(wild-type) + (A106V_D108N_D147Y_E155V)
pNMG-321	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_XTEN_nCas9_SGGS_NLS	(E59A_A106V_D108N_D147Y_E155V) + (A106V_D108N_D147Y_E155V)

pNMG-322	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_XTEN_nCas9_SGGS_NLS	(A106V_D108N_D147Y_E155V) + (E59A_A106V_D108N_D147Y_E155V)
pNMG-335	pCMV_TadA3p-XTEN-TadA2p-XTEN-nCas9-NLS	wild-type
pNMG-336	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_UGI_SGGS_NLS	L84F_A106V_D108N_H123Y_D147Y_E155V_I156Y
pNMG-337	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_UGI_SGGS_NLS	A106V_D108N_D147Y_E155V
pNMG-338	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_UGI_SGGS_NLS	L84F_A106V_D108N_H123Y_D147Y_E155V_I156F
pNMG-339	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_UGI_SGGS_NLS	(L84F_A106V_D108N_H123Y_D147Y_E155V_I156Y) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156Y)
pNMG-340	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_UGI_SGGS_NLS	(A106V_D108N_D147Y_E155V) + (A106V_D108N_D147Y_E155V)
pNMG-341	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_UGI_SGGS_NLS	(L84F_A106V_D108N_H123Y_D147Y_E155V_I156F) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-345	pCMV_*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-nCas9_SGGS_NLS	wild-type
pNMG-346	pCMV_*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-nCas9_SGGS_NLS	(D108N) + (D108N)
pNMG-347	pCMV_*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-nCas9_SGGS_NLS	(D107A_D018N) + (D107A_D108N)
pNMG-348	pCMV_*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-nCas9_SGGS_NLS	(G26P_D107A_D108N) + (G26P_D107A_D108N)
pNMG-349	pCMV_*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-nCas9_sGGS_NLS	(G26P_D107A_D108N_S142A) +(G26P_D107A_D108N_S142A)
pNMG-350	pCMV_*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-*S. aureus*TadA-(SGGS)2-XTEN-(SGGS)2-nCas9_SGGS_NLS	(D104A_D108N_S142A) + (D107A_D108N_S142A)
pNMG-351	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(R26G_L84F_A106V_R107H_D108N_H123Y_A142N_A143D_D147Y_E155V_I156F)
pNMG-352	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(E25G_R26G_L84F_A106V_R107H_D108N_H123Y_A142N_A143D_D147Y_E155V_I156F)

pNMG-353	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(E25D_R26G_L84F_A106V_R107K_D108N_H123Y_A142N_A143G_D147Y_E155V_I156F)
pNMG-354	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(R26Q_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F)
pNMG-355	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(E25M_R26G_L84F_A106V_R107P_D108N_H123Y_A142N_A143D_D147Y_E155V_I156F)
pNMG-356	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(R26C_L84F_A106V_R107H_D108N_H123Y_A142N_D147Y_E155V_I156F)
pNMG-357	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(L84F_A106V_D108N_H123Y_A142N_A143L_D147Y_E155V_I156F)
pNMG-358	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(R26G_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F)
pNMG-359	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(E25A_R26G_L84F_A106V_R107N_D108N_H123Y_A142N_A143E_D147Y_E155V_I156F)
pNMG-360	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(R26G_L84F_A106V_R107H_D108N_H123Y_A142N_A143D_D147Y_E155V_I156F) +(R26G_L84F_A106V_R107H_D108N_H123Y_A142N_A143D_D147Y_E155V_I156F)
pNMG-361	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(E25G_R26G_L84F_A106V_R107H_D108N_H123Y_A142N_A143D_D147Y_E155V_I156F) X 2
pNMG-362	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(E25D_R26G_L84F_A106V_R107K_D108N_H123Y_A142N_A143G_D147Y_E155V_I156F) X 2
pNMG-363	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(R26Q_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F) X 2
pNMG-364	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(E25M_R26G_L84F_A106V_R107P_D108N_H123Y_A142N_A143D_D147Y_E155V_I156F) X 2
pNMG-365	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(R26C_L84F_A106V_R107H_D108N_H123Y_A142N_D147Y_E155V_I156F) X 2
pNMG-366	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(L84F_A106V_D108N_H123Y_A142N_A143L_D147Y_E155V_I156F) X 2

pNMG-367	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(R26G_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F) X 2
pNMG-368	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(E25A_R26G_L84F_A106V_R107N_D108N_H123Y_A142N_A143E_D147Y_E155V_I156F) X 2
pNMG-369	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(L84F_A106V_D108N_H123Y_D147Y_E155V_I156Y) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156Y)
pNMG-370	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(A106V_D108N_D147Y_E155V) + (A106V_D108N_D147Y_E155V)
pNMG-371	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(L84F_A106V_D108N_H123Y_D147Y_E155V_I156F) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-372	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_NLS	A106V_D108N_A142N_D147Y_E155V
pNMG-373	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_NLS	R26G_A106V_D108N_A142N_D147Y_E155V
pNMG-374	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_NLS	E25D_R26G_A106V_R107K_D108N_A142N_A143G_D147Y_E155V
pNMG-375	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_NLS	R26G_A106V_D108N_R107H_A142N_A143D_D147Y_E155V
pNMG-376	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_NLS	E25D_R26G_A106V_D108N_A142N_D147Y_E155V
pNMG-377	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_NLS	A106V_R107K_D108N_A142N_D147Y_E155V
pNMG-378	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_NLS	A106V_D108N_A142N_A143G_D147Y_E155V
pNMG-379	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_NLS	A106V_D108N_A142N_A143L_D147Y_E155V
pNMG-382	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	A106V_D108N_A142N_D147Y_E155V X 2
pNMG-383	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	R26G_A106V_D108N_A142N_D147Y_E155V X 2
pNMG-384	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	E25D_R26G_A106V_R107K_D108N_A142N_A143G_D147Y_E155V X 2
pNMG-385	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	R26G_A106V_D108N_R107H_A142N_A143D_D147Y_E155V X 2

pNMG-386	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	E25D_R26G_A106V_D108N_A142N_D147Y_E155V X 2
pNMG-387	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	A106V_R107K_D108N_A142N_D147Y_E155V X 2
pNMG-388	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	A106V_D108N_A142N_A143G_D147Y_E155V X 2
pNMG-389	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	A106V_D108N_A142N_A143L_D147Y_E155V X 2
pNMG-391	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N
pNMG-392	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	N37T_P48T_M70L_L84F_A106V_D108N_H123Y_D147Y_I49V_E155V_I156F
pNMG-393	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	N37S_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F_K161T
pNMG-394	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	H36L_L84F_A106V_D108N_H123Y_D147Y_Q154H_E155V_I156F
pNMG-395	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	N72S_L84F_A106V_D108N_H123Y_S146R_D147Y_E155V_I156F
pNMG-396	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	H36L_P48L_L84F_A106V_D108N_H123Y_E134G_D147Y_E155V_I156F
pNMG-397	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	H36L_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F_K157N
pNMG-398	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	H36L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F
pNMG-399	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	L84F_A106V_D108N_H123Y_S146R_D147Y_E155V_I156F_K161T
pNMG-400	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	N37S_R51H_D77G_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F
pNMG-401	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	R51L_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F_K157N
pNMG-402	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N) x 2

pNMG-403	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(N37T_P48T_M70L_L84F_A106V_D108N_H123Y_D147Y_I49V_E155V_I156F) x 2
pNMG-404	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(N37S_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F_K161T) x 2
pNMG-405	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(H36L_L84F_A106V_D108N_H123Y_D147Y_Q154H_E155V_I156F) x 2
pNMG-406	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(N72S_L84F_A106V_D108N_H123Y_S146R_D147Y_E155V_I156F) x 2
pNMG-407	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(H36L_P48L_L84F_A106V_D108N_H123Y_E134G_D147Y_E155V_I156F) x 2
pNMG-408	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(H36L_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F_K157N) x 2
pNMG-409	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(H36L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F) x 2
pNMG-410	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(L84F_A106V_D108N_H123Y_S146R_D147Y_E155V_I156F_K161T) x 2
pNMG-411	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(N37S_R51H_D77G_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F) x 2
pNMG-412	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(R51L_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F_K157N) x 2
pNMG-440	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	D24G_Q71R_L84F_H96L_A106V_D108N_H123Y_D147Y_E155V_I156F_K160E
pNMG-441	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	H36L_G67V_L84F_A106V_D108N_H123Y_S146T_D147Y_E155V_I156F
pNMG-442	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	Q71L_L84F_A106V_D108N_H123Y_L137M_A143E_D147Y_E155V_I156F
pNMG-443	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	E25G_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F_Q159L
pNMG-444	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	L84F_A91T_F104I_A106V_D108N_H123Y_D147Y_E155V_I156F

pNMG-445	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	N72D_L84F_A106V_D108N_H123Y_G125A_D147Y_E155V_I156F
pNMG-446	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	P48S_L84F_S97C_A106V_D108N_H123Y_D147Y_E155V_I156F
pNMG-447	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	W23G_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F
pNMG-448	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	D24G_P48L_Q71R_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F_Q159L
pNMG-449	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(D24G_Q71R_L84F_H96L_A106V_D108N_H123Y_D147Y_E155V_I156F_K160E) x 2
pNMG-450	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(H36L_G67V_L84F_A106V_D108N_H123Y_S146T_D147Y_E155V_I156F) x 2
pNMG-451	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(Q71L_L84F_A106V_D108N_H123Y_L137M_A143E_D147Y_E155V_I156F) x 2
pNMG-452	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(E25G_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F_Q159L) x 2
pNMG-453	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(L84F_A91T_F104I_A106V_D108N_H123Y_D147Y_E155V_I156F) x 2
pNMG-454	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(N72D_L84F_A106V_D108N_H123Y_G125A_D147Y_E155V_I156F) x 2
pNMG-455	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(P48S_L84F_S97C_A106V_D108N_H123Y_D147Y_E155V_I156F) x 2
pNMG-456	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(W23G_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F) x 2
pNMG-457	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(D24G_P48L_Q71R_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F_Q159L) x 2
pNMG-473	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F
pNMG-474	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F) x 2

pNMG-475	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wild-typet) + (A106V_D108N_D147Y_E155V)
pNMG-476	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wild-type) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-477	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wild-type) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-478	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wild-type) + (N37S_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F_K161T)
pNMG-479	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wild-type) + (L84F_A106V_D108N_H123Y_S146R_D147Y_E155V_I156F_K161T)
pNMG-480	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_NLS	wild-type
pNMG-481	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_NLS	A106V_D108N
pNMG-482	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	wild-type + wild-type
pNMG-483	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(A106V_D108N) x2
pNMG-484	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wild-type) + (A106V_D108N)
pNMG-485	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	H36L_R51L_L84F_A106V_D108N_H123Y_A142N_S146C_D147Y_E155V_I156F _K157N
pNMG-486	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	N37S_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F_K161T
pNMG-487	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	L84F_A106V_D108N_D147Y_E155V_I156F
pNMG-488	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F_K157N_K161T
pNMG-489	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F_K161T
pNMG-490	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F_K157N_K160E_K161T
pNMG-491	pCMV_ecTadA_(SGGS)2-XTEN-(SGGS)2_Cas9n_SGGS_UGI_SGGS_NLS	L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F_K157N_K160E
pNMG-492	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F)
pNMG-493	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (D24G_Q71R_L84F_H96L_A106V_D108N_H123Y_D147Y_E155V_I156F_K160E)
pNMG-494	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (H36L_R51L_L84F_A106V_D108N_H123Y_A142N_S146C_D147Y_E155V_I156F _K157N)

pNMG-495	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (N37S_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F_K161T)
pNMG-496	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) +(L84F_A106V_D108N_D147Y_E155V_I156F)
pNMG-497	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F_K157N_K161T)
pNMG-498	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F_K161T)
pNMG-499	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F_K157N_K160E_K161T)
pNMG-500	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F_K157N_K160E)
pNMG-513	pCMV_ecTadA-92 a.a.-ecTadA-32 a.a._nCas9_SGGS_NLS	(wt) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-514	pCMV_ecTadA-92 a.a.-ecTadA-32 a.a._nCas9_SGGS_NLS	(L84F_A106V_D108N_H123Y_D147Y_E155V_I156F) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-515	pCMV_ecTadA-92 a.a.-ecTadA- 64 a.a._nCas9_SGGS_NLS	(wt) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-516	pCMV_ecTadA-92 a.a.-ecTadA- 64 a.a._nCas9_SGGS_NLS	(L84F_A106V_D108N_H123Y_D147Y_E155V_I156F) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-517	pCMV_ecTadA- 32 a.a.-ecTadA- 64 a.a._nCas9_SGGS_NLS	(wt) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-518	pCMV_ecTadA- 32 a.a.-ecTadA- 64 a.a._nCas9_SGGS_NLS	(L84F_A106V_D108N_H123Y_D147Y_E155V_I156F) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-519	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	R74Q
pNMG-520	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	R74Q L84F_A106V_D108N_H123Y_D147Y_E155V_I156F
pNMG-521	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	R74A_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F
pNMG-522	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	R98Q
pNMG-523	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	R129Q
pNMG-524	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt + R74Q) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-525	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt + R74Q) + (R74Q_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)

pNMG-526	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(R74A_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F) + (R74A_L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-527	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt + R98Q) + (L84F_R98Q_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-528	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt + R129Q) + (L84F_A106V_D108N_H123Y_R129Q_D147Y_E155V_I156F)
pNMG-529	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(L84F_A106V_D108N_H123Y_D147Y_E155V_I156F) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-530	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-543	pCMV_ ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(P48S_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F)
pNMG-544	pCMV_ ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(P48T_I49V_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F_L157N)
pNMG-545	pCMV_ ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	P48S_A142N
pNMG-546	pCMV_ ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	P48T_I49V_A142N
pNMG-547	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (P48S_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F)
pNMG-548	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(P48S_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F) + (P48S_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F))
pNMG-549	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(P48S_A142N) + (P48S_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F))
pNMG-550	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(P48S_A142N) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-551	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (P48T_I49V_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F_L157N)
pNMG-552	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(P48T_I49V_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F_L157N) + (P48T_I49V_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F_L157N)
pNMG-553	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(P48T_I49V_A142N) + (P48T_I49V_L84F_A106V_D108N_H123Y_A142N_D147Y_E155V_I156F_L157N)
pNMG-554	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(P48T_I49V_A142N) + (L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)
pNMG-555	pCMV_ecTadA-24 a.a. linker-ecTadA-24 a.a. linker_nCas9_SGGS_NLS	(wt) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146

		C_D147Y_E155V_I156F _K157N)
pNMG-556	pCMV_ecTadA-24 a.a. linker-ecTadA- 32 a.a. linker_nCas9_SGGS_NLS	(wt) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-557	pCMV_ecTadA-24 a.a. linker-ecTadA- 40 a.a. linker_nCas9_SGGS_NLS	(wt) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-558	pCMV_ecTadA- 32 a.a. linker-ecTadA- 24 a.a. linker_nCas9_SGGS_NLS	(wt) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-559	pCMV_ecTadA- 32 a.a. linker-ecTadA- 40 a.a. linker_nCas9_SGGS_NLS	(wt) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-560	pCMV_ecTadA- 40 a.a. linker-ecTadA- 24 a.a. linker_nCas9_SGGS_NLS	(wt) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-561	pCMV_ecTadA- 40 a.a. linker-ecTadA- 32 a.a. linker_nCas9_SGGS_NLS	(wt) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-562	pCMV_ecTadA- 40 a.a. linker-ecTadA- 40 a.a. linker_nCas9_SGGS_NLS	(wt) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-563	pCMV_ecTadA- 24 a.a. linker_nCas9_SGGS_NLS	wild-type
pNMG-564	pCMV_ecTadA- 24 a.a. linker_nCas9_SGGS_NLS	(H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-565	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_XTEN_MBD4_SGGS_NLS	(wt) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-566	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_XTEN_TDG_SGGS_NLS	(wt) + (H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-572	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(H36L_P48S_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-573	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(H36L_P48S_R51L_L84F_A106V_D108N_H123Y_S146C_A142N_D147Y_E155V_I156F _K157N)
pNMG-574	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(H36L_P48T_I49V_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-575	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(H36L_P48T_I49V_R51L_L84F_A106V_D108N_H123Y_A142N_S146C_D147Y_E155V_I156F _K157N)
pNMG-576	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (H36L_P48S_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-577	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (H36L_P48S_R51L_L84F_A106V_D108N_H123Y_S146C_A142N_D147Y_E155V_I156F _K157N)
pNMG-578	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (H36L_P48T_I49V_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)

pNMG-579	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (H36L_P48T_I49V_R51L_L84F_A106V_D108N_H123Y_A142N_S146C_D147Y_E155V_I156F_K157N)
pNMG-580	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(H36L_P48S_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N) + (H36L_P48S_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-581	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-583	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(H36L_P48A_R51L_L84F_A106V_D108N_H123Y_A142N_S146C_D147Y_E155V_I156F _K157N)
pNMG-586	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-588	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_A142N_D147Y_E155V_I156F _K157N)
pNMG-603	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-604	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(W23R_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-605	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146R_D147Y_E155V_I156F _K161T)
pNMG-606	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152H_E155V_I156F _K157N)
pNMG-607	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152P_E155V_I156F _K157N)
pNMG-608	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152P_E155V_I156F_K157N)
pNMG-609	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_A142A_S146C_D147Y_E155V_I156F_K157N)
pNMG-610	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_A142A_S146C_D147Y_R152P_E155V_I156F _K157N)
pNMG-611	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-612	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (W23R_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)
pNMG-613	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) +(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146R_D147Y_E155V_I156F _K161T)
pNMG-614	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152H_E155V_I156F _K157N)
pNMG-615	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152P_E155V_I156F _K157N)
pNMG-616	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (W23L_H36L_P48A_R51L_L84F_A106V_D108N

		_H123Y_S146C_D147Y_R152P_E155V_I156F _K157N)
pNMG-617	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (W23L_H36L_P48A_R51L_L84F_A106V_D108N _H123Y_A142A_S146C_D147Y_E155V_I156F _K157N)
pNMG-618	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (W23L_H36L_P48A_R51L_L84F_A106V_D108N _H123Y_A142A_S146C_D147Y_R152P_E155V_ I156F _K157N)
pNMG-619	pCMV_ecTadA- 32 a.a.-_nCas9_SGGS_NLS	(W23R_H36L_P48A_R51L_L84F_A106V_D108N _H123Y_S146C_D147Y_R152P_E155V_I156F _K157N)
pNMG-620	pCMV_ecTadA-(SGGS)2-XTEN-(SGGS)2-ecTadA-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS	(wt) + (W23R_H36L_P48A_R51L_L84F_A106V_D108N _H123Y_S146C_D147Y_R152P_E155V_I156F _K157N)
pNMG-621	pCMV_ecTadA- 32 a.a. linker-ecTadA- 24 a.a. linker_nCas9_SGGS_NLS	(wt) + (H36L_P48A_R51L_L84F_A106V_D108N_H123Y _S146C_D147Y_R152P_E155V_I156F _K157N)
pNMG-622	pCMV_ecTadA- 32 a.a. linker-ecTadA- 24 a.a. linker_nCas9_SGGS_NLS	(wt) + (H36L_P48A_R51L_L84F_A106V_D108N_H123Y _A142N_S146C_D147Y_R152P_E155V_I156F _K157N)
pNMG-623	pCMV_ecTadA- 32 a.a. linker-ecTadA- 24 a.a. linker_nCas9_SGGS_NLS	(wt) + (W23L_H36L_P48A_R51L_L84F_A106V_D108N _H123Y_S146C_D147Y_R152P_E155V_I156F _K157N)
pNMG-624	pCMV_ecTadA- 32 a.a. linker-ecTadA- 24 a.a. linker_nCas9_SGGS_NLS	(wt) + (W23R_H36L_P48A_R51L_L84F_A106V_D108N _H123Y_S146C_D147Y_R152P_E155V_I156F _K157N)

[0056] In some embodiments, the A to G nucleobase editor comprises a dCas9 or nCas9 fused to an adenosine deaminase. Such nucleobase editors are described in US provisional application, U.S.S.N. 62/370,684, filed August 3, 2016; US provisional application, U.S.S.N. 62/370,684, filed February 3, 2017, US provisional application, U.S.S.N. 62/473,714, filed March 20, 2017, and PCT Application PCT/US2017/045381, filed August 3, 2017; each of which is incorporated herein by reference.

[0057] In some embodiments, an A to G nucleobase editor comprises the structure of NH2-[second adenosine deaminase]-[first adenosine deaminase]-[dCas9]-COOH. In some embodiments, the second adenosine deaminase is a wile-type ecTadA (SEQ ID NO: 314). In some embodiments, the a linker is used between each domain. In some embodiments, the linker is 32 amino acids long and comprises the amino acid sequence of SGGSSGGSSGSETPGTSESATPESSGGSSGGS (SEQ ID NO: 384).

[0058] In some embodiments, the adenosine deaminase comprises one or more of a W23X, H36X, N37X, P48X, I49X, R51X, N72X, L84X, S97X, A106X, D108X, H123X, G125X, A142X, S146X, D147X, R152X, E155X, I156X, K157X, and/or K161X mutation in SEQ ID NO: 314, or one or more corresponding mutations in another adenosine deaminase, where the presence of X indicates any amino acid other than the corresponding amino acid in the wild-type adenosine deaminase. In some embodiments, the adenosine deaminase comprises one or more of W23L, W23R, H36L, P48S, P48A, R51L, L84F, A106V, D108N, H123Y, A142N, S146C, D147Y, R152P, E155V, I156F, and/or K157N mutation in SEQ ID NO: 314, or one or more corresponding mutations in another adenosine deaminase.

[0059] In some embodiments, the adenosine deaminase comprises or consists of one, two, three, four, five, six, seven, eight, nine, ten, eleven, or twelve mutations selected from H36X, P48X, R51X, L84X, A106X, D108X, H123X, S146X, D147X, E155X, I156X, and K157X in SEQ ID NO: 314, or a corresponding mutation or mutations in another adenosine deaminase, where X indicates the presence of any amino acid other than the corresponding amino acid in the wild-type adenosine deaminase. In some embodiments, the adenosine deaminase comprises or consists of one, two, three, four, five, six, seven, eight, nine, ten, eleven, or twelve mutations selected from H36L, P48S, R51L, L84F, A106V, D108N, H123Y, S146C, D147Y, E155V, I156F, and K157N in SEQ ID NO: 314, or a corresponding mutation or mutations in another adenosine deaminase. In some embodiments, the adenosine deaminse comprises or consists of a H36L, P48S, R51L, L84F, A106V, D108N, H123Y, S146C, D147Y, E155V, I156F, and K157N mutation in SEQ ID NO: 314, or corresponding mutations in another adenosine deaminase.

[0060] In some embodiments, the adenosine deaminase comprises or consists of one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, or thirteen mutations selected from H36X, P48X, R51X, L84X, A106X, D108X, H123X, A142X, S146X, D147X, E155X, I156X, and K157X in SEQ ID NO: 314, or a corresponding mutation or mutations in another adenosine deaminase, where X indicates the presence of any amino acid other than the corresponding amino acid in the wild-type adenosine deaminase. In some embodiments, the adenosine deaminase comprises or consists of one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, or thirteen mutations selected from H36L, P48S, R51L, L84F, A106V, D108N, H123Y, A142N, S146C, D147Y, E155V, I156F, and K157N in SEQ ID NO: 314, or a corresponding mutation or mutations in another adenosine deaminase. In some embodiments, the adenosine

deaminase comprises or consists of a H36L, P48S, R51L, L84F, A106V, D108N, H123Y, A142N, S146C, D147Y, E155V, I156F, and K157N mutation in SEQ ID NO: 314, or corresponding mutations in another adenosine deaminase.

[0061] In some embodiments, the adenosine deaminase comprises or consists of one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, or fourteen mutations selected from W23X, H36X, P48X, R51X, L84X, A106X, D108X, H123X, A142X, S146X, D147X, E155X, I156X, and K157X in SEQ ID NO: 314, or a corresponding mutation or mutations in another adenosine deaminase, where X indicates the presence of any amino acid other than the corresponding amino acid in the wild-type adenosine deaminase. In some embodiments, the adenosine deaminase comprises or consists of one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, or fourteen mutations selected from W23L, H36L, P48A, R51L, L84F, A106V, D108N, H123Y, A142N, S146C, D147Y, E155V, I156F, and K157N in SEQ ID NO: 314, or a corresponding mutation or mutations in another adenosine deaminase. In some embodiments, the adenosine deaminase comprises or consists of a W23L, H36L, P48A, R51L, L84F, A106V, D108N, H123Y, A142N, S146C, D147Y, E155V, I156F, and K157N mutation in SEQ ID NO: 314, or corresponding mutations in another adenosine deaminase.

[0062] In some embodiments, the adenosine deaminase comprises or consists of one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, or fifteen mutations selected from W23X, H36X, P48X, R51X, L84X, A106X, D108X, H123X, A142X, S146X, D147X, R152X, E155X, I156X, and K157X in SEQ ID NO: 314, or a corresponding mutation or mutations in another adenosine deaminase, where X indicates the presence of any amino acid other than the corresponding amino acid in the wild-type adenosine deaminase. In some embodiments, the adenosine deaminase comprises or consists of one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, or fifteen mutations selected from W23L, H36L, P48A, R51L, L84F, A106V, D108N, H123Y, A142N, S146C, D147Y, R152P, E155V, I156F, and K157N in SEQ ID NO: 314, or a corresponding mutation or mutations in another adenosine deaminase. In some embodiments, the adenosine deaminase comprises or consists of a W23L, H36L, P48A, R51L, L84F, A106V, D108N, H123Y, A142N, S146C, D147Y, R152P, E155V, I156F, and K157N mutation in SEQ ID NO: 314, or corresponding mutations in another adenosine deaminase.

[0063] In some embodiments, the adenosine deaminase comprises or consists of one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, or fourteen mutations selected from W23X, H36X, P48X, R51X, L84X, A106X, D108X, H123X, S146X, D147X, R152X, E155X, I156X, and K157X in SEQ ID NO: 314, or a corresponding mutation or mutations in another adenosine deaminase, where X indicates the presence of any amino acid other than the corresponding amino acid in the wild-type adenosine deaminase. In some embodiments, the adenosine deaminase comprises or consists of one, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, or fourteen mutations selected from W23R, H36L, P48A, R51L, L84F, A106V, D108N, H123Y, S146C, D147Y, R152P, E155V, I156F, and K157N in SEQ ID NO: 314, or a corresponding mutation or mutations in another adenosine deaminase. In some embodiments, the adenosine deaminse comprises or consists of a W23R, H36L, P48A, R51L, L84F, A106V, D108N, H123Y, S146C, D147Y, R152P, E155V, I156F, and K157N mutation in SEQ ID NO: 314, or corresponding mutations in another adenosine deaminase.

[0064] In some embodiments, a nucleobase editor converts a C to G. Such nucleobase editors are described in US provisional application, U.S.S.N. 62/470, 175, filed March 10, 2017, US provisional application, U.S.S.N. 62/470, 175, filed March 10, 2017incorporated herein by reference.

[0065] Non-limiting, exemplary types of nucleobase editors (including C to T, A to G, and C to G nucleobase editors) and their respective sequences are provided in Example 1. In some embodiments, the nucleobase editor is a variant of the nucleobase editors described herein. For example, in some embodiments, the nucleobase editor is at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75% at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.5% identical to a nucleobase editor described herein (exemplary sequences are provided in Example 1). In some embodiments, the nucleobase editor comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 30%, no more than 25%, no more than 20%, no more than 15%, no more than 10%, no more than 5%, no more than 1% longer or shorter) than any of the nucleobase editors provided herein. In some embodiments, the nucleobase editor comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 500 amino acids, no more than 450 amino acids, no more than 400 amino acids, no more than 350 amino acids, no more than 300 amino acids, no more than 250 amino acids, no more than 200 amino acids, no

more than 200 amino acids, no more than 150 amino acids, no more than 100 amino acids, no more than 50 amino acids, no more than 10 amino acids, no more than 5 amino acids longer or shorter) than any of the nucleobase editors provided herein.

[0066] A "deaminase" refers to an enzyme that catalyzes the removal of an amine group from a molecule, or deamination, for example, through hydrolysis. In some embodiments, the deaminase is a cytidine deaminase, catalyzing the deamination of cytidine (C) to uridine (U), deoxycytidine (dC) to deoxyuridine (dU), or 5-methyl-cytidine to thymidine (T, 5-methyl-U), respectively. Subsequent DNA repair mechanisms ensure that a dU is replaced by T, as described in Komor *et al.* (*Nature*, Programmable editing of a target base in genomic DNA without double-stranded DNA cleavage, 533, 420–424 (2016), which is incorporated herein by reference). In some embodiments, the deaminase is a cytosine deaminase, catalyzing and promoting the conversion of cytosine to uracil (*e.g.*, in RNA) or thymine (*e.g.*, in DNA). In some embodiments, the deaminase is an adenosine deaminase that converts an A to G. In some embodiments, the deaminase is a naturally-occurring deaminase from an organism, such as a human, chimpanzee, gorilla, monkey, cow, dog, rat, or mouse. In some embodiments, the deaminase is a variant of a naturally-occurring deaminase from an organism, and the variants do not occur in nature. For example, in some embodiments, the deaminase or deaminase domain is at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75% at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.5% identical to a naturally-occurring deaminase from an organism. In some embodiments, the deaminase comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 30%, no more than 25%, no more than 20%, no more than 15%, no more than 10%, no more than 5%, no more than 1% longer or shorter) than any of the deaminases provided herein. In some embodiments, the deaminase comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 100 amino acids, no more than 90 amino acids, no more than 80 amino acids, no more than 70 amino acids, no more than 60 amino acids, no more than 50 amino acids, no more than 40 amino acids, no more than 30 amino acids, no more than 20 amino acids, no more than 10 amino acids, no more than 5 amino acids, no more than 2 amino acids, longer or shorter) than any of the deaminases provided herein.

[0067] A "split nucleobase editor" refers to a nucleobase editor that is provided as an N-terminal portion (also referred to as a N-terminal half) and a C-terminal portion (also referred to as a C-

terminal half) encoded by two separate nucleic acids. The polypeptides corresponding to the N-terminal portion and the C-terminal portion of the nucleobase editor may be combined to form a complete nucleobase editor. In some embodiments, for a nucleobase editor that comprises a dCas9 or nCas9, the "split" is located in the dCas9 or nCas9 domain, at positions as described herein in the split Cas9. Accordingly, in some embodiments, the N-terminal portion of the nucleobase editor contains the N-terminal portion of the split Cas9, and the C-terminal portion of the nucleobase editor contains the C-terminal portion of the split Cas9. Similarly, intein-N or intein-C may be fused to the N-terminal portion or the C-terminal portion of the nucleobase editor, respectively, for the joining of the N- and C-terminal portions of the nucleobase editor to form a complete nucleobase editor.

[0068] Two proteins or protein domains are considered to be "fused" when a peptide bond is formed linking the two proteins or two protein domains. In some embodiments, a linker (*e.g.*, a peptide linker) is present between the two proteins or two protein domains. The term "linker," as used herein, refers to a chemical group or a molecule linking two molecules or moieties, *e.g.*, two domains of a fusion protein, such as, for example, a nuclease-inactive Cas9 domain and a nucleic acid editing domain (*e.g.*, a deaminase domain). Typically, the linker is positioned between, or flanked by, two groups, molecules, or other moieties and connected to each one via a covalent bond, thus connecting the two. In some embodiments, the linker is an amino acid or a plurality of amino acids (*e.g.*, a peptide or protein). In some embodiments, the linker is an organic molecule, group, polymer, or chemical moiety. In some embodiments, the linker is 5-100 amino acids in length, for example, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 30-35, 35-40, 40-45, 45-50, 50-60, 60-70, 70-80, 80-90, 90-100, 100-150, or 150-200 amino acids in length. Longer or shorter linkeare also contemplated.

[0069] A "uracil glycosylase inhibitor (UGI)" refers to a protein that inhibits the activity of uracil-DNA glycosylase. Suitable UGI proteins for use in accordance with the present disclosure include, for example, those published in Wang *et al.*, *J. Biol. Chem.* 264:1163-1171(1989); Lundquist *et al.*, *J. Biol. Chem.* 272:21408-21419(1997); Ravishankar *et al.*, *Nucleic Acids Res.* 26:4880-4887(1998); and Putnam *et al.*, *J. Mol. Biol.* 287:331-346(1999), each of which is incorporated herein by reference. Non-limiting, exemplary proteins that may be used as a UGI of the present disclosure and their respective sequences are provided in Example 1. In some

embodiments, the UGI is a variant of a naturally-occurring deaminase from an organism, and the variants do not occur in nature. For example, in some embodiments, the UGI is at least 50%, at least 55%, at least 60%, at least 65%, at least 70%, at least 75% at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.5% identical to a naturally-occurring UGI from an organism or any UGIs provided herein (*e.g.*, in Example 1). In some embodiments, the UGI comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 30%, no more than 25%, no more than 20%, no more than 15%, no more than 10%, no more than 5%, no more than 1% longer or shorter) than any of the UGIs provided herein. In some embodiments, the UGI comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 20 amino acids, no more than 15 amino acids, no more than 10 amino acids, no more than 5 amino acids, no more than 2 amino acids longer or shorter) than any of the UGIs provided herein.

[0070] A gRNA is a component of the CRISPR/Cas system. A "gRNA" (guide ribonucleic acid) herein refers to a fusion of a CRISPR-targeting RNA (crRNA) and a trans-activation crRNA (tracrRNA), providing both targeting specificity and scaffolding/binding ability for Cas9 nuclease. A "crRNA" is a bacterial RNA that confers target specificity and requires tracrRNA to bind to Cas9. A "tracrRNA" is a bacterial RNA that links the crRNA to the Cas9 nuclease and typically can bind any crRNA. The sequence specificity of a Cas DNA-binding protein is determined by gRNAs, which have nucleotide base-pairing complementarity to target DNA sequences. The native gRNA comprises a 20 nucleotide (nt) Specificity Determining Sequence (SDS), which specifies the DNA sequence to be targeted, and is immediately followed by a 80 nt scaffold sequence, which associates the gRNA with Cas9. In some embodiments, an SDS of the present disclosure has a length of 15 to 100 nucleotides, or more. For example, an SDS may have a length of 15 to 90, 15 to 85, 15 to 80, 15 to 75, 15 to 70, 15 to 65, 15 to 60, 15 to 55, 15 to 50, 15 to 45, 15 to 40, 15 to 35, 15 to 30, or 15 to 20 nucleotides. In some embodiments, the SDS is 20 nucleotides long. For example, the SDS may be 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, or 25 nucleotides long. At least a portion of the target DNA sequence is complementary to the SDS of the gRNA. For Cas9 to successfully bind to the DNA target sequence, a region of the target sequence is complementary to the SDS of the gRNA sequence and is immediately followed by the correct protospacer adjacent motif (PAM) sequence (*e.g.*, NGG for Cas9 and TTN, TTTN, or YTN for Cpf1). In some embodiments, an SDS is 100% complementary to its

target sequence. In some embodiments, the SDS sequence is less than 100% complementary to its target sequence and is, thus, considered to be partially complementary to its target sequence. For example, a targeting sequence may be 99%, 98%, 97%, 96%, 95%, 94%, 93%, 92%, 91%, or 90% complementary to its target sequence. In some embodiments, the SDS of template DNA or target DNA may differ from a complementary region of a gRNA by 1, 2, 3, 4 or 5 nucleotides.

[0071] In addition to the SDS, the gRNA comprises a scaffold sequence (corresponding to the tracrRNA in the native CRISPR/Cas system) that is required for its association with Cas9 (referred to herein as the "gRNA handle"). In some embodiments, the gRNA comprises a structure 5′-[SDS] -[gRNA handle]-3′. In some embodiments, the scaffold sequence comprises the nucleotide sequence of 5′-guuuuagagcuagaaauagcaaguuaaaauaaaggcuaguc cguuaucaacuugaaaaaguggcaccgagucggugcuuuuu-3′ (SEQ ID NO: 358). Other non-limiting, suitable gRNA handle sequences that may be used in accordance with the present disclosure are listed in Table 1.

Table 1. Guide RNA Handle Sequences

Organism	**gRNA handle sequence**	**SEQ ID NO**
S. pyogenes	GUUUAAGAGCUAUGCUGGAAACAGCACGGUGAAA AAGUUCAACUAUUGCCUGAUCGGAAUAAAUUUG AACGAUACGACAGUCGGUGCUUUUUUU	359
S. pyogenes	GUUUAAGAGCUAGAAAUAGCAAGUUUAAAUAA GGCUAGUCCGUUAUCAACUUGAAAAAGUGGCAC CGAGUCGGUGCUUUUUU	360
S. thermophilus CRISPR1	GUUUUUGUACUCUCAAGAUUCAAUAAUCUUGCA GAAGCUACAAAGAUAAGGCUUCAUGCCGAAAUC AACACCCUGUCAUUUUAUGGCAGGGUGUUUU	361
S. thermophilus CRISPR3	GUUUUAGAGCUGUGUUGUUUGUUAAAACAACA CAGCGAGUUAAAAUAAGGCUUAGUCCGUACUCA ACUUGAAAAGGUGGCACCGAUUCGGUGUUUUU	362
C. jejuni	AAGAAAUUUAAAAAGGGACUAAAAUAAAGAGU UUGCGGGACUCUGCGGGGUUACAAUCCCCUAAA ACCGCUUUU	363
F. novicida	AUCUAAAAUUAUAAAUGUACCAAAUAAUUAAU GCUCUGUAAUCAUUUAAAAGUAUUUUGAACGG ACCUCUGUUUGACACGUCUGAAUAACUAAAA	364
S. thermophilus2	UGUAAGGGACGCCUUACACAGUUACUUAAAUCU UGCAGAAGCUACAAAGAUAAGGCUUCAUGCCGA	365

	AAUCAACACCCUGUCAUUUUAUGGCAGGGUGUU UUCGUUAUUU	
M. mobile	UGUAUUUCGAAAUACAGAUGUACAGUUAAGAA UACAUAAGAAUGAUACAUCACUAAAAAAAGGCU UUAUGCCGUAACUACUACUUAUUUUCAAAAUAA GUAGUUUUUUUU	366
L. innocua	AUUGUUAGUAUUCAAAAUAACAUAGCAAGUUA AAAUAAGGCUUUGUCCGUUAUCAACUUUUAAUU AAGUAGCGCUGUUUCGGCGCUUUUUUU	367
S. pyogenes	GUUGGAACCAUUCAAAACAGCAUAGCAAGUUAA AAUAAGGCUAGUCCGUUAUCAACUUGAAAAAGU GGCACCGAGUCGGUGCUUUUUUU	368
S. mutans	GUUGGAAUCAUUCGAAACAACACAGCAAGUUAA AAUAAGGCAGUGAUUUUUAAUCCAGUCCGUACA CAACUUGAAAAAGUGCGCACCGAUUCGGUGCUU UUUUAUUU	369
S. thermophilus	UUGUGGUUUGAAACCAUUCGAAACAACACAGCG AGUUAAAAUAAGGCUUAGUCCGUACUCAACUUG AAAAGGUGGCACCGAUUCGGUGUUUUUUUU	370
N. meningitidis	ACAUAUUGUCGCACUGCGAAAUGAGAACCGUUG CUACAAUAAGGCCGUCUGAAAAGAUGUGCCGCA ACGCUCUGCCCCUUAAAGCUUCUGCUUUAAGGG GCA	371
P. multocida	GCAUAUUGUUGCACUGCGAAAUGAGAGACGUUG CUACAAUAAGGCUUCUGAAAAGAAUGACCGUAA CGCUCUGCCCCUUGUGAUUCUUAAUUGCAAGGG GCAUCGUUUUU	372

[0072] In some embodiments, the guide RNA is about 15-120 nucleotides long and comprises a sequence of at least 10 contiguous nucleotides that is complementary to a target sequence. In some embodiments, the guide RNA is 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 97, 98, 99, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, or 120 nucleotides long. In some embodiments, the guide RNA comprises a sequence of 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20 or more contiguous nucleotides that is complementary to a target sequence. Sequence complementarity refers to distinct interactions between adenine and thymine (DNA) or uracil (RNA), and between guanine and cytosine.

[0073] A "protospacer adjacent motif" (PAM) is typically a sequence of nucleotides located adjacent to (*e.g.*, within 10, 9, 8, 7, 6, 5, 4, 3, 3, or 1 nucleotide(s) of a target sequence). A PAM sequence is "immediately adjacent to" a target sequence if the PAM sequence is contiguous with the target sequence (that is, if there are no nucleotides located between the PAM sequence and the target sequence). In some embodiments, a PAM sequence is a wild-type PAM sequence. Examples of PAM sequences include, without limitation, NGG, NGR, NNGRR(T/N), NNNNGATT, NNAGAAW, NGGAG, NAAAAC, AWG, and CC. In some embodiments, a PAM sequence is obtained from *Streptococcus pyogenes* (*e.g.*, NGG or NGR). In some embodiments, a PAM sequence is obtained from *Staphylococcus aureus* (*e.g.*, NNGRR(T/N)). In some embodiments, a PAM sequence is obtained from *Neisseria meningitidis* (*e.g.*, NNNNGATT). In some embodiments, a PAM sequence is obtained from *Streptococcus thermophilus* (*e.g.*, NNAGAAW or NGGAG). In some embodiments, a PAM sequence is obtained from *Treponema denticola* (*e.g.*, NAAAAC). In some embodiments, a PAM sequence is obtained from *Escherichia coli* (*e.g.*, AWG). In some embodiments, a PAM sequence is obtained from *Pseudomonas auruginosa* (*e.g.*, CC). Other PAM sequences are contemplated. A PAM sequence is typically located downstream (*i.e.*, 3′) from the target sequence, although in some embodiments a PAM sequence may be located upstream (*i.e.*, 5′) from the target sequence.

[0074] A "nuclear localization signal" or "NLS" refers to as an amino acid sequence that "tags" a protein for import into the cell nucleus by nuclear transport. Typically, this signal consists of one or more short sequences of positively charged lysines or arginines exposed on the protein surface. One or more NLS may be added to the N- or C-terminus of a protein, or internally (*e.g.*, between two protein domains). For example, one or more NLS may be added to the N- or C-terminus of a nucleobase editor, or between the Cas9 and the deaminase in a nucleobase editor. In some embodiments, 1, 2, 3, 4, 5, or more NLS may be added. Nuclear localization sequences are known in the art and would be apparent to the skilled artisan. For example, NLS sequences are described in Plank *et al.*, PCT/EP2000/011690, filed November 23, 2000, the contents of which are incorporated herein by reference for its disclosure of exemplary nuclear localization sequences. In some embodiments, a NLS comprises the amino acid sequence PKKKRKV (SEQ ID NO: 373) or MDSLLMNRRKFLYQFKNVRWAKGRRETYLC (SEQ ID NO: 374). In some embodiments, a linker is inserted between the Cas9 and the deaminase.

[0075] An NLS can be classified as monopartite or bipartite. A non-limiting example of a monopartite NLS is the sequence PKKKRKV (SEQ ID NO: 373) in the SV40 Large T-antigen. A bipartite NLS typically contains two clusters of basic amino acids, separated by a spacer of about 10 amino acids. One non-limiting example of a bipartite NLS is the NLS of nucleoplasmin, KRPAATKKAGQAKKKK (spacer underlined) (SEQ ID NO: 344). In some embodiments, the NLS used in accordance with the present disclosure is the NLS of nucleoplasmin comprising the amino acid sequence of KRPAATKKAGQAKKKK (SEQ ID NO: 344). Other bipartite NLSs that may be used in accordance with the present disclosure include, without limitation: SV40 bipartite NLS (KRTADGSEFESPKKKRKV (SEQ ID NO: 375), *e.g.*, as described in Hodel *et al.*, J Biol Chem. 2001 Jan 12;276(2):1317-25, incorporated herein by reference); Kanadaptin bipartite NLS (KKTELQTTNAENKTKKL (SEQ ID NO: 345), *e.g.*, as described in Hubner *et al.*, Biochem J. 2002 Jan 15;361(Pt 2):287-96, incorporated herein by reference); influenza A nucleoprotein bipartite NLS (KRGINDRNFWRGENGRKTR (SEQ ID NO: 346), *e.g.*, as described in Ketha *et al.*, BMC Cell Biology. 2008;9:22, incorporated herein by reference); and ZO-2 bipartite NLS (RKSGKIAAIVVKRPRK (SEQ ID NO: 347), *e.g.*, as described in Quiros *et al.*, Nusrat A, ed. Molecular Biology of the Cell. 2013;24(16):2528-2543, incorporated herein by reference).

[0076] The nucleotide sequence encoding an NLS is "operably linked" to the nucleotide sequence encoding a protein to which the NLS is fused (*e.g.*, a Cas9 or a nucleobase editor) when two coding sequences are "in-frame with each other" and are translated as a single polypeptide fusing two sequences.

[0077] Nucleic acids of the present disclosure may include one or more genetic elements. A "genetic element" refers to a particular nucleotide sequence that has a role in nucleic acid expression (*e.g.*, promoter, enhancer, terminator) or encodes a discrete product of an engineered nucleic acid (*e.g.*, a nucleotide sequence encoding a guide RNA, a protein and/or an RNA interference molecule).

[0078] A "promoter" refers to a control region of a nucleic acid sequence at which initiation and rate of transcription of the remainder of a nucleic acid sequence are controlled. A promoter may also contain sub-regions at which regulatory proteins and molecules may bind, such as RNA polymerase and other transcription factors. Promoters may be constitutive, inducible, activatable, repressible, tissue-specific, or any combination thereof. A promoter drives

expression or drives transcription of the nucleic acid sequence that it regulates. Herein, a promoter is considered to be "operably linked" when it is in a correct functional location and orientation in relation to a nucleic acid sequence it regulates to control ("drive") transcriptional initiation and/or expression of that sequence.

[0079] A promoter may be one naturally associated with a gene or sequence, as may be obtained by isolating the 5′ non-coding sequences located upstream of the coding segment of a given gene or sequence. Such a promoter is referred to as an "endogenous promoter." In some embodiments, a coding nucleic acid sequence may be positioned under the control of a recombinant or heterologous promoter, which refers to a promoter that is not normally associated with the encoded sequence in its natural environment. Such promoters may include promoters of other genes; promoters isolated from any other cell; and synthetic promoters or enhancers that are not "naturally occurring" such as, for example, those that contain different elements of different transcriptional regulatory regions and/or mutations that alter expression through methods of genetic engineering that are known in the art. In addition to producing nucleic acid sequences of promoters and enhancers synthetically, sequences may be produced using recombinant cloning and/or nucleic acid amplification technology, including polymerase chain reaction (PCR).

[0080] In some embodiments, promoters used in accordance with the present disclosure are "inducible promoters," which are promoters that are characterized by regulating (*e.g.*, initiating or activating) transcriptional activity when in the presence of, influenced by or contacted by an inducer signal. An inducer signal may be endogenous or a normally exogenous condition (*e.g.*, light), compound (*e.g.*, chemical or non-chemical compound) or protein that contacts an inducible promoter in such a way as to be active in regulating transcriptional activity from the inducible promoter. Thus, a "signal that regulates transcription" of a nucleic acid refers to an inducer signal that acts on an inducible promoter. A signal that regulates transcription may activate or inactivate transcription, depending on the regulatory system used. Activation of transcription may involve directly acting on a promoter to drive transcription or indirectly acting on a promoter by inactivation a repressor that is preventing the promoter from driving transcription. Conversely, deactivation of transcription may involve directly acting on a promoter to prevent transcription or indirectly acting on a promoter by activating a repressor that then acts on the promoter.

[0081] A "transcriptional terminator" is a nucleic acid sequence that causes transcription to stop. A transcriptional terminator may be unidirectional or bidirectional. It is comprised of a DNA sequence involved in specific termination of an RNA transcript by an RNA polymerase. A transcriptional terminator sequence prevents transcriptional activation of downstream nucleic acid sequences by upstream promoters. A transcriptional terminator may be necessary *in vivo* to achieve desirable expression levels or to avoid transcription of certain sequences. A transcriptional terminator is considered to be "operably linked to" a nucleotide sequence when it is able to terminate the transcription of the sequence it is linked to.

[0082] The most commonly used type of terminator is a forward terminator. When placed downstream of a nucleic acid sequence that is usually transcribed, a forward transcriptional terminator will cause transcription to abort. In some embodiments, bidirectional transcriptional terminators are provided, which usually cause transcription to terminate on both the forward and reverse strand. In some embodiments, reverse transcriptional terminators are provided, which usually terminate transcription on the reverse strand only.

[0083] In prokaryotic systems, terminators usually fall into two categories (1) rho-independent terminators and (2) rho-dependent terminators. Rho-independent terminators are generally composed of palindromic sequence that forms a stem loop rich in G-C base pairs followed by several T bases. Without wishing to be bound by theory, the conventional model of transcriptional termination is that the stem loop causes RNA polymerase to pause, and transcription of the poly-A tail causes the RNA:DNA duplex to unwind and dissociate from RNA polymerase.

[0084] In eukaryotic systems, the terminator region may comprise specific DNA sequences that permit site-specific cleavage of the new transcript so as to expose a polyadenylation site. This signals a specialized endogenous polymerase to add a stretch of about 200 A residues (polyA) to the 3' end of the transcript. RNA molecules modified with this polyA tail appear to more stable and are translated more efficiently. Thus, in some embodiments involving eukaryotes, a terminator may comprise a signal for the cleavage of the RNA. In some embodiments, the terminator signal promotes polyadenylation of the message. The terminator and/or polyadenylation site elements may serve to enhance output nucleic acid levels and/or to minimize read through between nucleic acids.

[0085] Terminators for use in accordance with the present disclosure include any terminator of transcription described herein or known to one of ordinary skill in the art. Examples of terminators include, without limitation, the termination sequences of genes such as, for example, the bovine growth hormone terminator, and viral termination sequences such as, for example, the SV40 terminator, spy, yejM, secG-leuU, thrLABC, rrnB T1, hisLGDCBHAFI, metZWV, rrnC, xapR, aspA and arcA terminator. In some embodiments, the termination signal may be a sequence that cannot be transcribed or translated, such as those resulting from a sequence truncation.

[0086] A "Woodchuck Hepatitis Virus (WHP) Posttranscriptional Regulatory Element (WPRE)" is a DNA sequence that, when transcribed creates a tertiary structure enhancing expression. Commonly used in molecular biology to increase expression of genes delivered by viral vectors. WPRE is a tripartite regulatory element with gamma, alpha, and beta components. The full WPRE sequence is 609bp long:

GCTTATCGATAATCAACCTCTGGATTACAAAATTTGTGAAAGATTGACTGGTATTCT
TAACTATGTTGCTCCTTTTACGCTATGTGGATACGCTGCTTTAATGCCTTTGTATCAT
GCTATTGCTTCCCGTATGGCTTTCATTTTCTCCTCCTTGTATAAATCCTGGTTGCTGTC
TCTTTATGAGGAGTTGTGGCCCGTTGTCAGGCAACGTGGCGTGGTGTGCACTGTGTT
TGCTGACGCAACCCCCACTGGTTGGGGCATTGCCACCACCTGTCAGCTCCTTTCCGG
GACTTTCGCTTTCCCCCTCCCTATTGCCACGGCGGAACTCATCGCCGCCTGCCTTGCC
CGCTGCTGGACAGGGGCTCGGCTGTTGGGCACTGACAATTCCGTGGTGTTGTCGGGG
AAATCATCGTCCTTTCCTTGGCTGCTCGCCTATGTTGCCACCTGGATTCTGCGCGGGA
CGTCCTTCTGCTACGTCCCTTCGGCCCTCAATCCAGCGGACCTTCCTTCCCGCGGCCT
GCTGCCGGCTCTGCGGCCTCTTCCGCGTCTTCGCCTTCGCCCTCAGACGAGTCGGAT
CTCCCTTTGGGCCGCCTCCCCGCATCGATACCG (SEQ ID NO:376).

[0087] An "adeno-associated virus" or "AAV" is a virus which infects humans and some other primate species. The wild-type AAV genome is a single-stranded deoxyribonucleic acid (ssDNA), either positive- or negative-sensed. The genome comprises two inverted terminal repeats (ITRs), one at each end of the DNA strand, and two open reading frames (ORFs): rep and cap between the ITRs. The rep ORF comprises four overlapping genes encoding Rep proteins required for the AAV life cycle. The cap ORF comprises overlapping genes encoding capsid proteins: VP1, VP2 and VP3, which interact together to form the viral capsid. VP1, VP2 and VP3 are translated from one mRNA transcript, which can be spliced in two different manners: either a longer or shorter intron can be excised resulting in the formation of two isoforms of mRNAs: a ~2.3 kb- and a ~2.6 kb-long mRNA isoform. The capsid forms a supramolecular assembly of approximately 60 individual capsid protein subunits into a non-enveloped, T-1

icosahedral lattice capable of protecting the AAV genome. The mature capsid is composed of VP1, VP2, and VP3 (molecular masses of approximately 87, 73, and 62 kDa respectively) in a ratio of about 1:1:10.

[0088] rAAV particles may comprise a nucleic acid vector (*e.g.*, a recombinant genome), which may comprise at a minimum: (a) one or more heterologous nucleic acid regions comprising a sequence encoding a protein or polypeptide of interest (*e.g.*, a split Cas9 or split nucleobase) or an RNA of interest (*e.g.*, a gRNA), or one or more nucleic acid regions comprising a sequence encoding a Rep protein; and (b) one or more regions comprising inverted terminal repeat (ITR) sequences (*e.g.*, wild-type ITR sequences or engineered ITR sequences) flanking the one or more nucleic acid regions (*e.g.*, heterologous nucleic acid regions). In some embodiments, the nucleic acid vector is between 4 kb and 5 kb in size (*e.g.*, 4.2 to 4.7 kb in size). In some embodiments, the nucleic acid vector further comprises a region encoding a Rep protein. In some embodiments, the nucleic acid vector is circular. In some embodiments, the nucleic acid vector is single-stranded. In some embodiments, the nucleic acid vector is double-stranded. In some embodiments, a double-stranded nucleic acid vector may be, for example, a self-complimentary vector that contains a region of the nucleic acid vector that is complementary to another region of the nucleic acid vector, initiating the formation of the double-strandedness of the nucleic acid vector.

[0089] The terms "nucleic acid," and "polynucleotide," as used herein, refer to a compound comprising a nucleobase and an acidic moiety, *e.g.*, a nucleotide, or a polymer of nucleotides. Typically, polymeric nucleic acids, *e.g.*, nucleic acid molecules comprising three or more nucleotides are linear molecules, in which adjacent nucleotides are linked to each other via a phosphodiester linkage. In some embodiments, "nucleic acid" refers to individual nucleic acid residues (*e.g.* nucleotides and/or nucleosides). In some embodiments, "nucleic acid" refers to an oligonucleotide chain comprising three or more individual nucleotide residues. As used herein, the terms "oligonucleotide" and "polynucleotide" can be used interchangeably to refer to a polymer of nucleotides (*e.g.*, a string of at least three nucleotides). In some embodiments, "nucleic acid" encompasses RNA as well as single and/or double-stranded DNA. Nucleic acids may be naturally occurring, for example, in the context of a genome, a transcript, an mRNA, tRNA, rRNA, siRNA, snRNA, a plasmid, cosmid, chromosome, chromatid, or other naturally occurring nucleic acid molecule. On the other hand, a nucleic acid molecule may be a non-

naturally occurring molecule, *e.g.*, a recombinant DNA or RNA, an artificial chromosome, an engineered genome (*e.g.,* an engineered viral vector), an engineered vector, or fragment thereof, or a synthetic DNA, RNA, or DNA/RNA hybrid, optionally including non-naturally occurring nucleotides or nucleosides. Furthermore, the terms "nucleic acid," "DNA," "RNA," and/or similar terms include nucleic acid analogs, *e.g.,* analogs having other than a phosphodiester backbone. Nucleic acids can be purified from natural sources, produced using recombinant expression systems and optionally purified, chemically synthesized, *etc.* Where appropriate, *e.g.*, in the case of chemically synthesized molecules, nucleic acids can comprise nucleoside analogs such as analogs having chemically modified bases or sugars, and backbone modifications. A nucleic acid sequence is presented in the 5′ to 3′ direction unless otherwise indicated. In some embodiments, a nucleic acid is or comprises natural nucleosides (*e.g.* adenosine, thymidine, guanosine, cytidine, uridine, deoxyadenosine, deoxythymidine, deoxyguanosine, and deoxycytidine); nucleoside analogs (*e.g.*, 2-aminoadenosine, 2-thiothymidine, inosine, pyrrolo-pyrimidine, 3-methyl adenosine, 5-methylcytidine, 2-aminoadenosine, C5-bromouridine, C5-fluorouridine, C5-iodouridine, C5-propynyl-uridine, C5-propynyl-cytidine, C5-methylcytidine, 2-aminoadenosine, 7-deazaadenosine, 7-deazaguanosine, 8-oxoadenosine, 8-oxoguanosine, O(6)-methylguanine, and 2-thiocytidine); chemically modified bases; biologically modified bases (*e.g.*, methylated bases); intercalated bases; modified sugars (*e.g.*, 2′-fluororibose, ribose, 2′-deoxyribose, arabinose, and hexose); and/or modified phosphate groups (*e.g.*, phosphorothioates and 5′-*N*-phosphoramidite linkages).

[0090] The terms "protein," "peptide," and "polypeptide" are used interchangeably herein, and refer to a polymer of amino acid residues linked together by peptide (amide) bonds. The terms refer to a protein, peptide, or polypeptide of any size, structure, or function. Typically, a protein, peptide, or polypeptide will be at least three amino acids long. A protein, peptide, or polypeptide may refer to an individual protein or a collection of proteins. One or more of the amino acids in a protein, peptide, or polypeptide may be modified, for example, by the addition of a chemical entity such as a carbohydrate group, a hydroxyl group, a phosphate group, a farnesyl group, an isofarnesyl group, a fatty acid group, a linker for conjugation, functionalization, or other modification, *etc.* A protein, peptide, or polypeptide may also be a single molecule or may be a multi-molecular complex. A protein, peptide, or polypeptide may be just a fragment of a naturally occurring protein or peptide. A protein, peptide, or polypeptide may be naturally

occurring, recombinant, or synthetic, or any combination thereof. The term "fusion protein" as used herein refers to a hybrid polypeptide which comprises protein domains from at least two different proteins. One protein may be located at the amino-terminal (N-terminal) portion of the fusion protein or at the carboxy-terminal (C-terminal) protein thus forming an "amino-terminal fusion protein" or a "carboxy-terminal fusion protein," respectively. A protein may comprise different domains, for example, a nucleic acid binding domain (*e.g.*, the gRNA binding domain of Cas9 that directs the binding of the protein to a target site) and a nucleic acid cleavage domain or a catalytic domain of a nucleic-acid editing protein. In some embodiments, a protein is in a complex with, or is in association with, a nucleic acid, *e.g.*, RNA or DNA. Any of the proteins provided herein may be produced by any method known in the art. For example, the proteins provided herein may be produced via recombinant protein expression and purification, which is especially suited for fusion proteins comprising a peptide linker. Methods for recombinant protein expression and purification are well known, and include those described by Green and Sambrook, *Molecular Cloning: A Laboratory Manual* (4th ed., Cold Spring Harbor Laboratory Press, Cold Spring Harbor, N.Y. (2012)), which are incorporated herein by reference.

[0091] The term "subject," as used herein, refers to an individual organism, for example, an individual mammal. In some embodiments, the subject is a human. In some embodiments, the subject is a non-human mammal. In some embodiments, the subject is a non-human primate. In some embodiments, the subject is a rodent (*e.g.*, mouse, rat). In some embodiments, the subject is a domesticated animal. In some embodiments, the subject is a sheep, a goat, a cow, a cat, or a dog. In some embodiments, the subject is a research animal. In some embodiments, the subject is genetically engineered, *e.g.*, a genetically engineered non-human subject. The subject may be of either sex and at any stage of development.

[0092] The term "recombinant" as used herein in the context of proteins or nucleic acids refers to proteins or nucleic acids that do not occur in nature, but are the product of human engineering. For example, in some embodiments, a recombinant protein or nucleic acid molecule comprises an amino acid or nucleotide sequence that comprises at least one, at least two, at least three, at least four, at least five, at least six, or at least seven mutations as compared to any naturally occurring sequence. The fusion proteins (*e.g.*, base editors) described herein are made recombinantly. Recombinant technology is familiar to those skilled in the art.

[0093] The term "pharmaceutically-acceptable carrier" means a pharmaceutically-acceptable material, composition or vehicle, such as a liquid or solid filler, diluent, excipient, manufacturing aid (*e.g.*, lubricant, talc magnesium, calcium or zinc stearate, or steric acid), or solvent encapsulating material, involved in carrying or transporting the compound from one site (*e.g.*, the delivery site) of the body, to another site (*e.g.*, organ, tissue or portion of the body). A pharmaceutically acceptable carrier is "acceptable" in the sense of being compatible with the other ingredients of the formulation and not injurious to the tissue of the subject (*e.g.*, physiologically compatible, sterile, physiologic pH, *etc.*).

[0094] "A therapeutically effective amount" as used herein refers to the amount of each therapeutic agent (*e.g.*, nucleobase editor, rAAV) described in the present disclosure required to confer therapeutic effect on the subject, either alone or in combination with one or more other therapeutic agents. Effective amounts vary, as recognized by those skilled in the art, depending on the particular condition being treated, the severity of the condition, the individual subject parameters including age, physical condition, size, gender, and weight, the duration of the treatment, the nature of concurrent therapy (if any), the specific route of administration and like factors within the knowledge and expertise of the health practitioner. These factors are well known to those of ordinary skill in the art and can be addressed with no more than routine experimentation. It is generally preferred that a maximum dose of the individual components or combinations thereof be used, that is, the highest safe dose according to sound medical judgment. It will be understood by those of ordinary skill in the art, however, that a subject may insist upon a lower dose or tolerable dose for medical reasons, psychological reasons or for virtually any other reasons. Empirical considerations, such as the half-life, generally will contribute to the determination of the dosage. For example, therapeutic agents that are compatible with the human immune system, such as polypeptides comprising regions from humanized antibodies or fully human antibodies, may be used to prolong half-life of the polypeptide and to prevent the polypeptide being attacked by the host's immune system.

[0095] "A subject in need thereof" refers to an individual who has a disease, a sign and/or symptom of a disease, or a predisposition toward a disease, with the purpose to cure, heal, alleviate, relieve, alter, remedy, ameliorate, improve, or affect the disease, the symptom of the disease, or the predisposition toward the disease. In some embodiments, the subject is a mammal. In some embodiments, the subject is a non-human primate. In some embodiments, the

subject is human. In some embodiments, the mammal is a rodent. In some embodiments, the rodent is a mouse. In some embodiments, the rodent is a rat. In some embodiments, the mammal is a companion animal. A "companion animal" refers to pets and other domestic animals. Non-limiting examples of companion animals include dogs and cats; livestock, such as horses, cattle, pigs, sheep, goats, and chickens; and other animals, such as mice, rats, guinea pigs, and hamsters.

[0001] The terms "treatment," "treat," and "treating," refer to a clinical intervention aimed to reverse, alleviate, delay the onset of, or inhibit the progress of a disease or disorder, or one or more symptoms thereof, as described herein. As used herein, the terms "treatment," "treat," and "treating" refer to a clinical intervention aimed to reverse, alleviate, delay the onset of, or inhibit the progress of a disease or disorder, or one or more symptoms thereof, as described herein. In some embodiments, treatment may be administered after one or more symptoms have developed and/or after a disease has been diagnosed. In other embodiments, treatment may be administered in the absence of symptoms, *e.g.*, to prevent or delay onset of a symptom or inhibit onset or progression of a disease. For example, treatment may be administered to a susceptible individual prior to the onset of symptoms (*e.g.*, in light of a history of symptoms and/or in light of genetic or other susceptibility factors). Treatment may also be continued after symptoms have resolved, for example, to prevent or delay their recurrence.

DETAILED DESCRIPTION OF CERTAIN EMBODIMENTS

[0096] Provided herein, are compositions (*e.g.*, vectors, recombinant viruses) and kits comprising nucleic acids encoding split Cas9 proteins or nucleobase editors, and methods of delivering a nucleobase editor or a Cas9 protein into a cell using such nucleic acids. The N-terminal portion and C-terminal portion of a nucleobase editor or a Cas9 protein are encoded on separate nucleic acids and delivered into a cell, *e.g.*, a via recombinant adeno-associated virus (rAAV particles) delivery. The polypeptides corresponding to the N-terminal portion and C-terminal portions of the nucleobase editor or Cas9 protein may be joined to form a complete nucleobase editor or Cas9 protein, *e.g.*, via intein-mediated protein splicing.

[0097] Accordingly, some aspects of the present disclosure relate to compositions comprising (i) a first nucleotide sequence encoding an N-terminal portion of a Cas9 protein fused at its C-terminus to an intein-N; and (ii) a second nucleotide sequence encoding an intein-C fused to the

N-terminus of a C-terminal portion of the Cas9 protein, wherein the first nucleotide sequence or second nucleotide sequence is operably linked to a nucleotide sequence encoding at least one bipartite nuclear localization signal (NLS).

[0098] The Cas9 protein encoded by the first and second nucleotide sequence is herein referred as a "split Cas9." The Cas9 protein is known to have a N-terminal lobe and a C-terminal lobe linked by a disordered linker (*e.g.*, as described in Nishimasu *et al.*, Cell, Volume 156, Issue 5, pp. 935–949, 2014, incorporated herein by reference). In some embodiments, the N-terminal portion of the split Cas9 protein comprises the N-terminal lobe of a Cas9 protein. In some embodiments, the C-terminal portion of the split Cas9 comprises the C-terminal lobe of a Cas9 protein. In some embodiments, the N-terminal portion of the split Cas9 comprises a portion of any one of SEQ ID NO: 1-275 and 394-397 that corresponds to amino acids 1-(550-650) in SEQ ID NO: 1. "1-(550-650)" means starting from amino acid 1 and ending anywhere between amino acid 550-650 (inclusive). For example, the N-terminal portion of the split Cas9 may comprise a portion of any one of SEQ ID NOs: 1-275 and 394-397 that corresponds to amino acids 1-550, 1-551, 1-552, 1-553, 1-554, 1-555, 1-556, 1-557, 1-558, 1-559, 1-560, 1-561, 1-562, 1-563, 1-564, 1-565, 1-566, 1-567, 1-568, 1-569, 1-570, 1-571, 1-572, 1-573, 1-574, 1-575, 1-576, 1-577, 1-578, 1-579, 1-580, 1-581, 1-582, 1-583, 1-584, 1-585, 1-586, 1-587, 1-588, 1-589, 1-590, 1-591, 1-592, 1-593, 1-594, 1-595, 1-596, 1-597, 1-598, 1-599, 1-600, 1-601, 1-602, 1-603, 1-604, 1-605, 1-606, 1-607, 1-608, 1-609, 1-610, 1-611, 1-612, 1-613, 1-614, 1-615, 1-616, 1-617, 1-618, 1-619, 1-620, 1-621, 1-622, 1-623, 1-624, 1-625, 1-626, 1-627, 1-628, 1-629, 1-630, 1-631, 1-632, 1-633, 1-634, 1-635, 1-636, 1-637, 1-638, 1-639, 1-640, 1-641, 1-642, 1-643, 1-644, 1-645, 1-646, 1-647, 1-648, 1-649, or 1-650 in SEQ ID NO: 1. In some embodiments, the N-terminal portion of the split Cas9 protein comprises a portion of any one of SEQ ID NOs: 1-275 and 394-397 that corresponds to amino acids 1-573 or 1-637 of SEQ ID NO: 1.

[0099] The C-terminal portion of the split Cas9 can be joined with the N-terminal portion of the split Cas9 to form a complete Cas9 protein. In some embodiments, the C-terminal portion of the Cas9 protein starts from where the N-terminal portion of the Cas9 protein ends. As such, in some embodiments, the C-terminal portion of the split Cas9 comprises a portion of any one of SEQ ID NO: 1-275 and 394-397 that corresponds to amino acids (551-651)-1368 of SEQ ID NO: 1. "(551-651)-1368" means starting at an amino acid between amino acids 551-651 (inclusive) and ending at amino acid 1368. For example, the C-terminal portion of the split Cas9 may comprise a

portion of any one of SEQ ID NO: 1-275 and 394-397 that corresponds to amino acid 551-1368, 552-1368, 553-1368, 554-1368, 555-1368, 556-1368, 557-1368, 558-1368, 559-1368, 560-1368, 561-1368, 562-1368, 563-1368, 564-1368, 565-1368, 566-1368, 567-1368, 568-1368, 569-1368, 570-1368, 571-1368, 572-1368, 573-1368, 574-1368, 575-1368, 576-1368, 577-1368, 578-1368, 579-1368, 580-1368, 581-1368, 582-1368, 583-1368, 584-1368, 585-1368, 586-1368, 587-1368, 588-1368, 589-1368, 590-1368, 591-1368, 592-1368, 593-1368, 594-1368, 595-1368, 596-1368, 597-1368, 598-1368, 599-1368, 600-1368, 601-1368, 602-1368, 603-1368, 604-1368, 605-1368, 606-1368, 607-1368, 608-1368, 609-1368, 610-1368, 611-1368, 612-1368, 613-1368, 614-1368, 615-1368, 616-1368, 617-1368, 618-1368, 619-1368, 620-1368, 621-1368, 622-1368, 623-1368, 624-1368, 625-1368, 626-1368, 627-1368, 628-1368, 629-1368, 630-1368, 631-1368, 632-1368, 633-1368, 634-1368, 635-1368, 636-1368, 637-1368, 638-1368, 639-1368, 640-1368, 641-1368, 642-1368, 643-1368, 644-1368, 645-1368, 646-1368, 647-1368, 648-1368, 649-1368, 650-1368, or 651-1368 of SEQ ID NO: 1. In some embodiments, the C-terminal portion of the split Cas9 protein comprises a portion of any one of SEQ ID NO: 1-275 and 394-397 that corresponds to amino acids 574-1368 or 638-1368 of SEQ ID NO: 1.

[00100] Cas9 variants may also be delivered to cells using the methods described herein. For example, a Cas9 variant may also be "split" as described herein. A Cas9 variant may comprise an amino acid sequence that is at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.5% identical to any one of the Cas9 sequences provided herein. In some embodiments, the Cas9 variant comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 30%, no more than 25%, no more than 20%, no more than 15%, no more than 10%, no more than 5%, no more than 1% longer or shorter) than any of the Cas9 proteins provided herein (*e.g.*, in Example 1). In some embodiments, the UGI comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 200 amino acids, no more than 150 amino acids, no more than 100 amino acids, no more than 50 amino acids, no more than 10 amino acids, no more than 5 amino acids, or no more than 2 amino acids longer or shorter) than any of the Cas9 proteins provided herein.

[00101] In some embodiments, the N-terminal portion of a split Cas9 comprises an amino acid sequence that is at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least

99.5% identical to the corresponding portion of any one of the Cas9 sequences provided herein (*e.g.*, in Example 1). In some embodiments, the N-terminal portion of the split Cas9 comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 30%, no more than 25%, no more than 20%, no more than 15%, no more than 10%, no more than 5%, no more than 1% longer or shorter) than the corresponding portion of any of the Cas9 proteins provided herein. In some embodiments, the N-terminal portion of the split Cas9 comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 200 amino acids, no more than 150 amino acids, no more than 100 amino acids, no more than 50 amino acids, no more than 10 amino acids, no more than 5 amino acids, or no more than 2 amino acids longer or shorter) than the corresponding portion of any of the Cas9 proteins provided herein.

[00102] In some embodiments, the C-terminal portion of a split Cas9 comprises an amino acid sequence that is at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.5% identical to the corresponding portion of any one of the Cas9 sequences provided herein (*e.g.*, in Example 1). In some embodiments, the C-terminal portion of the split Cas9 comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 30%, no more than 25%, no more than 20%, no more than 15%, no more than 10%, no more than 5%, no more than 1% longer or shorter) than the corresponding portion of any of the Cas9 proteins provided herein. In some embodiments, the C-terminal portion of the split Cas9 comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 200 amino acids, no more than 150 amino acids, no more than 100 amino acids, no more than 50 amino acids, no more than 10 amino acids, no more than 5 amino acids, or no more than 2 amino acids longer or shorter) than the corresponding portion of any of the Cas9 proteins provided herein.

[00103] In some embodiments, the Cas9 variant is a dCas9 or nCas9. In some embodiments, the N-terminal portion of the split Cas9 comprises a mutation corresponding to a D10A mutation in SEQ ID NO: 1. In some embodiments, the N-terminal portion of the split Cas9 comprises a mutation corresponding to a D10A mutation in SEQ ID NO: 1 and the C-terminal portion of the split Cas9 comprises a mutation corresponding to a H840A mutation in SEQ ID NO:1. In some embodiments, the N-terminal portion of the split Cas9 comprises a mutation corresponding to a D10A mutation in SEQ ID NO: 1, and the C-terminal portion of the split Cas9 comprises a histidine at the position corresponding to position 840 in SEQ ID NO:1.

[00104] In some embodiments, to join the N-terminal portion of the Cas9 protein and the C-terminal portion of the Cas9 protein, an intein system may be used. In some embodiments, the N-terminal portion of the Cas9 is fused to an intein-N. In some embodiments, the intein-N is fused to the C-terminus of the N-terminal portion of the Cas9 to form a structure of NH_2-[N-terminal portion of Cas9]-[intein-N]-COOH. In some embodiments, the intein-N is encoded by the dnaE-n gene. In some embodiments, the intein-N comprises the amino acid sequence of any one of SEQ ID NOs: 350-351 and 354-355. In some embodiments, the C-terminal portion of the Cas9 is fused to an intein-C, and the intein-C is fused to the N-terminus of the C-terminal portion of the Cas9 to form a structure of NH_2-[intein-C]-[C-terminal portion of Cas9]-COOH. In some embodiments, the intein-C is encoded by the dnaE-c gene. In some embodiments, the intein-C comprises the amino acid sequence of any one of SEQ ID NOs: 352-353 and 356-357. Other split intein systems may also be used in the present disclosure and are known in the art.

[00105] Split nucleobase editors may be used in the present disclosure. Some aspects of the present disclosure relate to compositions comprising (i) a first nucleotide sequence encoding an N-terminal portion of a nucleobase editor fused at its C-terminus to an intein-N; and (ii) a second nucleotide sequence encoding an intein-C fused to the N-terminus of a C-terminal portion of the nucleobase editor.

[00106] Nucleobase editor variants are contemplated. For example, a nucleobase editor variant may also be "split" as described herein. A nucleobase editor variant may comprise an amino acid sequence that is at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.5% identical to any one of the nucleobase editor sequences (SEQ ID NOs: X-X) provided herein.

[00107] In some embodiments, the N-terminal portion of a split nucleobase editor comprises an amino acid sequence that is at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.5% identical to the corresponding portion of any one of the nucleobase editors provided herein (*e.g.*, in Example 1). In some embodiments, the N-terminal portion of the split nucleobase editor comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 30%, no more than 25%, no more than 20%, no more than 15%, no more than 10%, no more than 5%, no more than 1% longer or shorter) than the corresponding portion of any of the

nucleobase editors provided herein. In some embodiments, the N-terminal portion of the split nucleobase editor comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 200 amino acids, no more than 150 amino acids, no more than 100 amino acids, no more than 50 amino acids, no more than 10 amino acids, no more than 5 amino acids, or no more than 2 amino acids longer or shorter) than the corresponding portion of any of the nucleobase editors provided herein.

[00108] In some embodiments, the C-terminal portion of a split nucleobase editor comprises an amino acid sequence that is at least 60%, at least 65%, at least 70%, at least 75%, at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.5% identical to the corresponding portion of any one of the nucleobase editors provided herein (*e.g.*, in Example 1). In some embodiments, the C-terminal portion of the split nucleobase editor comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 30%, no more than 25%, no more than 20%, no more than 15%, no more than 10%, no more than 5%, no more than 1% longer or shorter) than the corresponding portion of any of the nucleobase editors provided herein. In some embodiments, the C-terminal portion of the split nucleobase editor comprises an amino acid sequence that is shorter or longer in length (*e.g.*, by no more than 200 amino acids, no more than 150 amino acids, no more than 100 amino acids, no more than 50 amino acids, no more than 10 amino acids, no more than 5 amino acids, or no more than 2 amino acids longer or shorter) than the corresponding portion of any of the nucleobase editors provided herein.

[00109] As described herein, the N-terminal portion of a nucleobase editor comprises the N-terminal portion of a nuclease-inactive Cas9 protein (dCas9) or a Cas9 nickase (nCas9) . In some embodiments, the N-terminal portion of a nucleobase editor further comprises a nucleobase modifying enzyme (*e.g.*, nucleases, nickases, recombinases, deaminases, DNA repair enzymes, DNA damage enzymes, dismutases, alkylation enzymes, depurination enzymes, oxidation enzymes, pyrimidine dimer forming enzymes, integrases, transposases, polymerases, ligases, helicases, photolyases, glycosylases, epigenetic modifiers such as methylases, acetylases, methyltransferase, demethylase, *etc.*). In some embodiments, the nucleobase modifying enzyme is a deaminase (*e.g.*, a cytosine deaminase or an adenosine deaminase, or functional variants thereof). In some embodiments, the nucleobase modifying enzyme is fused to the N-terminus of the N-terminal portion of the split dCas9 or split nCas9. In some embodiments, the N-terminal

portion of the nucleobase editor has of the structure: NH_2-[nucleobase modifying enzyme]-[N-terminal portion of dCas9 or nCas9]-COOH. In some embodiments, the N-terminal portion of the nucleobase editor is fused to an intein N. In some embodiments, the intein-N is fused to the C-terminus of the N-terminal portion of the nucleobase editor.

[00110] In some embodiments, the first nucleotide sequence encodes a polypeptide comprising the structure NH_2-[nucleobase modifying enzyme]-[N-terminal portion of dCas9 or nCas9]-[intein-N]-COOH.

[00111] In some embodiments, the C-terminal portion of the nucleobase editor comprises the C-terminal portion of a nuclease-inactive Cas9 protein (dCas9) or a Cas9 nickase (nCas9). In some embodiments, the nucleobase modifying enzyme is fused to the C-terminus of the C-terminal portion of the split dCas9 or split nCas9. In some embodiments, the C-terminal portion of the nucleobase editoris of the structure: NH_2-[C-terminal portion of dCas9 or nCas9]-[nucleobase modifying enzyme]-COOH. In some embodiments, the C-terminal portion of the nucleobase editor comprises an intein-C fused to the C-terminal portion of the Cas9 protein. In some embodiments, the intein-C is fused to the N-terminus of the C-terminal portion of the nucleobase editor. In some embodiments, the second nucleotide sequence encodes a polypeptide of the structure: NH_2-[intein-C]-[C-terminal portion of the Cas9 protein]-COOH.

[00112] In some embodiments, the N-terminal portion of a split nucleobase editor further comprises an inhibitor of uracil glycosylase (UGI). In some embodiments, the first nucleotide sequence encodes a polypeptide of the structure: NH_2-[UGI]-[nucleobase modifying enzyme]-[N-terminal portion of dCas9 or nCas9]-[intein-N]. In some embodiments, the first nucleotide sequence encodes a polypeptide is of the structure: NH_2-[nucleobase modifying enzyme]-[UGI]-[N-terminal portion of dCas9 or nCas9]-[intein-N].

[00113] In some embodiments, the C-terminal portion of a split nucleobase editor further comprises an enzyme that inhibits the activity of uracil glycosylase (UGI). In some embodiments, the second nucleotide sequence encodes a polypeptide of the structure: NH_2-[intein-C]-[C-terminal portion of dCas9 or nCas9]-[UGI]-COOH. In some embodiments, the second nucleotide sequence encodes a polypeptide of the structure: NH_2-[intein-C]-[C-terminal portion of dCas9 or nCas9]-[nucleobase modifying enzyme]-[UGI]-COOH. In some embodiments, the second nucleotide sequence encodes a polypeptide of the structure: NH_2-

[intein-C]-[C-terminal portion of dCas9 or nCas9]-[UGI]-[nucleobase modifying enzyme]-COOH.

[00114] In some embodiments, when the N-terminal portion and the C-terminal portion of the nucleobase are joined, to form a complete split nucleobase editor. In some embodiments, the split nucleobase editor may comprise any one of the following structures:

NH_2-[nucleobase modifying enzyme]-[dCas9 or nCas9]-COOH

NH_2-[UGI]-[nucleobase modifying enzyme]-[dCas9 or nCas9]-COOH

NH_2-[nucleobase modifying enzyme]-[UGI]-[dCas9 or nCas9]-COOH

NH_2-[nucleobase modifying enzyme]-[dCas9 or nCas9]-[UGI]-COOH

NH_2-[dCas9 or nCas9]-[nucleobase modifying enzyme]-COOH

NH_2-[UGI]-[dCas9 or nCas9]-[nucleobase modifying enzyme]-COOH

NH_2-[dCas9 or nCas9]-[UGI]-[nucleobase modifying enzyme]-COOH or

NH_2-[dCas9 or nCas9]-[nucleobase modifying enzyme]-[UGI]-COOH.

[00115] In some embodiments, the first nucleotide sequence or the second nucleotide sequence (encoding either the split Cas9 protein or the split nucleobase editor) is operably linked to a nucleotide sequence encoding at least one bipartite nuclear localization signal (NLS). For example, the first nucleotide sequence may be operably linked to a nucleotide sequence encoding one or more (*e.g.*, 2, 3, 4, 5, or more) bipartite NLS. In some embodiments, the second nucleotide sequence may be operably linked to a nucleotide sequence encoding one or more (*e.g.*, 2, 3, 4, 5, or more) bipartite NLSs. As such, the split Cas9 or split nucleobase editor formed by joining the N-terminal portion and the C-terminal portion may comprise one or more bipartite NLSs. For example, the split Cas9 or split nucleobase editor may comprise any one of the following structures (bNLS means one or more bipartite nuclear localization signals):

NH_2-bNLS-[Cas9]-COOH

NH_2-[Cas9]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-[dCas9 or nCas9]-COOH

NH_2-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-COOH

NH_2-[nucleobase modifying enzyme]-[dCas9 or nCas9]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-[dCas9 or nCas9]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-[dCas9 or nCas9]-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-bNLS-COOH

NH_2-bNLS-[UGI]-[nucleobase modifying enzyme]-[dCas9 or nCas9]-COOH

NH_2-[UGI]-bNLS-[nucleobase modifying enzyme]-[dCas9 or nCas9]-COOH

NH_2-[UGI]-[nucleobase modifying enzyme]-bNLS[dCas9 or nCas9]-COOH

NH_2-[UGI]-[nucleobase modifying enzyme]-[dCas9 or nCas9]-bNLS-COOH

NH_2-bNLS-[UGI]-bNLS-[nucleobase modifying enzyme]-[dCas9 or nCas9]-COOH

NH_2-bNLS-[UGI]-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-COOH

NH_2-bNLS-[UGI]-[nucleobase modifying enzyme]-[dCas9 or nCas9]-bNLS-COOH

NH_2-[UGI]-bNLS-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-COOH

NH_2-[UGI]-bNLS-[nucleobase modifying enzyme]-[dCas9 or nCas9]-bNLS-COOH

NH_2-[UGI]-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-bNLS-COOH

NH_2-bNLS-[UGI]-bNLS-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-COOH

NH_2-bNLS-[UGI]-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-bNLS-COOH

NH_2-[UGI]-bNLS-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-bNLS-COOH

NH_2-bNLS-[UGI]-bNLS-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-[UGI]-[dCas9 or nCas9]-COOH

NH_2-[nucleobase modifying enzyme]-bNLS-[UGI]-[dCas9 or nCas9]-COOH

NH_2-[nucleobase modifying enzyme]-[UGI]-bNLS-[dCas9 or nCas9]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-bNLS-[UGI]-[dCas9 or nCas9]-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-[UGI]-bNLS-[dCas9 or nCas9]-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-[UGI]-[dCas9 or nCas9]-bNLS-COOH

NH_2-[nucleobase modifying enzyme]-bNLS-[UGI]-bNLS-[dCas9 or nCas9]-COOH

NH_2-[nucleobase modifying enzyme]-bNLS-[UGI]-[dCas9 or nCas9]-bNLS-COOH

NH_2-[nucleobase modifying enzyme]-[UGI]-bNLS-[dCas9 or nCas9]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-bNLS-[UGI]-bNLS-[dCas9 or nCas9]-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-bNLS-[UGI]-[dCas9 or nCas9]-bNLS-COOH

NH_2-[nucleobase modifying enzyme]-bNLS-[UGI]-bNLS-[dCas9 or nCas9]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-bNLS-[UGI]-bNLS-[dCas9 or nCas9]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-[dCas9 or nCas9]-[UGI]-COOH

NH_2-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-[UGI]-COOH

NH_2-[nucleobase modifying enzyme]-[dCas9 or nCas9]-bNLS-[UGI]-COOH

NH_2-[nucleobase modifying enzyme]-[dCas9 or nCas9]-[UGI]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-[UGI]-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-[dCas9 or nCas9]-bNLS-[UGI]-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-[dCas9 or nCas9]-[UGI]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-bNLS-[UGI]-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-[UGI]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-[dCas9 or nCas9]-bNLS-[UGI]-bNLS-COOH

NH_2-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-bNLS-[UGI]-bNLS-COOH

NH_2-bNLS-[nucleobase modifying enzyme]-bNLS-[dCas9 or nCas9]-bNLS-[UGI]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-[nucleobase modifying enzyme]-COOH

NH_2-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-COOH

NH_2-[dCas9 or nCas9]-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-COOH

NH_2-bNLS-[dCas9 or nCas9]-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[UGI]-[dCas9 or nCas9]-[nucleobase modifying enzyme]-COOH

NH_2-[UGI]-bNLS-[dCas9 or nCas9]-[nucleobase modifying enzyme]-COOH

NH_2-[UGI]-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-COOH

NH_2-[UGI]-[dCas9 or nCas9]-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[UGI]-bNLS-[dCas9 or nCas9]-[nucleobase modifying enzyme]-COOH

NH_2-bNLS-[UGI]-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-COOH

NH_2-bNLS-[UGI]-[dCas9 or nCas9]-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-[UGI]-bNLS-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-COOH

NH_2-[UGI]-bNLS-[dCas9 or nCas9]-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-[UGI]-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[UGI]-bNLS-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-COOH

NH_2-bNLS-[UGI]-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[UGI]-bNLS-[dCas9 or nCas9]-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-[UGI]-bNLS-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[UGI]-bNLS-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-[UGI]-[nucleobase modifying enzyme]-COOH

NH_2-[dCas9 or nCas9]-bNLS-[UGI]-[nucleobase modifying enzyme]-COOH

NH_2-[dCas9 or nCas9]-[UGI]-bNLS-[nucleobase modifying enzyme]-COOH

NH_2-[dCas9 or nCas9]-[UGI]-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-bNLS[UGI]-[nucleobase modifying enzyme]-COOH

NH_2-bNLS-[dCas9 or nCas9]-[UGI]-bNLS-[nucleobase modifying enzyme]-COOH

NH_2-bNLS-[dCas9 or nCas9]-[UGI]-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-[dCas9 or nCas9]-bNLS-[UGI]-bNLS-[nucleobase modifying enzyme]-COOH

NH_2-[dCas9 or nCas9]-bNLS-[UGI]-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-[dCas9 or nCas9]-[UGI]-bNLS-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-bNLS-[UGI]-bNLS-[nucleobase modifying enzyme]-COOH

NH_2-bNLS-[dCas9 or nCas9]-bNLS-[UGI]-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-[UGI]-bNLS-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-[dCas9 or nCas9]-bNLS-[UGI]-bNLS-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-bNLS-[UGI]-bNLS-[nucleobase modifying enzyme]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-[nucleobase modifying enzyme]-[UGI]-COOH

NH_2-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-[UGI]-COOH

NH_2-[dCas9 or nCas9]-[nucleobase modifying enzyme]-bNLS-[UGI]-COOH

NH_2-[dCas9 or nCas9]-[nucleobase modifying enzyme]-[UGI]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-[UGI]-COOH

NH_2-bNLS-[dCas9 or nCas9]-[nucleobase modifying enzyme]-bNLS-[UGI]-COOH

NH_2-bNLS-[dCas9 or nCas9]-[nucleobase modifying enzyme]-[UGI]-bNLS-COOH

NH_2-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-bNLS-[UGI]-COOH

NH_2-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-[UGI]-bNLS-COOH

NH_2-[dCas9 or nCas9]-[nucleobase modifying enzyme]-bNLS-[UGI]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-bNLS-[UGI]-COOH

NH_2-bNLS-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-[UGI]-bNLS-COOH

NH_2-bNLS-[dCas9 or nCas9]-[nucleobase modifying enzyme]-bNLS-[UGI]-bNLS-COOH

NH_2-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-bNLS-[UGI]-bNLS-COOH or

NH_2-bNLS-[dCas9 or nCas9]-bNLS-[nucleobase modifying enzyme]-bNLS-[UGI]-bNLS-COOH

[00116] Herein, "NH_2-" represents the N-terminus of a protein or polypeptide, and "-COOH" represents the C-terminus of a protein or polypeptide. "]-[" represents a peptide bond or a linker. In some embodiments, linkers may be used to link any of the protein or protein domains described herein. The linker may be as simple as a covalent bond, or it may be a polymeric linker many atoms in length. In some embodiments, the linker is a polypeptide or based on

amino acids. In some embodiments, the linker is not peptide-like. In some embodiments, the linker is a covalent bond (*e.g.*, a carbon-carbon bond, disulfide bond, carbon-heteroatom bond, etc.). In some embodiments, the linker is a carbon-nitrogen bond of an amide linkage. In some embodiments, the linker is a cyclic or acyclic, substituted or unsubstituted, branched or unbranched aliphatic or heteroaliphatic linker. In some embodiments, the linker is polymeric (*e.g.*, polyethylene, polyethylene glycol, polyamide, polyester, etc.). In some embodiments, the linker comprises a monomer, dimer, or polymer of aminoalkanoic acid. In some embodiments, the linker comprises an aminoalkanoic acid (*e.g.*, glycine, ethanoic acid, alanine, beta-alanine, 3-aminopropanoic acid, 4-aminobutanoic acid, 5-pentanoic acid, etc.). In some embodiments, the linker comprises a monomer, dimer, or polymer of aminohexanoic acid (Ahx). In some embodiments, the linker is based on a carbocyclic moiety (*e.g.*, cyclopentane, cyclohexane). In some embodiments, the linker comprises a polyethylene glycol moiety (PEG). In some embodiments, the linker comprises amino acids. In some embodiments, the linker comprises a peptide. In some embodiments, the linker comprises an aryl or heteroaryl moiety. In some embodiments, the linker is based on a phenyl ring. The linker may include functionalized moieties to facilitate attachment of a nucleophile (*e.g.*, thiol, amino) from the peptide to the linker. Any electrophile may be used as part of the linker. Exemplary electrophiles include, but are not limited to, activated esters, activated amides, Michael acceptors, alkyl halides, aryl halides, acyl halides, and isothiocyanates.

[00117] In some embodiments, the linker is an amino acid or a plurality of amino acids (*e.g.*, a peptide or protein). In some embodiments, the linker is a bond (*e.g.*, a covalent bond), an organic molecule, group, polymer, or chemical moiety. In some embodiments, the linker is 5-100 amino acids in length, for example, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 30-35, 35-40, 40-45, 45-50, 50-60, 60-70, 70-80, 80-90, 90-100, 100-110, 110-120, 120-130, 130-140, 140-150, or 150-200 amino acids in length. Longer or shorter linkers are also contemplated. In some embodiments, a linker comprises the amino acid sequence SGSETPGTSESATPES (SEQ ID NO: 377), which may also be referred to as the XTEN linker. In some embodiments, a linker comprises the amino acid sequence: SGGS (SEQ ID NO: 378). In some embodiments, a linker comprises the amino acid sequence: $(SGGS)_n$ (SEQ ID NO: 379), $(GGGS)_n$ (SEQ ID NO: 380), $(GGGGS)_n$ (SEQ ID NO: 381), $(G)_n$ (SEQ ID NO: 390), $(EAAAK)_n$ (SEQ ID NO: 382), $(GGS)_n$, SGSETPGTSESATPES (SEQ ID NO: 377),

or $(XP)_n$ motif, or a combination of any of these, wherein n is independently an integer between 1 and 30, inclusive, and wherein X is any amino acid. In some embodiments, n is 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, or 15. In some embodiments, the linker comprises the amino acid sequence: SGSETPGTSESATPES (SEQ ID NO: 377), and SGGS (SEQ ID NO: 378). In some embodiments, the linker comprises the amino acid sequence: SGGSSGSETPGTSESATPESSGGS (SEQ ID NO: 383). In some embodiments, a linker comprises the amino acid sequence: SGGSSGGSSGSETPGTSESATPESSGGSSGGS (SEQ ID NO: 384). In some embodiments, a linker comprises the amino acid sequence: GGSGGSPGSPAGSPTSTEEGTSESATPESGPGTSTEPSEGSAPGSPAGSPTSTEEGTSTEPSEGSAPGTSTEPSEGSAPGTSESATPESGPGSEPATSGGSGGS (SEQ ID NO: 385).

[00118] In some embodiments, the linker is 24 amino acids in length. In some embodiments, the linker comprises the amino acid sequence SGGSSGGSSGSETPGTSESATPES (SEQ ID NO: 343). In some embodiments, the linker is 40 amino acids in length. In some embodiments, the linker comprises the amino acid sequence SGGSSGGSSGSETPGTSESATPESSGGSSGGSSGGSSGGS (SEQ ID NO: 391). In some embodiments, the linker is 64 amino acids in length. In some embodiments, the linker comprises the amino acid sequence SGGSSGGSSGSETPGTSESATPESSGGSSGGSSGGSSGGSSGSETPGTSESATPESSGGSSGGS (SEQ ID NO: 392). In some embodiments, the linker is 92 amino acids in length. In some embodiments, the linker comprises the amino acid sequence PGSPAGSPTSTEEGTSESATPESGPGTSTEPSEGSAPGSPAGSPTSTEEGTSTEPSEGSAPGTSTEPSEGSAPGTSESATPESGPGSEPATS (SEQ ID NO: 393).

[00119] In some embodiments, the first and second nucleotide sequences are on the same nucleic acid vector. In some embodiments, the first and second nucleotide sequences are on different nucleic acid vectors. In some embodiments, the vector is a plasmid. In some embodiments, the nucleic acid vector is a recombinant genome of a adeno-associated virus (rAAV). In some embodiments, the nucleic acid vector is the genome of an adeno-associated virus packaged in a rAAV particle. In some embodiments, the first and/or the second nucleotide sequence is operably linked to a promoter. In some embodiments, the nucleic acid vector further comprise a nucleotide sequence encoding one or more (*e.g.*, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or more) gRNAs

operably linked to a promoter. In some embodiments, the promoter is a constitutive promoter. In some embodiments, the promoter is an inducible promoter.

[00120] An inducible promoter of the present disclosure may be induced by (or repressed by) one or more physiological condition(s), such as changes in light, pH, temperature, radiation, osmotic pressure, saline gradients, cell surface binding, and the concentration of one or more extrinsic or intrinsic inducing agent(s). An extrinsic inducer signal or inducing agent may comprise, without limitation, amino acids and amino acid analogs, saccharides and polysaccharides, nucleic acids, protein transcriptional activators and repressors, cytokines, toxins, petroleum-based compounds, metal containing compounds, salts, ions, enzyme substrate analogs, hormones, or combinations thereof.

[00121] Inducible promoters of the present disclosure include any inducible promoter described herein or known to one of ordinary skill in the art. Examples of inducible promoters include, without limitation, chemically/biochemically-regulated and physically-regulated promoters such as alcohol-regulated promoters, tetracycline-regulated promoters (*e.g.*, anhydrotetracycline (aTc)-responsive promoters and other tetracycline-responsive promoter systems, which include a tetracycline repressor protein (tetR), a tetracycline operator sequence (tetO) and a tetracycline transactivator fusion protein (tTA)), steroid-regulated promoters (*e.g.*, promoters based on the rat glucocorticoid receptor, human estrogen receptor, moth ecdysone receptors, and promoters from the steroid/retinoid/thyroid receptor superfamily), metal-regulated promoters (*e.g.*, promoters derived from metallothionein (proteins that bind and sequester metal ions) genes from yeast, mouse and human), pathogenesis-regulated promoters (*e.g.*, induced by salicylic acid, ethylene or benzothiadiazole (BTH)), temperature/heat-inducible promoters (*e.g.*, heat shock promoters), and light-regulated promoters (*e.g.*, light responsive promoters from plant cells). Other inducible promoter systems are known in the art and may be used in accordance with the present disclosure.

[00122] In some embodiments, inducible promoters of the present disclosure function in prokaryotic cells (*e.g.*, bacterial cells). Examples of inducible promoters for use prokaryotic cells include, without limitation, bacteriophage promoters (*e.g.* Pls1con, T3, T7, SP6, PL) and bacterial promoters (*e.g.*, Pbad, PmgrB, Ptrc2, Plac/ara, Ptac, Pm), or hybrids thereof (*e.g.* PLlacO, PLtetO). Examples of bacterial promoters for use in accordance with the present disclosure include, without limitation, positively regulated *E. coli* promoters, such as positively

regulated σ70 promoters (*e.g.*, inducible pBad/araC promoter, Lux cassette right promoter, modified lamdba Prm promote, plac Or2-62 (positive), pBad/AraC with extra REN sites, pBad, P(Las) TetO, P(Las) CIO, P(Rhl), Pu, FecA, pRE, cadC, hns, pLas, pLux), σS promoters (*e.g.*, Pdps), σ32 promoters (*e.g.*, heat shock), and σ54 promoters (*e.g.*, glnAp2); negatively regulated *E. coli* promoters such as negatively regulated σ70 promoters (*e.g.*, Promoter (PRM+), modified lamdba Prm promoter, TetR - TetR-4C P(Las) TetO, P(Las) CIO, P(Lac) IQ, RecA_DlexO_DLacO1, dapAp, FecA, Pspac-hy, pcI, plux-cI, plux-lac, CinR, CinL, glucose controlled, modified Pr, modified Prm+, FecA, Pcya, rec A (SOS), Rec A (SOS), EmrR_regulated, BetI_regulated, pLac_lux, pTet_Lac, pLac/Mnt, pTet/Mnt, LsrA/cI, pLux/cI, LacI, LacIQ, pLacIQ1, pLas/cI, pLas/Lux, pLux/Las, pRecA with LexA binding site, reverse BBa_R0011, pLacI/ara-1, pLacIq, rrnB P1, cadC, hns, PfhuA, pBad/araC, nhaA, OmpF, RcnR), σS promoters (*e.g.*, Lutz-Bujard LacO with alternative sigma factor σ38), σ32 promoters (*e.g.*, Lutz-Bujard LacO with alternative sigma factor σ32), and σ54 promoters (*e.g.*, glnAp2); negatively regulated B. subtilis promoters such as repressible B. subtilis σA promoters (*e.g.*, Gram-positive IPTG-inducible, Xyl, hyper-spank) and σB promoters. Other inducible microbial promoters may be used in accordance with the present disclosure.

[00123] In some embodiments, inducible promoters of the present disclosure function in eukaryotic cells (*e.g.*, mammalian cells). Examples of inducible promoters for use eukaryotic cells include, without limitation, chemically-regulated promoters (*e.g.*, alcohol-regulated promoters, tetracycline-regulated promoters, steroid-regulated promoters, metal-regulated promoters, and pathogenesis-related (PR) promoters) and physically-regulated promoters (*e.g.*, temperature-regulated promoters and light-regulated promoters).

Recombinant Adeno-associated Virus (rAAV)

[00124] Some aspects of the present disclosure relate to using recombinant adeno-associated virus vectors for the delivery of a split Cas9 protein or a split nucleobase editor into a cell. The N-terminal portion of the Cas9 protein or the nucleobase editor and the C-terminal portion of the Cas9 protein or the nucleobase editor are delivered by separate rAAV vectors or particles into the same cell, since the full-length Cas9 protein or nucleobase editors exceeds the packaging limit of rAAV (~4.9 kb).

[00125] As such, in some embodiments, a composition for delivering the split Cas9 protein or split nucleobase editor into a cell (*e.g.*, a mammalian cell, a human cell) is provided. In some embodiments, the composition of the present disclosure comprises: (i) a first recombinant adeno-associated virus (rAAV) particle comprising a first nucleotide sequence encoding a N-terminal portion of a Cas9 protein or nucleobase editor fused at its C-terminus to an intein-N; and (ii) a second recombinant adeno-associated virus (rAAV) particle comprising a second nucleotide sequence encoding an intein-C fused to the N-terminus of a C-terminal portion of the Cas9 protein or nucleobase editor. The rAAV particles of the present disclosure comprise a rAAV vector (*i.e.*, a recombinant genome of the rAAV) encapsidated in the viral capsid proteins.

[00126] In some embodiments, the rAAV vector comprises: (1) a heterologous nucleic acid region comprising the first or second nucleotide sequence encoding the N-terminal portion or C-terminal portion of a split Cas9 protein or a split nucleobase editor in any form as described herein, (2) one or more nucleotide sequences comprising a sequence that facilitates expression of the heterologous nucleic acid region (*e.g.*, a promoter), and (3) one or more nucleic acid regions comprising a sequence that facilitate integration of the heterologous nucleic acid region (optionally with the one or more nucleic acid regions comprising a sequence that facilitates expression) into the genome of a cell. In some embodiments, viral sequences that facilitate integration comprise Inverted Terminal Repeat (ITR) sequences. In some embodiments, the first or second nucleotide sequence encoding the N-terminal portion or C-terminal portion of a split Cas9 protein or a split nucleobase editor is flanked on each side by an ITR sequence. In some embodiments, the nucleic acid vector further comprises a region encoding an AAV Rep protein as described herein, either contained within the region flanked by ITRs or outside the region. The ITR sequences can be derived from any AAV serotype (*e.g.*, 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10) or can be derived from more than one serotype. In some embodiments, the ITR sequences are derived from AAV2 or AAV6.

[00127] ITR sequences and plasmids containing ITR sequences are known in the art and commercially available (see, *e.g.*, products and services available from Vector Biolabs, Philadelphia, PA; Cellbiolabs, San Diego, CA; Agilent Technologies, Santa Clara, Ca; and Addgene, Cambridge, MA; and Gene delivery to skeletal muscle results in sustained expression and systemic delivery of a therapeutic protein. Kessler PD, Podsakoff GM, Chen X, McQuiston SA, Colosi PC, Matelis LA, Kurtzman GJ, Byrne BJ. Proc Natl Acad Sci USA. 1996 Nov

26;93(24):14082-7; and Curtis A. Machida. Methods in Molecular Medicine™. Viral Vectors for Gene Therapy Methods and Protocols. 10.1385/1-59259-304-6:201 © Humana Press Inc. 2003. Chapter 10. Targeted Integration by Adeno-Associated Virus. Matthew D. Weitzman, Samuel M. Young Jr., Toni Cathomen and Richard Jude Samulski; U.S. Pat. Nos. 5,139,941 and 5,962,313, all of which are incorporated herein by reference). Exemplary ITR sequences are provided below.

AAV2:
TTGGCCACTCCCTCTCTGCGCGCTCGCTCGCTCACTGAGGCCGGGCGACCAAAGGTC GCCCGACGCCCGGGCTTTGCCCGGGCGGCCTCAGTGAGCGAGCGAGCGCGCAGAGA GGGAGTGGCCAACTCCATCACTAGGGGTTCCT (SEQ ID NO: 386)

AAV3:
TTGGCCACTCCCTCTATGCGCACTCGCTCGCTCGGTGGGGCCTGGCGACCAAAGGTC GCCAGACGGACGTGCTTTGCACGTCCGGCCCCACCGAGCGAGCGAGTGCGCATAGA GGGAGTGGCCAACTCCATCACTAGAGGTATGGC (SEQ ID NO: 387)

AAV5:
CTCTCCCCCCTGTCGCGTTCGCTCGCTCGCTGGCTCGTTTGGGGGGGTGGCAGCTCA AAGAGCTGCCAGACGACGGCCCTCTGGCCGTCGCCCCCCCAAACGAGCCAGCGAGC GAGCGAACGCGACAGGGGGGAGAGTGCCACACTCTCAAGCAAGGGGGTTTTGTA (SEQ ID NO: 388)

AAV6:
TTGCCCACTCCCTCTATGCGCGCTCGCTCGCTCGGTGGGGCCTGCGGACCAAAGGTC CGCAGACGGCAGAGCTCTGCTCTGCCGGCCCCACCGAGCGAGCGAGCGCGCATAGA GGGAGTGGGCAACTCCATCACTAGGGGTA (SEQ ID NO: 389)

[00128] In some embodiments, the rAAV vector of the present disclosure comprises one or more regulatory elements to control the expression of the heterologous nucleic acid region (*e.g.*, promoters, transcriptional terminators, and/or other regulatory elements). In some embodiments, the first and/or second nucleotide sequence is operably linked to one or more (*e.g.*, 1, 2, 3, 4, 5,

or more) transcriptional terminators. Non-limiting examples of transcriptional terminators that may be used in accordance with the present disclosure include transcription terminators of the bovine growth hormone gene (bGH), human growth hormone gene (hGH), SV40, CW3, ϕ, or combinations thereof. The efficiencies of several transcriptional terminators have been tested to determine their respective effects in the expression level of the split Cas9 protein or the split nucleobase editor (*e.g.*, see Figure 4). In some embodiments, the transcriptional terminator used in the present disclosure is a bGH transcriptional terminator. In some embodiments, the rAAV vector further comprises a Woodchuck Hepatitis Virus Posttranscriptional Regulatory Element (WPRE). In some embodiments, the WPRE is inserted 5′ of the transcriptional terminator.

[00129] In some embodiments, the composition comprising the rAAV particle (in any form contemplated herein) further comprises a pharmaceutically acceptable carrier. In some embodiments, the composition is formulated in appropriate pharmaceutical vehicles for administration to human or animal subjects.

[00130] Some examples of materials which can serve as pharmaceutically-acceptable carriers include: (1) sugars, such as lactose, glucose and sucrose; (2) starches, such as corn starch and potato starch; (3) cellulose, and its derivatives, such as sodium carboxymethyl cellulose, methylcellulose, ethyl cellulose, microcrystalline cellulose and cellulose acetate; (4) powdered tragacanth; (5) malt; (6) gelatin; (7) lubricating agents, such as magnesium stearate, sodium lauryl sulfate and talc; (8) excipients, such as cocoa butter and suppository waxes; (9) oils, such as peanut oil, cottonseed oil, safflower oil, sesame oil, olive oil, corn oil and soybean oil; (10) glycols, such as propylene glycol; (11) polyols, such as glycerin, sorbitol, mannitol and polyethylene glycol (PEG); (12) esters, such as ethyl oleate and ethyl laurate; (13) agar; (14) buffering agents, such as magnesium hydroxide and aluminum hydroxide; (15) alginic acid; (16) pyrogen-free water; (17) isotonic saline; (18) Ringer's solution; (19) ethyl alcohol; (20) pH buffered solutions; (21) polyesters, polycarbonates and/or polyanhydrides; (22) bulking agents, such as polypeptides and amino acids (23) serum component, such as serum albumin, HDL and LDL; (22) C2-C12 alcohols, such as ethanol; and (23) other non-toxic compatible substances employed in pharmaceutical formulations. Wetting agents, coloring agents, release agents, coating agents, sweetening agents, flavoring agents, perfuming agents, preservative and antioxidants can also be present in the formulation. The terms such as "excipient", "carrier", "pharmaceutically acceptable carrier" or the like are used interchangeably herein.

Methods of Use

[00131] Other aspects of the present disclosure provide methods of delivering the split Cas9 protein or the split nucleobase editor into a cell to form a complete and functional Cas9 protein or nucleobase editor. For example, in some embodiments, a cell is contacted with a composition described herein (*e.g.*, compositions comprising nucleotide sequences encoding the split Cas9 or the split nucleobase editor or AAV particles containing nucleic acid vectors comprising such nucleotide sequences). In some embodiments, the contacting results in the delivery of such nucleotide sequences into a cell, wherein the N-terminal portion of the Cas9 protein or the nucleobase editor and the C-terminal portion of the Cas9 protein or the nucleobase editor are expressed in the cell and are joined to form a complete Cas9 protein or a complete nucleobase editor.

[00132] The split Cas9 protein or split nucleobase editor delivered using the methods described herein preferably have comparable activity compared to the original Cas9 protein or nucleobase editor (*i.e.*, unsplit protein delivered to a cell or expressed in a cell as a whole). For example, the split Cas9 protein or split nucleobase editor retains at least 50% (*e.g.*, at least 50%, at least 60%, at least 70%, at least 80%, at least 90%, at least 95%, at least 98%, at least 99%, or 100%) of the activity of the original Cas9 protein or nucleobase editor. In some embodiments, the split Cas9 protein or split nucleobase editor is more active (*e.g.*, 2-fold, 5-fold, 10-fold, 100-fold, 1000-fold, or more) than that of an original Cas9 protein or nucleobase editor.

[00133] The compositions described herein may be administered to a subject in need thereof in a therapeutically effective amount to treat and/or prevent a disease or disorder the subject is suffering from. Any disease or disorder that maybe treated and/or prevented using CRISPR/Cas9-based genome-editing technology may be treated by the split Cas9 protein or the split nucleobase editor described herein. It is to be understood that, if the nucleotide sequences encoding the split Cas9 protein or the nucleobase editor does not further encode a gRNA, a separate nucleic acid vector encoding the gRNA may be administered together with the compositions described herein.

[0002] Exemplary suitable diseases and disorders include, without limitation, [[The following diseases were included in the C to T editor application. Please indicate any that are still relevant and could be treated using an adenosine deaminase.]]cystic fibrosis (see, *e.g.*, Schwank *et al.*,

Functional repair of CFTR by CRISPR/Cas9 in intestinal stem cell organoids of cystic fibrosis patients. *Cell stem cell.* **2013**; 13: 653-658; and Wu et. al., Correction of a genetic disease in mouse via use of CRISPR-Cas9. *Cell stem cell.* **2013;** 13: 659-662, neither of which uses a deaminase fusion protein to correct the genetic defect); phenylketonuria – *e.g.*, phenylalanine to serine mutation at position 835 (mouse) or 240 (human) or a homologous residue in phenylalanine hydroxylase gene (T>C mutation) – see, *e.g.*, McDonald *et al.*, *Genomics.* **1997;** 39:402-405; Bernard-Soulier syndrome (BSS) – *e.g.*, phenylalanine to serine mutation at position 55 or a homologous residue, or cysteine to arginine at residue 24 or a homologous residue in the platelet membrane glycoprotein IX (T>C mutation) – see, *e.g.*, Noris *et al.*, *British Journal of Haematology.* **1997;** 97: 312-320, and Ali *et al.*, *Hematol.* **2014;** 93: 381-384; epidermolytic hyperkeratosis (EHK) – *e.g.*, leucine to proline mutation at position 160 or 161 (if counting the initiator methionine) or a homologous residue in keratin 1 (T>C mutation) – see, *e.g.*, Chipev *et al.*, *Cell.* **1992;** 70: 821-828, see also accession number P04264 in the UNIPROT database at www[dot]uniprot[dot]org; chronic obstructive pulmonary disease (COPD) – *e.g.*, leucine to proline mutation at position 54 or 55 (if counting the initiator methionine) or a homologous residue in the processed form of α_1-antitrypsin or residue 78 in the unprocessed form or a homologous residue (T>C mutation) – see, *e.g.*, Poller *et al.*, *Genomics.* **1993;** 17: 740-743, see also accession number P01011 in the UNIPROT database; Charcot-Marie-Toot disease type 4J – *e.g.*, isoleucine to threonine mutation at position 41 or a homologous residue in FIG4 (T>C mutation) – see, *e.g.*, Lenk *et al.*, PLoS Genetics. 2011; 7: e1002104; neuroblastoma (NB) – *e.g.*, leucine to proline mutation at position 197 or a homologous residue in Caspase-9 (T>C mutation) – see, *e.g.*, Kundu *et al.*, *3 Biotech.* **2013, 3:225-234**; von Willebrand disease (vWD) – *e.g.*, cysteine to arginine mutation at position 509 or a homologous residue in the processed form of von Willebrand factor, or at position 1272 or a homologous residue in the unprocessed form of von Willebrand factor (T>C mutation) – see, *e.g.*, Lavergne *et al.*, *Br. J. Haematol.* **1992**, see also accession number P04275 in the UNIPROT database; 82: 66-72; myotonia congenital – *e.g.*, cysteine to arginine mutation at position 277 or a homologous residue in the muscle chloride channel gene CLCN1 (T>C mutation) – see, *e.g.*, Weinberger *et al.*, *The J. of Physiology.* **2012;** 590: 3449-3464; hereditary renal amyloidosis – *e.g.*, stop codon to arginine mutation at position 78 or a homologous residue in the processed form of apolipoprotein AII or at position 101 or a homologous residue in the unprocessed form (T>C mutation) – see, *e.g.*, Yazaki *et al.*, *Kidney*

Int. **2003;** 64: 11-16; dilated cardiomyopathy (DCM) – *e.g.*, tryptophan to Arginine mutation at position 148 or a homologous residue in the FOXD4 gene (T>C mutation), see, *e.g.*, Minoretti et. al., *Int. J. of Mol. Med.* **2007;** 19: 369-372; hereditary lymphedema – *e.g.*, histidine to arginine mutation at position 1035 or a homologous residue in VEGFR3 tyrosine kinase (A>G mutation), see, *e.g.*, Irrthum *et al.*, *Am. J. Hum. Genet.* **2000;** 67: 295-301; familial Alzheimer's disease – *e.g.*, isoleucine to valine mutation at position 143 or a homologous residue in presenilin1 (A>G mutation), see, *e.g.*, Gallo et. al., *J. Alzheimer's disease.* **2011;** 25: 425-431; Prion disease – *e.g.*, methionine to valine mutation at position 129 or a homologous residue in prion protein (A>G mutation) – see, *e.g.*, Lewis et. al., *J. of General Virology.* **2006;** 87: 2443-2449; chronic infantile neurologic cutaneous articular syndrome (CINCA) – *e.g.*, Tyrosine to Cysteine mutation at position 570 or a homologous residue in cryopyrin (A>G mutation) – see, *e.g.*, Fujisawa et. al. *Blood.* **2007;** 109: 2903-2911; and desmin-related myopathy (DRM) – *e.g.*, arginine to glycine mutation at position 120 or a homologous residue in αβ crystallin (A>G mutation) – see, *e.g.*, Kumar *et al.*, *J. Biol. Chem.* **1999;** 274: 24137-24141. The entire contents of all references and database entries is incorporated herein by reference.

[00134] Suitable routes of administrating the composition for pain suppression include, without limitation: topical, subcutaneous, transdermal, intradermal, intralesional, intraarticular, intraperitoneal, intravesical, transmucosal, gingival, intradental, intracochlear, transtympanic, intraorgan, epidural, intrathecal, intramuscular, intravenous, intravascular, intraosseus, periocular, intratumoral, intracerebral, parenteral, and intracerebroventricular administration.

[00135] The compositions of this disclosure may be administered or packaged as a unit dose, for example. The term "unit dose" when used in reference to a pharmaceutical composition of the present disclosure refers to physically discrete units suitable as unitary dosage for the subject, each unit containing a predetermined quantity of active material calculated to produce the desired therapeutic effect in association with the required diluent, *i.e.*, a carrier or vehicle.

[00136] Treatment of a disease or disorder includes delaying the development or progression of the disease, or reducing disease severity. Treating the disease does not necessarily require curative results.

[00137] As used therein, "delaying" the development of a disease means to defer, hinder, slow, retard, stabilize, and/or postpone progression of the disease. This delay can be of varying lengths of time, depending on the history of the disease and/or individuals being treated. A method that

"delays" or alleviates the development of a disease, or delays the onset of the disease, is a method that reduces probability of developing one or more symptoms of the disease in a given time frame and/or reduces extent of the symptoms in a given time frame, when compared to not using the method. Such comparisons are typically based on clinical studies, using a number of subjects sufficient to give a statistically significant result.

[00138] "Development" or "progression" of a disease means initial manifestations and/or ensuing progression of the disease. Development of the disease can be detectable and assessed using standard clinical techniques as well known in the art. However, development also refers to progression that may be undetectable. For purpose of this disclosure, development or progression refers to the biological course of the symptoms. "Development" includes occurrence, recurrence, and onset.

[00139] As used herein "onset" or "occurrence" of a disease includes initial onset and/or recurrence. Conventional methods, known to those of ordinary skill in the art of medicine, can be used to administer the isolated polypeptide or pharmaceutical composition to the subject, depending upon the type of disease to be treated or the site of the disease.

Kits

[00140] The compositions of the present disclosure may be assembled into kits. In some embodiments, the kit comprises nucleic acid vectors for the expression of the nucleobase editors described herein. In some embodiments, the kit further comprises appropriate guide nucleotide sequences (*e.g.*, gRNAs) or nucleic acid vectors for the expression of such guide nucleotide sequences, to target the Cas9 protein or nucleobase editor to the desired target sequence.

[00141] The kit described herein may include one or more containers housing components for performing the methods described herein and optionally instructions for use. Any of the kit described herein may further comprise components needed for performing the assay methods. Each component of the kits, where applicable, may be provided in liquid form (*e.g.*, in solution) or in solid form, (*e.g.*, a dry powder). In certain cases, some of the components may be reconstitutable or otherwise processible (*e.g.*, to an active form), for example, by the addition of a suitable solvent or other species (for example, water), which may or may not be provided with the kit.

[00142] In some embodiments, the kits may optionally include instructions and/or promotion for use of the components provided. As used herein, "instructions" can define a component of instruction and/or promotion, and typically involve written instructions on or associated with packaging of the disclosure. Instructions also can include any oral or electronic instructions provided in any manner such that a user will clearly recognize that the instructions are to be associated with the kit, for example, audiovisual (*e.g.*, videotape, DVD, *etc.*), Internet, and/or web-based communications, *etc.* The written instructions may be in a form prescribed by a governmental agency regulating the manufacture, use, or sale of pharmaceuticals or biological products, which can also reflect approval by the agency of manufacture, use or sale for animal administration. As used herein, "promoted" includes all methods of doing business including methods of education, hospital and other clinical instruction, scientific inquiry, drug discovery or development, academic research, pharmaceutical industry activity including pharmaceutical sales, and any advertising or other promotional activity including written, oral and electronic communication of any form, associated with the disclosure. Additionally, the kits may include other components depending on the specific application, as described herein.

[00143] The kits may contain any one or more of the components described herein in one or more containers. The components may be prepared sterilely, packaged in a syringe and shipped refrigerated. Alternatively it may be housed in a vial or other container for storage. A second container may have other components prepared sterilely. Alternatively the kits may include the active agents premixed and shipped in a vial, tube, or other container.

[00144] The kits may have a variety of forms, such as a blister pouch, a shrink wrapped pouch, a vacuum sealable pouch, a sealable thermoformed tray, or a similar pouch or tray form, with the accessories loosely packed within the pouch, one or more tubes, containers, a box or a bag. The kits may be sterilized after the accessories are added, thereby allowing the individual accessories in the container to be otherwise unwrapped. The kits can be sterilized using any appropriate sterilization techniques, such as radiation sterilization, heat sterilization, or other sterilization methods known in the art. The kits may also include other components, depending on the specific application, for example, containers, cell media, salts, buffers, reagents, syringes, needles, a fabric, such as gauze, for applying or removing a disinfecting agent, disposable gloves, a support for the agents prior to administration, *etc.*

Host Cells

[00145] Cells that may contain any of the compositions described herein include prokaryotic cells and eukaryotic cells. The methods described herein are used to deliver a Cas9 protein or a nucleobase editor into a eukaryotic cell (*e.g.*, a mammalian cell, such as a human cell). In some embodiments, the cell is in vitro (*e.g.*, cultured cell. In some embodiments, the cell is in vivo (*e.g.*, in a subject such as a human subject). In some embodiments, the cell is ex vivo (*e.g.*, isolated from a subject and may be administered back to the same or a different subject).

[00146] Mammalian cells of the present disclosure include human cells, primate cells (*e.g.*, vero cells), rat cells (*e.g.*, GH3 cells, OC23 cells) or mouse cells (*e.g.*, MC3T3 cells). There are a variety of human cell lines, including, without limitation, human embryonic kidney (HEK) cells, HeLa cells, cancer cells from the National Cancer Institute's 60 cancer cell lines (NCI60), DU145 (prostate cancer) cells, Lncap (prostate cancer) cells, MCF-7 (breast cancer) cells, MDA-MB-438 (breast cancer) cells, PC3 (prostate cancer) cells, T47D (breast cancer) cells, THP-1 (acute myeloid leukemia) cells, U87 (glioblastoma) cells, SHSY5Y human neuroblastoma cells (cloned from a myeloma) and Saos-2 (bone cancer) cells. In some embodiments, rAAV vectors are delivered into human embryonic kidney (HEK) cells (*e.g.*, HEK 293 or HEK 293T cells). In some embodiments, rAAV vectors are delivered into stem cells (*e.g.*, human stem cells) such as, for example, pluripotent stem cells (*e.g.*, human pluripotent stem cells including human induced pluripotent stem cells (hiPSCs)). A stem cell refers to a cell with the ability to divide for indefinite periods in culture and to give rise to specialized cells. A pluripotent stem cell refers to a type of stem cell that is capable of differentiating into all tissues of an organism, but not alone capable of sustaining full organismal development. A human induced pluripotent stem cell refers to a somatic (*e.g.*, mature or adult) cell that has been reprogrammed to an embryonic stem cell-like state by being forced to express genes and factors important for maintaining the defining properties of embryonic stem cells (*see*, *e.g.*, Takahashi and Yamanaka, *Cell* 126 (4): 663–76, 2006, incorporated by reference herein). Human induced pluripotent stem cell cells express stem cell markers and are capable of generating cells characteristic of all three germ layers (ectoderm, endoderm, mesoderm).

[00147] Additional non-limiting examples of cell lines that may be used in accordance with the present disclosure include 293-T, 293-T, 3T3, 4T1, 721, 9L, A-549, A172, A20, A253, A2780, A2780ADR, A2780cis, A431, ALC, B16, B35, BCP-1, BEAS-2B, bEnd.3, BHK-21, BR 293,

BxPC3, C2C12, C3H-10T1/2, C6, C6/36, Cal-27, CGR8, CHO, CML T1, CMT, COR-L23, COR-L23/5010, COR-L23/CPR, COR-L23/R23, COS-7, COV-434, CT26, D17, DH82, DU145, DuCaP, E14Tg2a, EL4, EM2, EM3, EMT6/AR1, EMT6/AR10.0, FM3, H1299, H69, HB54, HB55, HCA2, Hepa1c1c7, High Five cells, HL-60, HMEC, HT-29, HUVEC, J558L cells, Jurkat, JY cells, K562 cells, KCL22, KG1, Ku812, KYO1, LNCap, Ma-Mel 1, 2, 3....48, MC-38, MCF-10A, MCF-7, MDA-MB-231, MDA-MB-435, MDA-MB-468, MDCK II, MG63, MONO-MAC 6, MOR/0.2R, MRC5, MTD-1A, MyEnd, NALM-1, NCI-H69/CPR, NCI-H69/LX10, NCI-H69/LX20, NCI-H69/LX4, NIH-3T3, NW-145, OPCN/OPCT Peer, PNT-1A/PNT 2, PTK2, Raji, RBL cells, RenCa, RIN-5F, RMA/RMAS, S2, Saos-2 cells, Sf21, Sf9, SiHa, SKBR3, SKOV-3, T-47D, T2, T84, THP1, U373, U87, U937, VCaP, WM39, WT-49, X63, YAC-1 and YAR cells.

[00148] Without further elaboration, it is believed that one skilled in the art can, based on the above description, utilize the present disclosure to its fullest extent. The following specific embodiments are, therefore, to be construed as merely illustrative, and not limitative of the remainder of the disclosure in any way whatsoever. All publications cited herein are incorporated by reference for the purposes or subject matter referenced herein.

EXAMPLES

[00149] In order that the invention described herein may be more fully understood, the following examples are set forth. The synthetic examples described in this application are offered to illustrate the compounds and methods provided herein and are not to be construed in any way as limiting their scope.

Example 1: Amino Acid Sequences of Cas9 Proteins and Nucleobase Editor

[00150] Non-limiting examples of suitable Cas9 proteins and variants, and nucleobase editors and variants are provided. The disclosure provides Cas9 variants, for example, Cas9 proteins from one or more organisms, which may comprise one or more mutations (*e.g.*, to generate dCas9 or Cas9 nickase). In some embodiments, one or more of the amino acid residues, identified below by an asterisk, of a Cas9 protein may be mutated. In some embodiments, the D10 and/or H840 residues of the amino acid sequence provided in SEQ ID NO: 1, or a corresponding mutation in any of the amino acid sequences provided in SEQ ID NOs: 2-275 and

394-397, are mutated. In some embodiments, the D10 residue of the amino acid sequence provided in SEQ ID NO: 1, or a corresponding mutation in any of the amino acid sequences provided in SEQ ID NOs: 2-275 and 394-397, is mutated to any amino acid residue, except for D. In some embodiments, the D10 residue of the amino acid sequence provided in SEQ ID NO: 1, or a corresponding mutation in any of the amino acid sequences provided in SEQ ID NOs: 2-275 and 394-397, is mutated to an A. In some embodiments, the H840 residue of the amino acid sequence provided in SEQ ID NO: 1, or a corresponding residue in any of the amino acid sequences provided in SEQ ID NOs: 2-275 and 394-397, is an H. In some embodiments, the H840 residue of the amino acid sequence provided in SEQ ID NO: 1, or a corresponding mutation in any of the amino acid sequences provided in SEQ ID NOs: 2-275 and 394-397, is mutated to any amino acid residue, except for H. In some embodiments, the H840 residue of the amino acid sequence provided in SEQ ID NO: 1, or a corresponding mutation in any of the amino acid sequences provided in SEQ ID NOs: 2-275 and 394-397, is mutated to an A. In some embodiments, the D10 residue of the amino acid sequence provided in SEQ ID NO: 1, or a corresponding residue in any of the amino acid sequences provided in SEQ ID NOs: 2-275 and 394-397, is a D.

[00151] A number of Cas9 sequences from various species were aligned to determine whether corresponding homologous amino acid residues of D10 and H840 of SEQ ID NO: 1 can be identified in other Cas9 proteins, allowing the generation of Cas9 variants with corresponding mutations of the homologous amino acid residues. The alignment was carried out using the NCBI Constraint-based Multiple Alignment Tool (COBALT (accessible at st-va.ncbi.nlm.nih.gov/tools/cobalt)), with the following parameters. Alignment parameters: Gap penalties -11,-1; End-Gap penalties -5,-1. CDD Parameters: Use RPS BLAST on; Blast E-value 0.003; Find Conserved columns and Recompute on. Query Clustering Parameters: Use query clusters on; Word Size 4; Max cluster distance 0.8; Alphabet Regular.

S. pyogenes Cas9 wild type (NCBI Reference Sequence: NC_002737.2, Uniprot Reference Sequence: Q99ZW2)

MDKKYSIGLDIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRR
YTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLV
DSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSAR
LSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQY
ADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNG

YAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYP
FLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLP
NEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIE
CFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDK
VMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQG
DSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGI
KELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTR
SDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITK
HVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIK
KYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEI
VWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYS
VLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRML
ASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADAN
LDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRI
DLSQLGGD (SEQ ID NO: 1)

S. pyogenes dCas9 (D10A and H840A)

MDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRR
YTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLV
DSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSAR
LSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQY
ADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNG
YAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYP
FLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLP
NEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIE
CFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDK
VMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQG
DSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGI
KELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDAIVPQSFLKDDSIDNKVLTR
SDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITK
HVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIK
KYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEI
VWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYS
VLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRML
ASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADAN
LDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRI
DLSQLGGD (SEQ ID NO: 2)

S. pyogenes Cas9 Nickase (D10A)

MDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRR
YTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLV
DSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSAR
LSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQY
ADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNG
YAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYP
FLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLP
NEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIE
CFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDK
VMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQG
DSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGI
KELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTR
SDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITK

HVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIK
KYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEI
VWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYS
VLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRML
ASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADAN
LDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRI
DLSQLGGD (SEQ ID NO: 3)

VRER-nCas9 (D10A/D1135V/G1218R/R1335E/T1337R) *S. pyogenes* Cas9 Nickase

MDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRR
YTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLV
DSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSAR
LSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQY
ADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNG
YAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYP
FLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLP
NEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIE
CFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDK
VMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQG
DSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGI
KELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTR
SDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITK
HVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIK
KYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEI
VWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFVSPTVAYS
VLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRML
ASARELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADAN
LDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKEYRSTKEVLDATLIHQSITGLYETRI
DLSQLGGD (SEQ ID NO: 4)

VQR-nCas9 (D10A/D1135V/R1335Q/T1337R) *S. pyogenes* Cas9 Nickase

MDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRR
YTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLV
DSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSAR
LSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQY
ADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNG
YAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYP
FLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLP
NEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIE
CFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDK
VMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQG
DSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGI
KELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTR
SDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITK
HVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIK
KYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEI
VWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFVSPTVAYS
VLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRML
ASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADAN
LDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKQYRSTKEVLDATLIHQSITGLYETR
IDLSQLGGD (SEQ ID NO: 5)

EQR-nCas9 (D10A/D1135E/R1335Q/T1337R) *S. pyogenes* Cas9 Nickase

MDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRR
YTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLV
DSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSAR
LSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQY
ADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNG
YAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYP
FLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLP
NEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIE
CFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDK
VMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQG
DSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGI
KELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTR
SDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITK
HVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIK
KYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEI
VWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFESPTVAYS
VLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRML
ASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADAN
LDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKQYRSTKEVLDATLIHQSITGLYETR
IDLSQLGGD (SEQ ID NO: 6)

KKH-nCas9 (D10A/E782K/N968K/R1015H) *S. aureus* Cas9 Nickase

MKRNYILGLAIGITSVGYGIIDYETRDVIDAGVRLFKEANVENNEGRRSKRGARRLKRRRRHRIQRVKKLLF
DYNLLTDHSELSGINPYEARVKGLSQKLSEEEFSAALLHLAKRRGVHNVNEVEEDTGNELSTKEQISRNSK
ALEEKYVAELQLERLKKDGEVRGSINRFKTSDYVKEAKQLLKVQKAYHQLDQSFIDTYIDLLETRRTYYEG
PGEGSPFGWKDIKEWYEMLMGHCTYFPEELRSVKYAYNADLYNALNDLNNLVITRDENEKLEYYEKFQII
ENVFKQKKKPTLKQIAKEILVNEEDIKGYRVTSTGKPEFTNLKVYHDIKDITARKEIIENAELLDQIAKILTIY
QSSEDIQEELTNLNSELTQEEIEQISNLKGYTGTHNLSLKAINLILDELWHTNDNQIAIFNRLKLVPKKVDLSQ
QKEIPTTLVDDFILSPVVKRSFIQSIKVINAIIKKYGLPNDIIIELAREKNSKDAQKMINEMQKRNRQTNERIEE
IIRTTGKENAKYLIEKIKLHDMQEGKCLYSLEAIPLEDLLNNPFNYEVDHIIPRSVSFDNSFNNKVLVKQEEN
SKKGNRTPFQYLSSSDSKISYETFKKHILNLAKGKGRISKTKKEYLLEERDINRFSVQKDFINRNLVDTRYAT
RGLMNLLRSYFRVNNLDVKVKSINGGFTSFLRRKWKFKKERNKGYKHHAEDALIIANADFIFKEWKKLDK
AKKVMENQMFEEKQAESMPEIETEQEYKEIFITPHQIKHIKDFKDYKYSHRVDKKPNRKLINDTLYSTRKD
DKGNTLIVNNLNGLYDKDNDKLKKLINKSPEKLLMYHHDPQTYQKLKLIMEQYGDEKNPLYKYYEETGN
YLTKYSKKDNGPVIKKIKYYGNKLNAHLDITDDYPNSRNKVVKLSLKPYRFDVYLDNGVYKFVTVKNLD
VIKKENYYEVNSKCYEEAKKLKKISNQAEFIASFYKNDLIKINGELYRVIGVNNDLLNRIEVNMIDITYREYL
ENMNDKRPPHIIKTIASKTQSIKKYSTDILGNLYEVKSKKHPQIIKKG (SEQ ID NO: 7)

Streptococcus thermophilus CRISPR1 Cas9 (St1Cas9) Nickase (D9A)

MSDLVLGLAIGIGSVGVGILNKVTGEIIHKNSRIFPAAQAENNLVRRTNRQGRRLTRRKKHRRVRLNRLFEE
SGLITDFTKISINLNPYQLRVKGLTDELSNEELFIALKNMVKHRGISYLDDASDDGNSSIGDYAQIVKENSKQ
LETKTPGQIQLERYQTYGQLRGDFTVEKDGKKHRLINVFPTSAYRSEALRILQTQQEFNPQITDEFINRYLEI
LTGKRKYYHGPGNEKSRTDYGRYRTSGETLDNIFGILIGKCTFYPDEFRAAKASYTAQEFNLLNDLNNLTV
PTETKKLSKEQKNQIINYVKNEKAMGPAKLFKYIAKLLSCDVADIKGYRIDKSGKAEIHTFEAYRKMKTLE
TLDIEQMDRETLDKLAYVLTLNTEREGIQEALEHEFADGSFSQKQVDELVQFRKANSSIFGKGWHNFSVKL
MMELIPELYETSEEQMTILTRLGKQKTTSSSNKTKYIDEKLLTEEIYNPVVAKSVRQAIKIVNAAIKEYGDFD
NIVIEMARETNEDDEKKAIQKIQKANKDEKDAAMLKAANQYNGKAELPHSVFHGHKQLATKIRLWHQQG
ERCLYTGKTISIHDLINNSNQFEVDHILPLSITFDDSLANKVLVYATANQEKGQRTPYQALDSMDDAWSFRE
LKAFVRESKTLSNKKKEYLLTEEDISKFDVRKKFIERNLVDTRYASRVVLNALQEHFRAHKIDTKVSVVRG
QFTSQLRRHWGIEKTRDTYHHHAVDALIIAASSQLNLWKKQKNTLVSYSEDQLLDIETGELISDDEYKESVF

KAPYQHFVDTLKSKEFEDSILFSYQVDSKFNRKISDATIYATRQAKVGKDKADETYVLGKIKDIYTQDGYD
AFMKIYKKDKSKFLMYRHDPQTFEKVIEPILENYPNKQINEKGKEVPCNPFLKYKEEHGYIRKYSKKGNGP
EIKSLKYYDSKLGNHIDITPKDSNNKVVLQSVSPWRADVYFNKTTGKYEILGLKYADLQFEKGTGTYKISQ
EKYNDIKKKEGVDSDSEFKFTLYKNDLLLVKDTETKEQQLFRFLSRTMPKQKHYVELKPYDKQKFEGGEA
LIKVLGNVANSGQCKKGLGKSNISIYKVRTDVLGNQHIIKNEGDKPKLDF (SEQ ID NO: 8)

Streptococcus thermophilus CRISPR3Cas9 (St3Cas9) Nickase (D10A)

MTKPYSIGLAIGTNSVGWAVITDNYKVPSKKMKVLGNTSKKYIKKNLLGVLLFDSGITAEGRRLKRTARRR
YTRRRNRILYLQEIFSTEMATLDDAFFQRLDDSFLVPDDKRDSKYPIFGNLVEEKVYHDEFPTIYHLRKYLA
DSTKKADLRLVYLALAHMIKYRGHFLIEGEFNSKNNDIQKNFQDFLDTYNAIFESDLSLENSKQLEEIVKDK
ISKLEKKDRILKLFPGEKNSGIFSEFLKLIVGNQADFRKCFNLDEKASLHFSKESYDEDLETLLGYIGDDYSD
VFLKAKKLYDAILLSGFLTVTDNETEAPLSSAMIKRYNEHKEDLALLKEYIRNISLKTYNEVFKDDTKNGY
AGYIDGKTNQEDFYVYLKNLLAEFEGADYFLEKIDREDFLRKQRTFDNGSIPYQIHLQEMRAILDKQAKFY
PFLAKNKERIEKILTFRIPYYVGPLARGNSDFAWSIRKRNEKITPWNFEDVIDKESSAEAFINRMTSFDLYLPE
EKVLPKHSLLYETFNVYNELTKVRFIAESMRDYQFLDSKQKKDIVRLYFKDKRKVTDKDIIEYLHAIYGYD
GIELKGIEKQFNSSLSTYHDLLNIINDKEFLDDSSNEAIIEEIIHTLTIFEDREMIKQRLSKFENIFDKSVLKKLS
RRHYTGWGKLSAKLINGIRDEKSGNTILDYLIDDGISNRNFMQLIHDDALSFKKKIQKAQIIGDEDKGNIKEV
VKSLPGSPAIKKGILQSIKIVDELVKVMGGRKPESIVVEMARENQYTNQGKSNSQQRLKRLEKSLKELGSKI
LKENIPAKLSKIDNNALQNDRLYLYYLQNGKDMYTGDDLDIDRLSNYDIDHIIPQAFLKDNSIDNKVLVSSA
SNRGKSDDFPSLEVVKKRKTFWYQLLKSKLISQRKFDNLTKAERGGLLPEDKAGFIQRQLVETRQITKHVA
RLLDEKFNNKKDENNRAVRTVKIITLKSTLVSQFRKDFELYKVREINDFHHAHDAYLNAVIASALLKKYPK
LEPEFVYGDYPKYNSFRERKSATEKVYFYSNIMNIFKKSISLADGRVIERPLIEVNEETGESVWNKESDLATV
RRVLSYPQVNVVKKVEEQNHGLDRGKPKGLFNANLSSKPKPNSNENLVGAKEYLDPKKYGGYAGISNSFA
VLVKGTIEKGAKKKITNVLEFQGISILDRINYRKDKLNFLLEKGYKDIELIIELPKYSLFELSDGSRRMLASILS
TNNKRGEIHKGNQIFLSQKFVKLLYHAKRISNTINENHRKYVENHKKEFEELFYYILEFNENYVGAKKNGK
LLNSAFQSWQNHSIDELCSSFIGPTGSERKGLFELTSRGSAADFEFLGVKIPRYRDYTPSSLLKDATLIHQSVT
GLYETRIDLAKLGEG (SEQ ID NO: 9)

S. aureus Cas9 wild type

MKRNYILGLDIGITSVGYGIIDYETRDVIDAGVRLFKEANVENNEGRRSKRGARRLKRRRRHRIQRVKKLLF
DYNLLTDHSELSGINPYEARVKGLSQKLSEEEFSAALLHLAKRRGVHNVNEVEEDTGNELSTKEQISRNSK
ALEEKYVAELQLERLKKDGEVRGSINRFKTSDYVKEAKQLLKVQKAYHQLDQSFIDTYIDLLETRRTYYEG
PGEGSPFGWKDIKEWYEMLMGHCTYFPEELRSVKYAYNADLYNALNDLNNLVITRDENEKLEYYEKFQII
ENVFKQKKKPTLKQIAKEILVNEEDIKGYRVTSTGKPEFTNLKVYHDIKDITARKEIIENAELLDQIAKILTIY
QSSEDIQEELTNLNSELTQEEIEQISNLKGYTGTHNLSLKAINLILDELWHTNDNQIAIFNRLKLVPKKVDLSQ
QKEIPTTLVDDFILSPVVKRSFIQSIKVINAIIKKYGLPNDIIIELAREKNSKDAQKMINEMQKRNRQTNERIEE
IIRTTGKENAKYLIEKIKLHDMQEGKCLYSLEAIPLEDLLNNPFNYEVDHIIPRSVSFDNSFNNKVLVKQEEN
SKKGNRTPFQYLSSSDSKISYETFKKHILNLAKGKGRISKTKKEYLLEERDINRFSVQKDFINRNLVDTRYAT
RGLMNLLRSYFRVNNLDVKVKSINGGFTSFLRRKWKFKKERNKGYKHHAEDALIIANADFIFKEWKKLDK
AKKVMENQMFEEKQAESMPEIETEQEYKEIFITPHQIKHIKDFKDYKYSHRVDKKPNRELINDTLYSTRKDD
KGNTLIVNNLNGLYDKDNDKLKKLINKSPEKLLMYHHDPQTYQKLKLIMEQYGDEKNPLYKYYEETGNY
LTKYSKKDNGPVIKKIKYYGNKLNAHLDITDDYPNSRNKVVKLSLKPYRFDVYLDNGVYKFVTVKNLDVI
KKENYYEVNSKCYEEAKKLKKISNQAEFIASFYNNDLIKINGELYRVIGVNNDLLNRIEVNMIDITYREYLE
NMNDKRPPRIIKTIASKTQSIKKYSTDILGNLYEVKSKKHPQIIKKG (SEQ ID NO: 10)

S. aureus Cas9 Nickase (D10A)

MKRNYILGLAIGITSVGYGIIDYETRDVIDAGVRLFKEANVENNEGRRSKRGARRLKRRRRHRIQRVKKLLF
DYNLLTDHSELSGINPYEARVKGLSQKLSEEEFSAALLHLAKRRGVHNVNEVEEDTGNELSTKEQISRNSK
ALEEKYVAELQLERLKKDGEVRGSINRFKTSDYVKEAKQLLKVQKAYHQLDQSFIDTYIDLLETRRTYYEG
PGEGSPFGWKDIKEWYEMLMGHCTYFPEELRSVKYAYNADLYNALNDLNNLVITRDENEKLEYYEKFQII

ENVFKQKKKPTLKQIAKEILVNEEDIKGYRVTSTGKPEFTNLKVYHDIKDITARKEIIENAELLDQIAKILTIY
QSSEDIQEELTNLNSELTQEEIEQISNLKGYTGTHNLSLKAINLILDELWHTNDNQIAIFNRLKLVPKKVDLSQ
QKEIPTTLVDDFILSPVVKRSFIQSIKVINAIIKKYGLPNDIIIELAREKNSKDAQKMINEMQKRNRQTNERIEE
IIRTTGKENAKYLIEKIKLHDMQEGKCLYSLEAIPLEDLLNNPFNYEVDHIIPRSVSFDNSFNNKVLVKQEEN
SKKGNRTPFQYLSSSDSKISYETFKKHILNLAKGKGRISKTKKEYLLEERDINRFSVQKDFINRNLVDTRYAT
RGLMNLLRSYFRVNNLDVKVKSINGGFTSFLRRKWKFKKERNKGYKHHAEDALIIANADFIFKEWKKLDK
AKKVMENQMFEEKQAESMPEIETEQEYKEIFITPHQIKHIKDFKDYKYSHRVDKKPNRELINDTLYSTRKDD
KGNTLIVNNLNGLYDKDNDKLKKLINKSPEKLLMYHHDPQTYQKLKLIMEQYGDEKNPLYKYYEETGNY
LTKYSKKDNGPVIKKIKYYGNKLNAHLDITDDYPNSRNKVVKLSLKPYRFDVYLDNGVYKFVTVKNLDVI
KKENYYEVNSKCYEEAKKLKKISNQAEFIASFYNNDLIKINGELYRVIGVNNDLLNRIEVNMIDITYREYLE
NMNDKRPPRIIKTIASKTQSIKKYSTDILGNLYEVKSKKHPQIIKKG (SEQ ID NO: 11)

Streptococcus thermophilus wild type CRISPR3 Cas9 (St3Cas9)

MTKPYSIGLDIGTNSVGWAVITDNYKVPSKKMKVLGNTSKKYIKKNLLGVLLFDSGITAEGRRLKRTARRR
YTRRRNRILYLQEIFSTEMATLDDAFFQRLDDSFLVPDDKRDSKYPIFGNLVEEKVYHDEFPTIYHLRKYLA
DSTKKADLRLVYLALAHMIKYRGHFLIEGEFNSKNNDIQKNFQDFLDTYNAIFESDLSLENSKQLEEIVKDK
ISKLEKKDRILKLFPGEKNSGIFSEFLKLIVGNQADFRKCFNLDEKASLHFSKESYDEDLETLLGYIGDDYSD
VFLKAKKLYDAILLSGFLTVTDNETEAPLSSAMIKRYNEHKEDLALLKEYIRNISLKTYNEVFKDDTKNGY
AGYIDGKTNQEDFYVYLKNLLAEFEGADYFLEKIDREDFLRKQRTFDNGSIPYQIHLQEMRAILDKQAKFY
PFLAKNKERIEKILTFRIPYYVGPLARGNSDFAWSIRKRNEKITPWNFEDVIDKESSAEAFINRMTSFDLYLPE
EKVLPKHSLLYETFNVYNELTKVRFIAESMRDYQFLDSKQKKDIVRLYFKDKRKVTDKDIIEYLHAIYGYD
GIELKGIEKQFNSSLSTYHDLLNIINDKEFLDDSSNEAIIEEIIHTLTIFEDREMIKQRLSKFENIFDKSVLKKLS
RRHYTGWGKLSAKLINGIRDEKSGNTILDYLIDDGISNRNFMQLIHDDALSFKKKIQKAQIIGDEDKGNIKEV
VKSLPGSPAIKKGILQSIKIVDELVKVMGGRKPESIVVEMARENQYTNQGKSNSQQRLKRLEKSLKELGSKI
LKENIPAKLSKIDNNALQNDRLYLYYLQNGKDMYTGDDLDIDRLSNYDIDHIIPQAFLKDNSIDNKVLVSSA
SNRGKSDDFPSLEVVKKRKTFWYQLLKSKLISQRKFDNLTKAERGGLLPEDKAGFIQRQLVETRQITKHVA
RLLDEKFNNKKDENNRAVRTVKIITLKSTLVSQFRKDFELYKVREINDFHHAHDAYLNAVIASALLKKYPK
LEPEFVYGDYPKYNSFRERKSATEKVYFYSNIMNIFKKSISLADGRVIERPLIEVNEETGESVWNKESDLATV
RRVLSYPQVNVVKKVEEQNHGLDRGKPKGLFNANLSSKPKPNSNENLVGAKEYLDPKKYGGYAGISNSFA
VLVKGTIEKGAKKKITNVLEFQGISILDRINYRKDKLNFLLEKGYKDIELIIELPKYSLFELSDGSRRMLASILS
TNNKRGEIHKGNQIFLSQKFVKLLYHAKRISNTINENHRKYVENHKKEFEELFYYILEFNENYVGAKKNGK
LLNSAFQSWQNHSIDELCSSFIGPTGSERKGLFELTSRGSAADFEFLGVKIPRYRDYTPSSLLKDATLIHQSVT
GLYETRIDLAKLGEG (SEQ ID NO: 12)

Streptococcus thermophilus CRISPR1 Cas9 wild type (St1Cas9)

MSDLVLGLDIGIGSVGVGILNKVTGEIIHKNSRIFPAAQAENNLVRRTNRQGRRLTRRKKHRRVRLNRLFEE
SGLITDFTKISINLNPYQLRVKGLTDELSNEELFIALKNMVKHRGISYLDDASDDGNSSIGDYAQIVKENSKQ
LETKTPGQIQLERYQTYGQLRGDFTVEKDGKKHRLINVFPTSAYRSEALRILQTQQEFNPQITDEFINRYLEI
LTGKRKYYHGPGNEKSRTDYGRYRTSGETLDNIFGILIGKCTFYPDEFRAAKASYTAQEFNLLNDLNNLTV
PTETKKLSKEQKNQIINYVKNEKAMGPAKLFKYIAKLLSCDVADIKGYRIDKSGKAEIHTFEAYRKMKTLE
TLDIEQMDRETLDKLAYVLTLNTEREGIQEALEHEFADGSFSQKQVDELVQFRKANSSIFGKGWHNFSVKL
MMELIPELYETSEEQMTILTRLGKQKTTSSSNKTKYIDEKLLTEEIYNPVVAKSVRQAIKIVNAAIKEYGDFD
NIVIEMARETNEDDEKKAIQKIQKANKDEKDAAMLKAANQYNGKAELPHSVFHGHKQLATKIRLWHQQG
ERCLYTGKTISIHDLINNSNQFEVDHILPLSITFDDSLANKVLVYATANQEKGQRTPYQALDSMDDAWSFRE
LKAFVRESKTLSNKKKEYLLTEEDISKFDVRKKFIERNLVDTRYASRVVLNALQEHFRAHKIDTKVSVVRG
QFTSQLRRHWGIEKTRDTYHHHAVDALIIAASSQLNLWKKQKNTLVSYSEDQLLDIETGELISDDEYKESVF
KAPYQHFVDTLKSKEFEDSILFSYQVDSKFNRKISDATIYATRQAKVGKDKADETYVLGKIKDIYTQDGYD
AFMKIYKKDKSKFLMYRHDPQTFEKVIEPILENYPNKQINEKGKEVPCNPFLKYKEEHGYIRKYSKKGNGP
EIKSLKYYDSKLGNHIDITPKDSNNKVVLQSVSPWRADVYFNKTTGKYEILGLKYADLQFEKGTGTYKISQ
EKYNDIKKKEGVDSDSEFKFTLYKNDLLLVKDTETKEQQLFRFLSRTMPKQKHYVELKPYDKQKFEGGEA
LIKVLGNVANSGQCKKGLGKSNISIYKVRTDVLGNQHIIKNEGDKPKLDF (SEQ ID NO: 13)

CasX from *Sulfolobus islandicus* (strain REY15A).

MEVPLYNIFGDNYIIQVATEAENSTIYNNKVEIDDEELRNVLNLAYKIAKNNEDAAAERRGKAKKKKGEEG
ETTTSNIILPLSGNDKNPWTETLKCYNFPTTVALSEVFKNFSQVKECEEVSAPSFVKPEFYKFGRSPGMVERT
RRVKLEVEPHYLIMAAAGWVLTRLGKAKVSEGDYVGVNVFTPTRGILYSLIQNVNGIVPGIKPETAFGLWI
ARKVVSSVTNPNVSVVSIYTISDAVGQNPTTINGGFSIDLTKLLEKRDLLSERLEAIARNALSISSNMRERYIV
LANYIYEYLTGSKRLEDLLYFANRDLIMNLNSDDGKVRDLKLISAYVNGELIRGEG (SEQ ID NO: 14)

CasY from *Sulfolobus islandicus* (strain REY15A).

MEVPLYNIFGDNYIIQVATEAENSTIYNNKVEIDDEELRNVLNLAYKIAKNNEDAAAERRGKAKKKKGEEG
ETTTSNIILPLSGNDKNPWTETLKCYNFPTTVALSEVFKNFSQVKECEEVSAPSFVKPEFYEFGRSPGMVERT
RRVKLEVEPHYLIIAAAGWVLTRLGKAKVSEGDYVGVNVFTPTRGILYSLIQNVNGIVPGIKPETAFGLWIA
RKVVSSVTNPNVSVVRIYTISDAVGQNPTTINGGFSIDLTKLLEKRYLLSERLEAIARNALSISSNMRERYIVL
ANYIYEYLTGSKRLEDLLYFANRDLIMNLNSDDGKVRDLKLISAYVNGELIRGEG (SEQ ID NO: 15)

Wild type *Francisella novicida* Cpf1 (D917, E1006, and D1255 are bolded and underlined)

MSIYQEFVNKYSLSKTLRFELIPQGKTLENIKARGLILDDEKRAKDYKKAKQIIDKYHQFFIEEILSSVCISED
LLQNYSDVYFKLKKSDDDNLQKDFKSAKDTIKKQISEYIKDSEKFKNLFNQNLIDAKKGQESDLILWLKQS
KDNGIELFKANSDITDIDEALEIIKSFKGWTTYFKGFHENRKNVYSSNDIPTSIIYRIVDDNLPKFLENKAKYE
SLKDKAPEAINYEQIKKDLAEELTFDIDYKTSEVNQRVFSLDEVFEIANFNNYLNQSGITKFNTIIGGKFVNG
ENTKRKGINEYINLYSQQINDKTLKKYKMSVLFKQILSDTESKSFVIDKLEDDSDVVTTMQSFYEQIAAFKT
VEEKSIKETLSLLFDDLKAQKLDLSKIYFKNDKSLTDLSQQVFDDYSVIGTAVLEYITQQIAPKNLDNPSKKE
QELIAKKTEKAKYLSLETIKLALEEFNKHRDIDKQCRFEEILANFAAIPMIFDEIAQNKDNLAQISIKYQNQG
KKDLLQASAEDDVKAIKDLLDQTNNLLHKLKIFHISQSEDKANILDKDEHFYLVFEECYFELANIVPLYNKI
RNYITQKPYSDEKFKLNFENSTLANGWDKNKEPDNTAILFIKDDKYYLGVMNKKNNKIFDDKAIKENKGE
GYKKIVYKLLPGANKMLPKVFFSAKSIKFYNPSEDILRIRNHSTHTKNGSPQKGYEKFEFNIEDCRKFIDFYK
QSISKHPEWKDFGFRFSDTQRYNSIDEFYREVENQGYKLTFENISESYIDSVVNQGKLYLFQIYNKDFSAYSK
GRPNLHTLYWKALFDERNLQDVVYKLNGEAELFYRKQSIPKKITHPAKEAIANKNKDNPKKESVFEYDLIK
DKRFTEDKFFFHCPITINFKSSGANKFNDEINLLLKEKANDVHILSI**D**RGERHLAYYTLVDGKGNIIKQDTFNI
IGNDRMKTNYHDKLAAIEKDRDSARKDWKKINNIKEMKEGYLSQVVHEIAKLVIEYNAIVVF**E**DLNFGFK
RGRFKVEKQVYQKLEKMLIEKLNYLVFKDNEFDKTGGVLRAYQLTAPFETFKKMGKQTGIIYYVPAGFTS
KICPVTGFVNQLYPKYESVSKSQEFFSKFDKICYNLDKGYFEFSFDYKNFGDKAAKGKWTIASFGSRLINFR
NSDKNHNWDTREVYPTKELEKLLKDYSIEYGHGECIKAAICGESDKKFFAKLTSVLNTILQMRNSKTGTEL
DYLISPVADVNGNFFDSRQAPKNMPQDA**D**ANGAYHIGLKGLMLLGRIKNNQEGKKLNLVIKNEEYFEFVQ
NRNN (SEQ ID NO: 16)

Francisella novicida Cpf1 D917A (A917, E1006, and D1255 are bolded and underlined)

MSIYQEFVNKYSLSKTLRFELIPQGKTLENIKARGLILDDEKRAKDYKKAKQIIDKYHQFFIEEILSSVCISED
LLQNYSDVYFKLKKSDDDNLQKDFKSAKDTIKKQISEYIKDSEKFKNLFNQNLIDAKKGQESDLILWLKQS
KDNGIELFKANSDITDIDEALEIIKSFKGWTTYFKGFHENRKNVYSSNDIPTSIIYRIVDDNLPKFLENKAKYE
SLKDKAPEAINYEQIKKDLAEELTFDIDYKTSEVNQRVFSLDEVFEIANFNNYLNQSGITKFNTIIGGKFVNG
ENTKRKGINEYINLYSQQINDKTLKKYKMSVLFKQILSDTESKSFVIDKLEDDSDVVTTMQSFYEQIAAFKT
VEEKSIKETLSLLFDDLKAQKLDLSKIYFKNDKSLTDLSQQVFDDYSVIGTAVLEYITQQIAPKNLDNPSKKE
QELIAKKTEKAKYLSLETIKLALEEFNKHRDIDKQCRFEEILANFAAIPMIFDEIAQNKDNLAQISIKYQNQG
KKDLLQASAEDDVKAIKDLLDQTNNLLHKLKIFHISQSEDKANILDKDEHFYLVFEECYFELANIVPLYNKI
RNYITQKPYSDEKFKLNFENSTLANGWDKNKEPDNTAILFIKDDKYYLGVMNKKNNKIFDDKAIKENKGE
GYKKIVYKLLPGANKMLPKVFFSAKSIKFYNPSEDILRIRNHSTHTKNGSPQKGYEKFEFNIEDCRKFIDFYK
QSISKHPEWKDFGFRFSDTQRYNSIDEFYREVENQGYKLTFENISESYIDSVVNQGKLYLFQIYNKDFSAYSK
GRPNLHTLYWKALFDERNLQDVVYKLNGEAELFYRKQSIPKKITHPAKEAIANKNKDNPKKESVFEYDLIK
DKRFTEDKFFFHCPITINFKSSGANKFNDEINLLLKEKANDVHILSI**A**RGERHLAYYTLVDGKGNIIKQDTFNI
IGNDRMKTNYHDKLAAIEKDRDSARKDWKKINNIKEMKEGYLSQVVHEIAKLVIEYNAIVVF**E**DLNFGFK

RGRFKVEKQVYQKLEKMLIEKLNYLVFKDNEFDKTGGVLRAYQLTAPFETFKKMGKQTGIIYYVPAGFTS
KICPVTGFVNQLYPKYESVSKSQEFFSKFDKICYNLDKGYFEFSFDYKNFGDKAAKGKWTIASFGSRLINFR
NSDKNHNWDTREVYPTKELEKLLKDYSIEYGHGECIKAAICGESDKKFFAKLTSVLNTILQMRNSKTGTEL
DYLISPVADVNGNFFDSRQAPKNMPQDA**D**ANGAYHIGLKGLMLLGRIKNNQEGKKLNLVIKNEEYFEFVQ
NRNN (SEQ ID NO: 17)

Francisella novicida Cpf1 E1006A (D917, A1006, and D1255 are bolded and underlined)

MSIYQEFVNKYSLSKTLRFELIPQGKTLENIKARGLILDDEKRAKDYKKAKQIIDKYHQFFIEEILSSVCISED
LLQNYSDVYFKLKKSDDDNLQKDFKSAKDTIKKQISEYIKDSEKFKNLFNQNLIDAKKGQESDLILWLKQS
KDNGIELFKANSDITDIDEALEIIKSFKGWTTYFKGFHENRKNVYSSNDIPTSIIYRIVDDNLPKFLENKAKYE
SLKDKAPEAINYEQIKKDLAEELTFDIDYKTSEVNQRVFSLDEVFEIANFNNYLNQSGITKFNTIIGGKFVNG
ENTKRKGINEYINLYSQQINDKTLKKYKMSVLFKQILSDTESKSFVIDKLEDDSDVVTTMQSFYEQIAAFKT
VEEKSIKETLSLLFDDLKAQKLDLSKIYFKNDKSLTDLSQQVFDDYSVIGTAVLEYITQQIAPKNLDNPSKKE
QELIAKKTEKAKYLSLETIKLALEEFNKHRDIDKQCRFEEILANFAAIPMIFDEIAQNKDNLAQISIKYQNQG
KKDLLQASAEDDVKAIKDLLDQTNNLLHKLKIFHISQSEDKANILDKDEHFYLVFEECYFELANIVPLYNKI
RNYITQKPYSDEKFKLNFENSTLANGWDKNKEPDNTAILFIKDDKYYLGVMNKKNNKIFDDKAIKENKGE
GYKKIVYKLLPGANKMLPKVFFSAKSIKFYNPSEDILRIRNHSTHTKNGSPQKGYEKFEFNIEDCRKFIDFYK
QSISKHPEWKDFGFRFSDTQRYNSIDEFYREVENQGYKLTFENISESYIDSVVNQGKLYLFQIYNKDFSAYSK
GRPNLHTLYWKALFDERNLQDVVYKLNGEAELFYRKQSIPKKITHPAKEAIANKNKDNPKKESVFEYDLIK
DKRFTEDKFFFHCPITINFKSSGANKFNDEINLLLKEKANDVHILSI**D**RGERHLAYYTLVDGKGNIIKQDTFNI
IGNDRMKTNYHDKLAAIEKDRDSARKDWKKINNIKEMKEGYLSQVVHEIAKLVIEYNAIVVF**A**DLNFGFK
RGRFKVEKQVYQKLEKMLIEKLNYLVFKDNEFDKTGGVLRAYQLTAPFETFKKMGKQTGIIYYVPAGFTS
KICPVTGFVNQLYPKYESVSKSQEFFSKFDKICYNLDKGYFEFSFDYKNFGDKAAKGKWTIASFGSRLINFR
NSDKNHNWDTREVYPTKELEKLLKDYSIEYGHGECIKAAICGESDKKFFAKLTSVLNTILQMRNSKTGTEL
DYLISPVADVNGNFFDSRQAPKNMPQDA**D**ANGAYHIGLKGLMLLGRIKNNQEGKKLNLVIKNEEYFEFVQ
NRNN (SEQ ID NO: 18)

Francisella novicida Cpf1 D1255A (D917, E1006, and A1255 are bolded and underlined)

MSIYQEFVNKYSLSKTLRFELIPQGKTLENIKARGLILDDEKRAKDYKKAKQIIDKYHQFFIEEILSSVCISED
LLQNYSDVYFKLKKSDDDNLQKDFKSAKDTIKKQISEYIKDSEKFKNLFNQNLIDAKKGQESDLILWLKQS
KDNGIELFKANSDITDIDEALEIIKSFKGWTTYFKGFHENRKNVYSSNDIPTSIIYRIVDDNLPKFLENKAKYE
SLKDKAPEAINYEQIKKDLAEELTFDIDYKTSEVNQRVFSLDEVFEIANFNNYLNQSGITKFNTIIGGKFVNG
ENTKRKGINEYINLYSQQINDKTLKKYKMSVLFKQILSDTESKSFVIDKLEDDSDVVTTMQSFYEQIAAFKT
VEEKSIKETLSLLFDDLKAQKLDLSKIYFKNDKSLTDLSQQVFDDYSVIGTAVLEYITQQIAPKNLDNPSKKE
QELIAKKTEKAKYLSLETIKLALEEFNKHRDIDKQCRFEEILANFAAIPMIFDEIAQNKDNLAQISIKYQNQG
KKDLLQASAEDDVKAIKDLLDQTNNLLHKLKIFHISQSEDKANILDKDEHFYLVFEECYFELANIVPLYNKI
RNYITQKPYSDEKFKLNFENSTLANGWDKNKEPDNTAILFIKDDKYYLGVMNKKNNKIFDDKAIKENKGE
GYKKIVYKLLPGANKMLPKVFFSAKSIKFYNPSEDILRIRNHSTHTKNGSPQKGYEKFEFNIEDCRKFIDFYK
QSISKHPEWKDFGFRFSDTQRYNSIDEFYREVENQGYKLTFENISESYIDSVVNQGKLYLFQIYNKDFSAYSK
GRPNLHTLYWKALFDERNLQDVVYKLNGEAELFYRKQSIPKKITHPAKEAIANKNKDNPKKESVFEYDLIK
DKRFTEDKFFFHCPITINFKSSGANKFNDEINLLLKEKANDVHILSI**D**RGERHLAYYTLVDGKGNIIKQDTFNI
IGNDRMKTNYHDKLAAIEKDRDSARKDWKKINNIKEMKEGYLSQVVHEIAKLVIEYNAIVVF**E**DLNFGFK
RGRFKVEKQVYQKLEKMLIEKLNYLVFKDNEFDKTGGVLRAYQLTAPFETFKKMGKQTGIIYYVPAGFTS
KICPVTGFVNQLYPKYESVSKSQEFFSKFDKICYNLDKGYFEFSFDYKNFGDKAAKGKWTIASFGSRLINFR
NSDKNHNWDTREVYPTKELEKLLKDYSIEYGHGECIKAAICGESDKKFFAKLTSVLNTILQMRNSKTGTEL
DYLISPVADVNGNFFDSRQAPKNMPQDA**A**ANGAYHIGLKGLMLLGRIKNNQEGKKLNLVIKNEEYFEFVQ
NRNN (SEQ ID NO: 19)

Francisella novicida Cpf1 D917A/E1006A (A917, A1006, and D1255 are bolded and underlined)

MSIYQEFVNKYSLSKTLRFELIPQGKTLENIKARGLILDDEKRAKDYKKAKQIIDKYHQFFIEEILSSVCISED
LLQNYSDVYFKLKKSDDDNLQKDFKSAKDTIKKQISEYIKDSEKFKNLFNQNLIDAKKGQESDLILWLKQS
KDNGIELFKANSDITDIDEALEIIKSFKGWTTYFKGFHENRKNVYSSNDIPTSIIYRIVDDNLPKFLENKAKYE
SLKDKAPEAINYEQIKKDLAEELTFDIDYKTSEVNQRVFSLDEVFEIANFNNYLNQSGITKFNTIIGGKFVNG
ENTKRKGINEYINLYSQQINDKTLKKYKMSVLFKQILSDTESKSFVIDKLEDDSDVVTTMQSFYEQIAAFKT
VEEKSIKETLSLLFDDLKAQKLDLSKIYFKNDKSLTDLSQQVFDDYSVIGTAVLEYITQQIAPKNLDNPSKKE
QELIAKKTEKAKYLSLETIKLALEEFNKHRDIDKQCRFEEILANFAAIPMIFDEIAQNKDNLAQISIKYQNQG
KKDLLQASAEDDVKAIKDLLDQTNNLLHKLKIFHISQSEDKANILDKDEHFYLVFEECYFELANIVPLYNKI
RNYITQKPYSDEKFKLNFENSTLANGWDKNKEPDNTAILFIKDDKYYLGVMNKKNNKIFDDKAIKENKGE
GYKKIVYKLLPGANKMLPKVFFSAKSIKFYNPSEDILRIRNHSTHTKNGSPQKGYEKFEFNIEDCRKFIDFYK
QSISKHPEWKDFGFRFSDTQRYNSIDEFYREVENQGYKLTFENISESYIDSVVNQGKLYLFQIYNKDFSAYSK
GRPNLHTLYWKALFDERNLQDVVYKLNGEAELFYRKQSIPKKITHPAKEAIANKNKDNPKKESVFEYDLIK
DKRFTEDKFFFHCPITINFKSSGANKFNDEINLLLKEKANDVHILSIARGERHLAYYTLVDGKGNIIKQDTFNI
IGNDRMKTNYHDKLAAIEKDRDSARKDWKKINNIKEMKEGYLSQVVHEIAKLVIEYNAIVVFADLNFGFK
RGRFKVEKQVYQKLEKMLIEKLNYLVFKDNEFDKTGGVLRAYQLTAPFETFKKMGKQTGIIYYVPAGFTS
KICPVTGFVNQLYPKYESVSKSQEFFSKFDKICYNLDKGYFEFSFDYKNFGDKAAKGKWTIASFGSRLINFR
NSDKNHNWDTREVYPTKELEKLLKDYSIEYGHGECIKAAICGESDKKFFAKLTSVLNTILQMRNSKTGTEL
DYLISPVADVNGNFFDSRQAPKNMPQDADANGAYHIGLKGLMLLGRIKNNQEGKKLNLVIKNEEYFEFVQ
NRNN (SEQ ID NO: 20)

Francisella novicida Cpf1 D917A/D1255A (A917, E1006, and A1255 are bolded and underlined)

MSIYQEFVNKYSLSKTLRFELIPQGKTLENIKARGLILDDEKRAKDYKKAKQIIDKYHQFFIEEILSSVCISED
LLQNYSDVYFKLKKSDDDNLQKDFKSAKDTIKKQISEYIKDSEKFKNLFNQNLIDAKKGQESDLILWLKQS
KDNGIELFKANSDITDIDEALEIIKSFKGWTTYFKGFHENRKNVYSSNDIPTSIIYRIVDDNLPKFLENKAKYE
SLKDKAPEAINYEQIKKDLAEELTFDIDYKTSEVNQRVFSLDEVFEIANFNNYLNQSGITKFNTIIGGKFVNG
ENTKRKGINEYINLYSQQINDKTLKKYKMSVLFKQILSDTESKSFVIDKLEDDSDVVTTMQSFYEQIAAFKT
VEEKSIKETLSLLFDDLKAQKLDLSKIYFKNDKSLTDLSQQVFDDYSVIGTAVLEYITQQIAPKNLDNPSKKE
QELIAKKTEKAKYLSLETIKLALEEFNKHRDIDKQCRFEEILANFAAIPMIFDEIAQNKDNLAQISIKYQNQG
KKDLLQASAEDDVKAIKDLLDQTNNLLHKLKIFHISQSEDKANILDKDEHFYLVFEECYFELANIVPLYNKI
RNYITQKPYSDEKFKLNFENSTLANGWDKNKEPDNTAILFIKDDKYYLGVMNKKNNKIFDDKAIKENKGE
GYKKIVYKLLPGANKMLPKVFFSAKSIKFYNPSEDILRIRNHSTHTKNGSPQKGYEKFEFNIEDCRKFIDFYK
QSISKHPEWKDFGFRFSDTQRYNSIDEFYREVENQGYKLTFENISESYIDSVVNQGKLYLFQIYNKDFSAYSK
GRPNLHTLYWKALFDERNLQDVVYKLNGEAELFYRKQSIPKKITHPAKEAIANKNKDNPKKESVFEYDLIK
DKRFTEDKFFFHCPITINFKSSGANKFNDEINLLLKEKANDVHILSIARGERHLAYYTLVDGKGNIIKQDTFNI
IGNDRMKTNYHDKLAAIEKDRDSARKDWKKINNIKEMKEGYLSQVVHEIAKLVIEYNAIVVFEDLNFGFK
RGRFKVEKQVYQKLEKMLIEKLNYLVFKDNEFDKTGGVLRAYQLTAPFETFKKMGKQTGIIYYVPAGFTS
KICPVTGFVNQLYPKYESVSKSQEFFSKFDKICYNLDKGYFEFSFDYKNFGDKAAKGKWTIASFGSRLINFR
NSDKNHNWDTREVYPTKELEKLLKDYSIEYGHGECIKAAICGESDKKFFAKLTSVLNTILQMRNSKTGTEL
DYLISPVADVNGNFFDSRQAPKNMPQDAAANGAYHIGLKGLMLLGRIKNNQEGKKLNLVIKNEEYFEFVQ
NRNN (SEQ ID NO: 21)

Francisella novicida Cpf1 E1006A/D1255A (D917, A1006, and A1255 are bolded and underlined)

MSIYQEFVNKYSLSKTLRFELIPQGKTLENIKARGLILDDEKRAKDYKKAKQIIDKYHQFFIEEILSSVCISED
LLQNYSDVYFKLKKSDDDNLQKDFKSAKDTIKKQISEYIKDSEKFKNLFNQNLIDAKKGQESDLILWLKQS
KDNGIELFKANSDITDIDEALEIIKSFKGWTTYFKGFHENRKNVYSSNDIPTSIIYRIVDDNLPKFLENKAKYE

SLKDKAPEAINYEQIKKDLAEELTFDIDYKTSEVNQRVFSLDEVFEIANFNNYLNQSGITKFNTIIGGKFVNG
ENTKRKGINEYINLYSQQINDKTLKKYKMSVLFKQILSDTESKSFVIDKLEDDSDVVTTMQSFYEQIAAFKT
VEEKSIKETLSLLFDDLKAQKLDLSKIYFKNDKSLTDLSQQVFDDYSVIGTAVLEYITQQIAPKNLDNPSKKE
QELIAKKTEKAKYLSLETIKLALEEFNKHRDIDKQCRFEEILANFAAIPMIFDEIAQNKDNLAQISIKYQNQG
KKDLLQASAEDDVKAIKDLLDQTNNLLHKLKIFHISQSEDKANILDKDEHFYLVFEECYFELANIVPLYNKI
RNYITQKPYSDEKFKLNFENSTLANGWDKNKEPDNTAILFIKDDKYYLGVMNKKNNKIFDDKAIKENKGE
GYKKIVYKLLPGANKMLPKVFFSAKSIKFYNPSEDILRIRNHSTHTKNGSPQKGYEKFEFNIEDCRKFIDFYK
QSISKHPEWKDFGFRFSDTQRYNSIDEFYREVENQGYKLTFENISESYIDSVVNQGKLYLFQIYNKDFSAYSK
GRPNLHTLYWKALFDERNLQDVVYKLNGEAELFYRKQSIPKKITHPAKEAIANKNKDNPKKESVFEYDLIK
DKRFTEDKFFFHCPITINFKSSGANKFNDEINLLLKEKANDVHILSI**D**RGERHLAYYTLVDGKGNIIKQDTFNI
IGNDRMKTNYHDKLAAIEKDRDSARKDWKKINNIKEMKEGYLSQVVHEIAKLVIEYNAIVVF**A**DLNFGFK
RGRFKVEKQVYQKLEKMLIEKLNYLVFKDNEFDKTGGVLRAYQLTAPFETFKKMGKQTGIIYYVPAGFTS
KICPVTGFVNQLYPKYESVSKSQEFFSKFDKICYNLDKGYFEFSFDYKNFGDKAAKGKWTIASFGSRLINFR
NSDKNHNWDTREVYPTKELEKLLKDYSIEYGHGECIKAAICGESDKKFFAKLTSVLNTILQMRNSKTGTEL
DYLISPVADVNGNFFDSRQAPKNMPQDA**A**ANGAYHIGLKGLMLLGRIKNNQEGKKLNLVIKNEEYFEFVQ
NRNN (SEQ ID NO: 22)

Francisella novicida Cpf1 D917A/E1006A/D1255A (A917, A1006, and A1255 are bolded and underlined)

MSIYQEFVNKYSLSKTLRFELIPQGKTLENIKARGLILDDEKRAKDYKKAKQIIDKYHQFFIEEILSSVCISED
LLQNYSDVYFKLKKSDDDNLQKDFKSAKDTIKKQISEYIKDSEKFKNLFNQNLIDAKKGQESDLILWLKQS
KDNGIELFKANSDITDIDEALEIIKSFKGWTTYFKGFHENRKNVYSSNDIPTSIIYRIVDDNLPKFLENKAKYE
SLKDKAPEAINYEQIKKDLAEELTFDIDYKTSEVNQRVFSLDEVFEIANFNNYLNQSGITKFNTIIGGKFVNG
ENTKRKGINEYINLYSQQINDKTLKKYKMSVLFKQILSDTESKSFVIDKLEDDSDVVTTMQSFYEQIAAFKT
VEEKSIKETLSLLFDDLKAQKLDLSKIYFKNDKSLTDLSQQVFDDYSVIGTAVLEYITQQIAPKNLDNPSKKE
QELIAKKTEKAKYLSLETIKLALEEFNKHRDIDKQCRFEEILANFAAIPMIFDEIAQNKDNLAQISIKYQNQG
KKDLLQASAEDDVKAIKDLLDQTNNLLHKLKIFHISQSEDKANILDKDEHFYLVFEECYFELANIVPLYNKI
RNYITQKPYSDEKFKLNFENSTLANGWDKNKEPDNTAILFIKDDKYYLGVMNKKNNKIFDDKAIKENKGE
GYKKIVYKLLPGANKMLPKVFFSAKSIKFYNPSEDILRIRNHSTHTKNGSPQKGYEKFEFNIEDCRKFIDFYK
QSISKHPEWKDFGFRFSDTQRYNSIDEFYREVENQGYKLTFENISESYIDSVVNQGKLYLFQIYNKDFSAYSK
GRPNLHTLYWKALFDERNLQDVVYKLNGEAELFYRKQSIPKKITHPAKEAIANKNKDNPKKESVFEYDLIK
DKRFTEDKFFFHCPITINFKSSGANKFNDEINLLLKEKANDVHILSI**A**RGERHLAYYTLVDGKGNIIKQDTFNI
IGNDRMKTNYHDKLAAIEKDRDSARKDWKKINNIKEMKEGYLSQVVHEIAKLVIEYNAIVVF**A**DLNFGFK
RGRFKVEKQVYQKLEKMLIEKLNYLVFKDNEFDKTGGVLRAYQLTAPFETFKKMGKQTGIIYYVPAGFTS
KICPVTGFVNQLYPKYESVSKSQEFFSKFDKICYNLDKGYFEFSFDYKNFGDKAAKGKWTIASFGSRLINFR
NSDKNHNWDTREVYPTKELEKLLKDYSIEYGHGECIKAAICGESDKKFFAKLTSVLNTILQMRNSKTGTEL
DYLISPVADVNGNFFDSRQAPKNMPQDA**A**ANGAYHIGLKGLMLLGRIKNNQEGKKLNLVIKNEEYFEFVQ
NRNN (SEQ ID NO: 23)

Wild type *Natronobacterium gregoryi* Argonaute

MTVIDLDSTTTADELTSGHTYDISVTLTGVYDNTDEQHPRMSLAFEQDNGERRYITLWKNTTPKDVFTYDY
ATGSTYIFTNIDYEVKDGYENLTATYQTTVENATAQEVGTTDEDETFAGGEPLDHHLDDALNETPDDAETE
SDSGHVMTSFASRDQLPEWTLHTYTLTATDGAKTDTEYARRTLAYTVRQELYTDHDAAPVATDGLMLLT
PEPLGETPLDLDCGVRVEADETRTLDYTTAKDRLLARELVEEGLKRSLWDDYLVRGIDEVLSKEPVLTCDE
FDLHERYDLSVEVGHSGRAYLHINFRHRFVPKLTLADIDDDNIYPGLRVKTTYRPRRGHIVWGLRDECATD
SLNTLGNQSVVAYHRNNQTPINTDLLDAIEAADRRVVETRRQGHGDDAVSFPQELLAVEPNTHQIKQFASD
GFHQQARSKTRLSASRCSEKAQAFAERLDPVRLNGSTVEFSSEFFTGNNEQQLRLLYENGESVLTFRDGAR
GAHPDETFSKGIVNPPESFEVAVVLPEQQADTCKAQWDTMADLLNQAGAPPTRSETVQYDAFSSPESISLN
VAGAIDPSEVDAAFVVLPPDQEGFADLASPTETYDELKKALANMGIYSQMAYFDRFRDAKIFYTRNVALG
LLAAAGGVAFTTEHAMPGDADMFIGIDVSRSYPEDGASGQINIAATATAVYKDGTILGHSSTRPQLGEKLQ
STDVRDIMKNAILGYQQVTGESPTHIVIHRDGFMNEDLDPATEFLNEQGVEYDIVEIRKQPQTRLLAVSDVQ

YDTPVKSIAAINQNEPRATVATFGAPEYLATRDGGGLPRPIQIERVAGETDIETLTRQVYLLSQSHIQVHNST
ARLPITTAYADQASTHATKGYLVQTGAFESNVGFL (SEQ ID NO: 24)

Cas9 variant with decreased electrostatic interactions between the Cas9 and DNA backbone

DKKYSIGL**A**IGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRY
TRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVD
STDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLS
KSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYAD
LFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYA
GYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMT**A**FDKNLPNE
KVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECF
DSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVM
KQLKRRRYTGWG**A**LSRKLINGIRDKQSGKTILDFLKSDGFANRNFM**A**LIHDDSLTFKEDIQKAQVSGQGDS
LHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE
LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSD
KNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETR**A**ITKHV
AQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYP
KLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVW
DKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLAS
AGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLD
KVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDL
SQLGGD (SEQ ID NO: 25)CasY (ncbi.nlm.nih.gov/protein/APG80656.1)

>APG80656.1 CRISPR-associated protein CasY [uncultured *Parcubacteria* group bacterium]

MSKRHPRISGVKGYRLHAQRLEYTGKSGAMRTIKYPLYSSPSGGRTVPREIVSAINDDYVGLYGLSNFDDL
YNAEKRNEEKVYSVLDFWYDCVQYGAVFSYTAPGLLKNVAEVRGGSYELTKTLKGSHLYDELQIDKVIKF
LNKKEISRANGSLDKLKKDIIDCFKAEYRERHKDQCNKLADDIKNAKKDAGASLGERQKKLFRDFFGISEQ
SENDKPSFTNPLNLTCCLLPFDTVNNNRNRGEVLFNKLKEYAQKLDKNEGSLEMWEYIGIGNSGTAFSNFL
GEGFLGRLRENKITELKKAMMDITDAWRGQEQEEELEKRLRILAALTIKLREPKFDNHWGGYRSDINGKLS
SWLQNYINQTVKIKEDLKGHKKDLKKAKEMINRFGESDTKEEAVVSSLLESIEKIVPDDSADDEKPDIPAIAI
YRRFLSDGRLTLNRFVQREDVQEALIKERLEAEKKKKPKKRKKKSDAEDEKETIDFKELFPHLAKPLKLVP
NFYGDSKRELYKKYKNAAIYTDALWKAVEKIYKSAFSSSLKNSFFDTDFDKDFFIKRLQKIFSVYRRFNTDK
WKPIVKNSFAPYCDIVSLAENEVLYKPKQSRSRKSAAIDKNRVRLPSTENIAKAGIALARELSVAGFDWKDL
LKKEEHEEYIDLIELHKTALALLLAVTETQLDISALDFVENGTVKDFMKTRDGNLVLEGRFLEMFSQSIVFS
ELRGLAGLMSRKEFITRSAIQTMNGKQAELLYIPHEFQSAKITTPKEMSRAFLDLAPAEFATSLEPESLSEKS
LLKLKQMRYYPHYFGYELTRTGQGIDGGVAENALRLEKSPVKKREIKCKQYKTLGRGQNKIVLYVRSSYY
QTQFLEWFLHRPKNVQTDVAVSGSFLIDEKKVKTRWNYDALTVALEPVSGSERVFVSQPFTIFPEKSAEEE
GQRYLGIDIGEYGIAYTALEITGDSAKILDQNFISDPQLKTLREEVKGLKLDQRRGTFAMPSTKIARIRESLV
HSLRNRIHHLALKHKAKIVYELEVSRFEEGKQKIKKVYATLKKADVYSEIDADKNLQTTVWGKLAVASEIS
ASYTSQFCGACKKLWRAEMQVDETITTQELIGTVRVIKGGTLIDAIKDFMRPPIFDENDTPFPKYRDFCDKH
HISKKMRGNSCLFICPFCRANADADIQASQTIALLRYVKEEKKVEDYFERFRKLKNIKVLGQMKKI (SEQ
ID NO: 26)

High-fidelity Cas9 domain

DKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRY
TRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVD
STDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLS
KSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYAD
LFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYA
GYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTAFDKNLPNE
KVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECF
DSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVM
KQLKRRRYTGWGALSRKLINGIRDKQSGKTILDFLKSDGFANRNFMALIHDDSLTFKEDIQKAQVSGQGDS
LHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE
LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSD
KNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRAITKHV
AQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYP
KLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVW
DKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLAS
AGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLD
KVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDL
SQLGGD (SEQ ID NO: 394)

C2c1 (uniprot.org/uniprot/T0D7A2#)

sp|T0D7A2|C2C1_ALIAG CRISPR-associated endonuclease C2c1 OS=Alicyclobacillus acidoterrestris (strain ATCC 49025 / DSM 3922 / CIP 106132 / NCIMB 13137 / GD3B) GN=c2c1 PE=1 SV=1

MAVKSIKVKLRLDDMPEIRAGLWKLHKEVNAGVRYYTEWLSLLRQENLYRRSPNGDGEQECDKTAEECK
AELLERLRARQVENGHRGPAGSDDELLQLARQLYELLVPQAIGAKGDAQQIARKFLSPLADKDAVGGLGI
AKAGNKPRWVRMREAGEPGWEEEKEKAETRKSADRTADVLRALADFGLKPLMRVYTDSEMSSVEWKPL
RKGQAVRTWDRDMFQQAIERMMSWESWNQRVGQEYAKLVEQKNRFEQKNFVGQEHLVHLVNQLQQD
MKEASPGLESKEQTAHYVTGRALRGSDKVFEKWGKLAPDAPFDLYDAEIKNVQRRNTRRFGSHDLFAKL
AEPEYQALWREDASFLTRYAVYNSILRKLNHAKMFATFTLPDATAHPIWTRFDKLGGNLHQYTFLFNEFGE
RRHAIRFHKLLKVENGVAREVDDVTVPISMSEQLDNLLPRDPNEPIALYFRDYGAEQHFTGEFGGAKIQCR
RDQLAHMHRRRGARDVYLNVSVRVQSQSEARGERRPPYAAVFRLVGDNHRAFVHFDKLSDYLAEHPDD
GKLGSEGLLSGLRVMSVDLGLRTSASISVFRVARKDELKPNSKGRVPFFFPIKGNDNLVAVHERSQLLKLPG
ETESKDLRAIREERQRTLRQLRTQLAYLRLLVRCGSEDVGRRERSWAKLIEQPVDAANHMTPDWREAFEN
ELQKLKSLHGICSDKEWMDAVYESVRRVWRHMGKQVRDWRKDVRSGERPKIRGYAKDVVGGNSIEQIEY
LERQYKFLKSWSFFGKVSGQVIRAEKGSRFAITLREHIDHAKEDRLKKLADRIIMEALGYVYALDERGKGK
WVAKYPPCQLILLEELSEYQFNNDRPPSENNQLMQWSHRGVFQELINQAQVHDLLVGTMYAAFSSRFDAR
TGAPGIRCRRVPARCTQEHNPEPFPWWLNKFVVEHTLDACPLRADDLIPTGEGEIFVSPFSAEEGDFHQIHA
DLNAAQNLQQRLWSDFDISQIRLRCDWGEVDGELVLIPRLTGKRTADSYSNKVFYTNTGVTYYERERGKK
RRKVFAQEKLSEEEAELLVEADEAREKSVVLMRDPSGIINRGNWTRQKEFWSMVNQRIEGYLVKQIRSRVP
LQDSACENTGDI (SEQ ID NO: 395)

C2c2 (uniprot.org/uniprot/P0DOC6)

>sp|P0DOC6|C2C2_LEPSD CRISPR-associated endoribonuclease C2c2 OS=Leptotrichia shahii (strain DSM 19757 / CCUG 47503 / CIP 107916 / JCM 16776 / LB37) GN=c2c2 PE=1 SV=1

MGNLFGHKRWYEVRDKKDFKIKRKVKVKRNYDGNKYILNINENNNKEKIDNNKFIRKYINYKKNDNILKE
FTRKFHAGNILFKLKGKEGIIRIENNDDFLETEEVVLYIEAYGKSEKLKALGITKKKIIDEAIRQGITKDDKKIE
IKRQENEEEIEIDIRDEYTNKTLNDCSIILRIIENDELETKKSIYEIFKNINMSLYKIIEKIIENETEKVFENRYYEE
HLREKLLKDDKIDVILTNFMEIREKIKSNLEILGFVKFYLNVGGDKKKSKNKKMLVEKILNINVDLTVEDIA
DFVIKELEFWNITKRIEKVKKVNNEFLEKRRNRTYIKSYVLLDKHEKFKIERENKKDKIVKFFVENIKNNSIK
EKIEKILAEFKIDELIKKLEKELKKGNCDTEIFGIFKKHYKVNFDSKKFSKKSDEEKELYKIIYRYLKGRIEKIL
VNEQKVRLKKMEKIEIEKILNESILSEKILKRVKQYTLEHIMYLGKLRHNDIDMTTVNTDDFSRLHAKEELD
LELITFFASTNMELNKIFSRENINNDENIDFFGGDREKNYVLDKKILNSKIKIIRDLDFIDNKNNITNNFIRKFT
KIGTNERNRILHAISKERDLQGTQDDYNKVINIIQNLKISDEEVSKALNLDVVFKDKKNIITKINDIKISEENN
NDIKYLPSFSKVLPEILNLYRNNPKNEPFDTIETEKIVLNALIYVNKELYKKLILEDDLEENESKNIFLQELKK
TLGNIDEIDENIIENYYKNAQISASKGNNKAIKKYQKKVIECYIGYLRKNYEELFDFSDFKMNIQEIKKQIKDI
NDNKTYERITVKTSDKTIVINDDFEYIISIFALLNSNAVINKIRNRFFATSVWLNTSEYQNIIDILDEIMQLNTL
RNECITENWNLNLEEFIQKMKEIEKDFDDFKIQTKKEIFNNYYEDIKNNILTEFKDDINGCDVLEKKLEKIVIF
DDETKFEIDKKSNILQDEQRKLSNINKKDLKKKVDQYIKDKDQEIKSKILCRIIFNSDFLKKYKKEIDNLIED
MESENENKFQEIYYPKERKNELYIYKKNLFLNIGNPNFDKIYGLISNDIKMADAKFLFNIDGKNIRKNKISEID
AILKNLNDKLNGYSKEYKEKYIKKLKENDDFFAKNIQNKNYKSFEKDYNRVSEYKKIRDLVEFNYLNKIES
YLIDINWKLAIQMARFERDMHYIVNGLRELGIIKLSGYNTGISRAYPKRNGSDGFYTTTAYYKFFDEESYKK
FEKICYGFGIDLSENSEINKPENESIRNYISHFYIVRNPFADYSIAEQIDRVSNLLSYSTRYNNSTYASVFEVFK
KDVNLDYDELKKKFKLIGNNDILERLMKPKKVSVLELESYNSDYIKNLIIELLTKIENTNDTL (SEQ ID NO: 396)

C2c3, translated from >CEPX01008730.1 marine metagenome genome assembly TARA_037_MES_0.1-0.22, contig TARA_037_MES_0.1-0.22_scaffold22115_1, whole genome shotgun sequence.

MRSNYHGGRNARQWRKQISGLARRTKETVFTYKFPLETDAAEIDFDKAVQTYGIAEGVGHGSLIGLVCAF
HLSGFRLFSKAGEAMAFRNRSRYPTDAFAEKLSAIMGIQLPTLSPEGLDLIFQSPPRSRDGIAPVWSENEVRN
RLYTNWTGRGPANKPDEHLLEIAGEIAKQVFPKFGGWDDLASDPDKALAAADKYFQSQGDFPSIASLPAAI
MLSPANSTVDFEGDYIAIDPAAETLLHQAVSRCAARLGRERPDLDQNKGPFVSSLQDALVSSQNNGLSWLF
GVGFQHWKEKSPKELIDEYKVPADQHGAVTQVKSFVDAIPLNPLFDTTHYGEFRASVAGKVRSWVANYW
KRLLDLKSLLATTEFTLPESISDPKAVSLFSGLLVDPQGLKKVADSLPARLVSAEEAIDRLMGVGIPTAADIA
QVERVADEIGAFIGQVQQFNNQVKQKLENLQDADDEEFLKGLKIELPSGDKEPPAINRISGGAPDAAAEISE
LEEKLQRLLDARSEHFQTISEWAEENAVTLDPIAAMVELERLRLAERGATGDPEEYALRLLLQRIGRLANR
VSPVSAGSIRELLKPVFMEEREFNLFFHNRLGSLYRSPYSTSRHQPFSIDVGKAKAIDWIAGLDQISSDIEKAL
SGAGEALGDQLRDWINLAGFAISQRLRGLPDTVPNALAQVRCPDDVRIPPLLAMLLEEDDIARDVCLKAFN
LYVSAINGCLFGALREGFIVRTRFQRIGTDQIHYVPKDKAWEYPDRLNTAKGPINAAVSSDWIEKDGAVIKP
VETVRNLSSTGFAGAGVSEYLVQAPHDWYTPLDLRDVAHLVTGLPVEKNITKLKRLTNRTAFRMVGASSF
KTHLDSVLLSDKIKLGDFTIIIDQHYRQSVTYGGKVKISYEPERLQVEAAVPVVDTRDRTVPEPDTLFDHIVA
IDLGERSVGFAVFDIKSCLRTGEVKPIHDNNGNPVVGTVAVPSIRRLMKAVRSHRRRRQPNQKVNQTYSTA
LQNYRENVIGDVCNRIDTLMERYNAFPVLEFQIKNFQAGAKQLEIVYGS (SEQ ID NO: 397)

[00152] An exemplary alignment of four Cas9 sequences is provided below. The Cas9 sequences in the alignment are: Sequence 1 (S1): SEQ ID NO: 1 | WP_010922251| gi 499224711 | type II CRISPR RNA-guided endonuclease Cas9 [*Streptococcus pyogenes*]; Sequence 2 (S2): SEQ ID NO: 27 | WP_039695303 | gi 746743737 | type II CRISPR RNA-guided endonuclease Cas9 [*Streptococcus gallolyticus*]; Sequence 3 (S3): SEQ ID NO: 28 | WP_045635197 | gi 782887988 | type II CRISPR RNA-guided endonuclease Cas9 [*Streptococcus mitis*]; Sequence 4 (S4): SEQ ID NO: 29 | 5AXW_A | gi 924443546 | *Staphylococcus aureus* Cas9. The HNH domain (bold

and underlined) and the RuvC domain (boxed) are identified for each of the four sequences. Amino acid residues 10 and 840 in S1 and the homologous amino acids in the aligned sequences are identified with an asterisk following the respective amino acid residue.

```
S1 1    --MDKK-YSIGLD*IGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLI--GALLFDSG--ETAEATRLKRTARRRYT  73
S2 1    --MTKKNYSIGLD*IGTNSVGWAVITDDYKVPAKKMKVLGNTDKKYIKKNLL--GALLFDSG--ETAEATRLKRTARRRYT  74
S3 1    --M-KKGYSIGLD*IGTNSVGFAVITDDYKVPSKKMKVLGNTDKRFIKKNLI--GALLFDEG--TTAEARRLKRTARRRYT  73
S4 1    GSHMKRNYILGLD*IGITSVGYGII--DYET-----------------RDVIDAGVRLFKEANVENNEGRRSKRGARRLKR  61

S1 74   RRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRL 153
S2 75   RRKNRLRYLQEIFANEIAKVDESFFQRLDESFLTDDDKTFDSHPIFGNKAEEDAYHQKFPTIYHLRKHLADSSEKADLRL 154
S3 74   RRKNRLRYLQEIFSEEMSKVDSSFFHRLDDSFLIPEDKRESKYPIFATLTEEKEYHKQFPTIYHLRKQLADSKEKTDLRL 153
S4 62   RRRHRIQRVKKLL---------------FDYNLLTD--------------------HSELSGINPYEARVKGLSQKLSEEE 107

S1 154  IYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEK  233
S2 155  VYLALAHMIKFRGHFLIEGELNAENTDVQKIFADFVGVYNRTFDDSHLSEITVDVASILTEKISKSRRLENLIKYYPTEK  234
S3 154  IYLALAHMIKYRGHFLYEEAFDIKNNDIQKIFNEFISIYDNTFEGSSLSGQNAQVEAIFTDKISKSAKRERVLKLFPDEK  233
S4 108  FSAALLHLAKRRG----------------------VHNVNEVEEDT---------------------------------  131

S1 234  KNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEIT 313
S2 235  KNTLFGNLIALALGLQPNFKTNFKLSEDAKLQFSKDTYEEDLEELLGKIGDDYADLFTSAKNLYDAILLSGILTVDDNST 314
S3 234  STGLFSEFLKLIVGNQADFKKHFDLEDKAPLQFSKDTYDEDLENLLGQIGDDFTDLFVSAKKLYDAILLSGILTVTDPST 313
S4 132  -----GNELS------------------TKEQISRN---------------------------------------------- 144

S1 314  KAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKM--DGTEELLV  391
S2 315  KAPLSASMIKRYVEHHEDLEKLKEFIKANKSELYHDIFKDKNKNGYAGYIENGVKQDEFYKYLKNILSKIKIDGSDYFLD  394
S3 314  KAPLSASMIERYENHQNDLAALKQFIKNNLPEKYDEVFSDQSKDGYAGYIDGKTTQETFYKYIKNLLSKF--EGTDYFLD  391
S4 145  ----SKALEEKYVAELQ-------------------------------------------------LERLKKDG------  165

S1 392  KLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEE  471
S2 395  KIEREDFLRKQRTFDNGSIPHQIHLQEMHAILRRQGDYYPFLKEKQDRIEKILTFRIPYYVGPLVRKDSRFAWAEYRSDE  474
S3 392  KIEREDFLRKQRTFDNGSIPHQIHLQEMNAILRRQGEYYPFLKDNKEKIEKILTFRIPYYVGPLARGNRDFAWLTRNSDE  471
S4 166  --EVRGSINRFKTSD--------YVKEAKQLLKVQKAYHQLDQSFIDTYIDLLETRRTYYEGP--GEGSPFGW------K  227

S1 472  TITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL 551
S2 475  KITPWNFDKVIDKEKSAEKFITRMTLNDLYLPEEKVLPKHSHVYETYAVYNELTKIKYVNEQGKE-SFFDSNMKQEIFDH 553
S3 472  AIRPWNFEEIVDKASSAEDFINKMTNYDLYLPEEKVLPKHSLLYETFAVYNELTKVKFIAEGLRDYQFLDSGQKKQIVNQ 551
S4 228  DIKEW----------------YEMLMGHCTYFPEELRSVKYAYNADLYNALNDLNNLVITRDENEK---LEYYEKFQIIEN 289

S1 552  LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDR---FNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFED  628
S2 554  VFKENRKVTKEKLLNYLNKEFPEYRIKDLIGLDKENKSFNASLGTYHDLKKIL-DKAFLDDKVNEEVIEDIIKTLTLFED  632
S3 552  LFKENRKVTEKDIIHYLHN-VDGYDGIELKGIEKQ---FNASLSTYHDLLKIIKDKEFMDDAKNEAILENIVHTLTIFED  627
S4 290  VFKQKKKPTLKQIAKEILVNEEDIKGYRVTSTGKPEF---TNLKVYHDIKDITARKEII---ENAELLDQIAKILTIYQS  363

S1 629  REMIEERLKTYAHLFDDKVMKQLKR-RRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKED 707
S2 633  KDMIHERLQKYSDIFTANQLKKLER-RHYTGWGRLSYKLINGIRNKENNKTILDYLIDDGSANRNFMQLINDDTLPFKQI 711
S3 628  REMIKQRLAQYDSLFDEKVIKALTR-RHYTGWGKLSAKLINGICDKQTGNTILDYLIDDGKINRNFMQLINDDGLSFKEI 706
S4 364  SEDIQEELTNLNSELTQEEIEQISNLKGYTGTHNLSLKAINLILDE------LWHTNDNQIAIFNRLKLVP--------- 428
```

```
S1 708  IQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTT------QKGQKNSRERM 781
S2 712  IQKSQVVGDVDDIEAVVHDLPGSPAIKKGILQSVKIVDELVKVMG-GNPDNIVIEMARENQTT------NRGRSQSQQRL 784
S3 707  IQKAQVIGKTDDVKQVVQELSGSPAIKKGILQSIKIVDELVKVMG-HAPESIVIEMARENQTT------ARGKKNSQQRY 779
S4 429  -KKVDLSQQKEIPTTLVDDFILSPVVKRSFIQSIKVINAIIKKYG--LPNDIIIELAREKNSKDAQKMINEMQKRNRQTN 505

S1 782  KRIEEGIKELGSQIL-------KEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSD----YDVDH*IVPQSFLKDD 850
S2 785  KKLQNSLKELGSNILNEEKPSYIEDKVENSHLQNDQLFLYYIQNGKDMYTGDELDIDHLSD----YDIDH*IIPQAFIKDD 860
S3 780  KRIEDSLKILASGL---DSNILKENPTDNNQLQNDRLFLYYLQNGKDMYTGEALDINQLSS----YDIDH*IIPQAFIKDD 852
S4 506  ERIEEIIRTTGK---------------ENAKYLIEKIKLHDMQEGKCLYSLEAIPLEDLLNNPFNYEVDH*IIPRSVSFDN 570

S1 851  SIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDN-LTKAERGGL-SELD------KAGFIKRQLV 922
S2 861  SIDNRVLTSSAKNRGKSDDVPSLDIVRARKAEWVRLYKSGLISKRKFDN-LTKAERGGL-TEAD------KAGFIKRQLV 932
S3 853  SLDNRVLTSSKDNRGKSDNVPSIEVVQKRKAFWQQLLDSKLISERKFNN-LTKAERGGL-DERD------KVGFIKRQLV 924
S4 571  SFNNKVLVKQEEASKKGNRTPFQYLSSSDSKISYETFKKHILNLAKGKGRISKTKKEYLLEERDINRFSVQKDFINRNLV 650

S1 923  ETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYP 1002
S2 933  ETRQITKHVAQILDARFNTEHDENDKVIRDVKVITLKSNLVSQFRKDFEFYKVREINDYHHAHDAYLNAVVGTALLKKYP 1012
S3 925  ETRQITKHVAQILDARYNTEVNEKDKKNRTVKIITLKSNLVSNFRKEFRLYKVREINDYHHAHDAYLNAVVAKAILKKYP 1004
S4 651  DTRYATRGLMNLLRSYFRVN-------NLDVKVKSINGGFTSFLRRKWKFKKERNKGYKHHAEDALIIA---------- 712

S1 1003 KLESEFVYGDYKVYDVRKMIAKSEQ--EIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKG--- 1077
S2 1013 KLASEFVYGEYKKYDIRKFITNSSD-----KATAKYFFYSNLMNFFKTKVKYADGTVFERPIIETNAD-GEIAWNKQ--- 1083
S3 1005 KLEPEFVYGEYQKYDLKRYISRSKDPKEVEKATEKYFFYSNLLNFFKEEVHYADGTIVKRENIEYSKDTGEIAWNKE--- 1081
S4 713  --NADFIFKEWKKLDKAKKVMENQM------------------------FEEKQAESMPEIETEQEYKEIFITPHQIK 764

S1 1078 -----RDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKD---WDPKKYGGFDSPTVAYSVLVVAKV 1149
S2 1084 -----IDFEKVRKVLSYPQVNIVKKVETQTGGFSKESILPKGDSDKLIPRKTKKVYWDTKKYGGFDSPTVAYSVFVVADV 1158
S3 1082 -----KDFAIIKKVLSLPQVNIVKKREVQTGGFSKESILPKGNSDKLIPRKTKDILLDTTKYGGFDSPVIAYSILLIADI 1156
S4 765  HIKDFKDYKYSHRVDKKPNRELINDTLYSTRKDDKGNTLIVNNLNGLYDKDNDKL----KKLIN-KSP----EKLLMYHH 835

S1 1150 EKGKSKKLKSVKELLGITIMERSSFEKNPI-DFLEAKG-----YKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKG 1223
S2 1159 EKGKAKKLKTVKELVGISIMERSFFEENPV-EFLENKG-----YHNIREDKLIKLPKYSLFEFEGGRRRLLASASELQKG 1232
S3 1157 EKGKAKKLKTVKTLVGITIMEKAAFEENPI-TFLENKG-----YHNVRKENILCLPKYSLFELENGRRRLLASAKELQKG 1230
S4 836  DPQTYQKLK---------LIMEQYGDEKNPLYKYYEETGNYLTKYSKKDNGPVIKKIKYYGNKLNAHLDITDDYPNSRNKV 907

S1 1224 NELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKH------ 1297
S2 1233 NEMVLPGYLVELLYHAHRADNF-----NSTEYLNYVSEHKKEFEKVLSCVEDFANLYVDVEKNLSKIRAVADSM------ 1301
S3 1231 NEIVLPVYLTTLLYHSKNVHKL-----DEPGHLEYIQKHRNEFKDLLNLVSEFSQKYVLADANLEKIKSLYADN------ 1299
S4 908  VKLSLKPYRFD-VYLDNGVYKFV-----TVKNLDVIK--KENYYEVNSKAYEEAKKLKKISNQAEFIASFYNNDLIKING 979

S1 1298 RDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSIT--------GLYETRI----DLSQL 1365
S2 1302 DNFSIEEISNSFINLLTLTALGAPADFNFLGEKIPRKRYTSTKECLNATLIHQSIT--------GLYETRI----DLSKL 1369
S3 1300 EQADIEILANSFINLLTFTALGAPAAFKFFGKDIDRKRYTTVSEILNATLIHQSIT--------GLYETWI----DLSKL 1367
S4 980  ELYRVIGVNNDLLNRIEVNMIDITYR-EYLENMNDKRPPRIIKTIASKT---QSIKKYSTDILGNLYEVKSKKHPQIIKK 1055
```

```
S1 1366 GGD  1368
S2 1370 GEE  1372
S3 1368 GED  1370
S4 1056 G--  1056
```

[00153] The alignment demonstrates that amino acid sequences and amino acid residues that are homologous to a reference Cas9 amino acid sequence or amino acid residue can be identified across Cas9 sequence variants, including, but not limited to Cas9 sequences from different species, by identifying the amino acid sequence or residue that aligns with the reference sequence or the reference residue using alignment programs and algorithms known in the art. This disclosure provides Cas9 variants in which one or more of the amino acid residues identified by an asterisk in SEQ ID NOs: 1 and 27-29 (*e.g.,* S1, S2, S3, and S4, respectively) are mutated as described herein. The residues D10 and H840 in Cas9 of SEQ ID NO: 1 that correspond to the residues identified in SEQ ID NOs: 1 and 27-29 by an asterisk are referred to herein as "homologous" or "corresponding" residues. Such homologous residues can be identified by sequence alignment, *e.g.*, as described above, and by identifying the sequence or residue that aligns with the reference sequence or residue. Similarly, mutations in Cas9 sequences that correspond to mutations identified in SEQ ID NO: 1 herein, *e.g.*, mutations of residues 10, and 840 in SEQ ID NO: 1, are referred to herein as "homologous" or "corresponding" mutations. For example, the mutations corresponding to the D10A mutation in SEQ ID NO: 1 (S1) for the four aligned sequences above are D11A for S2, D10A for S3, and D13A for S4; the corresponding mutations for H840A in SEQ ID NO: 1 (S1) are H850A for S2, H842A for S3, and H560A for S4.

[00154] A total of 250 Cas9 sequences (SEQ ID NOs: 1 and 27-275) from different species are provided. Amino acid residues corresponding to residues 10 and 840 of SEQ ID NO: 1 may be identified in the same manner as outlined above. All of these Cas9 sequences may be used in accordance with the present disclosure.

WP_010922251.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 1

WP_039695303.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus gallolyticus] SEQ ID NO: 27

WP_045635197.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mitis] SEQ ID NO: 28

5AXW_A Cas9, Chain A, Crystal Structure [Staphylococcus Aureus] SEQ ID NO: 29

WP_009880683.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 30

WP_010922251.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 31

WP_011054416.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 32

WP_011284745.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 33

WP_011285506.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 34

WP_011527619.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 35

WP_012560673.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 36

WP_014407541.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 37

WP_020905136.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 38

WP_023080005.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 39

WP_023610282.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 40

WP_030125963.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 41

WP_030126706.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 42

WP_031488318.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 43

WP_032460140.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 44

WP_032461047.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 45

WP_032462016.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 46

WP_032462936.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 47

WP_032464890.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 48

WP_033888930.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 49

WP_038431314.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 50

WP_038432938.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 51

WP_038434062.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pyogenes] SEQ ID NO: 52

BAQ51233.1	CRISPR-associated protein, Csn1 family [Streptococcus pyogenes] SEQ ID NO: 53
KGE60162.1	hypothetical protein MGAS2111_0903 [Streptococcus pyogenes MGAS2111] SEQ ID NO: 54
KGE60856.1	CRISPR-associated endonuclease protein [Streptococcus pyogenes SS1447] SEQ ID NO: 55
WP_002989955.1	MULTISPECIES: type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus] SEQ ID NO: 56
WP_003030002.1	MULTISPECIES: type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus] SEQ ID NO: 57
WP_003065552.1	MULTISPECIES: type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus] SEQ ID NO: 58
WP_001040076.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 59
WP_001040078.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 60
WP_001040080.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 61
WP_001040081.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 62
WP_001040083.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 63
WP_001040085.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 64
WP_001040087.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 65
WP_001040088.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 66
WP_001040089.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 67
WP_001040090.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 68
WP_001040091.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 69
WP_001040092.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 70
WP_001040094.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 71
WP_001040095.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 72
WP_001040096.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 73
WP_001040097.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 74
WP_001040098.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 75
WP_001040099.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 76
WP_001040100.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 77
WP_001040104.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 78
WP_001040105.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 79

WP_001040106.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 80
WP_001040107.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 81
WP_001040108.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 82
WP_001040109.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 83
WP_001040110.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 84
WP_015058523.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 85
WP_017643650.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 86
WP_017647151.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 87
WP_017648376.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 88
WP_017649527.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 89
WP_017771611.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 90
WP_017771984.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 91
CFQ25032.1	CRISPR-associated protein [Streptococcus agalactiae] SEQ ID NO: 92
CFV16040.1	CRISPR-associated protein [Streptococcus agalactiae] SEQ ID NO: 93
KLJ37842.1	CRISPR-associated protein Csn1 [Streptococcus agalactiae] SEQ ID NO: 94
KLJ72361.1	CRISPR-associated protein Csn1 [Streptococcus agalactiae] SEQ ID NO: 95
KLL20707.1	CRISPR-associated protein Csn1 [Streptococcus agalactiae] SEQ ID NO: 96
KLL42645.1	CRISPR-associated protein Csn1 [Streptococcus agalactiae] SEQ ID NO: 97
WP_047207273.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 98
WP_047209694.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 99
WP_050198062.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 100
WP_050201642.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 101
WP_050204027.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 102
WP_050881965.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 103
WP_050886065.1	type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus agalactiae] SEQ ID NO: 104
AHN30376.1	CRISPR-associated protein Csn1 [Streptococcus agalactiae 138P] SEQ ID NO: 105
EAO78426.1	reticulocyte binding protein [Streptococcus agalactiae H36B] SEQ ID NO: 106

CCW42055.1 CRISPR-associated protein, SAG0894 family [Streptococcus agalactiae ILRI112] SEQ ID NO:107

WP_003041502.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus anginosus] SEQ ID NO: 108

WP_037593752.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus anginosus] SEQ ID NO: 109

WP_049516684.1 CRISPR-associated protein Csn1 [Streptococcus anginosus] SEQ ID NO: 110

GAD46167.1 hypothetical protein ANG6_0662 [Streptococcus anginosus T5] SEQ ID NO: 111

WP_018363470.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus caballi] SEQ ID NO: 112

WP_003043819.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus canis] SEQ ID NO: 113

WP_006269658.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus constellatus] SEQ ID NO: 114

WP_048800889.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus constellatus] SEQ ID NO: 115

WP_012767106.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus dysgalactiae] SEQ ID NO: 116

WP_014612333.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus dysgalactiae] SEQ ID NO: 117

WP_015017095.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus dysgalactiae] SEQ ID NO: 118

WP_015057649.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus dysgalactiae] SEQ ID NO: 119

WP_048327215.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus dysgalactiae] SEQ ID NO: 120

WP_049519324.1 CRISPR-associated protein Csn1 [Streptococcus dysgalactiae] SEQ ID NO: 121

WP_012515931.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus equi] SEQ ID NO: 122

WP_021320964.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus equi] SEQ ID NO: 123

WP_037581760.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus equi] SEQ ID NO: 124

WP_004232481.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus equinus] SEQ ID NO: 125

WP_009854540.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus gallolyticus] SEQ ID NO: 126

WP_012962174.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus gallolyticus] SEQ ID NO: 127

WP_039695303.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus gallolyticus] SEQ ID NO: 128

WP_014334983.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus infantarius] SEQ ID NO: 129

WP_003099269.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus iniae] SEQ ID NO: 130

AHY15608.1 CRISPR-associated protein Csn1 [Streptococcus iniae] SEQ ID NO: 131

AHY17476.1 CRISPR-associated protein Csn1 [Streptococcus iniae] SEQ ID NO: 132

ESR09100.1 hypothetical protein IUSA1_08595 [Streptococcus iniae IUSA1] SEQ ID NO: 133

AGM98575.1 CRISPR-associated protein Cas9/Csn1, subtype II/NMEMI [Streptococcus iniae SF1] SEQ ID NO: 134

ALF27331.1 CRISPR-associated protein Csn1 [Streptococcus intermedius] SEQ ID NO: 135

WP_018372492.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus massiliensis] SEQ ID NO: 136

WP_045618028.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mitis] SEQ ID NO: 137

WP_045635197.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mitis] SEQ ID NO: 138

WP_002263549.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 139

WP_002263887.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 140

WP_002264920.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 141

WP_002269043.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 142

WP_002269448.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 143

WP_002271977.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 144

WP_002272766.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 145

WP_002273241.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 146

WP_002275430.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 147

WP_002276448.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 148

WP_002277050.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 149

WP_002277364.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 150

WP_002279025.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 151

WP_002279859.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 152

WP_002280230.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 153

WP_002281696.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 154

WP_002282247.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 155

WP_002282906.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 156

WP_002283846.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 157

WP_002287255.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 158

WP_002288990.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 159

WP_002289641.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 160

WP_002290427.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 161

WP_002295753.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 162

WP_002296423.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 163

WP_002304487.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 164

WP_002305844.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 165

WP_002307203.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 166

WP_002310390.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 167

WP_002352408.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 168

WP_012997688.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 169

WP_014677909.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 170

WP_019312892.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 171

WP_019313659.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 172

WP_019314093.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 173

WP_019315370.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 174

WP_019803776.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 175

WP_019805234.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 176

WP_024783594.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 177

WP_024784288.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 178

WP_024784666.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 179

WP_024784894.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 180

WP_024786433.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus mutans] SEQ ID NO: 181

WP_049473442.1 CRISPR-associated protein Csn1 [Streptococcus mutans] SEQ ID NO: 182

WP_049474547.1 CRISPR-associated protein Csn1 [Streptococcus mutans] SEQ ID NO: 183

EMC03581.1 hypothetical protein SMU69_09359 [Streptococcus mutans NLML4] SEQ ID NO: 184

WP_000428612.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus oralis] SEQ ID NO: 185

WP_000428613.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus oralis] SEQ ID NO: 186

WP_049523028.1 CRISPR-associated protein Csn1 [Streptococcus parasanguinis] SEQ ID NO: 187
WP_003107102.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus parauberis] SEQ ID NO: 188
WP_054279288.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus phocae] SEQ ID NO: 189
WP_049531101.1 CRISPR-associated protein Csn1 [Streptococcus pseudopneumoniae] SEQ ID NO: 190
WP_049538452.1 CRISPR-associated protein Csn1 [Streptococcus pseudopneumoniae] SEQ ID NO: 191
WP_049549711.1 CRISPR-associated protein Csn1 [Streptococcus pseudopneumoniae] SEQ ID NO: 192
WP_007896501.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus pseudoporcinus] SEQ ID NO: 193
EFR44625.1 CRISPR-associated protein, Csn1 family [Streptococcus pseudoporcinus SPIN 20026] SEQ ID NO: 194
WP_002897477.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus sanguinis] SEQ ID NO: 195
WP_002906454.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus sanguinis] SEQ ID NO: 196
WP_009729476.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus sp. F0441] SEQ ID NO: 197
CQR24647.1 CRISPR-associated protein [Streptococcus sp. FF10] SEQ ID NO: 198
WP_000066813.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus sp. M334] SEQ ID NO: 199
WP_009754323.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus sp. taxon 056] SEQ ID NO: 200
WP_044674937.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus suis] SEQ ID NO: 201
WP_044676715.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus suis] SEQ ID NO: 202
WP_044680361.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus suis] SEQ ID NO: 203
WP_044681799.1 type II CRISPR RNA-guided endonuclease Cas9 [Streptococcus suis] SEQ ID NO: 204
WP_049533112.1 CRISPR-associated protein Csn1 [Streptococcus suis] SEQ ID NO: 205
WP_029090905.1 type II CRISPR RNA-guided endonuclease Cas9 [Brochothrix thermosphacta] SEQ ID NO: 206
WP_006506696.1 type II CRISPR RNA-guided endonuclease Cas9 [Catenibacterium mitsuokai] SEQ ID NO: 207
AIT42264.1 Cas9hc:NLS:HA [Cloning vector pYB196] SEQ ID NO: 208
WP_034440723.1 type II CRISPR endonuclease Cas9 [Clostridiales bacterium S5-A11] SEQ ID NO: 209
AKQ21048.1 Cas9 [CRISPR-mediated gene targeting vector p(bhsp68-Cas9)] SEQ ID NO: 210
WP_004636532.1 type II CRISPR RNA-guided endonuclease Cas9 [Dolosigranulum pigrum] SEQ ID NO: 211
WP_002364836.1 MULTISPECIES: type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus] SEQ ID NO: 212
WP_016631044.1 MULTISPECIES: type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus] SEQ ID NO: 213

EMS75795.1	hypothetical protein H318_06676 [Enterococcus durans IPLA 655] SEQ ID NO: 214
WP_002373311.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecalis] SEQ ID NO: 215
WP_002378009.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecalis] SEQ ID NO: 216
WP_002407324.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecalis] SEQ ID NO: 217
WP_002413717.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecalis] SEQ ID NO: 218
WP_010775580.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecalis] SEQ ID NO: 219
WP_010818269.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecalis] SEQ ID NO: 220
WP_010824395.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecalis] SEQ ID NO: 221
WP_016622645.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecalis] SEQ ID NO: 222
WP_033624816.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecalis] SEQ ID NO: 223
WP_033625576.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecalis] SEQ ID NO: 224
WP_033789179.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecalis] SEQ ID NO: 225
WP_002310644.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecium] SEQ ID NO: 226
WP_002312694.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecium] SEQ ID NO: 227
WP_002314015.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecium] SEQ ID NO: 228
WP_002320716.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecium] SEQ ID NO: 229
WP_002330729.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecium] SEQ ID NO: 230
WP_002335161.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecium] SEQ ID NO: 231
WP_002345439.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecium] SEQ ID NO: 232
WP_034867970.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecium] SEQ ID NO: 233
WP_047937432.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus faecium] SEQ ID NO: 234
WP_010720994.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus hirae] SEQ ID NO: 235
WP_010737004.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus hirae] SEQ ID NO: 236
WP_034700478.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus hirae] SEQ ID NO: 237
WP_007209003.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus italicus] SEQ ID NO: 238
WP_023519017.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus mundtii] SEQ ID NO: 239
WP_010770040.1	type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus phoeniculicola] SEQ ID NO: 240

WP_048604708.1 type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus sp. AM1] SEQ ID NO: 241

WP_010750235.1 type II CRISPR RNA-guided endonuclease Cas9 [Enterococcus villorum] SEQ ID NO: 242

AII16583.1 Cas9 endonuclease [Expression vector pCas9] SEQ ID NO: 243

WP_029073316.1 type II CRISPR RNA-guided endonuclease Cas9 [Kandleria vitulina] SEQ ID NO: 244

WP_031589969.1 type II CRISPR RNA-guided endonuclease Cas9 [Kandleria vitulina] SEQ ID NO: 245

KDA45870.1 CRISPR-associated protein Cas9/Csn1, subtype II/NMEMI [Lactobacillus animalis] SEQ ID NO: 246

WP_039099354.1 type II CRISPR RNA-guided endonuclease Cas9 [Lactobacillus curvatus] SEQ ID NO: 247

AKP02966.1 hypothetical protein ABB45_04605 [Lactobacillus farciminis] SEQ ID NO: 248

WP_010991369.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria innocua] SEQ ID NO: 249

WP_033838504.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria innocua] SEQ ID NO: 250

EHN60060.1 CRISPR-associated protein, Csn1 family [Listeria innocua ATCC 33091] SEQ ID NO: 251

EFR89594.1 crispr-associated protein, Csn1 family [Listeria innocua FSL S4-378] SEQ ID NO: 252

WP_038409211.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria ivanovii] SEQ ID NO: 253

EFR95520.1 crispr-associated protein Csn1 [Listeria ivanovii FSL F6-596] SEQ ID NO: 254

WP_003723650.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria monocytogenes] SEQ ID NO: 255

WP_003727705.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria monocytogenes] SEQ ID NO: 256

WP_003730785.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria monocytogenes] SEQ ID NO: 257

WP_003733029.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria monocytogenes] SEQ ID NO: 258

WP_003739838.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria monocytogenes] SEQ ID NO: 259

WP_014601172.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria monocytogenes] SEQ ID NO: 260

WP_023548323.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria monocytogenes] SEQ ID NO: 261

WP_031665337.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria monocytogenes] SEQ ID NO: 262

WP_031669209.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria monocytogenes] SEQ ID NO: 263

WP_033920898.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria monocytogenes] SEQ ID NO: 264

AKI42028.1 CRISPR-associated protein [Listeria monocytogenes] SEQ ID NO: 265

AKI50529.1 CRISPR-associated protein [Listeria monocytogenes] SEQ ID NO: 266

EFR83390.1 crispr-associated protein Csn1 [Listeria monocytogenes FSL F2-208] SEQ ID NO: 267

WP_046323366.1 type II CRISPR RNA-guided endonuclease Cas9 [Listeria seeligeri] SEQ ID NO: 268

AKE81011.1 Cas9 [Plant multiplex genome editing vector pYLCRISPR/Cas9Pubi-H] SEQ ID NO: 269

CUO82355.1 Uncharacterized protein conserved in bacteria [Roseburia hominis] SEQ ID NO: 270

WP_033162887.1 type II CRISPR RNA-guided endonuclease Cas9 [Sharpea azabuensis] SEQ ID NO: 271

AGZ01981.1 Cas9 endonuclease [synthetic construct] SEQ ID NO: 272

AKA60242.1 nuclease deficient Cas9 [synthetic construct] SEQ ID NO: 273

AKS40380.1 Cas9 [Synthetic plasmid pFC330] SEQ ID NO: 274

4UN5_B Cas9, Chain B, Crystal Structure SEQ ID NO: 275

[00155] Non-limiting examples of suitable cytosine deaminase domains are provided.

Human AID

MDSLLMNRRKFLYQFKNVRWAKGRRETYLCYVVKRRDSATSFSLDFGYLRNKNGCHVELLFLRYISDWD
LDPGRCYRVTWFTSWSPCYDCARHVADFLRGNPNLSLRIFTARLYFCEDRKAEPEGLRRLHRAGVQIAIMT
FKDYFYCWNTFVENHERTFKAWEGLHENSVRLSRQLRRILLPLYEVDDLRDAFRTLGL (SEQ ID NO: 276)

Mouse AID

MDSLLMKQKKFLYHFKNVRWAKGRHETYLCYVVKRRDSATSCSLDFGHLRNKSGCHVELLFLRYISDWD
LDPGRCYRVTWFTSWSPCYDCARHVAEFLRWNPNLSLRIFTARLYFCEDRKAEPEGLRRLHRAGVQIGIMT
FKDYFYCWNTFVENRERTFKAWEGLHENSVRLTRQLRRILLPLYEVDDLRDAFRMLGF (SEQ ID NO: 277)

Dog AID

MDSLLMKQRKFLYHFKNVRWAKGRHETYLCYVVKRRDSATSFSLDFGHLRNKSGCHVELLFLRYISDWD
LDPGRCYRVTWFTSWSPCYDCARHVADFLRGYPNLSLRIFAARLYFCEDRKAEPEGLRRLHRAGVQIAIMT
FKDYFYCWNTFVENREKTFKAWEGLHENSVRLSRQLRRILLPLYEVDDLRDAFRTLGL (SEQ ID NO: 278)

Bovine AID

MDSLLKKQRQFLYQFKNVRWAKGRHETYLCYVVKRRDSPTSFSLDFGHLRNKAGCHVELLFLRYISDWD
LDPGRCYRVTWFTSWSPCYDCARHVADFLRGYPNLSLRIFTARLYFCDKERKAEPEGLRRLHRAGVQIAIM
TFKDYFYCWNTFVENHERTFKAWEGLHENSVRLSRQLRRILLPLYEVDDLRDAFRTLGL (SEQ ID NO:
279)

Mouse APOBEC-3

MGPFCLGCSHRKCYSPIRNLISQETFKFHFKNLGYAKGRKDTFLCYEVTRKDCDSPVSLHHGVFKNKDNIH
AEICFLYWFHDKVLKVLSPREEFKITWYMSWSPCFECAEQIVRFLATHHNLSLDIFSSRLYNVQDPETQQNL
CRLVQEGAQVAAMDLYEFKKCWKKFVDNGGRRFRPWKRLLTNFRYQDSKLQEILRPCYIPVPSSSSSTLSN
ICLTKGLPETRFCVEGRRMDPLSEEEFYSQFYNQRVKHLCYYHRMKPYLCYQLEQFNGQAPLKGCLLSEK
GKQHAEILFLDKIRSMELSQVTITCYLTWSPCPNCAWQLAAFKRDRPDLILHIYTSRLYFHWKRPFQKGLCS
LWQSGILVDVMDLPQFTDCWTNFVNPKRPFWPWKGLEIISRRTQRRLRRIKESWGLQDLVNDFGNLQLGP
PMS (SEQ ID NO: 280)

Rat APOBEC-3

MGPFCLGCSHRKCYSPIRNLISQETFKFHFKNLRYAIDRKDTFLCYEVTRKDCDSPVSLHHGVFKNKDNIHA
EICFLYWFHDKVLKVLSPREEFKITWYMSWSPCFECAEQVLRFLATHHNLSLDIFSSRLYNIRDPENQQNLC
RLVQEGAQVAAMDLYEFKKCWKKFVDNGGRRFRPWKKLLTNFRYQDSKLQEILRPCYIPVPSSSSSTLSNI
CLTKGLPETRFCVERRRVHLLSEEEFYSQFYNQRVKHLCYYHGVKPYLCYQLEQFNGQAPLKGCLLSEKG
KQHAEILFLDKIRSMELSQVIITCYLTWSPCPNCAWQLAAFKRDRPDLILHIYTSRLYFHWKRPFQKGLCSL
WQSGILVDVMDLPQFTDCWTNFVNPKRPFWPWKGLEIISRRTQRRLHRIKESWGLQDLVNDFGNLQLGPP
MS (SEQ ID NO: 281)

Rhesus macaque APOBEC-3G

MVEPMDPRTFVSNFNNRPILSGLNTVWLCCEVKTKDPSGPPLDAKIFQGKVYSKAKYHPEMRFLRWFHKW
RQLHHDQEYKVTWYVSWSPCTRCANSVATFLAKDPKVTLTIFVARLYYFWKPDYQQALRILCQKRGGPH

ATMKIMNYNEFQDCWNKFVDGRGKPFKPRNNLPKHYTLLQATLGELLRHLMDPGTFTSNFNNKPWVSGQ
HETYLCYKVERLHNDTWVPLNQHRGFLRNQAPNIHGFPKGRHAELCFLDLIPFWKLDGQQYRVTCFTSWS
PCFSCAQEMAKFISNNEHVSLCIFAARIYDDQGRYQEGLRALHRDGAKIAMMNYSEFEYCWDTFVDRQGR
PFQPWDGLDEHSQALSGRLRAI (SEQ ID NO: 282) (italic: nucleic acid editing domain; underline: cytoplasmic localization signal)

Chimpanzee APOBEC-3G

MKPHFRNPVERMYQDTFSDNFYNRPILSHRNTVWLCYEVKTKGPSRPPLDAKIFRGQVYSKLKYHPEMRF
FHWFSKWRKLHRDQEYEVTWYISWSPCTKCTRDVATFLAEDPKVTLTIFVARLYYFWDPDYQEALRSLCQ
KRDGPRATMKIMNYDEFQHCWSKFVYSQRELFEPWNNLPKYYILLHIMLGEILRHSMDPPTFTSNFNNELW
VRGRHETYLCYEVERLHNDTWVLLNQRRGFLCNQAPHKHGFLEGRHAELCFLDVIPFWKLDLHQDYRVT
CFTSWSPCFSCAQEMAKFISNNKHVSLCIFAARIYDDQGRCQEGLRTLAKAGAKISIMTYSEFKHCWDTFV
DHQGCPFQPWDGLEEHSQALSGRLRAILQNQGN (SEQ ID NO: 283)

Green monkey APOBEC-3G

MNPQIRNMVEQMEPDIFVYYFNNRPILSGRNTVWLCYEVKTKDPSGPPLDANIFQGKLYPEAKDHPEMKFL
HWFRKWRQLHRDQEYEVTWYVSWSPCTRCANSVATFLAEDPKVTLTIFVARLYYFWKPDYQQALRILCQ
ERGGPHATMKIMNYNEFQHCWNEFVDGQGKPFKPRKNLPKHYTLLHATLGELLRHVMDPGTFTSNFNNK
PWVSGQRETYLCYKVERSHNDTWVLLNQHRGFLRNQAPDRHGFPKGRHAELCFLDLIPFWKLDDQQYRV
TCFTSWSPCFSCAQKMAKFISNNKHVSLCIFAARIYDDQGRCQEGLRTLHRDGAKIAVMNYSEFEYCWDTF
VDRQGRPFQPWDGLDEHSQALSGRLRAI (SEQ ID NO: 284)

Human APOBEC-3G

MKPHFRNTVERMYRDTFSYNFYNRPILSRRNTVWLCYEVKTKGPSRPPLDAKIFRGQVYSELKYHPEMRFF
HWFSKWRKLHRDQEYEVTWYISWSPCTKCTRDMATFLAEDPKVTLTIFVARLYYFWDPDYQEALRSLCQ
KRDGPRATMKIMNYDEFQHCWSKFVYSQRELFEPWNNLPKYYILLHIMLGEILRHSMDPPTFTFNFNNEPW
VRGRHETYLCYEVERMHNDTWVLLNQRRGFLCNQAPHKHGFLEGRHAELCFLDVIPFWKLDLDQDYRVT
CFTSWSPCFSCAQEMAKFISKNKHVSLCIFTARIYDDQGRCQEGLRTLAEAGAKISIMTYSEFKHCWDTFVD
HQGCPFQPWDGLDEHSQDLSGRLRAILQNQEN (SEQ ID NO: 285)

Human APOBEC-3F

MKPHFRNTVERMYRDTFSYNFYNRPILSRRNTVWLCYEVKTKGPSRPRLDAKIFRGQVYSQPEHHAEMCF
LSWFCGNQLPAYKCFQITWFVSWTPCPDCVAKLAEFLAEHPNVTLTISAARLYYYWERDYRRALCRLSQA
GARVKIMDDEEFAYCWENFVYSEGQPFMPWYKFDDNYAFLHRTLKEILRNPMEAMYPHIFYFHFKNLRK
AYGRNESWLCFTMEVVKHHSPVSWKRGVFRNQVDPETHCHAERCFLSWFCDDILSPNTNYEVTWYTSWS
PCPECAGEVAEFLARHSNVNLTIFTARLYYFWDTDYQEGLRSLSQEGASVEIMGYKDFKYCWENFVYNDD
EPFKPWKGLKYNFLFLDSKLQEILE (SEQ ID NO: 286)

Human APOBEC-3B

MNPQIRNPMERMYRDTFYDNFENEPILYGRSYTWLCYEVKIKRGRSNLLWDTGVFRGQVYFKPQYHAEM
CFLSWFCGNQLPAYKCFQITWFVSWTPCPDCVAKLAEFLSEHPNVTLTISAARLYYYWERDYRRALCRLSQ
AGARVTIMDYEEFAYCWENFVYNEGQQFMPWYKFDENYAFLHRTLKEILRYLMDPDTFTFNFNNDPLVL
RRRQTYLCYEVERLDNGTWVLMDQHMGFLCNEAKNLLCGFYGRHAELRFLDLVPSLQLDPAQIYRVTWF
ISWSPCFSWGCAGEVRAFLQENTHVRLRIFAARIYDYDPLYKEALQMLRDAGAQVSIMTYDEFEYCWDTF
VYRQGCPFQPWDGLEEHSQALSGRLRAILQNQGN (SEQ ID NO: 287)

Human APOBEC-3C:

MNPQIRNPMKAMYPGTFYFQFKNLWEANDRNETWLCFTVEGIKRRSVVSWKTGVFRNQVDSETHCHAER
CFLSWFCDDILSPNTKYQVTWYTSWSPCPDCAGEVAEFLARHSNVNLTIFTARLYYFQYPCYQEGLRSLSQ
EGVAVEIMDYEDFKYCWENFVYNDNEPFKPWKGLKTNFRLLKRRLRESLQ (SEQ ID NO: 288)

Human APOBEC-3A:

MEASPASGPRHLMDPHIFTSNFNNGIGRHKTYLCYEVERLDNGTSVKMDQHRGFLHNQAKNLLCGFYGRH
AELRFLDLVPSLQLDPAQIYRVTWFISWSPCFSWGCAGEVRAFLQENTHVRLRIFAARIYDYDPLYKEALQ
MLRDAGAQVSIMTYDEFKHCWDTFVDHQGCPFQPWDGLDEHSQALSGRLRAILQNQGN (SEQ ID NO:
289)

Human APOBEC-3H:

MALLTAETFRLQFNNKRRLRRPYYPRKALLCYQLTPQNGSTPTRGYFENKKKCHAEICFINEIKSMGLDET
QCYQVTCYLTWSPCSSCAWELVDFIKAHDHLNLGIFASRLYYHWCKPQQKGLRLLCGSQVPVEVMGFPKF
ADCWENFVDHEKPLSFNPYKMLEELDKNSRAIKRRLERIKIPGVRAQGRYMDILCDAEV (SEQ ID NO:
290)

Human APOBEC-3D

MNPQIRNPMERMYRDTFYDNFENEPILYGRSYTWLCYEVKIKRGRSNLLWDTGVFRGPVLPKRQSNHRQE
VYFRFENHAEMCFLSWFCGNRLPANRRFQITWFVSWNPCLPCVVKVTKFLAEHPNVTLTISAARLYYYRD
RDWRWVLLRLHKAGARVKIMDYEDFAYCWENFVCNEGQPFMPWYKFDDNYASLHRTLKEILRNPMEAM
YPHIFYFHFKNLLKACGRNESWLCFTMEVTKHHSAVFRKRGVFRNQVDPETHCHAERCFLSWFCDDILSPN
TNYEVTWYTSWSPCPECAGEVAEFLARHSNVNLTIFTARLCYFWDTDYQEGLCSLSQEGASVKIMGYKDF
VSCWKNFVYSDDEPFKPWKGLQTNFRLLKRRLREILQ (SEQ ID NO: 291)

Human APOBEC-1

MTSEKGPSTGDPTLRRRIEPWEFDVFYDPRELRKEACLLYEIKWGMSRKIWRSSGKNTTNHVEVNFIKKFTS
ERDFHPSMSCSITWFLSWSPCWECSQAIREFLSRHPGVTLVIYVARLFWHMDQQNRQGLRDLVNSGVTIQI
MRASEYYHCWRNFVNYPPGDEAHWPQYPPLWMMLYALELHCIILSLPPCLKISRRWQNHLTFFRLHLQNC
HYQTIPPHILLATGLIHPSVAWR (SEQ ID NO: 292)

Mouse APOBEC-1

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSVWRHTSQNTSNHVEVNFLEKFTT
ERYFRPNTRCSITWFLSWSPCGECSRAITEFLSRHPYVTLFIYIARLYHHTDQRNRQGLRDLISSGVTIQIMTE
QEYCYCWRNFVNYPPSNEAYWPRYPHLWVKLYVLELYCIILGLPPCLKILRRKQPQLTFFTITLQTCHYQRI
PPHLLWATGLK (SEQ ID NO: 293)

Rat APOBEC-1

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLK (SEQ ID NO: 294)

Petromyzon marinus CDA1 (pmCDA1)

MTDAEYVRIHEKLDIYTFKKQFFNNKKSVSHRCYVLFELKRRGERRACFWGYAVNKPQSGTERGIHAEIFSI
RKVEEYLRDNPGQFTINWYSSWSPCADCAEKILEWYNQELRGNGHTLKIWACKLYYEKNARNQIGLWNL

RDNGVGLNVMVSEHYQCCRKIFIQSSHNQLNENRWLEKTLKRAEKRRSELSIMIQVKILHTTKSPAV (SEQ ID NO: 295)

Human APOBEC3G D316R_D317R

MKPHFRNTVERMYRDTFSYNFYNRPILSRRNTVWLCYEVKTKGPSRPPLDAKIFRGQVYSELKYHPEMRFF HWFSKWRKLHRDQEYEVTWYISWSPCTKCTRDMATFLAEDPKVTLTIFVARLYYFWDPDYQEALRSLCQ KRDGPRATMKIMNYDEFQHCWSKFVYSQRELFEPWNNLPKYYILLHIMLGEILRHSMDPPTFTFNFNNEPW VRGRHETYLCYEVERMHNDTWVLLNQRRGFLCNQAPHKHGFLEGRHAELCFLDVIPFWKLDLDQDYRVT CFTSWSPCFSCAQEMAKFISKNKHVSLCIFTARIYRRQGRCQEGLRTLAEAGAKISIMTYSEFKHCWDTFVD HQGCPFQPWDGLDEHSQDLSGRLRAILQNQEN (SEQ ID NO: 296)

Human APOBEC3G chain A

MDPPTFTFNFNNEPWVRGRHETYLCYEVERMHNDTWVLLNQRRGFLCNQAPHKHGFLEGRHAELCFLDV IPFWKLDLDQDYRVTCFTSWSPCFSCAQEMAKFISKNKHVSLCIFTARIYDDQGRCQEGLRTLAEAGAKISI MTYSEFKHCWDTFVDHQGCPFQPWDGLDEHSQDLSGRLRAILQ (SEQ ID NO: 297)

Human APOBEC3G chain A D120R_D121R

MDPPTFTFNFNNEPWVRGRHETYLCYEVERMHNDTWVLLNQRRGFLCNQAPHKHGFLEGRHAELCFLDV IPFWKLDLDQDYRVTCFTSWSPCFSCAQEMAKFISKNKHVSLCIFTARIYRRQGRCQEGLRTLAEAGAKISI MTYSEFKHCWDTFVDHQGCPFQPWDGLDEHSQDLSGRLRAILQ (SEQ ID NO: 298)

[00156] Nonlimiting, exemplary uracil glycosylase inhibitor sequences are provided.

Bacillus phage PBS2 (Bacteriophage PBS2) Uracil-DNA glycosylase inhibitor
MTNLSDIIEKETGKQLVIQESILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQ DSNGENKIKML (SEQ ID NO: 299)

Erwinia tasmaniensis SSB (themostable single-stranded DNA binding protein)

MASRGVNKVILVGNLGQDPEVRYMPNGGAVANITLATSESWRDKQTGETKEKTEWHRVVLFGKLAEVA GEYLRKGSQVYIEGALQTRKWTDQAGVEKYTTEVVVNVGGTMQMLGGRSQGGGASAGGQNGGSNNGW GQPQQPQGGNQFSGGAQQQARPQQQPQQNNAPANNEPPIDFDDDIP (SEQ ID NO: 300)

UdgX (binds to uracil in DNA but does not excise)

MAGAQDFVPHTADLAELAAAAGECRGCGLYRDATQAVFGAGGRSARIMMIGEQPGDKEDLAGLPFVGPA GRLLDRALEAADIDRDALYVTNAVKHFKFTRAAGGKRRIHKTPSRTEVVACRPWLIAEMTSVEPDVVVLL GATAAKALLGNDFRVTQHRGEVLHVDDVPGDPALVATVHPSSLLRGPKEERESAFAGLVDDLRVAADVR P (SEQ ID NO: 301)

UDG (catalytically inactive human UDG, binds to uracil in DNA but does not excise)

MIGQKTLYSFFSPSPARKRHAPSPEPAVQGTGVAGVPEESGDAAAIPAKKAPAGQEEPGTPPSSPLSAEQLD RIQRNKAAALLRLAARNVPVGFGESWKKHLSGEFGKPYFIKLMGFVAEERKHYTVYPPPHQVFTWTQMC DIKDVKVVILGQEPYHGPNQAHGLCFSVQRPVPPPPSLENIYKELSTDIEDFVHPGHGDLSGWAKQGVLLLN AVLTVRAHQANSHKERGWEQFTDAVVSWLNQNSNGLVFLLWGSYAQKKGSAIDRKRHHVLQTAHPSPLS VYRGFFGCRHFSKTNELLQKSGKKPIDWKEL (SEQ ID NO: 302)

[00157] Non-limiting examples of C to T nucleobase editors are provided.

His_6-rAPOBEC1-XTEN-dCas9 for *Escherichia coli* expression (SEQ ID NO: 303)

MGSSHHHHHHMSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKH
VEVNFIEKFTTERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLI
SSGVTIQIMTEQESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTI
ALQSCHYQRLPPHILWATGLKSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLG
NTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVE
EDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSD
VDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFK
SNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRY
DEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNRE
DLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKS
EETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFL
SGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEEN
EDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLK
SDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRH
KPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVD
QELDINRLSDYDVDAIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQR
KFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYF
FYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESI
LPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDF
LEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDN
EQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

rAPOBEC1-XTEN-dCas9-NLS for mammalian expression (SEQ ID NO: 304)

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKN
LIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIF
GNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQT
YNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKL
QLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLK
ALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDN
GSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEV
VDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLT
LFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFM
QLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARE
NQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDY
DVDAIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERG
GLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREI
NNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKT
EITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIA
RKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVK
KDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQH
KHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRY
TSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

hAPOBEC1-XTEN-dCas9-NLS for Mammalian expression (SEQ ID NO: 305)

MTSEKGPSTGDPTLRRRIEPWEFDVFYDPRELRKEACLLYEIKWGMSRKIWRSSGKNTTNHVEVNFIKKFTS
ERDFHPSMSCSITWFLSWSPCWECSQAIREFLSRHPGVTLVIYVARLFWHMDQQNRQGLRDLVNSGVTIQI
MRASEYYHCWRNFVNYPPGDEAHWPQYPPLWMMLYALELHCIILSLPPCLKISRRWQNHLTFFRLHLQNC
HYQTIPPHILLATGLIHPSVAWRSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVL
GNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLV
EEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNS
DVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNF
KSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKR
YDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNR
EDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRK
SEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAF
LSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEE
NEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFL
KSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGR
HKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYV
DQELDINRLSDYDVDAIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQ
RKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDF
RKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAK
YFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSK
ESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPI
DFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPE
DNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAA
FKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

rAPOBEC1-XTEN-dCas9-UGI-NLS (SEQ ID NO: 306)

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKN
LIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIF
GNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQT
YNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKL
QLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLK
ALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDN
GSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEV
VDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLT
LFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFM
QLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARE
NQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDY
DVDAIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERG
GLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREI
NNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKT
EITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIA
RKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVK
KDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQH
KHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRY
TSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLSDIIEKETGKQLVIQESILMLPEEVEEVIGNKPESD
ILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKKRKV

rAPOBEC1-XTEN-Cas9 nickase-UGI-NLS (BE3, SEQ ID NO: 307)

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKN
LIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIF
GNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQT
YNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKL
QLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLK
ALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDN
GSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEV
VDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTL
FEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQ
LIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMAREN
QTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYD
VDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREIN
NYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTE
ITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIAR
KKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKK
DLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYT
STKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLSDIIEKETGKQLVIQESILMLPEEVEEVIGNKPESDI
LVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKKRKV

pmCDA1-XTEN-dCas9-UGI (bacteria) (SEQ ID NO: 308)

MTDAEYVRIHEKLDIYTFKKQFFNNKKSVSHRCYVLFELKRRGERRACFWGYAVNKPQSGTERGIHAEIFSI
RKVEEYLRDNPGQFTINWYSSWSPCADCAEKILEWYNQELRGNGHTLKIWACKLYYEKNARNQIGLWNL
RDNGVGLNVMVSEHYQCCRKIFIQSSHNQLNENRWLEKTLKRAEKRRSELSIMIQVKILHTTKSPAVSGSET
PGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEAT
RLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPT
IYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGV
DAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNL
LAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEI
FFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAIL
RRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERM
TNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLK
EDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTY
AHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQK
AQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRER
MKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDAIVPQSFLKDDSI
DNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQL
VETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAV
VGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIET
NGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFD
SPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELEN
GRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKR
VILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSI
TGLYETRIDLSQLGGDSGGSMTNLSDIIEKETGKQLVIQESILMLPEEVEEVIGNKPESDILVHTAYDESTDEN
VMLLTSDAPEYKPWALVIQDSNGENKIKML

pmCDA1-XTEN-nCas9-UGI-NLS (mammalian construct) (SEQ ID NO: 309)

MTDAEYVRIHEKLDIYTFKKQFFNNKKSVSHRCYVLFELKRRGERRACFWGYAVNKPQSGTERGIHAEIFSI
RKVEEYLRDNPGQFTINWYSSWSPCADCAEKILEWYNQELRGNGHTLKIWACKLYYEKNARNQIGLWNL
RDNGVGLNVMVSEHYQCCRKIFIQSSHNQLNENRWLEKTLKRAEKRRSELSIMIQVKILHTTKSPAVSGSET
PGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEAT
RLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPT
IYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGV
DAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNL
LAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEI
FFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAIL
RRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERM
TNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLK
EDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTY
AHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQK
AQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRER
MKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSI
DNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQL
VETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAV
VGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIET
NGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFD
SPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELEN
GRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKR
VILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSI
TGLYETRIDLSQLGGDSGGSTNLSDIIEKETGKQLVIQESILMLPEEVEEVIGNKPESDILVHTAYDESTDENV
MLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKKRKV

huAPOBEC3G-XTEN-dCas9-UGI (bacteria) (SEQ ID NO: 310)

MDPPTFTFNFNNEPWVRGRHETYLCYEVERMHNDTWVLLNQRRGFLCNQAPHKHGFLEGRHAELCFLDV
IPFWKLDLDQDYRVTCFTSWSPCFSCAQEMAKFISKNKHVSLCIFTARIYDDQGRCQEGLRTLAEAGAKISI
MTYSEFKHCWDTFVDHQGCPFQPWDGLDEHSQDLSGRLRAILQSGSETPGTSESATPESDKKYSIGLAIGTN
SVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIF
SNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLAL
AHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPG
EKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILL
SDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYK
FIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIP
YYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFT
VYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNAS
LGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGR
LSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIK
KGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQ
LQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDAIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEV
VKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDE
NDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKV
YDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVL
SMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKL
KSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPS
KYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPI
REQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSMTN
LSDIIEKETGKQLVIQESILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSN
GENKIKML

huAPOBEC3G-XTEN-nCas9-UGI-NLS (mammalian construct) (SEQ ID NO: 311)

MDPPTFTFNFNNEPWVRGRHETYLCYEVERMHNDTWVLLNQRRGFLCNQAPHKHGFLEGRHAELCFLDV
IPFWKLDLDQDYRVTCFTSWSPCFSCAQEMAKFISKNKHVSLCIFTARIYDDQGRCQEGLRTLAEAGAKISI
MTYSEFKHCWDTFVDHQGCPFQPWDGLDEHSQDLSGRLRAILQSGSETPGTSESATPESDKKYSIGLAIGTN
SVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIF
SNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLAL
AHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPG
EKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILL
SDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYK
FIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIP
YYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFT
VYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNAS
LGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGR
LSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIK
KGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQ
LQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEV
VKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDE
NDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKV
YDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVL
SMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKL
KSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPS
KYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPI
REQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLS
DIIEKETGKQLVIQESILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGE
NKIKMLSGGSPKKKRKV

huAPOBEC3G (D316R_D317R)-XTEN-nCas9-UGI-NLS (mammalian construct) (SEQ ID NO: 312)

MDPPTFTFNFNNEPWVRGRHETYLCYEVERMHNDTWVLLNQRRGFLCNQAPHKHGFLEGRHAELCFLDV
IPFWKLDLDQDYRVTCFTSWSPCFSCAQEMAKFISKNKHVSLCIFTARIYRRQGRCQEGLRTLAEAGAKISI
MTYSEFKHCWDTFVDHQGCPFQPWDGLDEHSQDLSGRLRAILQSGSETPGTSESATPESDKKYSIGLAIGTN
SVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIF
SNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLAL
AHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPG
EKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILL
SDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYK
FIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIP
YYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFT
VYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNAS
LGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGR
LSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIK
KGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQ
LQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEV
VKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDE
NDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKV
YDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVL
SMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKL
KSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPS
KYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPI
REQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLS
DIIEKETGKQLVIQESILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGE
NKIKMLSGGSPKKKRKV

High fidelity nucleobase editor (SEQ ID NO: 313)

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKN
LIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIF
GNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQT
YNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKL
QLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLK
ALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDN
GSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEV
VDKGASAQSFIERMTAFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLT
LFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGALSRKLINGIRDKQSGKTILDFLKSDGFANRNFM
ALIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARE
NQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDY
DVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERG
GLSELDKAGFIKRQLVETRAITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREI
NNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKT
EITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIA
RKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVK
KDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQH
KHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRY
TSTKEVLDATLIHQSITGLYETRIDLSQLGGD

rAPOBEC1-XTEN-SaCas9n-UGI-NLS)

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGSETPGTSESATPESKRNYILGLDIGITSVGYGIIDYETRDVIDAGVRLFKEANVENNEGR
RSKRGARRLKRRRRHRIQRVKKLLFDYNLLTDHSELSGINPYEARVKGLSQKLSEEEFSAALLHLAKRRGV
HNVNEVEEDTGNELSTKEQISRNSKALEEKYVAELQLERLKKDGEVRGSINRFKTSDYVKEAKQLLKVQK
AYHQLDQSFIDTYIDLLETRRTYYEGPGEGSPFGWKDIKEWYEMLMGHCTYFPEELRSVKYAYNADLYNA
LNDLNNLVITRDENEKLEYYEKFQIIENVFKQKKKPTLKQIAKEILVNEEDIKGYRVTSTGKPEFTNLKVYH
DIKDITARKEIIENAELLDQIAKILTIYQSSEDIQEELTNLNSELTQEEIEQISNLKGYTGTHNLSLKAINLILDE
LWHTNDNQIAIFNRLKLVPKKVDLSQQKEIPTTLVDDFILSPVVKRSFIQSIKVINAIIKKYGLPNDIIIELARE
KNSKDAQKMINEMQKRNRQTNERIEEIIRTTGKENAKYLIEKIKLHDMQEGKCLYSLEAIPLEDLLNNPFNY
EVDHIIPRSVSFDNSFNNKVLVKQEEASKKGNRTPFQYLSSSDSKISYETFKKHILNLAKGKGRISKTKKEYL
LEERDINRFSVQKDFINRNLVDTRYATRGLMNLLRSYFRVNNLDVKVKSINGGFTSFLRRKWKFKKERNK
GYKHHAEDALIIANADFIFKEWKKLDKAKKVMENQMFEEKQAESMPEIETEQEYKEIFITPHQIKHIKDFKD
YKYSHRVDKKPNRELINDTLYSTRKDDKGNTLIVNNLNGLYDKDNDKLKKLINKSPEKLLMYHHDPQTYQ
KLKLIMEQYGDEKNPLYKYYEETGNYLTKYSKKDNGPVIKKIKYYGNKLNAHLDITDDYPNSRNKVVKLS
LKPYRFDVYLDNGVYKFVTVKNLDVIKKENYYEVNSKCYEEAKKLKKISNQAEFIASFYNNDLIKINGELY
RVIGVNNDLLNRIEVNMIDITYREYLENMNDKRPPRIIKTIASKTQSIKKYSTDILGNLYEVKSKKHPQIIKKG
SGGSTNLSDIIEKETGKQLVIQESILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWAL
VIQDSNGENKIKMLSGGSPKKKRKV (SEQ ID NO: 399)

rAPOBEC1-XTEN-SaCas9n-UGI-NLS

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGSETPGTSESATPESKRNYILGLDIGITSVGYGIIDYETRDVIDAGVRLFKEANVENNEGR
RSKRGARRLKRRRRHRIQRVKKLLFDYNLLTDHSELSGINPYEARVKGLSQKLSEEEFSAALLHLAKRRGV
HNVNEVEEDTGNELSTKEQISRNSKALEEKYVAELQLERLKKDGEVRGSINRFKTSDYVKEAKQLLKVQK

AYHQLDQSFIDTYIDLLETRRTYYEGPGEGSPFGWKDIKEWYEMLMGHCTYFPEELRSVKYAYNADLYNA
LNDLNNLVITRDENEKLEYYEKFQIIENVFKQKKKPTLKQIAKEILVNEEDIKGYRVTSTGKPEFTNLKVYH
DIKDITARKEIIENAELLDQIAKILTIYQSSEDIQEELTNLNSELTQEEIEQISNLKGYTGTHNLSLKAINLILDE
LWHTNDNQIAIFNRLKLVPKKVDLSQQKEIPTTLVDDFILSPVVKRSFIQSIKVINAIIKKYGLPNDIIIELARE
KNSKDAQKMINEMQKRNRQTNERIEEIIRTTGKENAKYLIEKIKLHDMQEGKCLYSLEAIPLEDLLNNPFNY
EVDHIIPRSVSFDNSFNNKVLVKQEEASKKGNRTPFQYLSSSDSKISYETFKKHILNLAKGKGRISKTKKEYL
LEERDINRFSVQKDFINRNLVDTRYATRGLMNLLRSYFRVNNLDVKVKSINGGFTSFLRRKWKFKKERNK
GYKHHAEDALIIANADFIFKEWKKLDKAKKVMENQMFEEKQAESMPEIETEQEYKEIFITPHQIKHIKDFKD
YKYSHRVDKKPNRKLINDTLYSTRKDDKGNTLIVNNLNGLYDKDNDKLKKLINKSPEKLLMYHHDPQTYQ
KLKLIMEQYGDEKNPLYKYYEETGNYLTKYSKKDNGPVIKKIKYYGNKLNAHLDITDDYPNSRNKVVKLS
LKPYRFDVYLDNGVYKFVTVKNLDVIKKENYYEVNSKCYEEAKKLKKISNQAEFIASFYKNDLIKINGELY
RVIGVNNDLLNRIEVNMIDITYREYLENMNDKRPPHIIKTIASKTQSIKKYSTDILGNLYEVKSKKHPQIIKKG
SGGSTNLSDIIEKETGKQLVIQESILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWAL
VIQDSNGENKIKMLSGGSPKKKRKV (SEQ ID NO: 400)

Nucleobase Editor 4-SSB

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKN
LIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIF
GNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQT
YNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKL
QLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLK
ALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDN
GSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEV
VDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLT
LFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFM
QLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARE
NQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDY
DVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERG
GLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREI
NNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKT
EITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIA
RKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVK
KDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQH
KHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRY
TSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSGGSGGSASRGVNKVILVGNLGQDPEVRYMPNGGAV
ANITLATSESWRDKATGEMKEQTEWHRVVLFGKLAEVASEYLRKGSQVYIEGQLRTRKWTDQSGQDRYT
TEVVVNVGGTMQMLGGRQGGGAPAGGNIGGGQPQGGWGQPQQPQGGNQFSGGAQSRPQQSAPAAPSNE
PPMDFDDDIPFSGGSPKKKRKV (SEQ ID NO: 401)

Nucleobase Editor 4-$(GGS)_3$

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKN
LIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIF
GNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQT
YNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKL
QLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLK
ALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDN
GSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEV

VDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLT
LFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFM
QLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARE
NQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDY
DVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERG
GLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREI
NNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKT
EITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIA
RKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVK
KDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQH
KHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRY
TSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSGGSGGSTNLSDIIEKETGKQLVIQESILMLPEEVEEVIG
NKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKKRKV (SEQ ID NO:
402)

Nucleobase Editor 4-XTEN

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKN
LIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIF
GNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQT
YNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKL
QLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLK
ALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDN
GSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEV
VDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLT
LFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFM
QLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARE
NQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDY
DVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERG
GLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREI
NNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKT
EITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIA
RKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVK
KDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQH
KHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRY
TSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGSETPGTSESATPESTNLSDIIEKETGKQLVIQESILMLPEE
VEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKKRKV (SEQ
ID NO: 403)

Nucleobase Editor 4-32aa linker

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGTNSVGWAVITDEYKVPSKK
FKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEE
SFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLN
PDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGL
TPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSAS
MIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLV

KLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAW
MTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGM
RKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDF
LDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGK
TILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVK
VMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGR
DMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNA
KLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSK
LVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGK
ATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTG
GFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFE
KNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLK
GSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLG
APAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLSDIIEKETGKQLVIQESIL
MLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKKRK
V (SEQ ID NO: 404)

Nucleobase Editor 4-2X UGI

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKN
LIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIF
GNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQT
YNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKL
QLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLK
ALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDN
GSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEV
VDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLT
LFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFM
QLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARE
NQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDY
DVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERG
GLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREI
NNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKT
EITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIA
RKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVK
KDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQH
KHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRY
TSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLSDIIEKETGKQLVIQESILMLPEEVEEVIGNKPESD
ILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSTNLSDIIEKETGKQLVIQESILMLP
EEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKKRKV
(SEQ ID NO: 405)

Nucleobase Editor 4

MSSETGPVAVDPTLRRRIEPHEFEVFFDPRELRKETCLLYEINWGGRHSIWRHTSQNTNKHVEVNFIEKFTT
ERYFCPNTRCSITWFLSWSPCGECSRAITEFLSRYPHVTLFIYIARLYHHADPRNRQGLRDLISSGVTIQIMTE
QESGYCWRNFVNYSPSNEAHWPRYPHLWVRLYVLELYCIILGLPPCLNILRRKQPQLTFFTIALQSCHYQRL
PPHILWATGLKSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGTNSVGWAVITDEYKVPSKK
FKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEE
SFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLN
PDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGL
TPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSAS

MIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLV
KLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAW
MTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGM
RKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDF
LDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGK
TILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVK
VMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGR
DMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNA
KLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSK
LVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGK
ATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTG
GFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFE
KNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLK
GSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLG
APAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSGGSGGSTNLSDIIEKETGKQ
LVIQESILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGG
SGGSGGSTNLSDIIEKETGKQLVIQESILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKP
WALVIQDSNGENKIKMLSGGSPKKKRKV (SEQ ID NO: 406)

[00158] Non-limiting examples evolved adenosine deaminases that accept DNA as substrates are provided.

ecTadA
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO: 314)

ecTadA (D108N)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO: 315)

ecTadA (D108G)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARGAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO: 316)

ecTadA (D108V)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARVAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO: 317)

ecTadA (H8Y, D108N, N127S)
SEVEFSYEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMSHRVEITEGILAD
ECAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO: 318)

ecTadA (H8Y, D108N, N127S, E155D)
SEVEFSYEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMSHRVEITEGILAD
ECAALLSDFFRMRRQDIKAQKKAQSSTD (SEQ ID NO: 319)

ecTadA (H8Y, D108N, N127S, E155G)

SEVEFSYEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMSHRVEITEGILAD
ECAALLSDFFRMRRQGIKAQKKAQSSTD (SEQ ID NO: 320)

ecTadA (H8Y, D108N, N127S, E155V)
SEVEFSYEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMSHRVEITEGILAD
ECAALLSDFFRMRRQVIKAQKKAQSSTD (SEQ ID NO: 321)

ecTadA (A106V, D108N, D147Y, and E155V)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSYFFRMRRQVIKAQKKAQSSTD (SEQ ID NO:322)

ecTadA (A106V, D108N, D147Y, and E155V)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSYFFRMRRQVIKAQKKAQSSTD (SEQ ID NO: 407)

ecTadA (L84F, A106V, D108N, H123Y, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECAALLSYFFRMRRQVFKAQKKAQSSTD (SEQ ID NO: 408)

ecTadA (S2A, I49F, A106V, D108N, D147Y, E155V)
AEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPFGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSYFFRMRRQVIKAQKKAQSSTD (SEQ ID NO: 409)

ecTadA (H8Y, A106T, D108N, N127S, K160S)
SEVEFSYEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGTRNAKTGAAGSLMDVLHHPGMSHRVEITEGILAD
ECAALLSDFFRMRRQEIKAQSKAQSSTD (SEQ ID NO: 410)

ecTadA (R26G, L84F, A106V, R107H, D108N, H123Y, A142N, A143D, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEGEVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVHNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECNDLLSYFFRMRRQVFKAQKKAQSSTD (SEQ ID NO: 411)

ecTadA (E25G, R26G, L84F, A106V, R107H, D108N, H123Y, A142N, A143D, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDGGEVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVHNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECNDLLSYFFRMRRQVFKAQKKAQSSTD (SEQ ID NO: 412)

ecTadA (E25D, R26G, L84F, A106V, R107K, D108N, H123Y, A142N, A143G, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDDGEVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVKNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECNGLLSYFFRMRRQVFKAQKKAQSSTD (SEQ ID NO: 413)

ecTadA (R26Q, L84F, A106V, D108N, H123Y, A142N, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEQEVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECNALLSYFFRMRRQVFKAQKKAQSSTD (SEQ ID NO: 414)

ecTadA (E25M, R26G, L84F, A106V, R107P, D108N, H123Y, A142N, A143D, D147Y, E155V, I156F)

SEVEFSHEYWMRHALTLAKRAWDMGEVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVPNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECNDLLSYFFRMRRQVFKAQKKAQSSTD (SEQ ID NO: 415)

ecTadA (R26C, L84F, A106V, R107H, D108N, H123Y, A142N , D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDECEVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVHNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECNALLSYFFRMRRQVFKAQKKAQSSTD (SEQ ID NO: 416)

ecTadA (L84F, A106V , D108N, H123Y, A142N, A143L, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECNLLLSYFFRMRRQVFKAQKKAQSSTD (SEQ ID NO: 417)

ecTadA (R26G, L84F, A106V, D108N, H123Y, A142N , D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEGEVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECNALLSYFFRMRRQVFKAQKKAQSSTD (SEQ ID NO: 418)

ecTadA (R51H, L84F, A106V, D108N, H123Y, D147Y, E155V, I156F, K157N)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGHHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECAALLSYFFRMRRQVFNAQKKAQSSTD (SEQ ID NO: 419)

ecTadA (E25A, R26G, L84F, A106V, R107N, D108N, H123Y, A142N, A143E, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDAGEVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVNNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECNELLSYFFRMRRQVFKAQKKAQSSTD (SEQ ID NO: 420)

ecTadA (L84F, A106V, D108N, H123Y, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECAALLSYFFRMRRQVFKAQKKAQSSTD
(SEQ ID NO: 421)

ecTadA (N37T, P48T, L84F, A106V, D108N, H123Y, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHTNRVIGEGWNRTIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECAALLSYFFRMRRQVFKAQKKAQSSTD
(SEQ ID NO: 422)

ecTadA (N37S, L84F, A106V, D108N, H123Y, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHSNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLVM
QNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADE
CAALLSYFFRMRRQVFKAQKKAQSSTD
(SEQ ID NO: 423)

ecTadA (H36L, L84F, A106V, D108N, H123Y, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVLNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLVM
QNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADE
CAALLSYFFRMRRQVFKAQKKAQSSTD
(SEQ ID NO: 424)

ecTadA (L84F, A106V, D108N, H123Y, S146R, D147Y, E155V, I156F)

SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECAALLRYFFRMRRQVFKAQKKAQSSTD
(SEQ ID NO: 425)

ecTadA (H36L, P48L, L84F, A106V, D108N, H123Y, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVLNNRVIGEGWNRLIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECAALLSYFFRMRRQVFKAQKKAQSSTD
(SEQ ID NO: 426)

ecTadA (H36L, L84F, A106V, D108N, H123Y, D147Y, E155V, K57N, I156F)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVLNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLVM
QNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADE
CAALLSYFFRMRRQVFNAQKKAQSSTD
(SEQ ID NO: 427)

ecTadA (H36L, L84F, A106V, D108N, H123Y, S146C, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVLNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLVM
QNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADE
CAALLCYFFRMRRQVFKAQKKAQSSTD
(SEQ ID NO: 428)

ecTadA (L84F, A106V, D108N, H123Y, S146R, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECAALLRYFFRMRRQVFKAQKKAQSSTD
(SEQ ID NO: 429)

ecTadA (N37S, R51H, L84F, A106V, D108N, H123Y, D147Y, E155V, I156F
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHSNRVIGEGWNRPIGHHDPTAHAEIMALRQGGLVM
QNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADE
CAALLSYFFRMRRQVFKAQKKAQSSTD
(SEQ ID NO: 430)

ecTadA (R51L, L84F, A106V, D108N, H123Y, D147Y, E155V, I156F, K157N
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGLHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECAALLSYFFRMRRQVFNAQKKAQSSTD
(SEQ ID NO: 431)

saTadA (wt)
MGSHMTNDIYFMTLAIEEAKKAAQLGEVPIGAIITKDDEVIARAHNLRETLQQPTAHAEHIAIERAAKVLGS
WRLEGCTLYVTLEPCVMCAGTIVMSRIPRVVYGADDPKGGCSGSLMNLLQQSNFNHRAIVDKGVLKEACS
TLLTTFFKNLRANKKSTN (SEQ ID NO: 432)

saTadA (D108N)
GSHMTNDIYFMTLAIEEAKKAAQLGEVPIGAIITKDDEVIARAHNLRETLQQPTAHAEHIAIERAAKVLGSW
RLEGCTLYVTLEPCVMCAGTIVMSRIPRVVYGADNPKGGCSGSLMNLLQQSNFNHRAIVDKGVLKEACST
LLTTFFKNLRANKKSTN (SEQ ID NO: 433)

saTadA (D107A_D108N)
GSHMTNDIYFMTLAIEEAKKAAQLGEVPIGAIITKDDEVIARAHNLRETLQQPTAHAEHIAIERAAKVLGSW
RLEGCTLYVTLEPCVMCAGTIVMSRIPRVVYGAANPKGGCSGSLMNLLQQSNFNHRAIVDKGVLKEACST
LLTTFFKNLRANKKSTN (SEQ ID NO: 434)

saTadA (G26P_D107A_D108N)
GSHMTNDIYFMTLAIEEAKKAAQLPEVPIGAIITKDDEVIARAHNLRETLQQPTAHAEHIAIERAAKVLGSW
RLEGCTLYVTLEPCVMCAGTIVMSRIPRVVYGAANPKGGCSGSLMNLLQQSNFNHRAIVDKGVLKEACST
LLTTFFKNLRANKKSTN (SEQ ID NO: 435)

saTadA (G26P_D107A_D108N_S142A)
GSHMTNDIYFMTLAIEEAKKAAQLPEVPIGAIITKDDEVIARAHNLRETLQQPTAHAEHIAIERAAKVLGSW
RLEGCTLYVTLEPCVMCAGTIVMSRIPRVVYGAANPKGGCSGSLMNLLQQSNFNHRAIVDKGVLKEACAT
LLTTFFKNLRANKKSTN (SEQ ID NO: 436)

saTadA (D107A_D108N_S142A)
GSHMTNDIYFMTLAIEEAKKAAQLGEVPIGAIITKDDEVIARAHNLRETLQQPTAHAEHIAIERAAKVLGSW
RLEGCTLYVTLEPCVMCAGTIVMSRIPRVVYGAANPKGGCSGSLMNLLQQSNFNHRAIVDKGVLKEACAT
LLTTFFKNLRANKKSTN (SEQ ID NO: 437)

ecTadA (P48S)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRSIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO: 438)

ecTadA (P48T)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRTIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO: 439)

ecTadA (P48A)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRAIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO: 440)

ecTadA (A142N)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECNALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO: 441)

ecTadA (W23R)
SEVEFSHEYWMRHALTLAKRARDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLVM
QNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILADE
CAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO: 442)

ecTadA (W23L)
SEVEFSHEYWMRHALTLAKRALDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLVM
QNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILADE
CAALLSDFFRMRRQEIKAQKKAQSSTD (SEQ ID NO: 443)

ecTadA (R152P)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSDFFRMPRQEIKAQKKAQSSTD (SEQ ID NO: 444)

ecTadA (R152H)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILAD
ECAALLSDFFRMHRQEIKAQKKAQSSTD (SEQ ID NO: 445)

ecTadA (L84F, A106V, D108N, H123Y, D147Y, E155V, I156F)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECAALLSYFFRMRRQVFKAQKKAQSSTD (SEQ ID NO: 446)

ecTadA (H36L, R51L, L84F, A106V, D108N, H123Y, S146C, D147Y, E155V, I156F, K157N)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVLNNRVIGEGWNRPIGLHDPTAHAEIMALRQGGLVM
QNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADE
CAALLCYFFRMRRQVFNAQKKAQSSTD (SEQ ID NO: 447)

ecTadA (H36L, P48S, R51L, L84F, A106V, D108N, H123Y, S146C, D147Y, E155V, I156F , K157N)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVLNNRVIGEGWNRSIGLHDPTAHAEIMALRQGGLVM
QNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADE
CAALLCYFFRMRRQVFNAQKKAQSSTD (SEQ ID NO: 448)

ecTadA (H36L, P48A, R51L, L84F, A106V, D108N, H123Y, S146C, D147Y, E155V, I156F , K157N)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVLNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLV
MQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILAD
ECAALLCYFFRMRRQVFNAQKKAQSSTD (SEQ ID NO: 449)

ecTadA (W23L, H36L, P48A, R51L, L84F, A106V, D108N, H123Y, S146C, D147Y, R152P, E155V, I156F,
K157N)
SEVEFSHEYWMRHALTLAKRALDEREVPVGAVLVLNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVM
QNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADE
CAALLCYFFRMPRQVFNAQKKAQSSTD (SEQ ID NO: 450)
ecTadA (W23R, H36L, P48A, R51L, L84F, A106V, D108N, H123Y, S146C, D147Y, R152P, E155V, I156F,
K157N)
SEVEFSHEYWMRHALTLAKRALDEREVPVGAVLVLNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVM
QNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADE
CAALLCYFFRMPRQVFNAQKKAQSSTD
(SEQ ID NO: 479)

Staphylococcus aureus TadA:
MGSHMTNDIYFMTLAIEEAKKAAQLGEVPIGAIITKDDEVIARAHNLRETLQQPTAHAEHIAIERAAKVLGS
WRLEGCTLYVTLEPCVMCAGTIVMSRIPRVVYGADDPKGGCSGSLMNLLQQSNFNHRAIVDKGVLKEACS
TLLTTFFKNLRANKKSTN (SEQ ID NO: 451)

Bacillus subtilis TadA:
MTQDELYMKEAIKEAKKAEEKGEVPIGAVLVINGEIIARAHNLRETEQRSIAHAEMLVID
EACKALGTWRLEGATLYVTLEPCPMCAGAVVLSRVEKVVFGAFDPKGGCSGTLMNLLQEERFNHQAEVV
SGVLEEECGGMLSAFFRELRKKKKAARKNLSE (SEQ ID NO: 452)

Salmonella typhimurium (*S. typhimurium*) TadA:
MPPAFITGVTSLSDVELDHEYWMRHALTLAKRAWDEREVPVGAVLVHNHRVIGEGWNRPIGRHDPTAHA
EIMALRQGGLVLQNYRLLDTTLYVTLEPCVMCAGAMVHSRIGRVVFGARDAKTGAAGSLIDVLHHPGMN
HRVEIIEGVLRDECATLLSDFFRMRRQEIKALKKADRAEGAGPAV (SEQ ID NO: 453)

Shewanella putrefaciens (*S. putrefaciens*) TadA:
MDEYWMQVAMQMAEKAEAAGEVPVGAVLVKDGQQIATGYNLSISQHDPTAHAEILCLRSAGKKLENYR
LLDATLYITLEPCAMCAGAMVHSRIARVVYGARDEKTGAAGTVVNLLQHPAFNHQVEVTSGVLAEACSA
QLSRFFKRRRDEKKALKLAQRAQQGIE (SEQ ID NO: 454)

Haemophilus influenzae F3031 (*H. influenzae*) TadA:
MDAAKVRSEFDEKMMRYALELADKAEALGEIPVGAVLVDDARNIIGEGWNLSIVQSDPTAHAEIIALRNG
AKNIQNYRLLNSTLYVTLEPCTMCAGAILHSRIKRLVFGASDYKTGAIGSRFHFFDDYKMNHTLEITSGVLA
EECSQKLSTFFQKRREEKKIEKALLKSLSDK (SEQ ID NO: 455)

Caulobacter crescentus (C. crescentus) TadA:
MRTDESEDQDHRMMRLALDAARAAAEAGETPVGAVILDPSTGEVIATAGNGPIAAHDPTAHAEIAAMRA
AAAKLGNYRLTDLTLVVTLEPCAMCAGAISHARIGRVVFGADDPKGGAVVHGPKFFAQPTCHWRPEVTG
GVLADESADLLRGFFRARRKAKI (SEQ ID NO: 456)

Geobacter sulfurreducens (*G. sulfurreducens*) TadA:
MSSLKKTPIRDDAYWMGKAIREAAKAAARDEVPIGAVIVRDGAVIGRGHNLREGSNDPSAHAEMIAIRQA
ARRSANWRLTGATLYVTLEPCLMCMGAIILARLERVVFGCYDPKGGAAGSLYDLSADPRLNHQVRLSPGV
CQEECGTMLSDFFRDLRRRKKAKATPALFIDERKVPPEP (SEQ ID NO: 457)

[00159] Non-limiting examples of A to G nucleobase editors are provided.

ecTadA(wt)-XTEN-nCas9-NLS (SEQ ID NO: 323)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

ecTadA(D108N)-XTEN-nCas9-NLS: (mammalian construct, active on DNA, A to G editing,

SEQ ID NO: 324)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL

VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

ecTadA(D108G)-XTEN-nCas9-NLS: (mammalian construct, active on DNA, A to G editing,

SEQ ID NO:325)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARGAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

ecTadA(D108V)-XTEN-nCas9-NLS: (mammalian construct, active on DNA, A to G editing,

SEQ ID NO: 326)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARVAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN

GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

ecTadA(D108N)-XTEN-nCas9-UGI-NLS (BE3 analog of A to G editor, SEQ ID NO: 327)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLSDIIEKETGKQLVIQE
SILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKK
RKV

ecTadA(D108G)-XTEN-nCas9-UGI-NLS (BE3 analog of A to G editor, SEQ ID NO: 328):

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARGAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI

GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLSDIIEKETGKQLVIQE
SILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKK
RKV

ecTadA(D108V)-XTEN-nCas9-UGI-NLS (BE3 analog of A to G editor, SEQ ID NO: 329):

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARVAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLSDIIEKETGKQLVIQE
SILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKK
RKV

ecTadA(D108N)-XTEN-dCas9-UGI-NLS (mammalian cells, BE2 analog of A to G editor, SEQ ID NO: 330):

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDAIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK

SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLSDIIEKETGKQLVIQE
SILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKK
RKV

ecTadA(D108G)-XTEN-dCas9-UGI-NLS (mammalian cells, BE2 analog of A to G editor, SEQ ID NO: 331):

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARGAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDAIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLSDIIEKETGKQLVIQE
SILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKMLSGGSPKKK
RKV

ecTadA(D108V)-XTEN-dCas9-UGI-NLS (mammalian cells, BE2 analog of A to G editor, SEQ ID NO: 332):

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARVAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL

VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDAIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSTNLSDIIEKETGKQLVIQE
SILMLPEEVEEVIGNKPESDILVHTAYDESTDENVMLLTSDAPEYKPWALVIQDSNGENKIKM
LSGGSPKKKRKV

ecTadA(D108N)-XTEN-nCas9-AAG(E125Q)-NLS – cat. alkyladenosine glycosylase (SEQ ID NO: 333)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSKGHLTRLGLEFFDQPAVP
LARAFLGQVLVRRLPNGTELRGRIVETQAYLGPEDEAAHSRGGRQTPRNRGMFMKPGTLYVYIIYGMYFC
MNISSQGDGACVLLRALEPLEGLETMRQLRSTLRKGTASRVLKDRELCSGPSKLCQALAINKSFDQRDLAQ
DEAVWLERGPLEPSEPAVVAAARVGVGHAGEWARKPLRFYVRGSPWVSVVDRVAEQDTQASGGSPKKK
RKV

ecTadA(D108G)-XTEN-nCas9-AAG(E125Q)-NLS – cat. alkyladenosine glycosylase (SEQ ID NO: 334)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARGAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL

LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSKGHLTRLGLEFFDQPAVP
LARAFLGQVLVRRLPNGTELRGRIVETQAYLGPEDEAAHSRGGRQTPRNRGMFMKPGTLYVYIIYGMYFC
MNISSQGDGACVLLRALEPLEGLETMRQLRSTLRKGTASRVLKDRELCSGPSKLCQALAINKSFDQRDLAQ
DEAVWLERGPLEPSEPAVVAAARVGVGHAGEWARKPLRFYVRGSPWVSVVDRVAEQDTQASGGSPKKK
RKV

ecTadA(D108V)-XTEN-nCas9-AAG(E125Q)-NLS – cat. alkyladenosine glycosylase (SEQ ID NO: 335)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARVAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSKGHLTRLGLEFFDQPAVP
LARAFLGQVLVRRLPNGTELRGRIVETQAYLGPEDEAAHSRGGRQTPRNRGMFMKPGTLYVYIIYGMYFC
MNISSQGDGACVLLRALEPLEGLETMRQLRSTLRKGTASRVLKDRELCSGPSKLCQALAINKSFDQRDLAQ
DEAVWLERGPLEPSEPAVVAAARVGVGHAGEWARKPLRFYVRGSPWVSVVDRVAEQDTQASGGSPKKK
RKV

ecTadA(D108N)-XTEN-nCas9-EndoV(D35A)-NLS: contains cat. endonuclease V (SEQ ID NO: 336)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSDLASLRAQQIELASSVIRE
DRLDKDPPDLIAGAAVGFEQGGEVTRAAMVLLKYPSLELVEYKVARIATTMPYIPGFLSFREYPALLAAWE
MLSQKPDLVFVDGHGISHPRRLGVASHFGLLVDVPTIGVAKKRLCGKFEPLSSEPGALAPLMDKGEQLAW
VWRSKARCNPLFIATGHRVSVDSALAWVQRCMKGYRLPEPTRWADAVASERPAFVRYTANQPSGGSPKK
KRKV

ecTadA(D108G)-XTEN-nCas9-EndoV (D35A)-NLS: contains cat. endonuclease V (SEQ ID NO: 337)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARGAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSDLASLRAQQIELASSVIRE
DRLDKDPPDLIAGAAVGFEQGGEVTRAAMVLLKYPSLELVEYKVARIATTMPYIPGFLSFREYPALLAAWE
MLSQKPDLVFVDGHGISHPRRLGVASHFGLLVDVPTIGVAKKRLCGKFEPLSSEPGALAPLMDKGEQLAW

VWRSKARCNPLFIATGHRVSVDSALAWVQRCMKGYRLPEPTRWADAVASERPAFVRYTANQPSGGSPKK
KRKV

ecTadA(D108V)-XTEN-nCas9-EndoV(D35A)-NLS: contains cat. endonuclease V (SEQ ID NO: 338)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARVAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSDLASLRAQQIELASSVIRE
DRLDKDPPDLIAGAAVGFEQGGEVTRAAMVLLKYPSLELVEYKVARIATTMPYIPGFLSFREYPALLAAWE
MLSQKPDLVFVDGHGISHPRRLGVASHFGLLVDVPTIGVAKKRLCGKFEPLSSEPGALAPLMDKGEQLAW
VWRSKARCNPLFIATGHRVSVDSALAWVQRCMKGYRLPEPTRWADAVASERPAFVRYTANQPSGGSPKK
KRKV

Variant resulting from first round of evolution (in bacteria) ecTadA(H8Y_D108N_N127S)-XTEN-dCas9 (SEQ ID NO: 339)

MSEVEFSYEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMSHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDAIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI

GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGD

Enriched variants from second round of evolution (in bacteria) ecTadA

(H8Y_D108N_N127S_E155X)-XTEN-dCas9; X=D, G or V (SEQ ID NO: 340)

MSEVEFSYEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMSHRVEITEGILA
DECAALLSDFFRMRRQXIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDAIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGD

pNMG-160: ecTadA(D108N)-XTEN-nCas9-GGS-AAG*(E125Q)-GGS-NLS (SEQ ID NO:

341)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ

TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDGGSKGHLTRLGLEFFDQPAVPL
ARAFLGQVLVRRLPNGTELRGRIVETQAYLGPEDEAAHSRGGRQTPRNRGMFMKPGTLYVYIIYGMYFCM
NISSQGDGACVLLRALEPLEGLETMRQLRSTLRKGTASRVLKDRELCSGPSKLCQALAINKSFDQRDLAQD
EAVWLERGPLEPSEPAVVAAARVGVGHAGEWARKPLRFYVRGSPWVSVVDRVAEQDTQAGGSPKKKRK
V

pNMG-161: ecTadA(D108N)-XTEN-nCas9-GGS-EndoV*(D35A)-GGS-NLS (SEQ ID NO: 342)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGL
VMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARNAKTGAAGSLMDVLHHPGMNHRVEITEGILA
DECAALLSDFFRMRRQEIKAQKKAQSSTDSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVITDEYKVP
SKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHR
LEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEG
DLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALS
LGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPL
SASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEEL
LVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRF
AWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTE
GMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDK
DFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQS
GKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDEL
VKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQN
GRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLL
NAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLK
SKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEI
GKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQ
TGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERS
SFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEK
LKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTN
LGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDGGSDLASLRAQQIELASSVIRE
DRLDKDPPDLIAGAAVGFEQGGEVTRAAMVLLKYPSLELVEYKVARIATTMPYIPGFLSFREYPALLAAWE
MLSQKPDLVFVDGHGISHPRRLGVASHFGLLVDVPTIGVAKKRLCGKFEPLSSEPGALAPLMDKGEQLAW
VWRSKARCNPLFIATGHRVSVDSALAWVQRCMKGYRLPEPTRWADAVASERPAFVRYTANQPGGSPKKK
RKV

pNMG-371: ecTadA(L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)-SGGS-SGGS-XTEN-SGGS-SGGS- ecTadA(L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)-SGGS-SGGS-XTEN-SGGS-SGGS-nCas9-SGGS- NLS (SEQ ID NO: 458)
SEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHA
EIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGS
LMDVLHYPGMNHRVEITEGILADECAALLSYFFRMRRQVFKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLV
HNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLSYFFRM
RRQVFKAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGT
NSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRY
TRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKY

PTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTY
NQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFK
SNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEIT
KAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEF
YKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIE
RMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEE
NEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIR
DKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSP
AIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE
LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-616 amino acid sequence: ecTadA(wild type)-(SGGS)2-XTEN-(SGGS)2-
ecTadA(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152P_E1
55V_I156F _K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS (SEQ ID NO: 459)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRALDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRM
PRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGTN
SVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYT
RRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYP
TIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYN
QLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKS
NFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITK
APLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFY
KFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLK
DNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIER
MTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLL
FKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEEN
EDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRD
KQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPA
IKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKEL
GSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD

DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-624 amino acid sequence: ecTadA(wild type)-32 a.a. linker-
ecTadA(W23R_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152P_E1
55V_I156F _K157N)-24 a.a. linker_nCas9_SGGS_NLS (SEQ ID NO: 460)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRARDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRM
PRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVI
TDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRIC
YLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRK
KLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENP
INASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAED
AKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASM
IKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILE
KMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIE
KILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKN
LPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVT
VKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVL
TLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTIL
DFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQT
VKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEH
PVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVL
TRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKA
GFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYK
VREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKA
TAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQV
NIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEK
GKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKR
MLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIE
QISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTID
RKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-476 amino acid sequence (evolution #3 hetero dimer, wt TadA + TadA evo #3
mutations): ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-

ecTadA(L84F_A106V_D108N_H123Y_D147Y_E155V_I156F)-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS (SEQ ID NO: 461)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLV
HNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLSYFFRM
RRQVFKAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGT
NSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRY
TRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKY
PTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTY
NQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFK
SNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEIT
KAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEF
YKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIE
RMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEE
NEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIR
DKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSP
AIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE
LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-477 amino acid sequence: ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-ecTadA(H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS (SEQ ID NO: 462)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLV
LNNRVIGEGWNRPIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRM
RRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGT
NSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRY
TRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKY
PTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTY

NQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFK
SNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEIT
KAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEF
YKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIE
RMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEE
NEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIR
DKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSP
AIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE
LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-558 amino acid sequence: ecTadA(wild-type)- 32 a.a. linker-
ecTadA(H36L_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)-
24 a.a. linker_nCas9_SGGS_NLS (SEQ ID NO: 463)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLV
LNNRVIGEGWNRPIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRM
RRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVI
TDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRIC
YLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRK
KLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENP
INASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAED
AKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASM
IKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILE
KMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIE
KILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKN
LPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVT
VKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVL
TLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTIL
DFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQT
VKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEH
PVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVL

TRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKA
GFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYK
VREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKA
TAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQV
NIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEK
GKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKR
MLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIE
QISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTID
RKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-576 amino acid sequence: ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-
ecTadA(H36L_P48S_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F
_K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_GGS_NLS (SEQ ID NO: 464)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLV
LNNRVIGEGWNRSIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRM
RRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGT
NSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRY
TRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKY
PTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTY
NQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFK
SNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEIT
KAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEF
YKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIE
RMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEE
NEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIR
DKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSP
AIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE
LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-577 amino acid sequence: ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-ecTadA(H36L_P48S_R51L_L84F_A106V_D108N_H123Y_S146C_A142N_D147Y_E155V_I156F _K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_GGS_NLS (SEQ ID NO: 465)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVLNNRVIGEGWNRSIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECNALLCYFFRMRRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-586 amino acid sequence: ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-ecTadA(H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F _K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_GGS_NLS (SEQ ID NO: 466)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAGSLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVLNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGAMIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRMRRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGTNSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKY

PTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTY
NQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFK
SNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEIT
KAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEF
YKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIE
RMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEE
NEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIR
DKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSP
AIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE
LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-588 amino acid sequence: ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-
ecTadA(H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_A142N_D147Y_E155V_I
156F _K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_GGS_NLS (SEQ ID NO: 467)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECNALLCYFFRM
RRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGT
NSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRY
TRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKY
PTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTY
NQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFK
SNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEIT
KAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEF
YKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIE
RMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEE
NEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIR
DKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSP
AIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE

LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-620 amino acid sequence: ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-
ecTadA(W23R_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152P_E1
55V_I156F _K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_GGS_NLS (SEQ ID NO: 468)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRARDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRM
PRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGTN
SVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYT
RRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYP
TIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYN
QLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKS
NFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITK
APLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFY
KFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLK
DNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIER
MTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLL
FKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEEN
EDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRD
KQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPA
IKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKEL
GSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-617 amino acid sequence: ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-ecTadA(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_A142A_S146C_D147Y_E155V_I156F _K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_GGS_NLS (SEQ ID NO: 469)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRALDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECNALLCYFFRM
RRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGT
NSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRY
TRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKY
PTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTY
NQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFK
SNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEIT
KAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEF
YKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIE
RMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEE
NEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIR
DKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSP
AIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE
LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-618 amino acid sequence: ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-ecTadA(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_A142A_S146C_D147Y_R152P_E155V_I156F _K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_GGS_NLS (SEQ ID NO: 470)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRALDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECNALLCYFFRM
PRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGTN
SVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYT

RRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYP
TIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYN
QLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKS
NFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITK
APLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFY
KFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLK
DNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIER
MTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLL
FKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEEN
EDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRD
KQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPA
IKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKEL
GSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-620 amino acid sequence: ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-
ecTadA(W23R_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152P_E1
55V_I156F _K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_GGS_NLS (SEQ ID NO: 471)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRARDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRM
PRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGTN
SVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYT
RRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYP
TIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYN
QLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKS
NFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITK
APLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFY
KFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLK
DNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIER
MTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLL
FKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEEN
EDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRD
KQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPA

IKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKEL
GSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-621 amino acid sequence: ecTadA(wild-type)- 32 a.a. linker-
ecTadA(H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152P_E155V_I1
56F _K157N)- 24 a.a. linker_nCas9_GGS_NLS (SEQ ID NO: 472)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRM
PRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVI
TDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRIC
YLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRK
KLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENP
INASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAED
AKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASM
IKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILE
KMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIE
KILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKN
LPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVT
VKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVL
TLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTIL
DFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQT
VKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEH
PVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVL
TRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKA
GFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYK
VREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKA
TAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQV
NIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEK
GKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKR
MLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIE
QISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTID
RKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-622 amino acid sequence: ecTadA(wild-type)- 32 a.a. linker-ecTadA(H36L_P48A_R51L_L84F_A106V_D108N_H123Y_A142N_S146C_D147Y_R152P_E155V_I156F _K157N)- 24 a.a. linker_nCas9_GGS_NLS (SEQ ID NO: 473)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECNALLCYFFRM
PRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVI
TDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRIC
YLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRK
KLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENP
INASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAED
AKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASM
IKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILE
KMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIE
KILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKN
LPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVT
VKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVL
TLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTIL
DFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQT
VKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEH
PVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVL
TRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKA
GFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYK
VREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKA
TAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQV
NIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEK
GKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKR
MLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIE
QISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTID
RKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

pNMG-623 amino acid sequence: ecTadA(wild-type)- 32 a.a. linker-ecTadA(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152P_E155V_I156F _K157N)- 24 a.a. linker_nCas9_GGS_NLS (SEQ ID NO: 474)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRALDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRM

PRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESDKKYSIGLAIGTNSVGWAVI
TDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYTRRKNRIC
YLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYPTIYHLRK
KLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYNQLFEENP
INASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKSNFDLAED
AKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITKAPLSASM
IKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFYKFIKPILE
KMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLKDNREKIE
KILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIERMTNFDKN
LPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLLFKTNRKVT
VKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEENEDILEDIVL
TLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRDKQSGKTIL
DFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPAIKKGILQT
VKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKELGSQILKEH
PVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKDDSIDNKVL
TRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGGLSELDKA
GFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFRKDFQFYK
VREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKSEQEIGKA
TAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRKVLSMPQV
NIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVLVVAKVEK
GKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFELENGRKR
MLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHKHYLDEIIE
QISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFKYFDTTID
RKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

ABE6.3 ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-
ecTadA(H36L_P48S_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_E155V_I156F_K1
57N)-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS (SEQ ID NO: 475)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLV
LNNRVIGEGWNRSIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRM
RRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGT
NSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRY
TRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKY
PTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTY
NQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFK
SNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEIT
KAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEF
YKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIE
RMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEE
NEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIR

DKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSP
AIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE
LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV*

ABE7.8 ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-
ecTadA(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_A142N_S146C_D147Y_E
155V_I156F_K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS (SEQ ID NO: 476)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRALDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECNALLCYFFRM
RRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGT
NSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRY
TRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKY
PTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTY
NQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFK
SNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEIT
KAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEF
YKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIE
RMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEE
NEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIR
DKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSP
AIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE
LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV*

ABE7.9 ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-ecTadA(W23L_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_A142N_S146C_D147Y_R152P¬_E155V_I156F_K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS (SEQ ID NO: 477)

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRALDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECNALLCYFFRM
PRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGTN
SVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYT
RRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYP
TIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYN
QLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKS
NFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITK
APLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFY
KFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLK
DNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIER
MTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLL
FKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEEN
EDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRD
KQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPA
IKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKEL
GSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV*

ABE7.10 ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-ecTadA(W23R_H36L_P48A_R51L_L84F_A106V_D108N_H123Y_S146C_D147Y_R152P¬_E155V_I156F_K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS

MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRARDEREVPVGAVLV
LNNRVIGEGWNRAIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECAALLCYFFRM

PRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGTN
SVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRYT
RRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKYP
TIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTYN
QLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFKS
NFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEITK
APLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEFY
KFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFLK
DNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIER
MTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDLL
FKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEEN
EDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIRD
KQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSPA
IKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKEL
GSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV*

ABE6.4: ecTadA(wild-type)-(SGGS)2-XTEN-(SGGS)2-
ecTadA(H36L_P48S_R51L_L84F_A106V_D108N_H123Y_A142N_S146C_D147Y_E155V_I1
56F_K157N)-(SGGS)2-XTEN-(SGGS)2_nCas9_SGGS_NLS (SEQ ID NO: 480)
MSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLVHNNRVIGEGWNRPIGRHDPTAH
AEIMALRQGGLVMQNYRLIDATLYVTLEPCVMCAGAMIHSRIGRVVFGARDAKTGAAG
SLMDVLHHPGMNHRVEITEGILADECAALLSDFFRMRRQEIKAQKKAQSSTDSGGSSGG
SSGSETPGTSESATPESSGGSSGGSSEVEFSHEYWMRHALTLAKRAWDEREVPVGAVLV
LNNRVIGEGWNRSIGLHDPTAHAEIMALRQGGLVMQNYRLIDATLYVTFEPCVMCAGA
MIHSRIGRVVFGVRNAKTGAAGSLMDVLHYPGMNHRVEITEGILADECNALLCYFFRM
RRQVFNAQKKAQSSTDSGGSSGGSSGSETPGTSESATPESSGGSSGGSDKKYSIGLAIGT
NSVGWAVITDEYKVPSKKFKVLGNTDRHSIKKNLIGALLFDSGETAEATRLKRTARRRY
TRRKNRICYLQEIFSNEMAKVDDSFFHRLEESFLVEEDKKHERHPIFGNIVDEVAYHEKY
PTIYHLRKKLVDSTDKADLRLIYLALAHMIKFRGHFLIEGDLNPDNSDVDKLFIQLVQTY
NQLFEENPINASGVDAKAILSARLSKSRRLENLIAQLPGEKKNGLFGNLIALSLGLTPNFK
SNFDLAEDAKLQLSKDTYDDDLDNLLAQIGDQYADLFLAAKNLSDAILLSDILRVNTEIT
KAPLSASMIKRYDEHHQDLTLLKALVRQQLPEKYKEIFFDQSKNGYAGYIDGGASQEEF
YKFIKPILEKMDGTEELLVKLNREDLLRKQRTFDNGSIPHQIHLGELHAILRRQEDFYPFL
KDNREKIEKILTFRIPYYVGPLARGNSRFAWMTRKSEETITPWNFEEVVDKGASAQSFIE
RMTNFDKNLPNEKVLPKHSLLYEYFTVYNELTKVKYVTEGMRKPAFLSGEQKKAIVDL
LFKTNRKVTVKQLKEDYFKKIECFDSVEISGVEDRFNASLGTYHDLLKIIKDKDFLDNEE
NEDILEDIVLTLTLFEDREMIEERLKTYAHLFDDKVMKQLKRRRYTGWGRLSRKLINGIR

DKQSGKTILDFLKSDGFANRNFMQLIHDDSLTFKEDIQKAQVSGQGDSLHEHIANLAGSP
AIKKGILQTVKVVDELVKVMGRHKPENIVIEMARENQTTQKGQKNSRERMKRIEEGIKE
LGSQILKEHPVENTQLQNEKLYLYYLQNGRDMYVDQELDINRLSDYDVDHIVPQSFLKD
DSIDNKVLTRSDKNRGKSDNVPSEEVVKKMKNYWRQLLNAKLITQRKFDNLTKAERGG
LSELDKAGFIKRQLVETRQITKHVAQILDSRMNTKYDENDKLIREVKVITLKSKLVSDFR
KDFQFYKVREINNYHHAHDAYLNAVVGTALIKKYPKLESEFVYGDYKVYDVRKMIAKS
EQEIGKATAKYFFYSNIMNFFKTEITLANGEIRKRPLIETNGETGEIVWDKGRDFATVRK
VLSMPQVNIVKKTEVQTGGFSKESILPKRNSDKLIARKKDWDPKKYGGFDSPTVAYSVL
VVAKVEKGKSKKLKSVKELLGITIMERSSFEKNPIDFLEAKGYKEVKKDLIIKLPKYSLFE
LENGRKRMLASAGELQKGNELALPSKYVNFLYLASHYEKLKGSPEDNEQKQLFVEQHK
HYLDEIIEQISEFSKRVILADANLDKVLSAYNKHRDKPIREQAENIIHLFTLTNLGAPAAFK
YFDTTIDRKRYTSTKEVLDATLIHQSITGLYETRIDLSQLGGDSGGSPKKKRKV

Example 2: AAV Delivery of Split Nucleobase Editor

[00160] Thisstudy was designed to show that a nucleobase editor may be delivered by recombinant AAV (rAAV) in two sections, which may be joined to form a complete and active nucleobase editor in cells via protein splicing. Different elements of the rAAV constructs were tested for optimized nucleobase editor expression and activity.

[00161] Recombinant AAV (rAAV) is widely used for transgene delivery. Transgenes were inserted into the AAV genome between the inverted terminal repeat (ITR) sequences and packaged into AAV viral particles, which are used to transduce a host cell (*e.g.*, mammalian cell, human cell). However, there is a limitation on the size of the transgene that may be packaged into rAAV, typically approximately 4.9 kilobases. Nucleic acids encoding a nucleobase editor (*e.g.*, cytosine deaminase-dCas9-UGI) typically exceed the packaging limit of rAAV. As described herein, the nucleic acids encoding a nucleobase editor were split (see Figure 1A), and each section was packaged into a separate rAAV particle. The two sections of the nucleobase editor were delivered to the cells and can be ligated to form a complete nucleobase editor via protein splicing (*e.g.*, mediated by an intein, such as the DnaE intein; see Figure 1C). The ligated, complete nucleobase editor was active in editing target bases (see Figure 1B). The rAAV constructs encoding the split nucleobase editors were tested in different cell lines, *e.g.*, U118 and HEK293T, and are active in editing the target base (see Figures 3A-3B and Figures 5A-5B).

[00162] Different transcriptional terminators and nuclear localization signals (NLS) were tested in the rAAV constructs to optimize the expression and activity of the nucleobase editors (see Figures 4, 6, and 7).

Example 3: Editing of DNMT1 gene in mouse neuron using AAV encoded split nucleobase editor

[00163] This study was designed to test the base editing activity of an AAV encoded split nucleobase editor *in vivo*. A split nucleobase editor as shown in Figure 1A was used. The amino acid sequence of the linker between the dCas9 domain and the deaminase domain is SGGSSGGSSGSETPGTSESATPESSGGSSGGS (SEQ ID NO: 384). A guide RNA targeting a well-characterized site in the *DNMT1* gene was selected. It was expected that the cells would be able to tolerate the editing. These experiments aim to determine whether AAV encoded split base editor can edit the locus *in vitro* or *in vivo* in several cell types including primary neurons.

[00164] In one experiment, AAV vectors encoding the split nucleobase editor and a guide RNA targeting *DNMT1* were used to transduce dissociated mouse cortical neurons, two days after the cortical neurons were isolated and cultured. The neurons were harvested 16 days post transduction and the *DNMT1* gene was sequenced (Figure 8A) to determine editing efficiency as well as off-target effects. An editing efficiency of 17.34% (C to T editing, darker grey in Figure 8B) was detected, while only 0.82% of undesired editing (C to G or C to A change, lighter grey in Figure 8B) was detected.

[00165] In another experiment, cultured mouse Neuro-2 cells were either transduced with AAV vectors encoding the split nucleobase editor and a guide RNA targeting *DNMT1*, or transfected with lipid-encapsulated DNA encoding the nucleobase editor and guide RNA, allowing direct comparison of editing efficiency using different delivery methods of the nucleobase editor (Figure 9A). An editing efficiency of 5.96% (C to T editing, dark grey in Figure 9B) was observed for AAV encoded split nucleobase editor, while an editing efficiency of 27.3% (C to T editing, dark grey in Figure 9B) was observed for lipid-transfected DNA encoded nucleobase editor. The amount of undesired products was 0.15% for AAV encoded split nucleobase editor and 1.3% for lipid-transfected DNA encoded nucleobase editor (C to G or C to A change, lighter grey in Figure 9B).

EQUIVALENTS AND SCOPE

[00166] In the claims articles such as "a," "an," and "the" may mean one or more than one unless indicated to the contrary or otherwise evident from the context. Claims or descriptions that include "or" between one or more members of a group are considered satisfied if one, more than one, or all of the group members are present in, employed in, or otherwise relevant to a given product or process unless indicated to the contrary or otherwise evident from the context.

The invention includes embodiments in which exactly one member of the group is present in, employed in, or otherwise relevant to a given product or process. The invention includes embodiments in which more than one, or all of the group members are present in, employed in, or otherwise relevant to a given product or process.

[00167] Furthermore, the invention encompasses all variations, combinations, and permutations in which one or more limitations, elements, clauses, and descriptive terms from one or more of the listed claims is introduced into another claim. For example, any claim that is dependent on another claim can be modified to include one or more limitations found in any other claim that is dependent on the same base claim. Where elements are presented as lists, *e.g.*, in Markush group format, each subgroup of the elements is also disclosed, and any element(s) can be removed from the group. It should it be understood that, in general, where the invention, or aspects of the invention, is/are referred to as comprising particular elements and/or features, certain embodiments of the invention or aspects of the invention consist, or consist essentially of, such elements and/or features. For purposes of simplicity, those embodiments have not been specifically set forth *in haec verba* herein.

[00168] It is also noted that the terms "comprising" and "containing" are intended to be open and permits the inclusion of additional elements or steps. Where ranges are given, endpoints are included. Furthermore, unless otherwise indicated or otherwise evident from the context and understanding of one of ordinary skill in the art, values that are expressed as ranges can assume any specific value or sub-range within the stated ranges in different embodiments of the invention, to the tenth of the unit of the lower limit of the range, unless the context clearly dictates otherwise.

[00169] This application refers to various issued patents, published patent applications, journal articles, and other publications, all of which are incorporated herein by reference. If there is a conflict between any of the incorporated references and the instant specification, the specification shall control. In addition, any particular embodiment of the present invention that falls within the prior art may be explicitly excluded from any one or more of the claims. Because such embodiments are deemed to be known to one of ordinary skill in the art, they may be excluded even if the exclusion is not set forth explicitly herein. Any particular embodiment of the invention can be excluded from any claim, for any reason, whether or not related to the existence of prior art.

[00170] Those skilled in the art will recognize or be able to ascertain using no more than routine experimentation many equivalents to the specific embodiments described herein. The scope of the present embodiments described herein is not intended to be limited to the above Description, but rather is as set forth in the appended claims. Those of ordinary skill in the art will appreciate that various changes and modifications to this description may be made without departing from the spirit or scope of the present invention, as defined in the following claims.

2017342543 31 May 2024

CLAIMS

What is claimed is:

1. A composition comprising:

(i) a first nucleotide sequence encoding a N-terminal portion of a nucleobase editor fused at its C-terminus to an intein-N; and

(ii) a second nucleotide sequence encoding an intein-C fused to the N-terminus of a C-terminal portion of the nucleobase editor, wherein the nucleobase editor comprises a deaminase fused to a CRISPR/Cas programmable DNA binding protein domain, wherein the N-terminal portion and the C-terminal portion may be joined to form the complete nucleobase editor.

2. The composition of claim 1, wherein the N-terminal portion of the Cas9 protein comprises an amino acid sequence that is at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, at least 99.5%, or at least 100% identical to a portion of any one of SEQ ID NOs: 1-275 and 394-397 that corresponds to amino acids 1-573 of SEQ ID NO: 1.

3. The composition of claim 1, wherein the C-terminal portion of the Cas9 protein comprises an amino acid sequence that is at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, at least 99.5%, or at least 100% identical to a portion of any one of SEQ ID NOs: 1-275 and 394-397 that corresponds to amino acids 574-1368 of SEQ ID NO: 1.

4. The composition of any one of claims 1-3, wherein the nucleotide sequence encoding the intein-N comprises a nucleic acid sequence that is at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, at least 99.5%, or at least 100% identical to a nucleic acid sequence as set forth in SEQ ID NO: 350 or 354.

5. The composition of any one of claims 1-4, wherein the nucleotide sequence encoding the intein-C comprises a nucleic acid sequence that is at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, at least 99.5%, or at least 100% identical to a nucleic acid sequence as set forth in SEQ ID NO: 352 or 356.

2017342543 31 May 2024

6. The composition of any one of claims 1-5, wherein the first nucleotide sequence and/or the second nucleotide sequence further comprises a nucleotide encoding a guide RNA (gRNA) operably linked to a promoter.

7. The composition of any one of claims 1-6, wherein the first nucleotide sequence and/or the second nucleotide sequence further comprises a transcriptional terminator.

8. The composition of claim 7, wherein the transcriptional terminator is a transcriptional terminator from a bGH gene, hGH gene, or SV40 gene.

9. The composition of claim 8, wherein the transcriptional terminal is from a bGH gene.

10. The composition of any one of claims 1-9, wherein the first nucleotide sequence and/or the second nucleotide sequence further comprises a woodchuck hepatitis posttranscriptional regulatory element (WPRE) inserted 5′ of the transcriptional terminator.

11. The composition of any one of claims 1-9, wherein the first nucleotide sequence and/or second nucleotide sequence are operably linked to a nucleotide sequence encoding at least one bipartite nuclear localization signal.

12. The composition of any one of claims 1-11, wherein the bipartite nuclear localization signal comprises an amino acid sequence selected from the group consisting of: KRPAATKKAGQAKKKK (SEQ ID NO: 344), KKTELQTTNAENKTKKL(SEQ ID NO: 345), KRGINDRNFWRGENGRKTR(SEQ ID NO: 346), and RKSGKIAAIVVKRPRK(SEQ ID NO: 347).

13. The composition of claim 12, wherein the bipartite nuclear localization signal comprises the amino acid sequence as set forth in SEQ ID NO: 344.

14. The composition of any one of claims 1-13, wherein the nucleobase editor comprises a cytosine deaminase fused to the N-terminus of a catalytically inactive Cas9 protein or a Cas9 nickase.

15. The composition of claim 14, wherein the cytosine deaminase is selected from the group consisting of: APOBEC1, APOBEC3, AID, and pmCDA1.

16. The composition of claim 14 or 15, wherein the nucleobase editor further comprises a uracil glycosylase inhibitor (UGI).

17. The composition of claim 16, wherein the UGI comprises an amino acid sequence that is at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, at least 99.5%, or at least 100% identical to any one of SEQ ID NOs: 299-302.

18. The composition of any one of claims 1-17, wherein the first nucleotide sequence and the second nucleotide sequence are on different vectors.

19. The composition of claim 18, wherein each of the different vectors is a genome of a recombinant adeno-associated virus (rAAV).

20. The composition of claim 19, wherein each of the different vectors is packaged in a rAAV particle.

21. A composition comprising:

(i) a first recombinant adeno associated virus (rAAV) particle comprising a first nucleotide sequence encoding a N-terminal portion of a nucleobase editor fused at its C-terminus to an intein-N; and

(ii) a second recombinant adeno associated virus (rAAV) particle comprising a second nuclei acid encoding an intein-C fused to the N-terminus of a C-terminal portion of the nucleobase editor, wherein the nucleobase editor comprises a deaminase fused to a CRISPR/Cas programmable DNA binding protein domain,
wherein the N-terminal portion and the C-terminal portion may be joined to form the complete nucleobase editor.

22. The composition of claim 21, wherein the N-terminal portion of the Cas9 protein comprises an amino acid sequence that is at least 95%, at least 96%, at least 97%, at least

98%, at least 99%, at least 99.5%, or at least 100% identical to a portion of any one of SEQ ID NOs: 1-275 and 394-397 that corresponds to amino acids 1-573 of SEQ ID NO: 1.

23. The composition of claim 21, wherein the C-terminal portion of the Cas9 protein comprises an amino acid sequence that is at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, at least 99.5%, or at least 100% identical to a portion of any one of SEQ ID NOs: 1-275 and 394-397 that corresponds to amino acids 574-1368 of SEQ ID NO: 1.

24. The composition of any one of claims 21-23, wherein the deaminase is a cytosine deaminase.

25. The composition of any one of claims 21-24, wherein the deaminase is an adenosine deaminase.

26. The composition of any one of claims 21-25, wherein the Cas9 protein is a catalytically inactive Cas9 (dCas9) or a Cas9 nickase (nCas9).

27. The composition of any one of claims 21-26, wherein the nucleotide sequence encoding the intein-N comprises a nucleic acid sequence that is at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, at least 99.5%, or at least 100% identical to a nucleic acid sequence as set forth in SEQ ID NOs: 350 or 355.

28. The composition of any one of claims 21-27, wherein the nucleotide sequence encoding the intein-C comprises the amino acid sequence that is at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, at least 99.5%, or at least 100% identical to an amino acid sequence as set forth in any one of SEQ ID NOs: 352 or 356.

29. The composition of any one of claims 21-28, wherein the first nucleotide sequence or the second nucleotide sequence further comprises a nucleotide encoding a guide RNA (gRNA) operably linked to a promoter.

30. The composition of any one of claims 21-29, wherein the first nucleotide sequence or the second nucleotide sequence further comprises a transcriptional terminator.

31. The composition of claim 30, wherein the transcriptional terminator is the transcriptional terminator from a bGH gene, hGH gene, or SV40 gene.

32. The composition of claim 31, wherein the transcriptional terminator is the transcriptional terminator from a bGH gene.

33. The composition of any one of claims 21-32, wherein the first nucleotide sequence or the second nucleotide sequence further comprises a woodchuck hepatitis posttranscriptional regulatory element (WPRE) inserted 5' of the transcriptional terminator.

34. The composition of any one of claims 21-33, wherein the first nucleotide sequence or second nucleotide sequence is fused to a nucleotide sequence encoding at least one bipartite nuclear localization signal.

35. The composition of any one of claims 21-34, wherein the bipartite nuclear localization signal comprises an amino acid sequence selected from the group consisting of: KRPAATKKAGQAKKKK (SEQ ID NO: 344), KKTELQTTNAENKTKKL(SEQ ID NO: 345), KRGINDRNFWRGENGRKTR(SEQ ID NO: 346), and RKSGKIAAIVVKRPRK(SEQ ID NO: 347).

36. The composition of claim 34 or 35, wherein the bipartite nuclear localization signal comprises the amino acid sequence as set forth in SEQ ID NO: 344.

37. The composition of any one of claims 21-24, wherein the cytidine deaminase is selected from the group consisting of: APOBEC1, APOBEC3, AID, and pmCDA1.

38. The composition of any one of claims 21-37, wherein the nucleobase editor further comprises a uracil glycosylase inhibitor (UGI).

39. The composition of claim 38, wherein the UGI comprises an amino acid sequence that is at least 80%, at least 85%, at least 90%, at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 99.5% identical to the amino acid sequence of any one of SEQ ID NOs: 299-302.

2017342543 04 Jun 2024

40. The composition of any one of claims 21-39, wherein the UGI comprises the amino acid sequence of any one of SEQ ID NOs: 299-302.

41. A cell comprising the composition of any one of claims 1-40.

42. The cell of claim 41, wherein the cell is a prokaryotic cell.

43. The cell of claim 42, wherein the cell is a bacterial cell.

44. The cell of claim 41, wherein the cell is a eukaryotic cell.

45. The cell of claim 44, wherein the cell is a yeast cell, a plant cell, or a mammalian cell.

46. The cell of claim 44 or 45, wherein the cell is a human cell.

47. A kit comprising the composition of any one of claims 1-40 or the cell of any one of claims 41-46.

48. A method comprising:

contacting a cell with the composition of any one of claims 1-40, wherein the contacting results in the delivery of the first nucleotide sequence and the second nucleotide sequence into the cell, and wherein the N-terminal portion of the nucleobase editor and the C-terminal portion of the nucleobase editor are joined to form a nucleobase editor.

49. A method comprising:

administering a therapeutically effective amount of the composition of any one of claims 1-40 to a subject having a disease or disorder.

50. The method of claim 49, wherein the disease or disorder is selected from the group consisting of: cystic fibrosis, phenylketonuria, Bernard-Soulier syndrome (BSS), epidermolytic hyperkeratosis (EHK), chronic obstructive pulmonary disease (COPD), Charcot-Marie-Toot disease type 4J, neuroblastoma (NB), von Willebrand disease (vWD), myotonia congenital, hereditary renal amyloidosis, dilated cardiomyopathy, hereditary

2017342543 04 Jun 2024

lymphedema, familial Alzheimer's disease, prion disease, chronic infantile neurologic cutaneous articular syndrome (CINCA), and desmin-related myopathy (DRM).

51. Use of the composition of any one of claims 1-40 in the manufacture of a medicament for therapeutically or prophylactically treating a disease or disorder selected from the group consisting of: cystic fibrosis, phenylketonuria, Bernard-Soulier syndrome (BSS), epidermolytic hyperkeratosis (EHK), chronic obstructive pulmonary disease (COPD), Charcot-Marie-Toot disease type 4J, neuroblastoma (NB), von Willebrand disease (vWD), myotonia congenital, hereditary renal amyloidosis, dilated cardiomyopathy, hereditary lymphedema, familial Alzheimer's disease, prion disease, chronic infantile neurologic cutaneous articular syndrome (CINCA), and desmin-related myopathy (DRM).

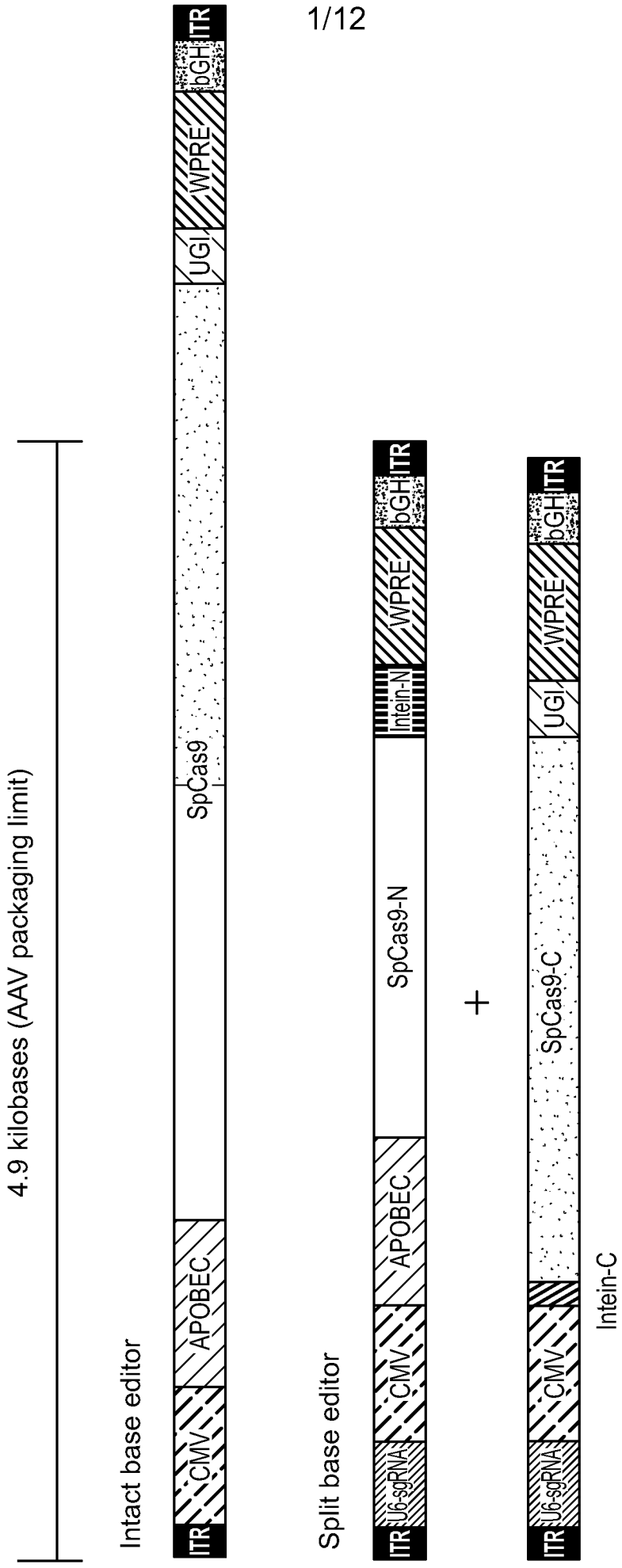

4.9 kilobases (AAV packaging limit)
Intact base editor
ITR
U6-sgRNA
CMV
APOBEC
SpCas9
UGI
WPRE
bGH
ITR
Split base editor
ITR
U6-sgRNA
CMV
APOBEC
SpCas9-N
Intein-N
WPRE
bGH
ITR
+
ITR
U6-sgRNA
CMV
Intein-C
SpCas9-C
UGI
WPRE
bGH
ITR

Figure 1A

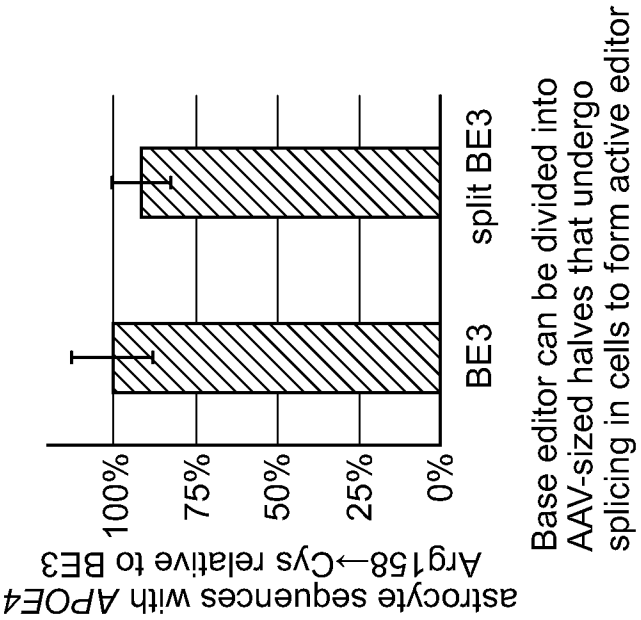

astrocyte sequences with APOE4
Arg158→Cys relative to BE3
100%
75%
50%
25%
0%
BE3
split BE3
Base editor can be divided into
AAV-sized halves that undergo
splicing in cells to form active editor

Figure 1B

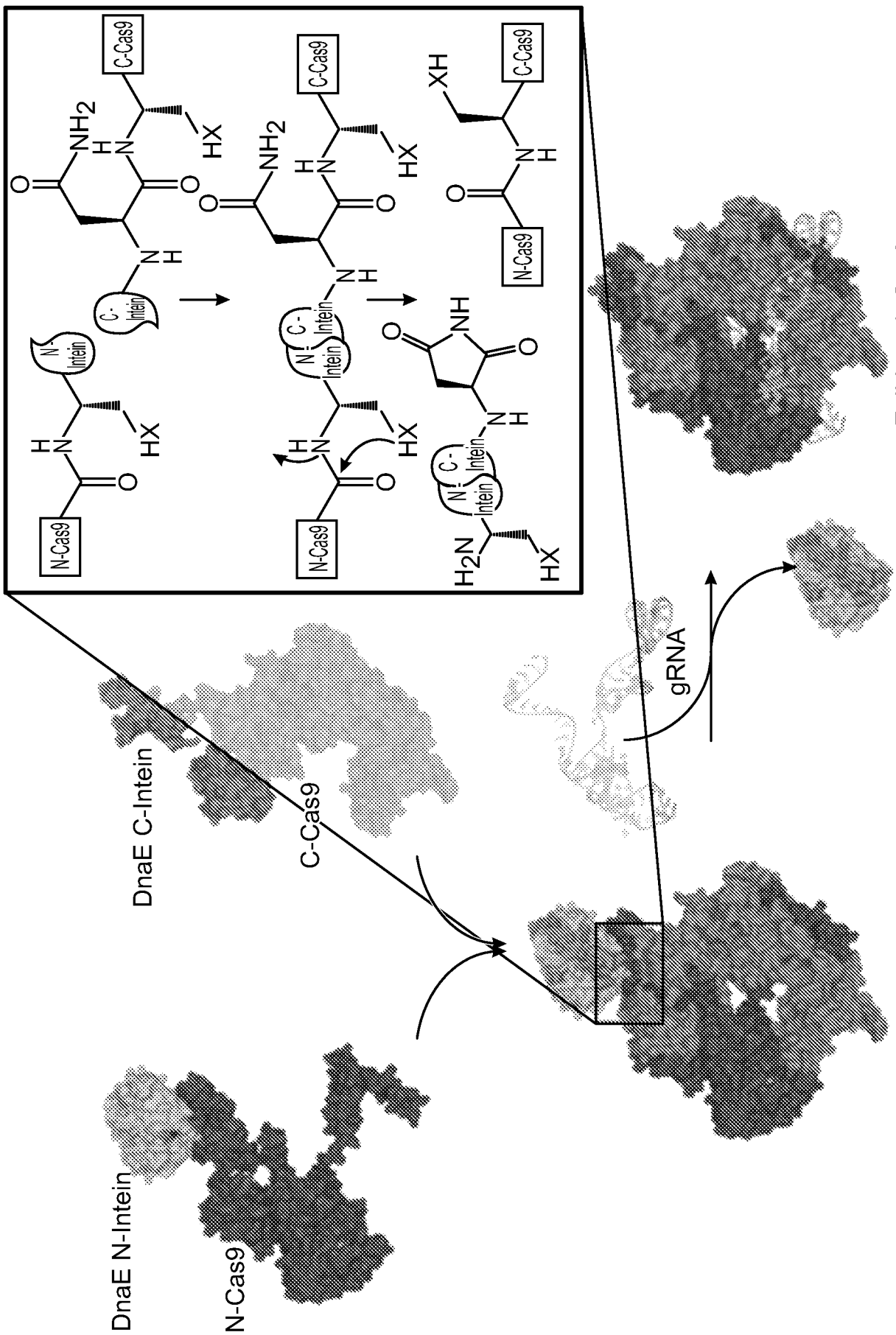

DnaE N-Intein
N-Cas9
DnaE C-Intein
C-Cas9
gRNA
DnaE intein
Full-length Cas9
N-Cas9
C-Cas9
N-Intein
C-Intein
HX
XH
NH_2
H_2N

Figure 1C

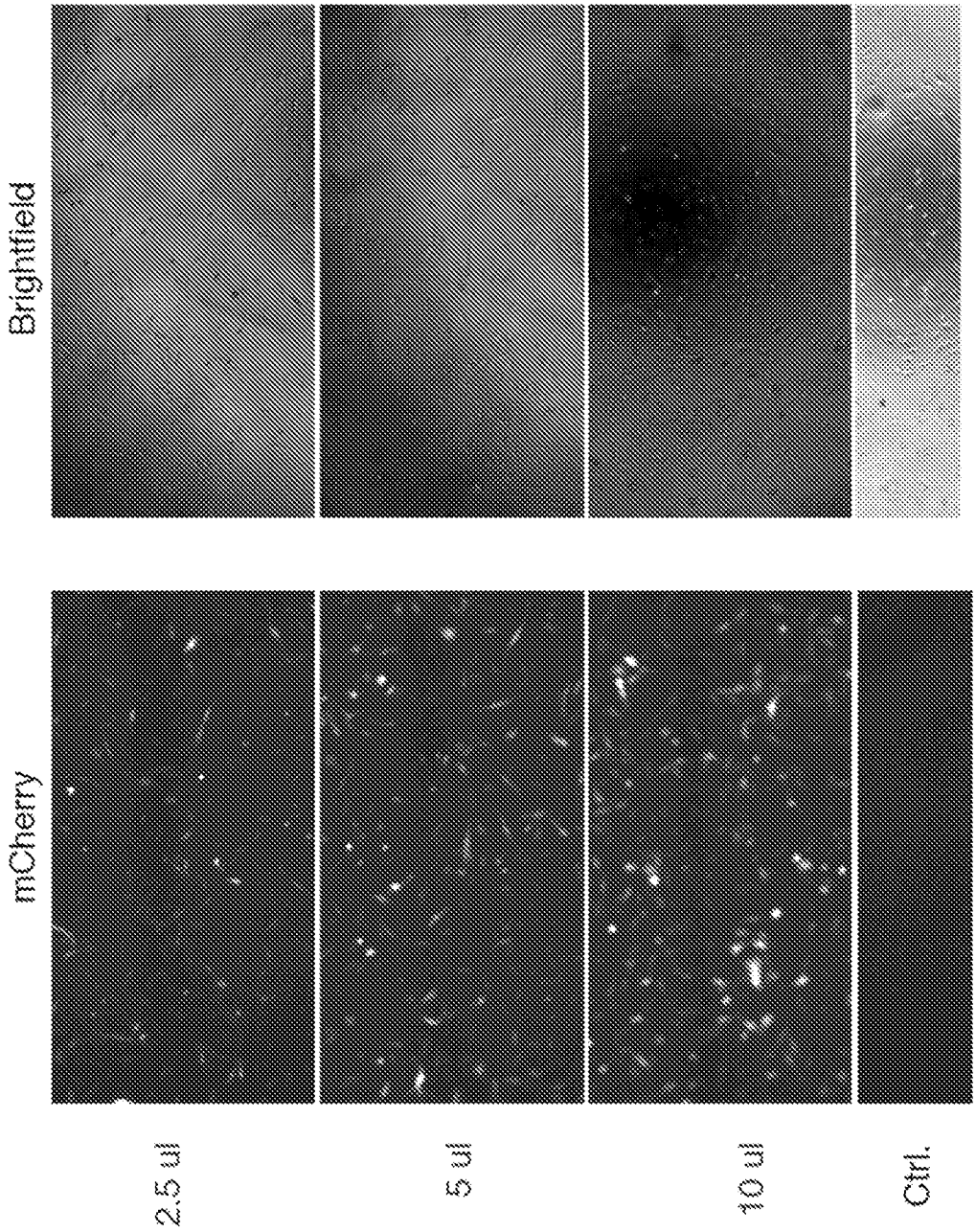


Figure 2

Virus harvested at 24 hours

72 hours:

C1

N1

	C7	C8	C7	C8	C7	C8	C7	C8	C7	C8	C7	C8
U118	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	99.8	99.8	99.9	99.9	99.9	100.0	99.8	99.9	100.0	100.0	100.0	100.0
	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	0.2	0.2	0.1	0.1	0.1	0.0	0.2	0.1	0.0	0.0	0.0	0.0
HEK	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	97.0	97.1	99.8	99.8	99.8	99.8	99.6	99.7	99.5	99.5	99.8	99.8
	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	2.9	2.9	0.2	0.2	0.2	0.2	0.3	0.3	0.5	0.5	0.2	0.2

Control – lipid transfection with BE3 and PRNP guide(U118 top row; HEK bottom row)

Gly			Ser -> Ser		Arg -> stop		Tyr			Pro			Gly				Glu				
G	G	C4	A	G	C7	C8	G	A	T	A	C	C	C	G	G	G	G	C	A	G	G	G
0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
0.0	0.0	99.8	0.0	0.0	98.0	98.1	0.0	0.0	0.0	0.0	100.0	100.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
100.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	100.0	100.0	100.0	0.0	0.0	100.0	100.0	100.0
0.0	0.0	0.2	0.0	0.0	1.9	1.9	0.0	0.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

G	G	C4	A	G	C7	C8	G	A	T	A	C	C	C	G	G	G	G	C	A	G	G	G
0.0	0.0	0.1	100.0	0.1	1.3	0.6	0.1	99.9	0.0	100.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0
0.0	0.0	96.0	0.0	0.0	68.8	70.8	0.0	0.0	0.0	0.0	99.8	99.7	99.9	0.0	0.1	0.1	0.0	100.0	0.0	0.0	0.0	0.0
100.0	100.0	0.0	0.0	99.9	2.1	2.0	99.9	0.0	0.0	0.0	0.0	0.0	0.0	99.9	99.9	99.9	99.9	0.0	0.0	100.0	100.0	100.0
0.0	0.0	3.8	0.0	0.0	27.9	26.6	0.0	0.0	100.0	0.0	0.2	0.2	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0

Figure 3A

SUBSTITUTE SHEET (RULE 26)

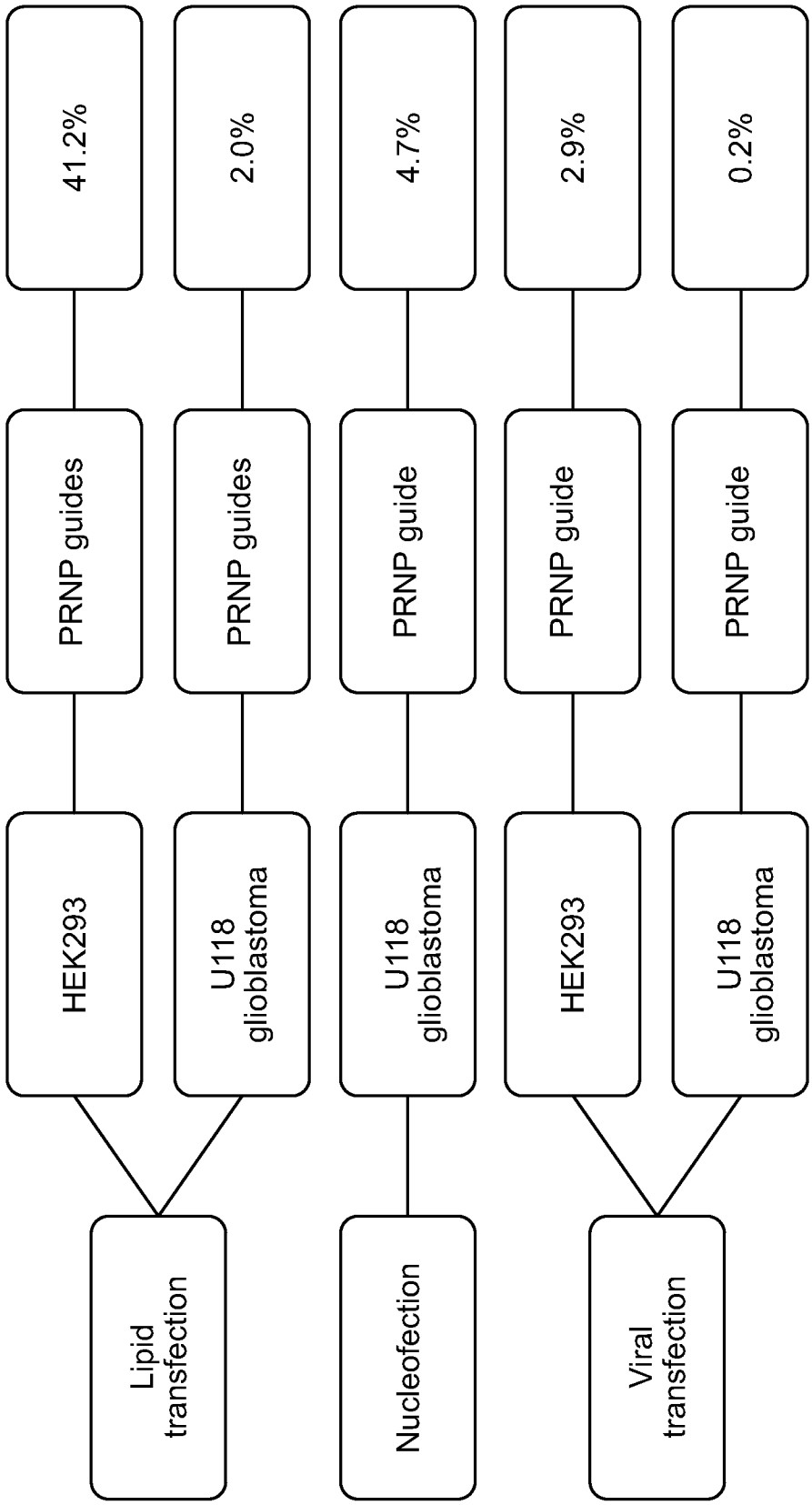

Lipid transfection
Nucleofection
Viral transfection
HEK293
U118 glioblastoma
U118 glioblastoma
HEK293
U118 glioblastoma
PRNP guides
PRNP guides
PRNP guide
PRNP guide
PRNP guide
41.2%
2.0%
4.7%
2.9%
0.2%

Figure 3B

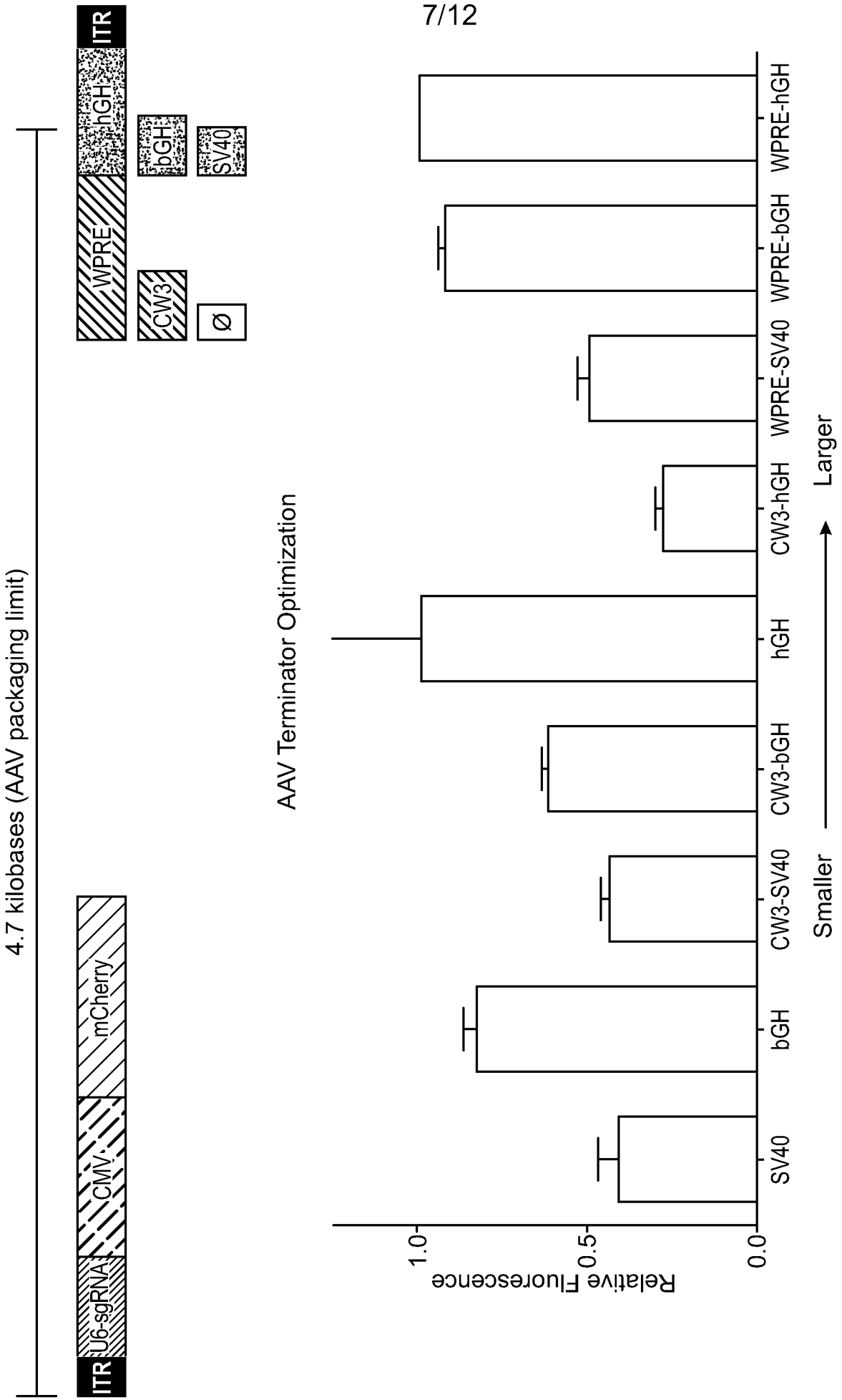
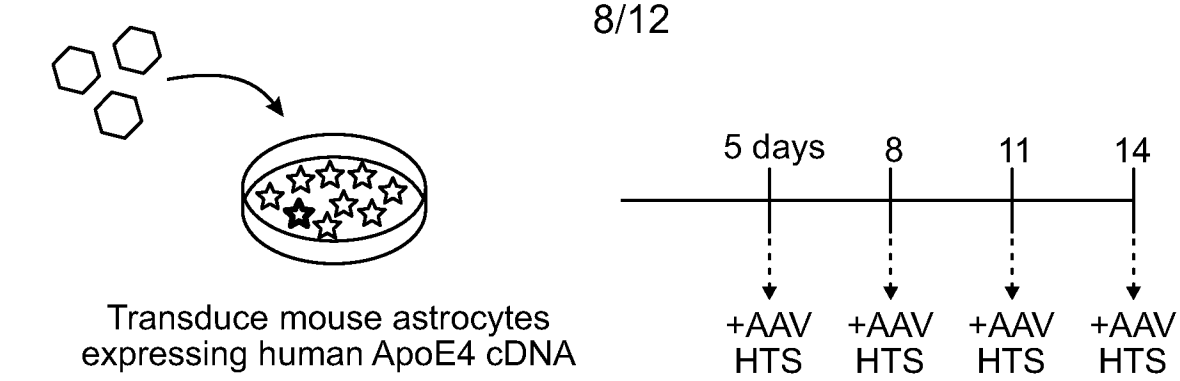

4.7 kilobases (AAV packaging limit)
ITR
U6-sgRNA
CMV
mCherry
WPRE
hGH
ITR
CW3
bGH
Ø
SV40
AAV Terminator Optimization
Relative Fluorescence
0.0
0.5
1.0
SV40
bGH
CW3-SV40
CW3-bGH
hGH
CW3-hGH
WPRE-SV40
WPRE-bGH
WPRE-hGH
Smaller
Larger

Figure 4



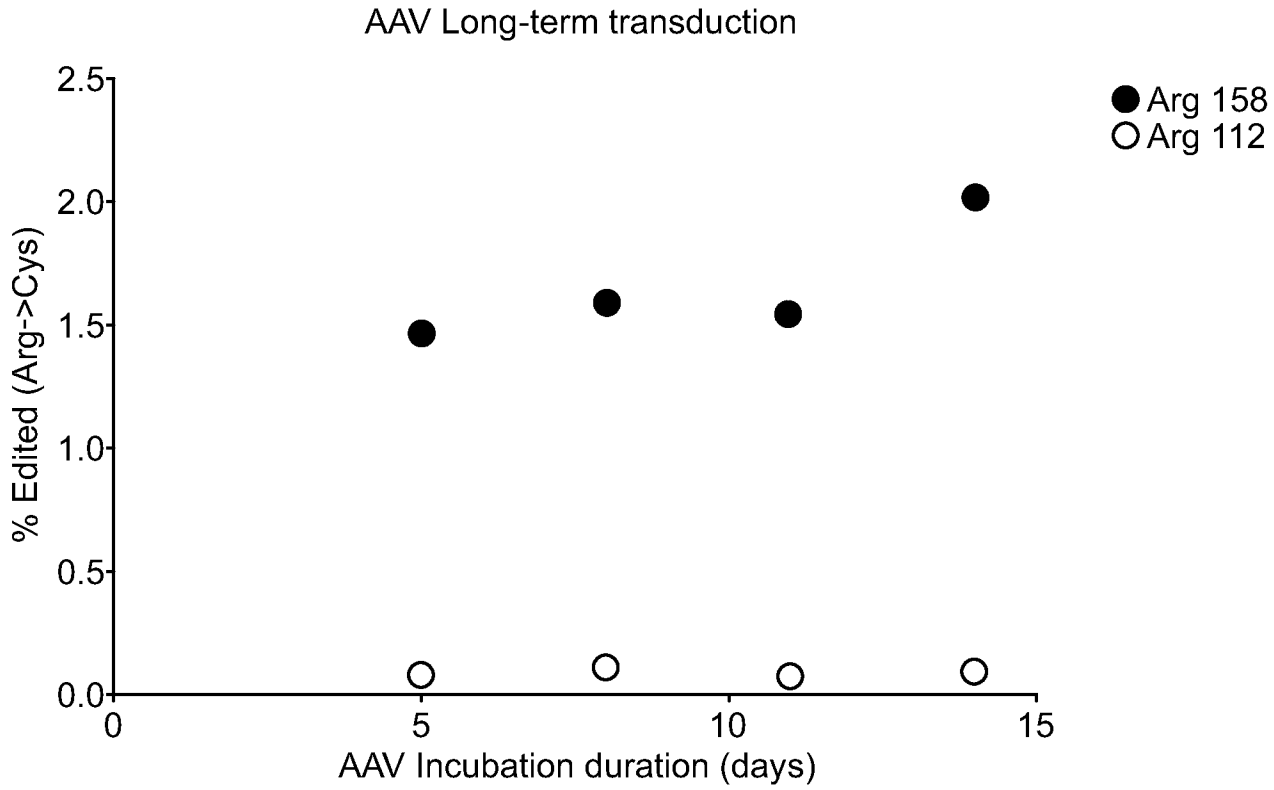


Figure 5A

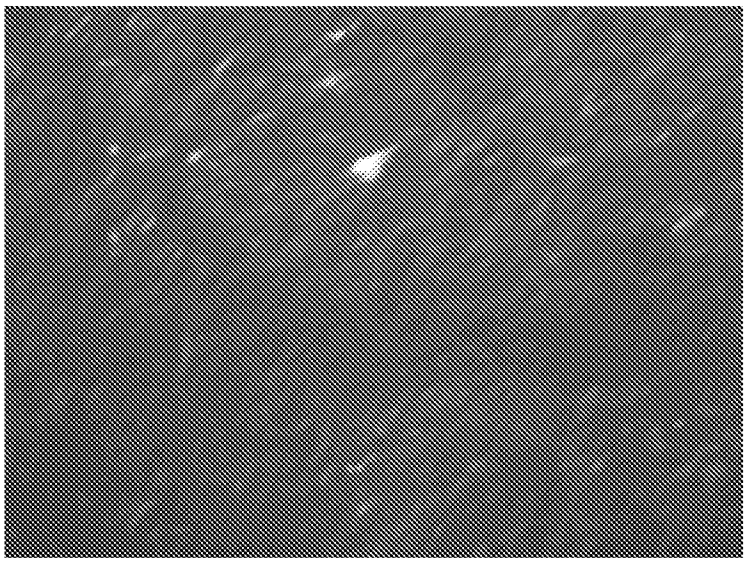


Figure 5B

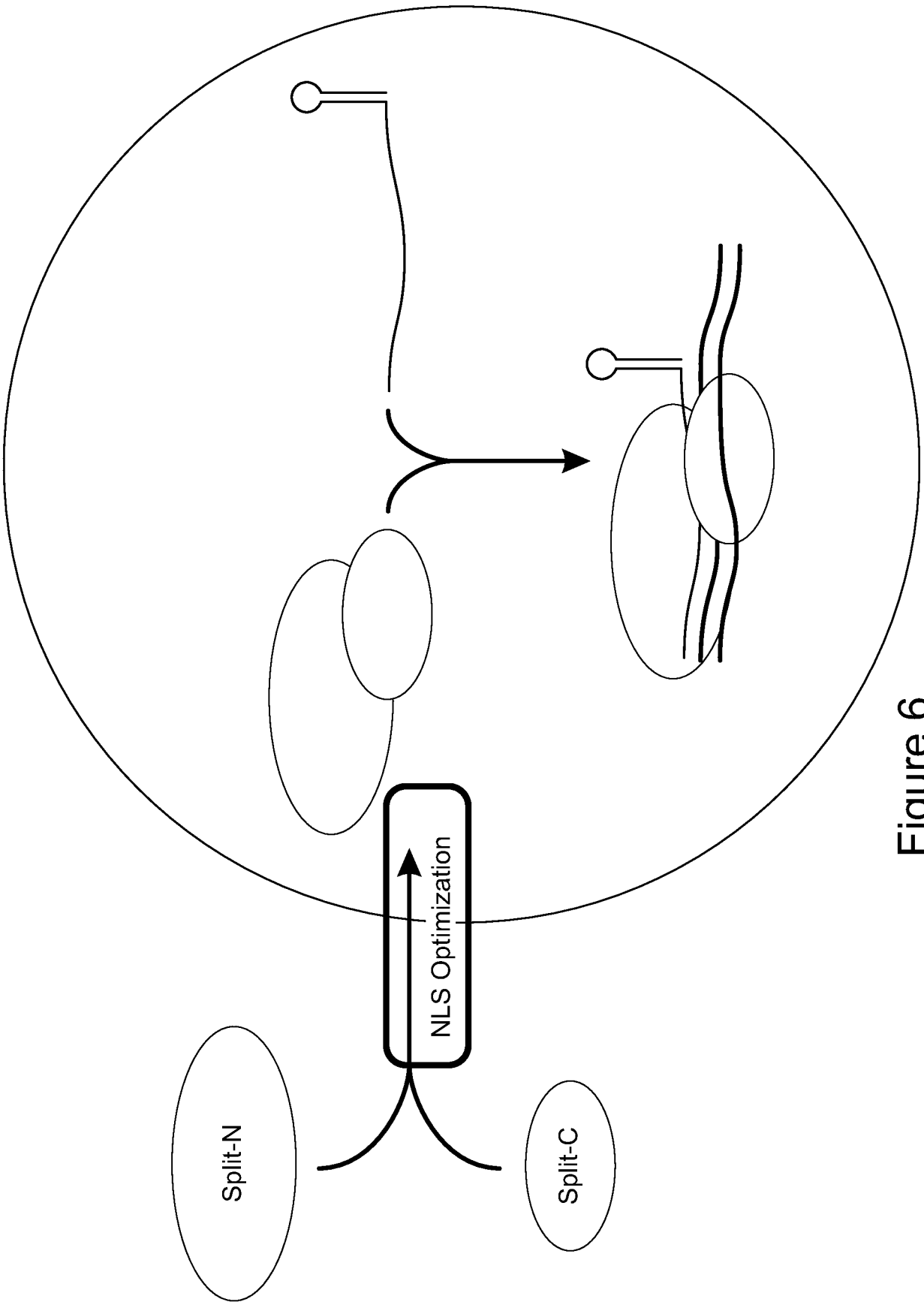


Figure 6

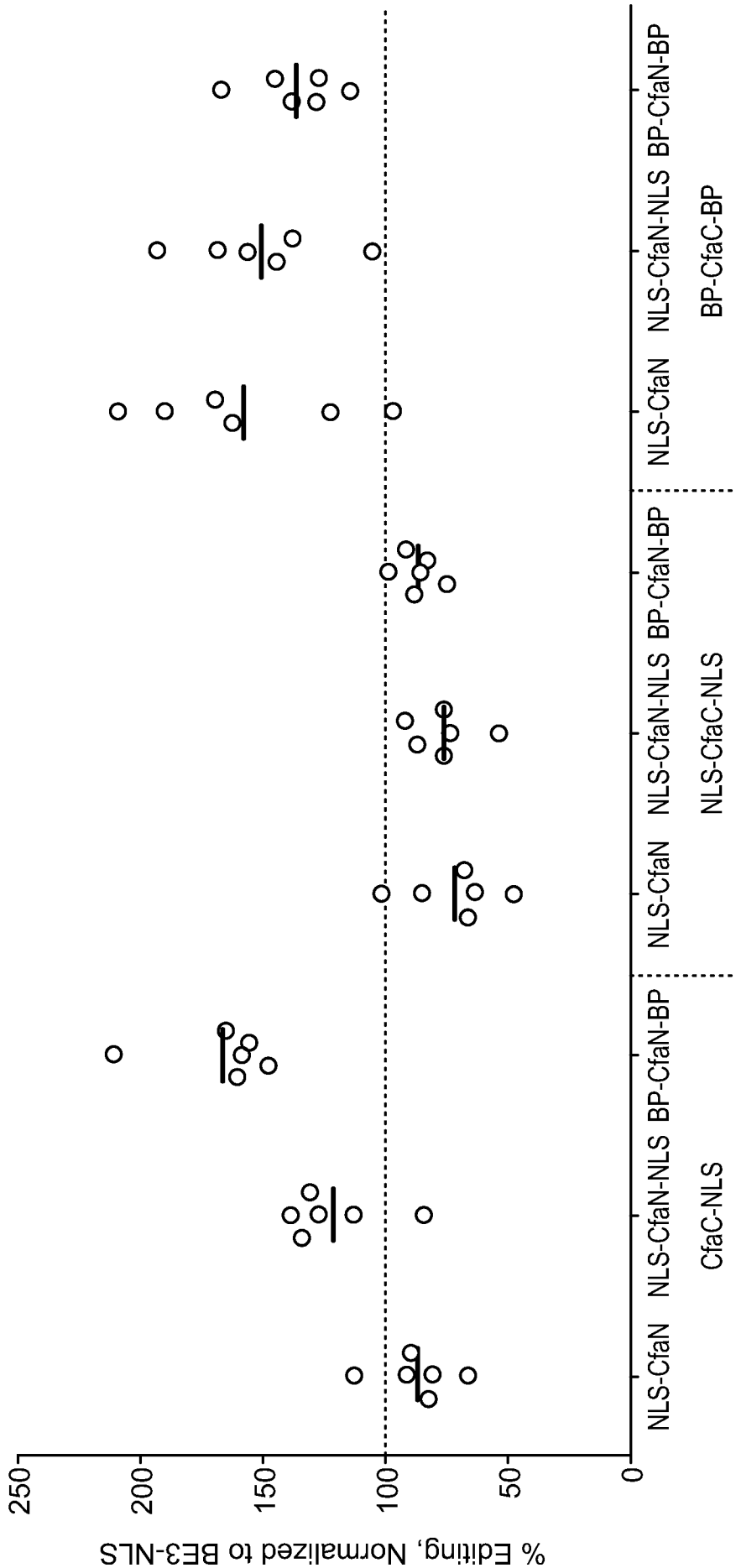

% Editing, Normalized to BE3-NLS
250
200
150
100
50
0
NLS-CfaN
NLS-CfaN-NLS
BP-CfaN-BP
CfaC-NLS
NLS-CfaN
NLS-CfaN-NLS
BP-CfaN-BP
NLS-CfaC-NLS
NLS-CfaN
NLS-CfaN-NLS
BP-CfaN-BP
BP-CfaC-BP

Figure 7

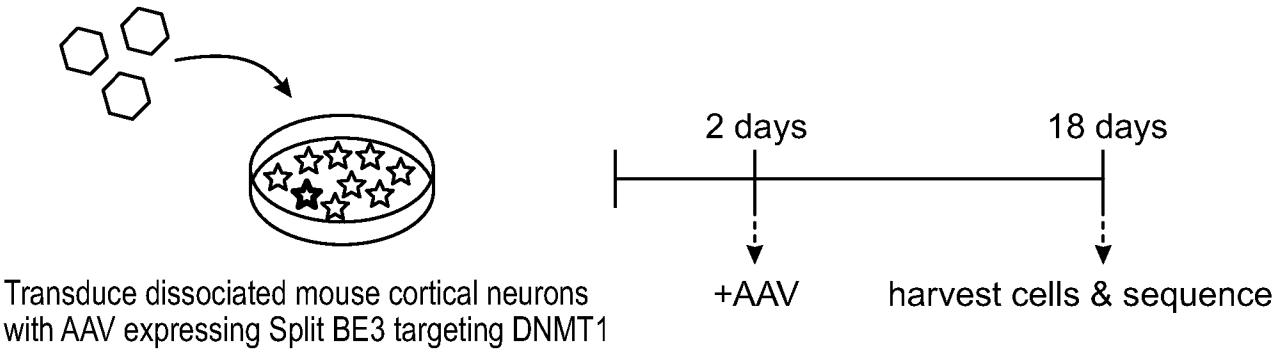


Figure 8A

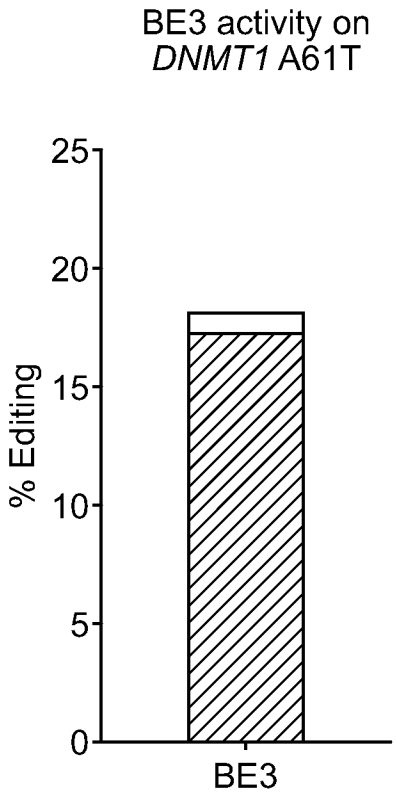


Figure 8B

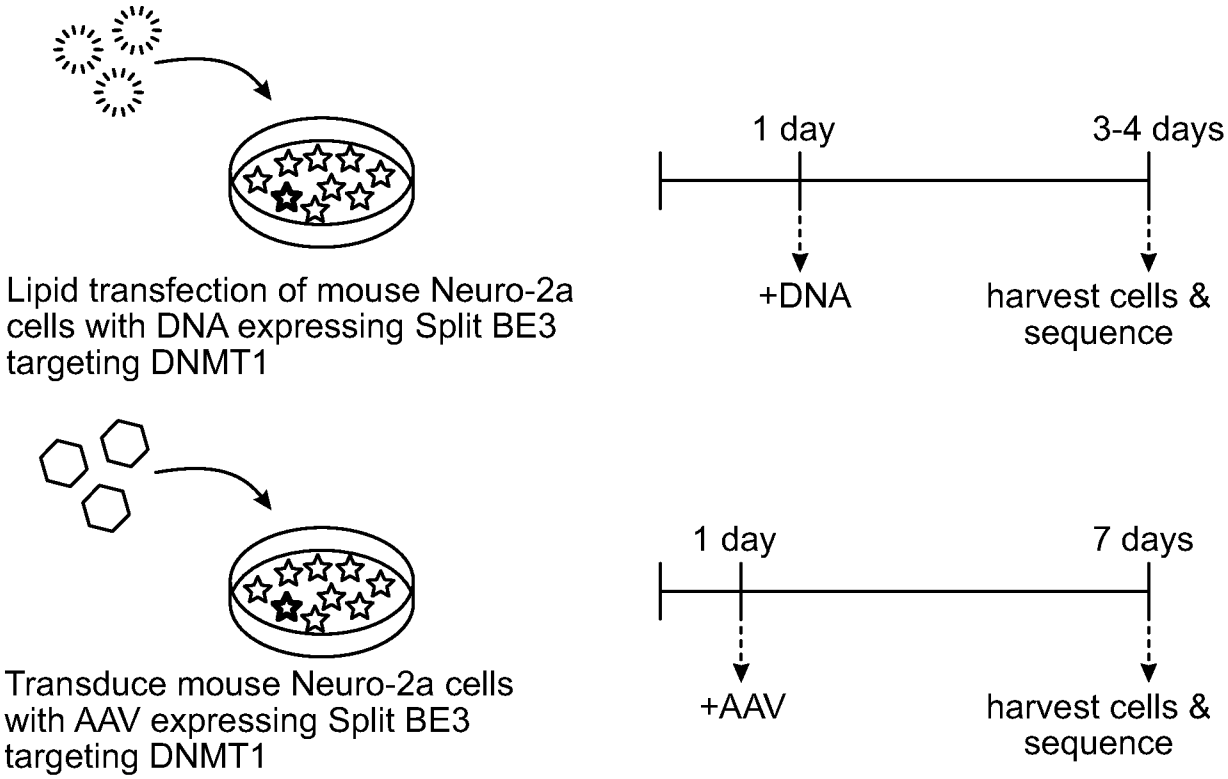


Figure 9A

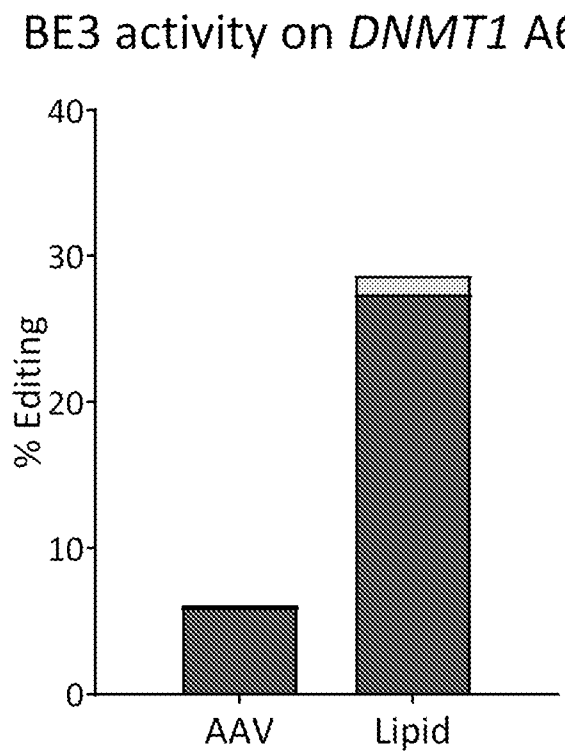


Figure 9B

SEQUENCE LISTING

<110> President and Fellows of Harvard College

<120> AAV DELIVERY OF NUCLEOBASE EDITORS

<130> H0824.70246WO00

<140> Not Yet Assigned
<141> 2017-10-13

<150> US 62/475,780
<151> 2017-03-23

<150> US 62/408,575
<151> 2016-10-14

<160> 479

<170> PatentIn version 3.5

<210> 1
<211> 1368
<212> PRT
<213> Streptococcus pyogenes

<400> 1

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
20 25 30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
85 90 95

```
Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140


Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175


Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190


Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205


Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220


Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240


Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255


Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270


Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285


Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300
```

```
Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320


Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335


Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350


Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365


Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380


Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400


Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415


Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430


Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445


Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460


Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480


Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495


Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510
```

```
Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525


Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540


Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560


Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575


Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590


Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605


Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620


Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640


His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655


Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670


Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685


Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700


Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720
```

```
His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925
```

```
Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125
```

```
Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140


Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155


Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170


Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185


Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200


Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215


Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230


Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245


Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260


His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275


Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290


Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305


Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320
```

```
Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335


Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365


<210>  2
<211>  1368
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  2

Met Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125
```

```
His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335
```

```
Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540
```

```
Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750
```

```
Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp Ala Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960
```

```
Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
           980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155
```

```
Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245

Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260

His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275

Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290

Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305

Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320

Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335

Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350
```

```
Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365


<210>  3
<211>  1368
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  3

Met Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140
```

```
Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175


Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190


Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205


Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220


Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240


Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255


Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270


Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285


Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300


Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320


Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335


Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350
```

```
Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560
```

```
Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765
```

```
Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975
```

```
Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020


Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035


Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050


Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065


Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080


Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095


Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110


Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125


Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140


Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155


Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170
```

```
Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185


Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200


Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215


Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230


Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245


Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260


His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275


Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290


Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305


Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320


Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1325                1330                1335


Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365
```

<210> 4
<211> 1368
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 4

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140


Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175
```

```
Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380
```

```
Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590
```

```
Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800
```

```
Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005
```

```
Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Val  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200
```

```
Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Arg
    1205                 1210                 1215


Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                 1225                 1230


Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                 1240                 1245


Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                 1255                 1260


His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                 1270                 1275


Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                 1285                 1290


Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                 1300                 1305


Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                 1315                 1320


Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Glu  Tyr Arg Ser
    1325                 1330                 1335


Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                 1345                 1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                 1360                 1365


<210>  5
<211>  1368
<212>  PRT
<213>  Artificial Sequence

<220>
```

<223> Synthetic Polypeptide

<400> 5

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140


Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175


Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190
```

```
Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400
```

```
Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605
```

```
Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815
```

```
Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845

Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020
```

```
Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050

Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Val  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215
```

```
Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230


Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245


Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                1255                1260


His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                1270                1275


Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                1285                1290


Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                1300                1305


Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                1315                1320


Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Gln  Tyr Arg Ser
    1325                1330                1335


Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                1345                1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                1360                1365


<210>  6
<211>  1368
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  6

Met Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val
1               5                  10                  15
```

```
Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala
        195                 200                 205

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220
```

```
Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
        275                 280                 285

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
    290                 295                 300

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
                325                 330                 335

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
            340                 345                 350

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
        355                 360                 365

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
    370                 375                 380

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
            420                 425                 430
```

```
Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
    450                 455                 460

Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
    530                 535                 540

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
545                 550                 555                 560

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
                565                 570                 575

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
            580                 585                 590

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
        595                 600                 605

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
    610                 615                 620

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
625                 630                 635                 640
```

```
His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe
        675                 680                 685

Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe
    690                 695                 700

Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu
705                 710                 715                 720

His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
                725                 730                 735

Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly
            740                 745                 750

Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile
    770                 775                 780

Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys
        835                 840                 845
```

```
Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys
865                 870                 875                 880

Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp
    930                 935                 940

Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser
945                 950                 955                 960

Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Gly Thr Ala Leu Ile Lys Lys  Tyr Pro Lys Leu Glu  Ser Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val Arg Lys  Met Ile Ala
    1010                1015                1020

Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr Ala Lys  Tyr Phe Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr Glu Ile  Thr Leu Ala
    1040                1045                1050
```

```
Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile Glu Thr  Asn Gly Glu
    1055                1060                1065

Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg Asp Phe  Ala Thr Val
    1070                1075                1080

Arg Lys  Val Leu Ser Met Pro  Gln Val Asn Ile Val  Lys Lys Thr
    1085                1090                1095

Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu Ser Ile  Leu Pro Lys
    1100                1105                1110

Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys Lys Asp  Trp Asp Pro
    1115                1120                1125

Lys Lys  Tyr Gly Gly Phe Glu  Ser Pro Thr Val Ala  Tyr Ser Val
    1130                1135                1140

Leu Val  Val Ala Lys Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys
    1145                1150                1155

Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile Met Glu  Arg Ser Ser
    1160                1165                1170

Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu Ala Lys  Gly Tyr Lys
    1175                1180                1185

Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1190                1195                1200

Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met Leu Ala  Ser Ala Gly
    1205                1210                1215

Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Ser  Lys Tyr Val
    1220                1225                1230

Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu Lys Leu  Lys Gly Ser
    1235                1240                1245
```

```
Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe Val Glu  Gln His Lys
    1250                 1255                 1260


His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile Ser Glu  Phe Ser Lys
    1265                 1270                 1275


Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp Lys Val  Leu Ser Ala
    1280                 1285                 1290


Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg Glu Gln  Ala Glu Asn
    1295                 1300                 1305


Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu Gly Ala  Pro Ala Ala
    1310                 1315                 1320


Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg Lys Gln  Tyr Arg Ser
    1325                 1330                 1335


Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1340                 1345                 1350


Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Gln Leu  Gly Gly Asp
    1355                 1360                 1365


<210>  7
<211>  1053
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  7

Met Lys Arg Asn Tyr Ile Leu Gly Leu Ala Ile Gly Ile Thr Ser Val
1               5                  10                  15


Gly Tyr Gly Ile Ile Asp Tyr Glu Thr Arg Asp Val Ile Asp Ala Gly
            20                  25                  30
```

```
Val Arg Leu Phe Lys Glu Ala Asn Val Glu Asn Asn Glu Gly Arg Arg
        35                  40                  45

Ser Lys Arg Gly Ala Arg Arg Leu Lys Arg Arg Arg Arg His Arg Ile
    50                  55                  60

Gln Arg Val Lys Lys Leu Leu Phe Asp Tyr Asn Leu Leu Thr Asp His
65                  70                  75                  80

Ser Glu Leu Ser Gly Ile Asn Pro Tyr Glu Ala Arg Val Lys Gly Leu
                85                  90                  95

Ser Gln Lys Leu Ser Glu Glu Glu Phe Ser Ala Ala Leu Leu His Leu
            100                 105                 110

Ala Lys Arg Arg Gly Val His Asn Val Asn Glu Val Glu Glu Asp Thr
        115                 120                 125

Gly Asn Glu Leu Ser Thr Lys Glu Gln Ile Ser Arg Asn Ser Lys Ala
    130                 135                 140

Leu Glu Glu Lys Tyr Val Ala Glu Leu Gln Leu Glu Arg Leu Lys Lys
145                 150                 155                 160

Asp Gly Glu Val Arg Gly Ser Ile Asn Arg Phe Lys Thr Ser Asp Tyr
                165                 170                 175

Val Lys Glu Ala Lys Gln Leu Leu Lys Val Gln Lys Ala Tyr His Gln
            180                 185                 190

Leu Asp Gln Ser Phe Ile Asp Thr Tyr Ile Asp Leu Leu Glu Thr Arg
        195                 200                 205

Arg Thr Tyr Tyr Glu Gly Pro Gly Glu Gly Ser Pro Phe Gly Trp Lys
    210                 215                 220

Asp Ile Lys Glu Trp Tyr Glu Met Leu Met Gly His Cys Thr Tyr Phe
225                 230                 235                 240
```

```
Pro Glu Glu Leu Arg Ser Val Lys Tyr Ala Tyr Asn Ala Asp Leu Tyr
                245                 250                 255

Asn Ala Leu Asn Asp Leu Asn Asn Leu Val Ile Thr Arg Asp Glu Asn
            260                 265                 270

Glu Lys Leu Glu Tyr Tyr Glu Lys Phe Gln Ile Ile Glu Asn Val Phe
        275                 280                 285

Lys Gln Lys Lys Lys Pro Thr Leu Lys Gln Ile Ala Lys Glu Ile Leu
    290                 295                 300

Val Asn Glu Glu Asp Ile Lys Gly Tyr Arg Val Thr Ser Thr Gly Lys
305                 310                 315                 320

Pro Glu Phe Thr Asn Leu Lys Val Tyr His Asp Ile Lys Asp Ile Thr
                325                 330                 335

Ala Arg Lys Glu Ile Ile Glu Asn Ala Glu Leu Leu Asp Gln Ile Ala
            340                 345                 350

Lys Ile Leu Thr Ile Tyr Gln Ser Ser Glu Asp Ile Gln Glu Glu Leu
        355                 360                 365

Thr Asn Leu Asn Ser Glu Leu Thr Gln Glu Glu Ile Glu Gln Ile Ser
    370                 375                 380

Asn Leu Lys Gly Tyr Thr Gly Thr His Asn Leu Ser Leu Lys Ala Ile
385                 390                 395                 400

Asn Leu Ile Leu Asp Glu Leu Trp His Thr Asn Asp Asn Gln Ile Ala
                405                 410                 415

Ile Phe Asn Arg Leu Lys Leu Val Pro Lys Lys Val Asp Leu Ser Gln
            420                 425                 430

Gln Lys Glu Ile Pro Thr Thr Leu Val Asp Asp Phe Ile Leu Ser Pro
        435                 440                 445
```

```
Val Val Lys Arg Ser Phe Ile Gln Ser Ile Lys Val Ile Asn Ala Ile
    450                 455                 460

Ile Lys Lys Tyr Gly Leu Pro Asn Asp Ile Ile Ile Glu Leu Ala Arg
465                 470                 475                 480

Glu Lys Asn Ser Lys Asp Ala Gln Lys Met Ile Asn Glu Met Gln Lys
                485                 490                 495

Arg Asn Arg Gln Thr Asn Glu Arg Ile Glu Glu Ile Ile Arg Thr Thr
            500                 505                 510

Gly Lys Glu Asn Ala Lys Tyr Leu Ile Glu Lys Ile Lys Leu His Asp
        515                 520                 525

Met Gln Glu Gly Lys Cys Leu Tyr Ser Leu Glu Ala Ile Pro Leu Glu
    530                 535                 540

Asp Leu Leu Asn Asn Pro Phe Asn Tyr Glu Val Asp His Ile Ile Pro
545                 550                 555                 560

Arg Ser Val Ser Phe Asp Asn Ser Phe Asn Asn Lys Val Leu Val Lys
                565                 570                 575

Gln Glu Glu Asn Ser Lys Lys Gly Asn Arg Thr Pro Phe Gln Tyr Leu
            580                 585                 590

Ser Ser Ser Asp Ser Lys Ile Ser Tyr Glu Thr Phe Lys Lys His Ile
        595                 600                 605

Leu Asn Leu Ala Lys Gly Lys Gly Arg Ile Ser Lys Thr Lys Lys Glu
    610                 615                 620

Tyr Leu Leu Glu Glu Arg Asp Ile Asn Arg Phe Ser Val Gln Lys Asp
625                 630                 635                 640

Phe Ile Asn Arg Asn Leu Val Asp Thr Arg Tyr Ala Thr Arg Gly Leu
                645                 650                 655
```

```
Met Asn Leu Leu Arg Ser Tyr Phe Arg Val Asn Asn Leu Asp Val Lys
            660                 665                 670

Val Lys Ser Ile Asn Gly Gly Phe Thr Ser Phe Leu Arg Arg Lys Trp
        675                 680                 685

Lys Phe Lys Lys Glu Arg Asn Lys Gly Tyr Lys His His Ala Glu Asp
    690                 695                 700

Ala Leu Ile Ile Ala Asn Ala Asp Phe Ile Phe Lys Glu Trp Lys Lys
705                 710                 715                 720

Leu Asp Lys Ala Lys Lys Val Met Glu Asn Gln Met Phe Glu Glu Lys
                725                 730                 735

Gln Ala Glu Ser Met Pro Glu Ile Glu Thr Glu Gln Glu Tyr Lys Glu
            740                 745                 750

Ile Phe Ile Thr Pro His Gln Ile Lys His Ile Lys Asp Phe Lys Asp
        755                 760                 765

Tyr Lys Tyr Ser His Arg Val Asp Lys Lys Pro Asn Arg Lys Leu Ile
    770                 775                 780

Asn Asp Thr Leu Tyr Ser Thr Arg Lys Asp Asp Lys Gly Asn Thr Leu
785                 790                 795                 800

Ile Val Asn Asn Leu Asn Gly Leu Tyr Asp Lys Asp Asn Asp Lys Leu
                805                 810                 815

Lys Lys Leu Ile Asn Lys Ser Pro Glu Lys Leu Leu Met Tyr His His
            820                 825                 830

Asp Pro Gln Thr Tyr Gln Lys Leu Lys Leu Ile Met Glu Gln Tyr Gly
        835                 840                 845

Asp Glu Lys Asn Pro Leu Tyr Lys Tyr Tyr Glu Glu Thr Gly Asn Tyr
    850                 855                 860
```

```
Leu Thr Lys Tyr Ser Lys Lys Asp Asn Gly Pro Val Ile Lys Lys Ile
865                 870                 875                 880


Lys Tyr Tyr Gly Asn Lys Leu Asn Ala His Leu Asp Ile Thr Asp Asp
                885                 890                 895


Tyr Pro Asn Ser Arg Asn Lys Val Val Lys Leu Ser Leu Lys Pro Tyr
            900                 905                 910


Arg Phe Asp Val Tyr Leu Asp Asn Gly Val Tyr Lys Phe Val Thr Val
        915                 920                 925


Lys Asn Leu Asp Val Ile Lys Lys Glu Asn Tyr Tyr Glu Val Asn Ser
    930                 935                 940


Lys Cys Tyr Glu Glu Ala Lys Lys Leu Lys Lys Ile Ser Asn Gln Ala
945                 950                 955                 960


Glu Phe Ile Ala Ser Phe Tyr Lys Asn Asp Leu Ile Lys Ile Asn Gly
                965                 970                 975


Glu Leu Tyr Arg Val Ile Gly Val Asn Asn Asp Leu Leu Asn Arg Ile
            980                 985                 990


Glu Val Asn Met Ile Asp Ile Thr  Tyr Arg Glu Tyr Leu  Glu Asn Met
        995                 1000                1005


Asn Asp  Lys Arg Pro Pro His  Ile Ile Lys Thr Ile  Ala Ser Lys
    1010                1015                1020


Thr Gln  Ser Ile Lys Lys Tyr  Ser Thr Asp Ile Leu  Gly Asn Leu
    1025                1030                1035


Tyr Glu  Val Lys Ser Lys Lys  His Pro Gln Ile Ile  Lys Lys Gly
    1040                1045                1050
```

<210> 8
<211> 1121
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 8

```
Met Ser Asp Leu Val Leu Gly Leu Ala Ile Gly Ile Gly Ser Val Gly
1               5                  10                  15


Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
            20                  25                  30


Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Leu Val Arg Arg Thr
        35                  40                  45


Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Arg Val
    50                  55                  60


Arg Leu Asn Arg Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65                  70                  75                  80


Lys Ile Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
                85                  90                  95


Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
            100                 105                 110


Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
        115                 120                 125


Asn Ser Ser Ile Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
    130                 135                 140


Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145                 150                 155                 160


Thr Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Lys Asp Gly Lys
                165                 170                 175


Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190
```

```
Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Pro Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Arg Thr Ser Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Glu Phe Arg Ala Ala Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile
    290                 295                 300

Ile Asn Tyr Val Lys Asn Glu Lys Ala Met Gly Pro Ala Lys Leu Phe
305                 310                 315                 320

Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Val Ala Asp Ile Lys Gly
                325                 330                 335

Tyr Arg Ile Asp Lys Ser Gly Lys Ala Glu Ile His Thr Phe Glu Ala
            340                 345                 350

Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu Asp Ile Glu Gln Met Asp
        355                 360                 365

Arg Glu Thr Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Ala Asp Gly Ser
385                 390                 395                 400
```

```
Phe Ser Gln Lys Gln Val Asp Glu Leu Val Gln Phe Arg Lys Ala Asn
                405                 410                 415

Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu Met
            420                 425                 430

Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr Thr Ser Ser Ser Asn Lys
    450                 455                 460

Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr Glu Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Val Asn Ala Ala
                485                 490                 495

Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile Val Ile Glu Met Ala Arg
            500                 505                 510

Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Lys Ile Gln Lys
        515                 520                 525

Ala Asn Lys Asp Glu Lys Asp Ala Ala Met Leu Lys Ala Ala Asn Gln
    530                 535                 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Ser Val Phe His Gly His Lys
545                 550                 555                 560

Gln Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg Cys
                565                 570                 575

Leu Tyr Thr Gly Lys Thr Ile Ser Ile His Asp Leu Ile Asn Asn Ser
            580                 585                 590

Asn Gln Phe Glu Val Asp His Ile Leu Pro Leu Ser Ile Thr Phe Asp
        595                 600                 605
```

```
Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu Asp Ser Met Asp Asp Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Lys Ala Phe Val Arg Glu Ser Lys Thr Leu
                645                 650                 655

Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys
            660                 665                 670

Phe Asp Val Arg Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ala Leu Gln Glu His Phe Arg Ala
    690                 695                 700

His Lys Ile Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg His Trp Gly Ile Glu Lys Thr Arg Asp Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Asn
            740                 745                 750

Leu Trp Lys Lys Gln Lys Asn Thr Leu Val Ser Tyr Ser Glu Asp Gln
        755                 760                 765

Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile Ser Asp Asp Glu Tyr Lys
    770                 775                 780

Glu Ser Val Phe Lys Ala Pro Tyr Gln His Phe Val Asp Thr Leu Lys
785                 790                 795                 800

Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser
                805                 810                 815
```

```
Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg Gln
            820                 825                 830

Ala Lys Val Gly Lys Asp Lys Ala Asp Glu Thr Tyr Val Leu Gly Lys
        835                 840                 845

Ile Lys Asp Ile Tyr Thr Gln Asp Gly Tyr Asp Ala Phe Met Lys Ile
    850                 855                 860

Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met Tyr Arg His Asp Pro Gln
865                 870                 875                 880

Thr Phe Glu Lys Val Ile Glu Pro Ile Leu Glu Asn Tyr Pro Asn Lys
                885                 890                 895

Gln Ile Asn Glu Lys Gly Lys Glu Val Pro Cys Asn Pro Phe Leu Lys
            900                 905                 910

Tyr Lys Glu Glu His Gly Tyr Ile Arg Lys Tyr Ser Lys Lys Gly Asn
        915                 920                 925

Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Ser Lys Leu Gly Asn
    930                 935                 940

His Ile Asp Ile Thr Pro Lys Asp Ser Asn Asn Lys Val Val Leu Gln
945                 950                 955                 960

Ser Val Ser Pro Trp Arg Ala Asp Val Tyr Phe Asn Lys Thr Thr Gly
                965                 970                 975

Lys Tyr Glu Ile Leu Gly Leu Lys Tyr Ala Asp Leu Gln Phe Glu Lys
            980                 985                 990

Gly Thr Gly Thr Tyr Lys Ile Ser  Gln Glu Lys Tyr Asn  Asp Ile Lys
        995                 1000                1005

Lys Lys  Glu Gly Val Asp Ser  Asp Ser Glu Phe Lys  Phe Thr Leu
    1010                1015                1020
```

```
Tyr Lys  Asn Asp Leu Leu Leu  Val Lys Asp Thr Glu  Thr Lys Glu
    1025                1030                1035


Gln Gln  Leu Phe Arg Phe Leu  Ser Arg Thr Met Pro  Lys Gln Lys
    1040                1045                1050


His Tyr  Val Glu Leu Lys Pro  Tyr Asp Lys Gln Lys  Phe Glu Gly
    1055                1060                1065


Gly Glu  Ala Leu Ile Lys Val  Leu Gly Asn Val Ala  Asn Ser Gly
    1070                1075                1080


Gln Cys  Lys Lys Gly Leu Gly  Lys Ser Asn Ile Ser  Ile Tyr Lys
    1085                1090                1095


Val Arg  Thr Asp Val Leu Gly  Asn Gln His Ile Ile  Lys Asn Glu
    1100                1105                1110


Gly Asp  Lys Pro Lys Leu Asp  Phe
    1115                1120


<210>  9
<211>  1388
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  9

Met Thr Lys Pro Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asn Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Ser Lys Lys Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45
```

```
Gly Val Leu Leu Phe Asp Ser Gly Ile Thr Ala Glu Gly Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Thr Glu Met Ala Thr Leu Asp Asp Ala
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Pro Asp Asp Lys Arg
            100                 105                 110

Asp Ser Lys Tyr Pro Ile Phe Gly Asn Leu Val Glu Glu Lys Val Tyr
        115                 120                 125

His Asp Glu Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
    130                 135                 140

Ser Thr Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Phe Asn Ser
                165                 170                 175

Lys Asn Asn Asp Ile Gln Lys Asn Phe Gln Asp Phe Leu Asp Thr Tyr
            180                 185                 190

Asn Ala Ile Phe Glu Ser Asp Leu Ser Leu Glu Asn Ser Lys Gln Leu
        195                 200                 205

Glu Glu Ile Val Lys Asp Lys Ile Ser Lys Leu Glu Lys Lys Asp Arg
    210                 215                 220

Ile Leu Lys Leu Phe Pro Gly Glu Lys Asn Ser Gly Ile Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Arg Lys Cys Phe
                245                 250                 255
```

```
Asn Leu Asp Glu Lys Ala Ser Leu His Phe Ser Lys Glu Ser Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Thr Leu Leu Gly Tyr Ile Gly Asp Asp Tyr Ser Asp
        275                 280                 285

Val Phe Leu Lys Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Phe Leu Thr Val Thr Asp Asn Glu Thr Glu Ala Pro Leu Ser Ser Ala
305                 310                 315                 320

Met Ile Lys Arg Tyr Asn Glu His Lys Glu Asp Leu Ala Leu Leu Lys
                325                 330                 335

Glu Tyr Ile Arg Asn Ile Ser Leu Lys Thr Tyr Asn Glu Val Phe Lys
            340                 345                 350

Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Asp Phe Tyr Val Tyr Leu Lys Asn Leu Leu Ala Glu Phe Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Glu Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Leu Asp Lys Gln Ala Lys Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Lys Asn Lys Glu Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala Trp
    450                 455                 460
```

```
Ser Ile Arg Lys Arg Asn Glu Lys Ile Thr Pro Trp Asn Phe Glu Asp
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Ser Phe Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Asn Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Phe Ile Ala Glu Ser Met Arg Asp Tyr Gln Phe Leu Asp Ser Lys Gln
    530                 535                 540

Lys Lys Asp Ile Val Arg Leu Tyr Phe Lys Asp Lys Arg Lys Val Thr
545                 550                 555                 560

Asp Lys Asp Ile Ile Glu Tyr Leu His Ala Ile Tyr Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ser Ser Leu Ser Thr
            580                 585                 590

Tyr His Asp Leu Leu Asn Ile Ile Asn Asp Lys Glu Phe Leu Asp Asp
        595                 600                 605

Ser Ser Asn Glu Ala Ile Ile Glu Glu Ile Ile His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ser Lys Phe Glu Asn
625                 630                 635                 640

Ile Phe Asp Lys Ser Val Leu Lys Lys Leu Ser Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Glu
            660                 665                 670
```

```
Lys Ser Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ile Ser
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ala Leu Ser Phe Lys
    690                 695                 700

Lys Lys Ile Gln Lys Ala Gln Ile Ile Gly Asp Glu Asp Lys Gly Asn
705                 710                 715                 720

Ile Lys Glu Val Val Lys Ser Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly Gly Arg Lys Pro Glu Ser Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Tyr Thr Asn Gln Gly Lys Ser Asn Ser Gln Gln Arg Leu Lys Arg
    770                 775                 780

Leu Glu Lys Ser Leu Lys Glu Leu Gly Ser Lys Ile Leu Lys Glu Asn
785                 790                 795                 800

Ile Pro Ala Lys Leu Ser Lys Ile Asp Asn Asn Ala Leu Gln Asn Asp
                805                 810                 815

Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly
            820                 825                 830

Asp Asp Leu Asp Ile Asp Arg Leu Ser Asn Tyr Asp Ile Asp His Ile
        835                 840                 845

Ile Pro Gln Ala Phe Leu Lys Asp Asn Ser Ile Asp Asn Lys Val Leu
    850                 855                 860

Val Ser Ser Ala Ser Asn Arg Gly Lys Ser Asp Asp Phe Pro Ser Leu
865                 870                 875                 880
```

```
Glu Val Val Lys Lys Arg Lys Thr Phe Trp Tyr Gln Leu Leu Lys Ser
                885                 890                 895

Lys Leu Ile Ser Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg
            900                 905                 910

Gly Gly Leu Leu Pro Glu Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu
        915                 920                 925

Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Arg Leu Leu Asp Glu
    930                 935                 940

Lys Phe Asn Asn Lys Lys Asp Glu Asn Asn Arg Ala Val Arg Thr Val
945                 950                 955                 960

Lys Ile Ile Thr Leu Lys Ser Thr Leu Val Ser Gln Phe Arg Lys Asp
                965                 970                 975

Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Phe His His Ala His
            980                 985                 990

Asp Ala Tyr Leu Asn Ala Val Ile  Ala Ser Ala Leu Leu  Lys Lys Tyr
        995                 1000                1005

Pro Lys  Leu Glu Pro Glu Phe  Val Tyr Gly Asp Tyr  Pro Lys Tyr
    1010                1015                1020

Asn Ser  Phe Arg Glu Arg Lys  Ser Ala Thr Glu Lys  Val Tyr Phe
    1025                1030                1035

Tyr Ser  Asn Ile Met Asn Ile  Phe Lys Lys Ser Ile  Ser Leu Ala
    1040                1045                1050

Asp Gly  Arg Val Ile Glu Arg  Pro Leu Ile Glu Val  Asn Glu Glu
    1055                1060                1065

Thr Gly  Glu Ser Val Trp Asn  Lys Glu Ser Asp Leu  Ala Thr Val
    1070                1075                1080
```

```
Arg Arg  Val Leu Ser Tyr Pro  Gln Val Asn Val Val  Lys Lys Val
    1085                1090                1095

Glu Glu  Gln Asn His Gly Leu  Asp Arg Gly Lys Pro  Lys Gly Leu
    1100                1105                1110

Phe Asn  Ala Asn Leu Ser Ser  Lys Pro Lys Pro Asn  Ser Asn Glu
    1115                1120                1125

Asn Leu  Val Gly Ala Lys Glu  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1130                1135                1140

Gly Tyr  Ala Gly Ile Ser Asn  Ser Phe Ala Val Leu  Val Lys Gly
    1145                1150                1155

Thr Ile  Glu Lys Gly Ala Lys  Lys Lys Ile Thr Asn  Val Leu Glu
    1160                1165                1170

Phe Gln  Gly Ile Ser Ile Leu  Asp Arg Ile Asn Tyr  Arg Lys Asp
    1175                1180                1185

Lys Leu  Asn Phe Leu Leu Glu  Lys Gly Tyr Lys Asp  Ile Glu Leu
    1190                1195                1200

Ile Ile  Glu Leu Pro Lys Tyr  Ser Leu Phe Glu Leu  Ser Asp Gly
    1205                1210                1215

Ser Arg  Arg Met Leu Ala Ser  Ile Leu Ser Thr Asn  Asn Lys Arg
    1220                1225                1230

Gly Glu  Ile His Lys Gly Asn  Gln Ile Phe Leu Ser  Gln Lys Phe
    1235                1240                1245

Val Lys  Leu Leu Tyr His Ala  Lys Arg Ile Ser Asn  Thr Ile Asn
    1250                1255                1260

Glu Asn  His Arg Lys Tyr Val  Glu Asn His Lys Lys  Glu Phe Glu
    1265                1270                1275
```

```
Glu Leu  Phe Tyr Tyr Ile Leu  Glu Phe Asn Glu Asn  Tyr Val Gly
    1280                1285                1290


Ala Lys  Lys Asn Gly Lys Leu  Leu Asn Ser Ala Phe  Gln Ser Trp
    1295                1300                1305


Gln Asn  His Ser Ile Asp Glu  Leu Cys Ser Ser Phe  Ile Gly Pro
    1310                1315                1320


Thr Gly  Ser Glu Arg Lys Gly  Leu Phe Glu Leu Thr  Ser Arg Gly
    1325                1330                1335


Ser Ala  Ala Asp Phe Glu Phe  Leu Gly Val Lys Ile  Pro Arg Tyr
    1340                1345                1350


Arg Asp  Tyr Thr Pro Ser Ser  Leu Leu Lys Asp Ala  Thr Leu Ile
    1355                1360                1365


His Gln  Ser Val Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ala
    1370                1375                1380


Lys Leu  Gly Glu Gly
    1385
```

<210> 10
<211> 1053
<212> PRT
<213> Staphylococcus aureus

<400> 10

```
Met Lys Arg Asn Tyr Ile Leu Gly Leu Asp Ile Gly Ile Thr Ser Val
1               5                   10                  15


Gly Tyr Gly Ile Ile Asp Tyr Glu Thr Arg Asp Val Ile Asp Ala Gly
            20                  25                  30


Val Arg Leu Phe Lys Glu Ala Asn Val Glu Asn Asn Glu Gly Arg Arg
        35                  40                  45


Ser Lys Arg Gly Ala Arg Arg Leu Lys Arg Arg Arg Arg His Arg Ile
```

```
    50                  55                  60

Gln Arg Val Lys Lys Leu Leu Phe Asp Tyr Asn Leu Leu Thr Asp His
65                  70                  75                  80

Ser Glu Leu Ser Gly Ile Asn Pro Tyr Glu Ala Arg Val Lys Gly Leu
                85                  90                  95

Ser Gln Lys Leu Ser Glu Glu Glu Phe Ser Ala Ala Leu Leu His Leu
            100                 105                 110

Ala Lys Arg Arg Gly Val His Asn Val Asn Glu Val Glu Glu Asp Thr
        115                 120                 125

Gly Asn Glu Leu Ser Thr Lys Glu Gln Ile Ser Arg Asn Ser Lys Ala
    130                 135                 140

Leu Glu Glu Lys Tyr Val Ala Glu Leu Gln Leu Glu Arg Leu Lys Lys
145                 150                 155                 160

Asp Gly Glu Val Arg Gly Ser Ile Asn Arg Phe Lys Thr Ser Asp Tyr
                165                 170                 175

Val Lys Glu Ala Lys Gln Leu Leu Lys Val Gln Lys Ala Tyr His Gln
            180                 185                 190

Leu Asp Gln Ser Phe Ile Asp Thr Tyr Ile Asp Leu Leu Glu Thr Arg
        195                 200                 205

Arg Thr Tyr Tyr Glu Gly Pro Gly Glu Gly Ser Pro Phe Gly Trp Lys
    210                 215                 220

Asp Ile Lys Glu Trp Tyr Glu Met Leu Met Gly His Cys Thr Tyr Phe
225                 230                 235                 240

Pro Glu Glu Leu Arg Ser Val Lys Tyr Ala Tyr Asn Ala Asp Leu Tyr
                245                 250                 255

Asn Ala Leu Asn Asp Leu Asn Asn Leu Val Ile Thr Arg Asp Glu Asn
```

```
            260                 265                 270

Glu Lys Leu Glu Tyr Tyr Glu Lys Phe Gln Ile Ile Glu Asn Val Phe
        275                 280                 285

Lys Gln Lys Lys Lys Pro Thr Leu Lys Gln Ile Ala Lys Glu Ile Leu
    290                 295                 300

Val Asn Glu Glu Asp Ile Lys Gly Tyr Arg Val Thr Ser Thr Gly Lys
305                 310                 315                 320

Pro Glu Phe Thr Asn Leu Lys Val Tyr His Asp Ile Lys Asp Ile Thr
                325                 330                 335

Ala Arg Lys Glu Ile Ile Glu Asn Ala Glu Leu Leu Asp Gln Ile Ala
            340                 345                 350

Lys Ile Leu Thr Ile Tyr Gln Ser Ser Glu Asp Ile Gln Glu Glu Leu
        355                 360                 365

Thr Asn Leu Asn Ser Glu Leu Thr Gln Glu Glu Ile Glu Gln Ile Ser
    370                 375                 380

Asn Leu Lys Gly Tyr Thr Gly Thr His Asn Leu Ser Leu Lys Ala Ile
385                 390                 395                 400

Asn Leu Ile Leu Asp Glu Leu Trp His Thr Asn Asp Asn Gln Ile Ala
                405                 410                 415

Ile Phe Asn Arg Leu Lys Leu Val Pro Lys Lys Val Asp Leu Ser Gln
            420                 425                 430

Gln Lys Glu Ile Pro Thr Thr Leu Val Asp Asp Phe Ile Leu Ser Pro
        435                 440                 445

Val Val Lys Arg Ser Phe Ile Gln Ser Ile Lys Val Ile Asn Ala Ile
    450                 455                 460

Ile Lys Lys Tyr Gly Leu Pro Asn Asp Ile Ile Ile Glu Leu Ala Arg
```

```
465                 470                 475                 480

Glu Lys Asn Ser Lys Asp Ala Gln Lys Met Ile Asn Glu Met Gln Lys
                485                 490                 495

Arg Asn Arg Gln Thr Asn Glu Arg Ile Glu Glu Ile Ile Arg Thr Thr
            500                 505                 510

Gly Lys Glu Asn Ala Lys Tyr Leu Ile Glu Lys Ile Lys Leu His Asp
        515                 520                 525

Met Gln Glu Gly Lys Cys Leu Tyr Ser Leu Glu Ala Ile Pro Leu Glu
    530                 535                 540

Asp Leu Leu Asn Asn Pro Phe Asn Tyr Glu Val Asp His Ile Ile Pro
545                 550                 555                 560

Arg Ser Val Ser Phe Asp Asn Ser Phe Asn Asn Lys Val Leu Val Lys
                565                 570                 575

Gln Glu Glu Asn Ser Lys Lys Gly Asn Arg Thr Pro Phe Gln Tyr Leu
            580                 585                 590

Ser Ser Ser Asp Ser Lys Ile Ser Tyr Glu Thr Phe Lys Lys His Ile
        595                 600                 605

Leu Asn Leu Ala Lys Gly Lys Gly Arg Ile Ser Lys Thr Lys Lys Glu
    610                 615                 620

Tyr Leu Leu Glu Glu Arg Asp Ile Asn Arg Phe Ser Val Gln Lys Asp
625                 630                 635                 640

Phe Ile Asn Arg Asn Leu Val Asp Thr Arg Tyr Ala Thr Arg Gly Leu
                645                 650                 655

Met Asn Leu Leu Arg Ser Tyr Phe Arg Val Asn Asn Leu Asp Val Lys
            660                 665                 670

Val Lys Ser Ile Asn Gly Gly Phe Thr Ser Phe Leu Arg Arg Lys Trp
```

675 680 685

Lys Phe Lys Lys Glu Arg Asn Lys Gly Tyr Lys His His Ala Glu Asp
690 695 700

Ala Leu Ile Ile Ala Asn Ala Asp Phe Ile Phe Lys Glu Trp Lys Lys
705 710 715 720

Leu Asp Lys Ala Lys Lys Val Met Glu Asn Gln Met Phe Glu Glu Lys
725 730 735

Gln Ala Glu Ser Met Pro Glu Ile Glu Thr Glu Gln Glu Tyr Lys Glu
740 745 750

Ile Phe Ile Thr Pro His Gln Ile Lys His Ile Lys Asp Phe Lys Asp
755 760 765

Tyr Lys Tyr Ser His Arg Val Asp Lys Lys Pro Asn Arg Glu Leu Ile
770 775 780

Asn Asp Thr Leu Tyr Ser Thr Arg Lys Asp Asp Lys Gly Asn Thr Leu
785 790 795 800

Ile Val Asn Asn Leu Asn Gly Leu Tyr Asp Lys Asp Asn Asp Lys Leu
805 810 815

Lys Lys Leu Ile Asn Lys Ser Pro Glu Lys Leu Leu Met Tyr His His
820 825 830

Asp Pro Gln Thr Tyr Gln Lys Leu Lys Leu Ile Met Glu Gln Tyr Gly
835 840 845

Asp Glu Lys Asn Pro Leu Tyr Lys Tyr Tyr Glu Glu Thr Gly Asn Tyr
850 855 860

Leu Thr Lys Tyr Ser Lys Lys Asp Asn Gly Pro Val Ile Lys Lys Ile
865 870 875 880

Lys Tyr Tyr Gly Asn Lys Leu Asn Ala His Leu Asp Ile Thr Asp Asp

885 890 895

Tyr Pro Asn Ser Arg Asn Lys Val Val Lys Leu Ser Leu Lys Pro Tyr
900 905 910

Arg Phe Asp Val Tyr Leu Asp Asn Gly Val Tyr Lys Phe Val Thr Val
915 920 925

Lys Asn Leu Asp Val Ile Lys Lys Glu Asn Tyr Tyr Glu Val Asn Ser
930 935 940

Lys Cys Tyr Glu Glu Ala Lys Lys Leu Lys Lys Ile Ser Asn Gln Ala
945 950 955 960

Glu Phe Ile Ala Ser Phe Tyr Asn Asn Asp Leu Ile Lys Ile Asn Gly
965 970 975

Glu Leu Tyr Arg Val Ile Gly Val Asn Asn Asp Leu Leu Asn Arg Ile
980 985 990

Glu Val Asn Met Ile Asp Ile Thr Tyr Arg Glu Tyr Leu Glu Asn Met
995 1000 1005

Asn Asp Lys Arg Pro Pro Arg Ile Ile Lys Thr Ile Ala Ser Lys
1010 1015 1020

Thr Gln Ser Ile Lys Lys Tyr Ser Thr Asp Ile Leu Gly Asn Leu
1025 1030 1035

Tyr Glu Val Lys Ser Lys Lys His Pro Gln Ile Ile Lys Lys Gly
1040 1045 1050

<210> 11
<211> 1053
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 11

```
Met Lys Arg Asn Tyr Ile Leu Gly Leu Ala Ile Gly Ile Thr Ser Val
1               5                  10                  15

Gly Tyr Gly Ile Ile Asp Tyr Glu Thr Arg Asp Val Ile Asp Ala Gly
            20                  25                  30

Val Arg Leu Phe Lys Glu Ala Asn Val Glu Asn Asn Glu Gly Arg Arg
        35                  40                  45

Ser Lys Arg Gly Ala Arg Arg Leu Lys Arg Arg Arg Arg His Arg Ile
    50                  55                  60

Gln Arg Val Lys Lys Leu Leu Phe Asp Tyr Asn Leu Leu Thr Asp His
65                  70                  75                  80

Ser Glu Leu Ser Gly Ile Asn Pro Tyr Glu Ala Arg Val Lys Gly Leu
                85                  90                  95

Ser Gln Lys Leu Ser Glu Glu Glu Phe Ser Ala Ala Leu Leu His Leu
            100                 105                 110

Ala Lys Arg Arg Gly Val His Asn Val Asn Glu Val Glu Glu Asp Thr
        115                 120                 125

Gly Asn Glu Leu Ser Thr Lys Glu Gln Ile Ser Arg Asn Ser Lys Ala
    130                 135                 140

Leu Glu Glu Lys Tyr Val Ala Glu Leu Gln Leu Glu Arg Leu Lys Lys
145                 150                 155                 160

Asp Gly Glu Val Arg Gly Ser Ile Asn Arg Phe Lys Thr Ser Asp Tyr
                165                 170                 175

Val Lys Glu Ala Lys Gln Leu Leu Lys Val Gln Lys Ala Tyr His Gln
            180                 185                 190

Leu Asp Gln Ser Phe Ile Asp Thr Tyr Ile Asp Leu Leu Glu Thr Arg
        195                 200                 205
```

```
Arg Thr Tyr Tyr Glu Gly Pro Gly Glu Gly Ser Pro Phe Gly Trp Lys
    210                 215                 220

Asp Ile Lys Glu Trp Tyr Glu Met Leu Met Gly His Cys Thr Tyr Phe
225                 230                 235                 240

Pro Glu Glu Leu Arg Ser Val Lys Tyr Ala Tyr Asn Ala Asp Leu Tyr
                245                 250                 255

Asn Ala Leu Asn Asp Leu Asn Asn Leu Val Ile Thr Arg Asp Glu Asn
            260                 265                 270

Glu Lys Leu Glu Tyr Tyr Glu Lys Phe Gln Ile Ile Glu Asn Val Phe
        275                 280                 285

Lys Gln Lys Lys Lys Pro Thr Leu Lys Gln Ile Ala Lys Glu Ile Leu
    290                 295                 300

Val Asn Glu Glu Asp Ile Lys Gly Tyr Arg Val Thr Ser Thr Gly Lys
305                 310                 315                 320

Pro Glu Phe Thr Asn Leu Lys Val Tyr His Asp Ile Lys Asp Ile Thr
                325                 330                 335

Ala Arg Lys Glu Ile Ile Glu Asn Ala Glu Leu Leu Asp Gln Ile Ala
            340                 345                 350

Lys Ile Leu Thr Ile Tyr Gln Ser Ser Glu Asp Ile Gln Glu Glu Leu
        355                 360                 365

Thr Asn Leu Asn Ser Glu Leu Thr Gln Glu Glu Ile Glu Gln Ile Ser
    370                 375                 380

Asn Leu Lys Gly Tyr Thr Gly Thr His Asn Leu Ser Leu Lys Ala Ile
385                 390                 395                 400

Asn Leu Ile Leu Asp Glu Leu Trp His Thr Asn Asp Asn Gln Ile Ala
                405                 410                 415
```

```
Ile Phe Asn Arg Leu Lys Leu Val Pro Lys Lys Val Asp Leu Ser Gln
            420                 425                 430

Gln Lys Glu Ile Pro Thr Thr Leu Val Asp Asp Phe Ile Leu Ser Pro
        435                 440                 445

Val Val Lys Arg Ser Phe Ile Gln Ser Ile Lys Val Ile Asn Ala Ile
    450                 455                 460

Ile Lys Lys Tyr Gly Leu Pro Asn Asp Ile Ile Ile Glu Leu Ala Arg
465                 470                 475                 480

Glu Lys Asn Ser Lys Asp Ala Gln Lys Met Ile Asn Glu Met Gln Lys
                485                 490                 495

Arg Asn Arg Gln Thr Asn Glu Arg Ile Glu Glu Ile Ile Arg Thr Thr
            500                 505                 510

Gly Lys Glu Asn Ala Lys Tyr Leu Ile Glu Lys Ile Lys Leu His Asp
        515                 520                 525

Met Gln Glu Gly Lys Cys Leu Tyr Ser Leu Glu Ala Ile Pro Leu Glu
    530                 535                 540

Asp Leu Leu Asn Asn Pro Phe Asn Tyr Glu Val Asp His Ile Ile Pro
545                 550                 555                 560

Arg Ser Val Ser Phe Asp Asn Ser Phe Asn Asn Lys Val Leu Val Lys
                565                 570                 575

Gln Glu Glu Asn Ser Lys Lys Gly Asn Arg Thr Pro Phe Gln Tyr Leu
            580                 585                 590

Ser Ser Ser Asp Ser Lys Ile Ser Tyr Glu Thr Phe Lys Lys His Ile
        595                 600                 605

Leu Asn Leu Ala Lys Gly Lys Gly Arg Ile Ser Lys Thr Lys Lys Glu
    610                 615                 620
```

```
Tyr Leu Leu Glu Glu Arg Asp Ile Asn Arg Phe Ser Val Gln Lys Asp
625                 630                 635                 640

Phe Ile Asn Arg Asn Leu Val Asp Thr Arg Tyr Ala Thr Arg Gly Leu
                645                 650                 655

Met Asn Leu Leu Arg Ser Tyr Phe Arg Val Asn Asn Leu Asp Val Lys
            660                 665                 670

Val Lys Ser Ile Asn Gly Gly Phe Thr Ser Phe Leu Arg Arg Lys Trp
        675                 680                 685

Lys Phe Lys Lys Glu Arg Asn Lys Gly Tyr Lys His His Ala Glu Asp
    690                 695                 700

Ala Leu Ile Ile Ala Asn Ala Asp Phe Ile Phe Lys Glu Trp Lys Lys
705                 710                 715                 720

Leu Asp Lys Ala Lys Lys Val Met Glu Asn Gln Met Phe Glu Glu Lys
                725                 730                 735

Gln Ala Glu Ser Met Pro Glu Ile Glu Thr Glu Gln Glu Tyr Lys Glu
            740                 745                 750

Ile Phe Ile Thr Pro His Gln Ile Lys His Ile Lys Asp Phe Lys Asp
        755                 760                 765

Tyr Lys Tyr Ser His Arg Val Asp Lys Lys Pro Asn Arg Glu Leu Ile
    770                 775                 780

Asn Asp Thr Leu Tyr Ser Thr Arg Lys Asp Asp Lys Gly Asn Thr Leu
785                 790                 795                 800

Ile Val Asn Asn Leu Asn Gly Leu Tyr Asp Lys Asp Asn Asp Lys Leu
                805                 810                 815

Lys Lys Leu Ile Asn Lys Ser Pro Glu Lys Leu Leu Met Tyr His His
            820                 825                 830
```

```
Asp Pro Gln Thr Tyr Gln Lys Leu Lys Leu Ile Met Glu Gln Tyr Gly
        835                 840                 845

Asp Glu Lys Asn Pro Leu Tyr Lys Tyr Tyr Glu Glu Thr Gly Asn Tyr
    850                 855                 860

Leu Thr Lys Tyr Ser Lys Lys Asp Asn Gly Pro Val Ile Lys Lys Ile
865                 870                 875                 880

Lys Tyr Tyr Gly Asn Lys Leu Asn Ala His Leu Asp Ile Thr Asp Asp
                885                 890                 895

Tyr Pro Asn Ser Arg Asn Lys Val Val Lys Leu Ser Leu Lys Pro Tyr
            900                 905                 910

Arg Phe Asp Val Tyr Leu Asp Asn Gly Val Tyr Lys Phe Val Thr Val
        915                 920                 925

Lys Asn Leu Asp Val Ile Lys Lys Glu Asn Tyr Tyr Glu Val Asn Ser
    930                 935                 940

Lys Cys Tyr Glu Glu Ala Lys Lys Leu Lys Lys Ile Ser Asn Gln Ala
945                 950                 955                 960

Glu Phe Ile Ala Ser Phe Tyr Asn Asn Asp Leu Ile Lys Ile Asn Gly
                965                 970                 975

Glu Leu Tyr Arg Val Ile Gly Val Asn Asn Asp Leu Leu Asn Arg Ile
            980                 985                 990

Glu Val Asn Met Ile Asp Ile Thr  Tyr Arg Glu Tyr Leu  Glu Asn Met
        995                 1000                1005

Asn Asp  Lys Arg Pro Pro Arg  Ile Ile Lys Thr Ile  Ala Ser Lys
    1010                1015                1020

Thr Gln  Ser Ile Lys Lys Tyr  Ser Thr Asp Ile Leu  Gly Asn Leu
    1025                1030                1035
```

```
Tyr Glu  Val Lys Ser Lys Lys  His Pro Gln Ile Ile  Lys Lys Gly
    1040                1045                1050


<210>  12
<211>  1388
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  12

Met Thr Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asn Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Ser Lys Lys Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Val Leu Leu Phe Asp Ser Gly Ile Thr Ala Glu Gly Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Thr Glu Met Ala Thr Leu Asp Asp Ala
                85                  90                  95


Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Pro Asp Asp Lys Arg
            100                 105                 110


Asp Ser Lys Tyr Pro Ile Phe Gly Asn Leu Val Glu Glu Lys Val Tyr
        115                 120                 125


His Asp Glu Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
    130                 135                 140


Ser Thr Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
```

145 150 155 160

Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Phe Asn Ser
165 170 175

Lys Asn Asn Asp Ile Gln Lys Asn Phe Gln Asp Phe Leu Asp Thr Tyr
180 185 190

Asn Ala Ile Phe Glu Ser Asp Leu Ser Leu Glu Asn Ser Lys Gln Leu
195 200 205

Glu Glu Ile Val Lys Asp Lys Ile Ser Lys Leu Glu Lys Lys Asp Arg
210 215 220

Ile Leu Lys Leu Phe Pro Gly Glu Lys Asn Ser Gly Ile Phe Ser Glu
225 230 235 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Arg Lys Cys Phe
245 250 255

Asn Leu Asp Glu Lys Ala Ser Leu His Phe Ser Lys Glu Ser Tyr Asp
260 265 270

Glu Asp Leu Glu Thr Leu Leu Gly Tyr Ile Gly Asp Asp Tyr Ser Asp
275 280 285

Val Phe Leu Lys Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
290 295 300

Phe Leu Thr Val Thr Asp Asn Glu Thr Glu Ala Pro Leu Ser Ser Ala
305 310 315 320

Met Ile Lys Arg Tyr Asn Glu His Lys Glu Asp Leu Ala Leu Leu Lys
325 330 335

Glu Tyr Ile Arg Asn Ile Ser Leu Lys Thr Tyr Asn Glu Val Phe Lys
340 345 350

Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn

355 360 365

Gln Glu Asp Phe Tyr Val Tyr Leu Lys Asn Leu Leu Ala Glu Phe Glu
370 375 380

Gly Ala Asp Tyr Phe Leu Glu Lys Ile Asp Arg Glu Asp Phe Leu Arg
385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
405 410 415

Gln Glu Met Arg Ala Ile Leu Asp Lys Gln Ala Lys Phe Tyr Pro Phe
420 425 430

Leu Ala Lys Asn Lys Glu Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala Trp
450 455 460

Ser Ile Arg Lys Arg Asn Glu Lys Ile Thr Pro Trp Asn Phe Glu Asp
465 470 475 480

Val Ile Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
485 490 495

Ser Phe Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
500 505 510

Leu Leu Tyr Glu Thr Phe Asn Val Tyr Asn Glu Leu Thr Lys Val Arg
515 520 525

Phe Ile Ala Glu Ser Met Arg Asp Tyr Gln Phe Leu Asp Ser Lys Gln
530 535 540

Lys Lys Asp Ile Val Arg Leu Tyr Phe Lys Asp Lys Arg Lys Val Thr
545 550 555 560

Asp Lys Asp Ile Ile Glu Tyr Leu His Ala Ile Tyr Gly Tyr Asp Gly

565 570 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ser Ser Leu Ser Thr
580 585 590

Tyr His Asp Leu Leu Asn Ile Ile Asn Asp Lys Glu Phe Leu Asp Asp
595 600 605

Ser Ser Asn Glu Ala Ile Ile Glu Glu Ile Ile His Thr Leu Thr Ile
610 615 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ser Lys Phe Glu Asn
625 630 635 640

Ile Phe Asp Lys Ser Val Leu Lys Lys Leu Ser Arg Arg His Tyr Thr
645 650 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Glu
660 665 670

Lys Ser Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ile Ser
675 680 685

Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ala Leu Ser Phe Lys
690 695 700

Lys Lys Ile Gln Lys Ala Gln Ile Ile Gly Asp Glu Asp Lys Gly Asn
705 710 715 720

Ile Lys Glu Val Val Lys Ser Leu Pro Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met
740 745 750

Gly Gly Arg Lys Pro Glu Ser Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Tyr Thr Asn Gln Gly Lys Ser Asn Ser Gln Gln Arg Leu Lys Arg

```
    770                 775                 780

Leu Glu Lys Ser Leu Lys Glu Leu Gly Ser Lys Ile Leu Lys Glu Asn
785                 790                 795                 800

Ile Pro Ala Lys Leu Ser Lys Ile Asp Asn Asn Ala Leu Gln Asn Asp
                805                 810                 815

Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly
            820                 825                 830

Asp Asp Leu Asp Ile Asp Arg Leu Ser Asn Tyr Asp Ile Asp His Ile
        835                 840                 845

Ile Pro Gln Ala Phe Leu Lys Asp Asn Ser Ile Asp Asn Lys Val Leu
    850                 855                 860

Val Ser Ser Ala Ser Asn Arg Gly Lys Ser Asp Asp Phe Pro Ser Leu
865                 870                 875                 880

Glu Val Val Lys Lys Arg Lys Thr Phe Trp Tyr Gln Leu Leu Lys Ser
                885                 890                 895

Lys Leu Ile Ser Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg
            900                 905                 910

Gly Gly Leu Leu Pro Glu Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu
        915                 920                 925

Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Arg Leu Leu Asp Glu
    930                 935                 940

Lys Phe Asn Asn Lys Lys Asp Glu Asn Asn Arg Ala Val Arg Thr Val
945                 950                 955                 960

Lys Ile Ile Thr Leu Lys Ser Thr Leu Val Ser Gln Phe Arg Lys Asp
                965                 970                 975

Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Phe His His Ala His
```

980 985 990

Asp Ala Tyr Leu Asn Ala Val Ile Ala Ser Ala Leu Leu Lys Lys Tyr
995 1000 1005

Pro Lys Leu Glu Pro Glu Phe Val Tyr Gly Asp Tyr Pro Lys Tyr
1010 1015 1020

Asn Ser Phe Arg Glu Arg Lys Ser Ala Thr Glu Lys Val Tyr Phe
1025 1030 1035

Tyr Ser Asn Ile Met Asn Ile Phe Lys Lys Ser Ile Ser Leu Ala
1040 1045 1050

Asp Gly Arg Val Ile Glu Arg Pro Leu Ile Glu Val Asn Glu Glu
1055 1060 1065

Thr Gly Glu Ser Val Trp Asn Lys Glu Ser Asp Leu Ala Thr Val
1070 1075 1080

Arg Arg Val Leu Ser Tyr Pro Gln Val Asn Val Val Lys Lys Val
1085 1090 1095

Glu Glu Gln Asn His Gly Leu Asp Arg Gly Lys Pro Lys Gly Leu
1100 1105 1110

Phe Asn Ala Asn Leu Ser Ser Lys Pro Lys Pro Asn Ser Asn Glu
1115 1120 1125

Asn Leu Val Gly Ala Lys Glu Tyr Leu Asp Pro Lys Lys Tyr Gly
1130 1135 1140

Gly Tyr Ala Gly Ile Ser Asn Ser Phe Ala Val Leu Val Lys Gly
1145 1150 1155

Thr Ile Glu Lys Gly Ala Lys Lys Lys Ile Thr Asn Val Leu Glu
1160 1165 1170

Phe Gln Gly Ile Ser Ile Leu Asp Arg Ile Asn Tyr Arg Lys Asp

1175 1180 1185

Lys Leu Asn Phe Leu Leu Glu Lys Gly Tyr Lys Asp Ile Glu Leu
1190 1195 1200

Ile Ile Glu Leu Pro Lys Tyr Ser Leu Phe Glu Leu Ser Asp Gly
1205 1210 1215

Ser Arg Arg Met Leu Ala Ser Ile Leu Ser Thr Asn Asn Lys Arg
1220 1225 1230

Gly Glu Ile His Lys Gly Asn Gln Ile Phe Leu Ser Gln Lys Phe
1235 1240 1245

Val Lys Leu Leu Tyr His Ala Lys Arg Ile Ser Asn Thr Ile Asn
1250 1255 1260

Glu Asn His Arg Lys Tyr Val Glu Asn His Lys Lys Glu Phe Glu
1265 1270 1275

Glu Leu Phe Tyr Tyr Ile Leu Glu Phe Asn Glu Asn Tyr Val Gly
1280 1285 1290

Ala Lys Lys Asn Gly Lys Leu Leu Asn Ser Ala Phe Gln Ser Trp
1295 1300 1305

Gln Asn His Ser Ile Asp Glu Leu Cys Ser Ser Phe Ile Gly Pro
1310 1315 1320

Thr Gly Ser Glu Arg Lys Gly Leu Phe Glu Leu Thr Ser Arg Gly
1325 1330 1335

Ser Ala Ala Asp Phe Glu Phe Leu Gly Val Lys Ile Pro Arg Tyr
1340 1345 1350

Arg Asp Tyr Thr Pro Ser Ser Leu Leu Lys Asp Ala Thr Leu Ile
1355 1360 1365

His Gln Ser Val Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ala

1370 1375 1380

Lys Leu Gly Glu Gly
1385

<210> 13
<211> 1121
<212> PRT
<213> Streptococcus thermophilus

<400> 13

Met Ser Asp Leu Val Leu Gly Leu Asp Ile Gly Ile Gly Ser Val Gly
1 5 10 15

Val Gly Ile Leu Asn Lys Val Thr Gly Glu Ile Ile His Lys Asn Ser
20 25 30

Arg Ile Phe Pro Ala Ala Gln Ala Glu Asn Asn Leu Val Arg Arg Thr
35 40 45

Asn Arg Gln Gly Arg Arg Leu Thr Arg Arg Lys Lys His Arg Arg Val
50 55 60

Arg Leu Asn Arg Leu Phe Glu Glu Ser Gly Leu Ile Thr Asp Phe Thr
65 70 75 80

Lys Ile Ser Ile Asn Leu Asn Pro Tyr Gln Leu Arg Val Lys Gly Leu
85 90 95

Thr Asp Glu Leu Ser Asn Glu Glu Leu Phe Ile Ala Leu Lys Asn Met
100 105 110

Val Lys His Arg Gly Ile Ser Tyr Leu Asp Asp Ala Ser Asp Asp Gly
115 120 125

Asn Ser Ser Ile Gly Asp Tyr Ala Gln Ile Val Lys Glu Asn Ser Lys
130 135 140

Gln Leu Glu Thr Lys Thr Pro Gly Gln Ile Gln Leu Glu Arg Tyr Gln
145 150 155 160

```
Thr Tyr Gly Gln Leu Arg Gly Asp Phe Thr Val Glu Lys Asp Gly Lys
                165                 170                 175

Lys His Arg Leu Ile Asn Val Phe Pro Thr Ser Ala Tyr Arg Ser Glu
            180                 185                 190

Ala Leu Arg Ile Leu Gln Thr Gln Gln Glu Phe Asn Pro Gln Ile Thr
        195                 200                 205

Asp Glu Phe Ile Asn Arg Tyr Leu Glu Ile Leu Thr Gly Lys Arg Lys
    210                 215                 220

Tyr Tyr His Gly Pro Gly Asn Glu Lys Ser Arg Thr Asp Tyr Gly Arg
225                 230                 235                 240

Tyr Arg Thr Ser Gly Glu Thr Leu Asp Asn Ile Phe Gly Ile Leu Ile
                245                 250                 255

Gly Lys Cys Thr Phe Tyr Pro Asp Glu Phe Arg Ala Ala Lys Ala Ser
            260                 265                 270

Tyr Thr Ala Gln Glu Phe Asn Leu Leu Asn Asp Leu Asn Asn Leu Thr
        275                 280                 285

Val Pro Thr Glu Thr Lys Lys Leu Ser Lys Glu Gln Lys Asn Gln Ile
    290                 295                 300

Ile Asn Tyr Val Lys Asn Glu Lys Ala Met Gly Pro Ala Lys Leu Phe
305                 310                 315                 320

Lys Tyr Ile Ala Lys Leu Leu Ser Cys Asp Val Ala Asp Ile Lys Gly
                325                 330                 335

Tyr Arg Ile Asp Lys Ser Gly Lys Ala Glu Ile His Thr Phe Glu Ala
            340                 345                 350

Tyr Arg Lys Met Lys Thr Leu Glu Thr Leu Asp Ile Glu Gln Met Asp
        355                 360                 365
```

```
Arg Glu Thr Leu Asp Lys Leu Ala Tyr Val Leu Thr Leu Asn Thr Glu
    370                 375                 380

Arg Glu Gly Ile Gln Glu Ala Leu Glu His Glu Phe Ala Asp Gly Ser
385                 390                 395                 400

Phe Ser Gln Lys Gln Val Asp Glu Leu Val Gln Phe Arg Lys Ala Asn
                405                 410                 415

Ser Ser Ile Phe Gly Lys Gly Trp His Asn Phe Ser Val Lys Leu Met
            420                 425                 430

Met Glu Leu Ile Pro Glu Leu Tyr Glu Thr Ser Glu Glu Gln Met Thr
        435                 440                 445

Ile Leu Thr Arg Leu Gly Lys Gln Lys Thr Thr Ser Ser Ser Asn Lys
    450                 455                 460

Thr Lys Tyr Ile Asp Glu Lys Leu Leu Thr Glu Glu Ile Tyr Asn Pro
465                 470                 475                 480

Val Val Ala Lys Ser Val Arg Gln Ala Ile Lys Ile Val Asn Ala Ala
                485                 490                 495

Ile Lys Glu Tyr Gly Asp Phe Asp Asn Ile Val Ile Glu Met Ala Arg
            500                 505                 510

Glu Thr Asn Glu Asp Asp Glu Lys Lys Ala Ile Gln Lys Ile Gln Lys
        515                 520                 525

Ala Asn Lys Asp Glu Lys Asp Ala Ala Met Leu Lys Ala Ala Asn Gln
    530                 535                 540

Tyr Asn Gly Lys Ala Glu Leu Pro His Ser Val Phe His Gly His Lys
545                 550                 555                 560

Gln Leu Ala Thr Lys Ile Arg Leu Trp His Gln Gln Gly Glu Arg Cys
                565                 570                 575
```

```
Leu Tyr Thr Gly Lys Thr Ile Ser Ile His Asp Leu Ile Asn Asn Ser
            580                 585                 590

Asn Gln Phe Glu Val Asp His Ile Leu Pro Leu Ser Ile Thr Phe Asp
        595                 600                 605

Asp Ser Leu Ala Asn Lys Val Leu Val Tyr Ala Thr Ala Asn Gln Glu
    610                 615                 620

Lys Gly Gln Arg Thr Pro Tyr Gln Ala Leu Asp Ser Met Asp Asp Ala
625                 630                 635                 640

Trp Ser Phe Arg Glu Leu Lys Ala Phe Val Arg Glu Ser Lys Thr Leu
                645                 650                 655

Ser Asn Lys Lys Lys Glu Tyr Leu Leu Thr Glu Glu Asp Ile Ser Lys
            660                 665                 670

Phe Asp Val Arg Lys Lys Phe Ile Glu Arg Asn Leu Val Asp Thr Arg
        675                 680                 685

Tyr Ala Ser Arg Val Val Leu Asn Ala Leu Gln Glu His Phe Arg Ala
    690                 695                 700

His Lys Ile Asp Thr Lys Val Ser Val Val Arg Gly Gln Phe Thr Ser
705                 710                 715                 720

Gln Leu Arg Arg His Trp Gly Ile Glu Lys Thr Arg Asp Thr Tyr His
                725                 730                 735

His His Ala Val Asp Ala Leu Ile Ile Ala Ala Ser Ser Gln Leu Asn
            740                 745                 750

Leu Trp Lys Lys Gln Lys Asn Thr Leu Val Ser Tyr Ser Glu Asp Gln
        755                 760                 765

Leu Leu Asp Ile Glu Thr Gly Glu Leu Ile Ser Asp Asp Glu Tyr Lys
    770                 775                 780
```

```
Glu Ser Val Phe Lys Ala Pro Tyr Gln His Phe Val Asp Thr Leu Lys
785                 790                 795                 800

Ser Lys Glu Phe Glu Asp Ser Ile Leu Phe Ser Tyr Gln Val Asp Ser
                805                 810                 815

Lys Phe Asn Arg Lys Ile Ser Asp Ala Thr Ile Tyr Ala Thr Arg Gln
            820                 825                 830

Ala Lys Val Gly Lys Asp Lys Ala Asp Glu Thr Tyr Val Leu Gly Lys
        835                 840                 845

Ile Lys Asp Ile Tyr Thr Gln Asp Gly Tyr Asp Ala Phe Met Lys Ile
    850                 855                 860

Tyr Lys Lys Asp Lys Ser Lys Phe Leu Met Tyr Arg His Asp Pro Gln
865                 870                 875                 880

Thr Phe Glu Lys Val Ile Glu Pro Ile Leu Glu Asn Tyr Pro Asn Lys
                885                 890                 895

Gln Ile Asn Glu Lys Gly Lys Glu Val Pro Cys Asn Pro Phe Leu Lys
            900                 905                 910

Tyr Lys Glu Glu His Gly Tyr Ile Arg Lys Tyr Ser Lys Lys Gly Asn
        915                 920                 925

Gly Pro Glu Ile Lys Ser Leu Lys Tyr Tyr Asp Ser Lys Leu Gly Asn
    930                 935                 940

His Ile Asp Ile Thr Pro Lys Asp Ser Asn Asn Lys Val Val Leu Gln
945                 950                 955                 960

Ser Val Ser Pro Trp Arg Ala Asp Val Tyr Phe Asn Lys Thr Thr Gly
                965                 970                 975

Lys Tyr Glu Ile Leu Gly Leu Lys Tyr Ala Asp Leu Gln Phe Glu Lys
            980                 985                 990
```

```
Gly Thr Gly Thr Tyr Lys Ile Ser  Gln Glu Lys Tyr Asn  Asp Ile Lys
        995                 1000                1005


Lys Lys  Glu Gly Val Asp Ser  Asp Ser Glu Phe Lys  Phe Thr Leu
    1010                1015                1020


Tyr Lys  Asn Asp Leu Leu Leu  Val Lys Asp Thr Glu  Thr Lys Glu
    1025                1030                1035


Gln Gln  Leu Phe Arg Phe Leu  Ser Arg Thr Met Pro  Lys Gln Lys
    1040                1045                1050


His Tyr  Val Glu Leu Lys Pro  Tyr Asp Lys Gln Lys  Phe Glu Gly
    1055                1060                1065


Gly Glu  Ala Leu Ile Lys Val  Leu Gly Asn Val Ala  Asn Ser Gly
    1070                1075                1080


Gln Cys  Lys Lys Gly Leu Gly  Lys Ser Asn Ile Ser  Ile Tyr Lys
    1085                1090                1095


Val Arg  Thr Asp Val Leu Gly  Asn Gln His Ile Ile  Lys Asn Glu
    1100                1105                1110


Gly Asp  Lys Pro Lys Leu Asp  Phe
    1115                1120


<210>  14
<211>  345
<212>  PRT
<213>  Sulfolobus islandicus

<400>  14

Met Glu Val Pro Leu Tyr Asn Ile Phe Gly Asp Asn Tyr Ile Ile Gln
1               5                  10                  15


Val Ala Thr Glu Ala Glu Asn Ser Thr Ile Tyr Asn Asn Lys Val Glu
            20                  25                  30
```

```
Ile Asp Asp Glu Glu Leu Arg Asn Val Leu Asn Leu Ala Tyr Lys Ile
        35                  40                  45

Ala Lys Asn Asn Glu Asp Ala Ala Ala Glu Arg Arg Gly Lys Ala Lys
    50                  55                  60

Lys Lys Lys Gly Glu Glu Gly Glu Thr Thr Thr Ser Asn Ile Ile Leu
65                  70                  75                  80

Pro Leu Ser Gly Asn Asp Lys Asn Pro Trp Thr Glu Thr Leu Lys Cys
                85                  90                  95

Tyr Asn Phe Pro Thr Thr Val Ala Leu Ser Glu Val Phe Lys Asn Phe
            100                 105                 110

Ser Gln Val Lys Glu Cys Glu Glu Val Ser Ala Pro Ser Phe Val Lys
        115                 120                 125

Pro Glu Phe Tyr Lys Phe Gly Arg Ser Pro Gly Met Val Glu Arg Thr
    130                 135                 140

Arg Arg Val Lys Leu Glu Val Glu Pro His Tyr Leu Ile Met Ala Ala
145                 150                 155                 160

Ala Gly Trp Val Leu Thr Arg Leu Gly Lys Ala Lys Val Ser Glu Gly
                165                 170                 175

Asp Tyr Val Gly Val Asn Val Phe Thr Pro Thr Arg Gly Ile Leu Tyr
            180                 185                 190

Ser Leu Ile Gln Asn Val Asn Gly Ile Val Pro Gly Ile Lys Pro Glu
        195                 200                 205

Thr Ala Phe Gly Leu Trp Ile Ala Arg Lys Val Val Ser Ser Val Thr
    210                 215                 220

Asn Pro Asn Val Ser Val Val Ser Ile Tyr Thr Ile Ser Asp Ala Val
225                 230                 235                 240
```

```
Gly Gln Asn Pro Thr Thr Ile Asn Gly Gly Phe Ser Ile Asp Leu Thr
               245                 250                 255

Lys Leu Leu Glu Lys Arg Asp Leu Leu Ser Glu Arg Leu Glu Ala Ile
            260                 265                 270

Ala Arg Asn Ala Leu Ser Ile Ser Ser Asn Met Arg Glu Arg Tyr Ile
        275                 280                 285

Val Leu Ala Asn Tyr Ile Tyr Glu Tyr Leu Thr Gly Ser Lys Arg Leu
    290                 295                 300

Glu Asp Leu Leu Tyr Phe Ala Asn Arg Asp Leu Ile Met Asn Leu Asn
305                 310                 315                 320

Ser Asp Asp Gly Lys Val Arg Asp Leu Lys Leu Ile Ser Ala Tyr Val
               325                 330                 335

Asn Gly Glu Leu Ile Arg Gly Glu Gly
            340                 345
```

<210> 15
<211> 345
<212> PRT
<213> Sulfolobus islandicus

<400> 15

```
Met Glu Val Pro Leu Tyr Asn Ile Phe Gly Asp Asn Tyr Ile Ile Gln
1               5                   10                  15

Val Ala Thr Glu Ala Glu Asn Ser Thr Ile Tyr Asn Asn Lys Val Glu
            20                  25                  30

Ile Asp Asp Glu Glu Leu Arg Asn Val Leu Asn Leu Ala Tyr Lys Ile
        35                  40                  45

Ala Lys Asn Asn Glu Asp Ala Ala Ala Glu Arg Arg Gly Lys Ala Lys
    50                  55                  60
```

```
Lys Lys Lys Gly Glu Glu Gly Glu Thr Thr Thr Ser Asn Ile Ile Leu
65                  70                  75                  80

Pro Leu Ser Gly Asn Asp Lys Asn Pro Trp Thr Glu Thr Leu Lys Cys
                85                  90                  95

Tyr Asn Phe Pro Thr Thr Val Ala Leu Ser Glu Val Phe Lys Asn Phe
            100                 105                 110

Ser Gln Val Lys Glu Cys Glu Glu Val Ser Ala Pro Ser Phe Val Lys
        115                 120                 125

Pro Glu Phe Tyr Glu Phe Gly Arg Ser Pro Gly Met Val Glu Arg Thr
    130                 135                 140

Arg Arg Val Lys Leu Glu Val Glu Pro His Tyr Leu Ile Ile Ala Ala
145                 150                 155                 160

Ala Gly Trp Val Leu Thr Arg Leu Gly Lys Ala Lys Val Ser Glu Gly
                165                 170                 175

Asp Tyr Val Gly Val Asn Val Phe Thr Pro Thr Arg Gly Ile Leu Tyr
            180                 185                 190

Ser Leu Ile Gln Asn Val Asn Gly Ile Val Pro Gly Ile Lys Pro Glu
        195                 200                 205

Thr Ala Phe Gly Leu Trp Ile Ala Arg Lys Val Val Ser Ser Val Thr
    210                 215                 220

Asn Pro Asn Val Ser Val Val Arg Ile Tyr Thr Ile Ser Asp Ala Val
225                 230                 235                 240

Gly Gln Asn Pro Thr Thr Ile Asn Gly Gly Phe Ser Ile Asp Leu Thr
                245                 250                 255

Lys Leu Leu Glu Lys Arg Tyr Leu Leu Ser Glu Arg Leu Glu Ala Ile
            260                 265                 270
```

```
Ala Arg Asn Ala Leu Ser Ile Ser Ser Asn Met Arg Glu Arg Tyr Ile
        275                 280                 285


Val Leu Ala Asn Tyr Ile Tyr Glu Tyr Leu Thr Gly Ser Lys Arg Leu
    290                 295                 300


Glu Asp Leu Leu Tyr Phe Ala Asn Arg Asp Leu Ile Met Asn Leu Asn
305                 310                 315                 320


Ser Asp Asp Gly Lys Val Arg Asp Leu Lys Leu Ile Ser Ala Tyr Val
                325                 330                 335


Asn Gly Glu Leu Ile Arg Gly Glu Gly
            340                 345


<210>  16
<211>  1300
<212>  PRT
<213>  Francisella novicida

<400>  16

Met Ser Ile Tyr Gln Glu Phe Val Asn Lys Tyr Ser Leu Ser Lys Thr
1               5                   10                  15


Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Glu Asn Ile Lys
            20                  25                  30


Ala Arg Gly Leu Ile Leu Asp Asp Glu Lys Arg Ala Lys Asp Tyr Lys
        35                  40                  45


Lys Ala Lys Gln Ile Ile Asp Lys Tyr His Gln Phe Phe Ile Glu Glu
    50                  55                  60


Ile Leu Ser Ser Val Cys Ile Ser Glu Asp Leu Leu Gln Asn Tyr Ser
65                  70                  75                  80


Asp Val Tyr Phe Lys Leu Lys Lys Ser Asp Asp Asp Asn Leu Gln Lys
                85                  90                  95


Asp Phe Lys Ser Ala Lys Asp Thr Ile Lys Lys Gln Ile Ser Glu Tyr
```

```
            100                 105                 110

Ile Lys Asp Ser Glu Lys Phe Lys Asn Leu Phe Asn Gln Asn Leu Ile
        115                 120                 125

Asp Ala Lys Lys Gly Gln Glu Ser Asp Leu Ile Leu Trp Leu Lys Gln
    130                 135                 140

Ser Lys Asp Asn Gly Ile Glu Leu Phe Lys Ala Asn Ser Asp Ile Thr
145                 150                 155                 160

Asp Ile Asp Glu Ala Leu Glu Ile Ile Lys Ser Phe Lys Gly Trp Thr
                165                 170                 175

Thr Tyr Phe Lys Gly Phe His Glu Asn Arg Lys Asn Val Tyr Ser Ser
            180                 185                 190

Asn Asp Ile Pro Thr Ser Ile Ile Tyr Arg Ile Val Asp Asp Asn Leu
        195                 200                 205

Pro Lys Phe Leu Glu Asn Lys Ala Lys Tyr Glu Ser Leu Lys Asp Lys
    210                 215                 220

Ala Pro Glu Ala Ile Asn Tyr Glu Gln Ile Lys Lys Asp Leu Ala Glu
225                 230                 235                 240

Glu Leu Thr Phe Asp Ile Asp Tyr Lys Thr Ser Glu Val Asn Gln Arg
                245                 250                 255

Val Phe Ser Leu Asp Glu Val Phe Glu Ile Ala Asn Phe Asn Asn Tyr
            260                 265                 270

Leu Asn Gln Ser Gly Ile Thr Lys Phe Asn Thr Ile Ile Gly Gly Lys
        275                 280                 285

Phe Val Asn Gly Glu Asn Thr Lys Arg Lys Gly Ile Asn Glu Tyr Ile
    290                 295                 300

Asn Leu Tyr Ser Gln Gln Ile Asn Asp Lys Thr Leu Lys Lys Tyr Lys
```

305 310 315 320

Met Ser Val Leu Phe Lys Gln Ile Leu Ser Asp Thr Glu Ser Lys Ser
325 330 335

Phe Val Ile Asp Lys Leu Glu Asp Asp Ser Asp Val Val Thr Thr Met
340 345 350

Gln Ser Phe Tyr Glu Gln Ile Ala Ala Phe Lys Thr Val Glu Glu Lys
355 360 365

Ser Ile Lys Glu Thr Leu Ser Leu Leu Phe Asp Asp Leu Lys Ala Gln
370 375 380

Lys Leu Asp Leu Ser Lys Ile Tyr Phe Lys Asn Asp Lys Ser Leu Thr
385 390 395 400

Asp Leu Ser Gln Gln Val Phe Asp Asp Tyr Ser Val Ile Gly Thr Ala
405 410 415

Val Leu Glu Tyr Ile Thr Gln Gln Ile Ala Pro Lys Asn Leu Asp Asn
420 425 430

Pro Ser Lys Lys Glu Gln Glu Leu Ile Ala Lys Lys Thr Glu Lys Ala
435 440 445

Lys Tyr Leu Ser Leu Glu Thr Ile Lys Leu Ala Leu Glu Glu Phe Asn
450 455 460

Lys His Arg Asp Ile Asp Lys Gln Cys Arg Phe Glu Glu Ile Leu Ala
465 470 475 480

Asn Phe Ala Ala Ile Pro Met Ile Phe Asp Glu Ile Ala Gln Asn Lys
485 490 495

Asp Asn Leu Ala Gln Ile Ser Ile Lys Tyr Gln Asn Gln Gly Lys Lys
500 505 510

Asp Leu Leu Gln Ala Ser Ala Glu Asp Asp Val Lys Ala Ile Lys Asp

515 520 525

Leu Leu Asp Gln Thr Asn Asn Leu Leu His Lys Leu Lys Ile Phe His
530 535 540

Ile Ser Gln Ser Glu Asp Lys Ala Asn Ile Leu Asp Lys Asp Glu His
545 550 555 560

Phe Tyr Leu Val Phe Glu Glu Cys Tyr Phe Glu Leu Ala Asn Ile Val
565 570 575

Pro Leu Tyr Asn Lys Ile Arg Asn Tyr Ile Thr Gln Lys Pro Tyr Ser
580 585 590

Asp Glu Lys Phe Lys Leu Asn Phe Glu Asn Ser Thr Leu Ala Asn Gly
595 600 605

Trp Asp Lys Asn Lys Glu Pro Asp Asn Thr Ala Ile Leu Phe Ile Lys
610 615 620

Asp Asp Lys Tyr Tyr Leu Gly Val Met Asn Lys Lys Asn Asn Lys Ile
625 630 635 640

Phe Asp Asp Lys Ala Ile Lys Glu Asn Lys Gly Glu Gly Tyr Lys Lys
645 650 655

Ile Val Tyr Lys Leu Leu Pro Gly Ala Asn Lys Met Leu Pro Lys Val
660 665 670

Phe Phe Ser Ala Lys Ser Ile Lys Phe Tyr Asn Pro Ser Glu Asp Ile
675 680 685

Leu Arg Ile Arg Asn His Ser Thr His Thr Lys Asn Gly Ser Pro Gln
690 695 700

Lys Gly Tyr Glu Lys Phe Glu Phe Asn Ile Glu Asp Cys Arg Lys Phe
705 710 715 720

Ile Asp Phe Tyr Lys Gln Ser Ile Ser Lys His Pro Glu Trp Lys Asp

725 730 735

Phe Gly Phe Arg Phe Ser Asp Thr Gln Arg Tyr Asn Ser Ile Asp Glu
740 745 750

Phe Tyr Arg Glu Val Glu Asn Gln Gly Tyr Lys Leu Thr Phe Glu Asn
755 760 765

Ile Ser Glu Ser Tyr Ile Asp Ser Val Val Asn Gln Gly Lys Leu Tyr
770 775 780

Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ser Ala Tyr Ser Lys Gly Arg
785 790 795 800

Pro Asn Leu His Thr Leu Tyr Trp Lys Ala Leu Phe Asp Glu Arg Asn
805 810 815

Leu Gln Asp Val Val Tyr Lys Leu Asn Gly Glu Ala Glu Leu Phe Tyr
820 825 830

Arg Lys Gln Ser Ile Pro Lys Lys Ile Thr His Pro Ala Lys Glu Ala
835 840 845

Ile Ala Asn Lys Asn Lys Asp Asn Pro Lys Lys Glu Ser Val Phe Glu
850 855 860

Tyr Asp Leu Ile Lys Asp Lys Arg Phe Thr Glu Asp Lys Phe Phe Phe
865 870 875 880

His Cys Pro Ile Thr Ile Asn Phe Lys Ser Ser Gly Ala Asn Lys Phe
885 890 895

Asn Asp Glu Ile Asn Leu Leu Leu Lys Glu Lys Ala Asn Asp Val His
900 905 910

Ile Leu Ser Ile Asp Arg Gly Glu Arg His Leu Ala Tyr Tyr Thr Leu
915 920 925

Val Asp Gly Lys Gly Asn Ile Ile Lys Gln Asp Thr Phe Asn Ile Ile

930 935 940

Gly Asn Asp Arg Met Lys Thr Asn Tyr His Asp Lys Leu Ala Ala Ile
945 950 955 960

Glu Lys Asp Arg Asp Ser Ala Arg Lys Asp Trp Lys Lys Ile Asn Asn
965 970 975

Ile Lys Glu Met Lys Glu Gly Tyr Leu Ser Gln Val Val His Glu Ile
980 985 990

Ala Lys Leu Val Ile Glu Tyr Asn Ala Ile Val Val Phe Glu Asp Leu
995 1000 1005

Asn Phe Gly Phe Lys Arg Gly Arg Phe Lys Val Glu Lys Gln Val
1010 1015 1020

Tyr Gln Lys Leu Glu Lys Met Leu Ile Glu Lys Leu Asn Tyr Leu
1025 1030 1035

Val Phe Lys Asp Asn Glu Phe Asp Lys Thr Gly Gly Val Leu Arg
1040 1045 1050

Ala Tyr Gln Leu Thr Ala Pro Phe Glu Thr Phe Lys Lys Met Gly
1055 1060 1065

Lys Gln Thr Gly Ile Ile Tyr Tyr Val Pro Ala Gly Phe Thr Ser
1070 1075 1080

Lys Ile Cys Pro Val Thr Gly Phe Val Asn Gln Leu Tyr Pro Lys
1085 1090 1095

Tyr Glu Ser Val Ser Lys Ser Gln Glu Phe Phe Ser Lys Phe Asp
1100 1105 1110

Lys Ile Cys Tyr Asn Leu Asp Lys Gly Tyr Phe Glu Phe Ser Phe
1115 1120 1125

Asp Tyr Lys Asn Phe Gly Asp Lys Ala Ala Lys Gly Lys Trp Thr

1130 1135 1140

Ile Ala Ser Phe Gly Ser Arg Leu Ile Asn Phe Arg Asn Ser Asp
1145 1150 1155

Lys Asn His Asn Trp Asp Thr Arg Glu Val Tyr Pro Thr Lys Glu
1160 1165 1170

Leu Glu Lys Leu Leu Lys Asp Tyr Ser Ile Glu Tyr Gly His Gly
1175 1180 1185

Glu Cys Ile Lys Ala Ala Ile Cys Gly Glu Ser Asp Lys Lys Phe
1190 1195 1200

Phe Ala Lys Leu Thr Ser Val Leu Asn Thr Ile Leu Gln Met Arg
1205 1210 1215

Asn Ser Lys Thr Gly Thr Glu Leu Asp Tyr Leu Ile Ser Pro Val
1220 1225 1230

Ala Asp Val Asn Gly Asn Phe Phe Asp Ser Arg Gln Ala Pro Lys
1235 1240 1245

Asn Met Pro Gln Asp Ala Asp Ala Asn Gly Ala Tyr His Ile Gly
1250 1255 1260

Leu Lys Gly Leu Met Leu Leu Gly Arg Ile Lys Asn Asn Gln Glu
1265 1270 1275

Gly Lys Lys Leu Asn Leu Val Ile Lys Asn Glu Glu Tyr Phe Glu
1280 1285 1290

Phe Val Gln Asn Arg Asn Asn
1295 1300

<210> 17
<211> 1300
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 17

```
Met Ser Ile Tyr Gln Glu Phe Val Asn Lys Tyr Ser Leu Ser Lys Thr
1               5                  10                  15

Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Glu Asn Ile Lys
            20                  25                  30

Ala Arg Gly Leu Ile Leu Asp Asp Glu Lys Arg Ala Lys Asp Tyr Lys
        35                  40                  45

Lys Ala Lys Gln Ile Ile Asp Lys Tyr His Gln Phe Phe Ile Glu Glu
    50                  55                  60

Ile Leu Ser Ser Val Cys Ile Ser Glu Asp Leu Leu Gln Asn Tyr Ser
65                  70                  75                  80

Asp Val Tyr Phe Lys Leu Lys Lys Ser Asp Asp Asp Asn Leu Gln Lys
                85                  90                  95

Asp Phe Lys Ser Ala Lys Asp Thr Ile Lys Lys Gln Ile Ser Glu Tyr
            100                 105                 110

Ile Lys Asp Ser Glu Lys Phe Lys Asn Leu Phe Asn Gln Asn Leu Ile
        115                 120                 125

Asp Ala Lys Lys Gly Gln Glu Ser Asp Leu Ile Leu Trp Leu Lys Gln
    130                 135                 140

Ser Lys Asp Asn Gly Ile Glu Leu Phe Lys Ala Asn Ser Asp Ile Thr
145                 150                 155                 160

Asp Ile Asp Glu Ala Leu Glu Ile Ile Lys Ser Phe Lys Gly Trp Thr
                165                 170                 175

Thr Tyr Phe Lys Gly Phe His Glu Asn Arg Lys Asn Val Tyr Ser Ser
            180                 185                 190
```

```
Asn Asp Ile Pro Thr Ser Ile Ile Tyr Arg Ile Val Asp Asp Asn Leu
        195                 200                 205

Pro Lys Phe Leu Glu Asn Lys Ala Lys Tyr Glu Ser Leu Lys Asp Lys
    210                 215                 220

Ala Pro Glu Ala Ile Asn Tyr Glu Gln Ile Lys Lys Asp Leu Ala Glu
225                 230                 235                 240

Glu Leu Thr Phe Asp Ile Asp Tyr Lys Thr Ser Glu Val Asn Gln Arg
                245                 250                 255

Val Phe Ser Leu Asp Glu Val Phe Glu Ile Ala Asn Phe Asn Asn Tyr
            260                 265                 270

Leu Asn Gln Ser Gly Ile Thr Lys Phe Asn Thr Ile Ile Gly Gly Lys
        275                 280                 285

Phe Val Asn Gly Glu Asn Thr Lys Arg Lys Gly Ile Asn Glu Tyr Ile
    290                 295                 300

Asn Leu Tyr Ser Gln Gln Ile Asn Asp Lys Thr Leu Lys Lys Tyr Lys
305                 310                 315                 320

Met Ser Val Leu Phe Lys Gln Ile Leu Ser Asp Thr Glu Ser Lys Ser
                325                 330                 335

Phe Val Ile Asp Lys Leu Glu Asp Asp Ser Asp Val Val Thr Thr Met
            340                 345                 350

Gln Ser Phe Tyr Glu Gln Ile Ala Ala Phe Lys Thr Val Glu Glu Lys
        355                 360                 365

Ser Ile Lys Glu Thr Leu Ser Leu Leu Phe Asp Asp Leu Lys Ala Gln
    370                 375                 380

Lys Leu Asp Leu Ser Lys Ile Tyr Phe Lys Asn Asp Lys Ser Leu Thr
385                 390                 395                 400
```

```
Asp Leu Ser Gln Gln Val Phe Asp Asp Tyr Ser Val Ile Gly Thr Ala
                405                 410                 415

Val Leu Glu Tyr Ile Thr Gln Gln Ile Ala Pro Lys Asn Leu Asp Asn
            420                 425                 430

Pro Ser Lys Lys Glu Gln Glu Leu Ile Ala Lys Lys Thr Glu Lys Ala
        435                 440                 445

Lys Tyr Leu Ser Leu Glu Thr Ile Lys Leu Ala Leu Glu Glu Phe Asn
    450                 455                 460

Lys His Arg Asp Ile Asp Lys Gln Cys Arg Phe Glu Glu Ile Leu Ala
465                 470                 475                 480

Asn Phe Ala Ala Ile Pro Met Ile Phe Asp Glu Ile Ala Gln Asn Lys
                485                 490                 495

Asp Asn Leu Ala Gln Ile Ser Ile Lys Tyr Gln Asn Gln Gly Lys Lys
            500                 505                 510

Asp Leu Leu Gln Ala Ser Ala Glu Asp Asp Val Lys Ala Ile Lys Asp
        515                 520                 525

Leu Leu Asp Gln Thr Asn Asn Leu Leu His Lys Leu Lys Ile Phe His
    530                 535                 540

Ile Ser Gln Ser Glu Asp Lys Ala Asn Ile Leu Asp Lys Asp Glu His
545                 550                 555                 560

Phe Tyr Leu Val Phe Glu Glu Cys Tyr Phe Glu Leu Ala Asn Ile Val
                565                 570                 575

Pro Leu Tyr Asn Lys Ile Arg Asn Tyr Ile Thr Gln Lys Pro Tyr Ser
            580                 585                 590

Asp Glu Lys Phe Lys Leu Asn Phe Glu Asn Ser Thr Leu Ala Asn Gly
        595                 600                 605
```

```
Trp Asp Lys Asn Lys Glu Pro Asp Asn Thr Ala Ile Leu Phe Ile Lys
    610                 615                 620

Asp Asp Lys Tyr Tyr Leu Gly Val Met Asn Lys Lys Asn Asn Lys Ile
625                 630                 635                 640

Phe Asp Asp Lys Ala Ile Lys Glu Asn Lys Gly Glu Gly Tyr Lys Lys
                645                 650                 655

Ile Val Tyr Lys Leu Leu Pro Gly Ala Asn Lys Met Leu Pro Lys Val
            660                 665                 670

Phe Phe Ser Ala Lys Ser Ile Lys Phe Tyr Asn Pro Ser Glu Asp Ile
        675                 680                 685

Leu Arg Ile Arg Asn His Ser Thr His Thr Lys Asn Gly Ser Pro Gln
    690                 695                 700

Lys Gly Tyr Glu Lys Phe Glu Phe Asn Ile Glu Asp Cys Arg Lys Phe
705                 710                 715                 720

Ile Asp Phe Tyr Lys Gln Ser Ile Ser Lys His Pro Glu Trp Lys Asp
                725                 730                 735

Phe Gly Phe Arg Phe Ser Asp Thr Gln Arg Tyr Asn Ser Ile Asp Glu
            740                 745                 750

Phe Tyr Arg Glu Val Glu Asn Gln Gly Tyr Lys Leu Thr Phe Glu Asn
        755                 760                 765

Ile Ser Glu Ser Tyr Ile Asp Ser Val Val Asn Gln Gly Lys Leu Tyr
    770                 775                 780

Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ser Ala Tyr Ser Lys Gly Arg
785                 790                 795                 800

Pro Asn Leu His Thr Leu Tyr Trp Lys Ala Leu Phe Asp Glu Arg Asn
                805                 810                 815
```

```
Leu Gln Asp Val Val Tyr Lys Leu Asn Gly Glu Ala Glu Leu Phe Tyr
            820                 825                 830

Arg Lys Gln Ser Ile Pro Lys Lys Ile Thr His Pro Ala Lys Glu Ala
        835                 840                 845

Ile Ala Asn Lys Asn Lys Asp Asn Pro Lys Lys Glu Ser Val Phe Glu
    850                 855                 860

Tyr Asp Leu Ile Lys Asp Lys Arg Phe Thr Glu Asp Lys Phe Phe Phe
865                 870                 875                 880

His Cys Pro Ile Thr Ile Asn Phe Lys Ser Ser Gly Ala Asn Lys Phe
                885                 890                 895

Asn Asp Glu Ile Asn Leu Leu Leu Lys Glu Lys Ala Asn Asp Val His
            900                 905                 910

Ile Leu Ser Ile Ala Arg Gly Glu Arg His Leu Ala Tyr Tyr Thr Leu
        915                 920                 925

Val Asp Gly Lys Gly Asn Ile Ile Lys Gln Asp Thr Phe Asn Ile Ile
    930                 935                 940

Gly Asn Asp Arg Met Lys Thr Asn Tyr His Asp Lys Leu Ala Ala Ile
945                 950                 955                 960

Glu Lys Asp Arg Asp Ser Ala Arg Lys Asp Trp Lys Lys Ile Asn Asn
                965                 970                 975

Ile Lys Glu Met Lys Glu Gly Tyr Leu Ser Gln Val Val His Glu Ile
            980                 985                 990

Ala Lys Leu Val Ile Glu Tyr Asn  Ala Ile Val Val Phe  Glu Asp Leu
        995                 1000                1005

Asn Phe  Gly Phe Lys Arg Gly  Arg Phe Lys Val Glu  Lys Gln Val
    1010                1015                1020
```

```
Tyr Gln  Lys Leu Glu Lys Met  Leu Ile Glu Lys Leu  Asn Tyr Leu
    1025                1030                1035

Val Phe  Lys Asp Asn Glu Phe  Asp Lys Thr Gly Gly  Val Leu Arg
    1040                1045                1050

Ala Tyr  Gln Leu Thr Ala Pro  Phe Glu Thr Phe Lys  Lys Met Gly
    1055                1060                1065

Lys Gln  Thr Gly Ile Ile Tyr  Tyr Val Pro Ala Gly  Phe Thr Ser
    1070                1075                1080

Lys Ile  Cys Pro Val Thr Gly  Phe Val Asn Gln Leu  Tyr Pro Lys
    1085                1090                1095

Tyr Glu  Ser Val Ser Lys Ser  Gln Glu Phe Phe Ser  Lys Phe Asp
    1100                1105                1110

Lys Ile  Cys Tyr Asn Leu Asp  Lys Gly Tyr Phe Glu  Phe Ser Phe
    1115                1120                1125

Asp Tyr  Lys Asn Phe Gly Asp  Lys Ala Ala Lys Gly  Lys Trp Thr
    1130                1135                1140

Ile Ala  Ser Phe Gly Ser Arg  Leu Ile Asn Phe Arg  Asn Ser Asp
    1145                1150                1155

Lys Asn  His Asn Trp Asp Thr  Arg Glu Val Tyr Pro  Thr Lys Glu
    1160                1165                1170

Leu Glu  Lys Leu Leu Lys Asp  Tyr Ser Ile Glu Tyr  Gly His Gly
    1175                1180                1185

Glu Cys  Ile Lys Ala Ala Ile  Cys Gly Glu Ser Asp  Lys Lys Phe
    1190                1195                1200

Phe Ala  Lys Leu Thr Ser Val  Leu Asn Thr Ile Leu  Gln Met Arg
    1205                1210                1215
```

```
Asn Ser  Lys Thr Gly Thr Glu  Leu Asp Tyr Leu Ile  Ser Pro Val
    1220                1225                1230


Ala Asp  Val Asn Gly Asn Phe  Phe Asp Ser Arg Gln  Ala Pro Lys
    1235                1240                1245


Asn Met  Pro Gln Asp Ala Asp  Ala Asn Gly Ala Tyr  His Ile Gly
    1250                1255                1260


Leu Lys  Gly Leu Met Leu Leu  Gly Arg Ile Lys Asn  Asn Gln Glu
    1265                1270                1275


Gly Lys  Lys Leu Asn Leu Val  Ile Lys Asn Glu Glu  Tyr Phe Glu
    1280                1285                1290


Phe Val  Gln Asn Arg Asn Asn
    1295                1300


<210>  18
<211>  1300
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  18

Met Ser Ile Tyr Gln Glu Phe Val Asn Lys Tyr Ser Leu Ser Lys Thr
1               5                  10                  15


Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Glu Asn Ile Lys
            20                  25                  30


Ala Arg Gly Leu Ile Leu Asp Asp Glu Lys Arg Ala Lys Asp Tyr Lys
        35                  40                  45


Lys Ala Lys Gln Ile Ile Asp Lys Tyr His Gln Phe Phe Ile Glu Glu
    50                  55                  60


Ile Leu Ser Ser Val Cys Ile Ser Glu Asp Leu Leu Gln Asn Tyr Ser
```

```
65                  70                  75                  80

Asp Val Tyr Phe Lys Leu Lys Lys Ser Asp Asp Asp Asn Leu Gln Lys
                85                  90                  95

Asp Phe Lys Ser Ala Lys Asp Thr Ile Lys Lys Gln Ile Ser Glu Tyr
            100                 105                 110

Ile Lys Asp Ser Glu Lys Phe Lys Asn Leu Phe Asn Gln Asn Leu Ile
        115                 120                 125

Asp Ala Lys Lys Gly Gln Glu Ser Asp Leu Ile Leu Trp Leu Lys Gln
    130                 135                 140

Ser Lys Asp Asn Gly Ile Glu Leu Phe Lys Ala Asn Ser Asp Ile Thr
145                 150                 155                 160

Asp Ile Asp Glu Ala Leu Glu Ile Ile Lys Ser Phe Lys Gly Trp Thr
                165                 170                 175

Thr Tyr Phe Lys Gly Phe His Glu Asn Arg Lys Asn Val Tyr Ser Ser
            180                 185                 190

Asn Asp Ile Pro Thr Ser Ile Ile Tyr Arg Ile Val Asp Asp Asn Leu
        195                 200                 205

Pro Lys Phe Leu Glu Asn Lys Ala Lys Tyr Glu Ser Leu Lys Asp Lys
    210                 215                 220

Ala Pro Glu Ala Ile Asn Tyr Glu Gln Ile Lys Lys Asp Leu Ala Glu
225                 230                 235                 240

Glu Leu Thr Phe Asp Ile Asp Tyr Lys Thr Ser Glu Val Asn Gln Arg
                245                 250                 255

Val Phe Ser Leu Asp Glu Val Phe Glu Ile Ala Asn Phe Asn Asn Tyr
            260                 265                 270

Leu Asn Gln Ser Gly Ile Thr Lys Phe Asn Thr Ile Ile Gly Gly Lys
```

```
        275                 280                 285

Phe Val Asn Gly Glu Asn Thr Lys Arg Lys Gly Ile Asn Glu Tyr Ile
    290                 295                 300

Asn Leu Tyr Ser Gln Gln Ile Asn Asp Lys Thr Leu Lys Lys Tyr Lys
305                 310                 315                 320

Met Ser Val Leu Phe Lys Gln Ile Leu Ser Asp Thr Glu Ser Lys Ser
                325                 330                 335

Phe Val Ile Asp Lys Leu Glu Asp Asp Ser Asp Val Val Thr Thr Met
            340                 345                 350

Gln Ser Phe Tyr Glu Gln Ile Ala Ala Phe Lys Thr Val Glu Glu Lys
        355                 360                 365

Ser Ile Lys Glu Thr Leu Ser Leu Leu Phe Asp Asp Leu Lys Ala Gln
    370                 375                 380

Lys Leu Asp Leu Ser Lys Ile Tyr Phe Lys Asn Asp Lys Ser Leu Thr
385                 390                 395                 400

Asp Leu Ser Gln Gln Val Phe Asp Asp Tyr Ser Val Ile Gly Thr Ala
                405                 410                 415

Val Leu Glu Tyr Ile Thr Gln Gln Ile Ala Pro Lys Asn Leu Asp Asn
            420                 425                 430

Pro Ser Lys Lys Glu Gln Glu Leu Ile Ala Lys Lys Thr Glu Lys Ala
        435                 440                 445

Lys Tyr Leu Ser Leu Glu Thr Ile Lys Leu Ala Leu Glu Glu Phe Asn
    450                 455                 460

Lys His Arg Asp Ile Asp Lys Gln Cys Arg Phe Glu Glu Ile Leu Ala
465                 470                 475                 480

Asn Phe Ala Ala Ile Pro Met Ile Phe Asp Glu Ile Ala Gln Asn Lys
```

485 490 495

Asp Asn Leu Ala Gln Ile Ser Ile Lys Tyr Gln Asn Gln Gly Lys Lys
500 505 510

Asp Leu Leu Gln Ala Ser Ala Glu Asp Asp Val Lys Ala Ile Lys Asp
515 520 525

Leu Leu Asp Gln Thr Asn Asn Leu Leu His Lys Leu Lys Ile Phe His
530 535 540

Ile Ser Gln Ser Glu Asp Lys Ala Asn Ile Leu Asp Lys Asp Glu His
545 550 555 560

Phe Tyr Leu Val Phe Glu Glu Cys Tyr Phe Glu Leu Ala Asn Ile Val
565 570 575

Pro Leu Tyr Asn Lys Ile Arg Asn Tyr Ile Thr Gln Lys Pro Tyr Ser
580 585 590

Asp Glu Lys Phe Lys Leu Asn Phe Glu Asn Ser Thr Leu Ala Asn Gly
595 600 605

Trp Asp Lys Asn Lys Glu Pro Asp Asn Thr Ala Ile Leu Phe Ile Lys
610 615 620

Asp Asp Lys Tyr Tyr Leu Gly Val Met Asn Lys Lys Asn Asn Lys Ile
625 630 635 640

Phe Asp Asp Lys Ala Ile Lys Glu Asn Lys Gly Glu Gly Tyr Lys Lys
645 650 655

Ile Val Tyr Lys Leu Leu Pro Gly Ala Asn Lys Met Leu Pro Lys Val
660 665 670

Phe Phe Ser Ala Lys Ser Ile Lys Phe Tyr Asn Pro Ser Glu Asp Ile
675 680 685

Leu Arg Ile Arg Asn His Ser Thr His Thr Lys Asn Gly Ser Pro Gln

690 695 700

Lys Gly Tyr Glu Lys Phe Glu Phe Asn Ile Glu Asp Cys Arg Lys Phe
705 710 715 720

Ile Asp Phe Tyr Lys Gln Ser Ile Ser Lys His Pro Glu Trp Lys Asp
725 730 735

Phe Gly Phe Arg Phe Ser Asp Thr Gln Arg Tyr Asn Ser Ile Asp Glu
740 745 750

Phe Tyr Arg Glu Val Glu Asn Gln Gly Tyr Lys Leu Thr Phe Glu Asn
755 760 765

Ile Ser Glu Ser Tyr Ile Asp Ser Val Val Asn Gln Gly Lys Leu Tyr
770 775 780

Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ser Ala Tyr Ser Lys Gly Arg
785 790 795 800

Pro Asn Leu His Thr Leu Tyr Trp Lys Ala Leu Phe Asp Glu Arg Asn
805 810 815

Leu Gln Asp Val Val Tyr Lys Leu Asn Gly Glu Ala Glu Leu Phe Tyr
820 825 830

Arg Lys Gln Ser Ile Pro Lys Lys Ile Thr His Pro Ala Lys Glu Ala
835 840 845

Ile Ala Asn Lys Asn Lys Asp Asn Pro Lys Lys Glu Ser Val Phe Glu
850 855 860

Tyr Asp Leu Ile Lys Asp Lys Arg Phe Thr Glu Asp Lys Phe Phe Phe
865 870 875 880

His Cys Pro Ile Thr Ile Asn Phe Lys Ser Ser Gly Ala Asn Lys Phe
885 890 895

Asn Asp Glu Ile Asn Leu Leu Leu Lys Glu Lys Ala Asn Asp Val His

900 905 910

Ile Leu Ser Ile Asp Arg Gly Glu Arg His Leu Ala Tyr Tyr Thr Leu
915 920 925

Val Asp Gly Lys Gly Asn Ile Ile Lys Gln Asp Thr Phe Asn Ile Ile
930 935 940

Gly Asn Asp Arg Met Lys Thr Asn Tyr His Asp Lys Leu Ala Ala Ile
945 950 955 960

Glu Lys Asp Arg Asp Ser Ala Arg Lys Asp Trp Lys Lys Ile Asn Asn
965 970 975

Ile Lys Glu Met Lys Glu Gly Tyr Leu Ser Gln Val Val His Glu Ile
980 985 990

Ala Lys Leu Val Ile Glu Tyr Asn Ala Ile Val Val Phe Ala Asp Leu
995 1000 1005

Asn Phe Gly Phe Lys Arg Gly Arg Phe Lys Val Glu Lys Gln Val
1010 1015 1020

Tyr Gln Lys Leu Glu Lys Met Leu Ile Glu Lys Leu Asn Tyr Leu
1025 1030 1035

Val Phe Lys Asp Asn Glu Phe Asp Lys Thr Gly Gly Val Leu Arg
1040 1045 1050

Ala Tyr Gln Leu Thr Ala Pro Phe Glu Thr Phe Lys Lys Met Gly
1055 1060 1065

Lys Gln Thr Gly Ile Ile Tyr Tyr Val Pro Ala Gly Phe Thr Ser
1070 1075 1080

Lys Ile Cys Pro Val Thr Gly Phe Val Asn Gln Leu Tyr Pro Lys
1085 1090 1095

Tyr Glu Ser Val Ser Lys Ser Gln Glu Phe Phe Ser Lys Phe Asp

```
    1100                1105                1110

Lys Ile  Cys Tyr Asn Leu Asp  Lys Gly Tyr Phe Glu  Phe Ser Phe
    1115                1120                1125

Asp Tyr  Lys Asn Phe Gly Asp  Lys Ala Ala Lys Gly  Lys Trp Thr
    1130                1135                1140

Ile Ala  Ser Phe Gly Ser Arg  Leu Ile Asn Phe Arg  Asn Ser Asp
    1145                1150                1155

Lys Asn  His Asn Trp Asp Thr  Arg Glu Val Tyr Pro  Thr Lys Glu
    1160                1165                1170

Leu Glu  Lys Leu Leu Lys Asp  Tyr Ser Ile Glu Tyr  Gly His Gly
    1175                1180                1185

Glu Cys  Ile Lys Ala Ala Ile  Cys Gly Glu Ser Asp  Lys Lys Phe
    1190                1195                1200

Phe Ala  Lys Leu Thr Ser Val  Leu Asn Thr Ile Leu  Gln Met Arg
    1205                1210                1215

Asn Ser  Lys Thr Gly Thr Glu  Leu Asp Tyr Leu Ile  Ser Pro Val
    1220                1225                1230

Ala Asp  Val Asn Gly Asn Phe  Phe Asp Ser Arg Gln  Ala Pro Lys
    1235                1240                1245

Asn Met  Pro Gln Asp Ala Asp  Ala Asn Gly Ala Tyr  His Ile Gly
    1250                1255                1260

Leu Lys  Gly Leu Met Leu Leu  Gly Arg Ile Lys Asn  Asn Gln Glu
    1265                1270                1275

Gly Lys  Lys Leu Asn Leu Val  Ile Lys Asn Glu Glu  Tyr Phe Glu
    1280                1285                1290

Phe Val  Gln Asn Arg Asn Asn
```

1295 1300

<210> 19
<211> 1300
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 19

Met Ser Ile Tyr Gln Glu Phe Val Asn Lys Tyr Ser Leu Ser Lys Thr
1 5 10 15

Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Glu Asn Ile Lys
20 25 30

Ala Arg Gly Leu Ile Leu Asp Asp Glu Lys Arg Ala Lys Asp Tyr Lys
35 40 45

Lys Ala Lys Gln Ile Ile Asp Lys Tyr His Gln Phe Phe Ile Glu Glu
50 55 60

Ile Leu Ser Ser Val Cys Ile Ser Glu Asp Leu Leu Gln Asn Tyr Ser
65 70 75 80

Asp Val Tyr Phe Lys Leu Lys Lys Ser Asp Asp Asp Asn Leu Gln Lys
85 90 95

Asp Phe Lys Ser Ala Lys Asp Thr Ile Lys Lys Gln Ile Ser Glu Tyr
100 105 110

Ile Lys Asp Ser Glu Lys Phe Lys Asn Leu Phe Asn Gln Asn Leu Ile
115 120 125

Asp Ala Lys Lys Gly Gln Glu Ser Asp Leu Ile Leu Trp Leu Lys Gln
130 135 140

Ser Lys Asp Asn Gly Ile Glu Leu Phe Lys Ala Asn Ser Asp Ile Thr
145 150 155 160

```
Asp Ile Asp Glu Ala Leu Glu Ile Ile Lys Ser Phe Lys Gly Trp Thr
                165                 170                 175

Thr Tyr Phe Lys Gly Phe His Glu Asn Arg Lys Asn Val Tyr Ser Ser
            180                 185                 190

Asn Asp Ile Pro Thr Ser Ile Ile Tyr Arg Ile Val Asp Asp Asn Leu
        195                 200                 205

Pro Lys Phe Leu Glu Asn Lys Ala Lys Tyr Glu Ser Leu Lys Asp Lys
    210                 215                 220

Ala Pro Glu Ala Ile Asn Tyr Glu Gln Ile Lys Lys Asp Leu Ala Glu
225                 230                 235                 240

Glu Leu Thr Phe Asp Ile Asp Tyr Lys Thr Ser Glu Val Asn Gln Arg
                245                 250                 255

Val Phe Ser Leu Asp Glu Val Phe Glu Ile Ala Asn Phe Asn Asn Tyr
            260                 265                 270

Leu Asn Gln Ser Gly Ile Thr Lys Phe Asn Thr Ile Ile Gly Gly Lys
        275                 280                 285

Phe Val Asn Gly Glu Asn Thr Lys Arg Lys Gly Ile Asn Glu Tyr Ile
    290                 295                 300

Asn Leu Tyr Ser Gln Gln Ile Asn Asp Lys Thr Leu Lys Lys Tyr Lys
305                 310                 315                 320

Met Ser Val Leu Phe Lys Gln Ile Leu Ser Asp Thr Glu Ser Lys Ser
                325                 330                 335

Phe Val Ile Asp Lys Leu Glu Asp Asp Ser Asp Val Val Thr Thr Met
            340                 345                 350

Gln Ser Phe Tyr Glu Gln Ile Ala Ala Phe Lys Thr Val Glu Glu Lys
        355                 360                 365
```

```
Ser Ile Lys Glu Thr Leu Ser Leu Leu Phe Asp Asp Leu Lys Ala Gln
    370                 375                 380

Lys Leu Asp Leu Ser Lys Ile Tyr Phe Lys Asn Asp Lys Ser Leu Thr
385                 390                 395                 400

Asp Leu Ser Gln Gln Val Phe Asp Asp Tyr Ser Val Ile Gly Thr Ala
                405                 410                 415

Val Leu Glu Tyr Ile Thr Gln Gln Ile Ala Pro Lys Asn Leu Asp Asn
            420                 425                 430

Pro Ser Lys Lys Glu Gln Glu Leu Ile Ala Lys Lys Thr Glu Lys Ala
        435                 440                 445

Lys Tyr Leu Ser Leu Glu Thr Ile Lys Leu Ala Leu Glu Glu Phe Asn
    450                 455                 460

Lys His Arg Asp Ile Asp Lys Gln Cys Arg Phe Glu Glu Ile Leu Ala
465                 470                 475                 480

Asn Phe Ala Ala Ile Pro Met Ile Phe Asp Glu Ile Ala Gln Asn Lys
                485                 490                 495

Asp Asn Leu Ala Gln Ile Ser Ile Lys Tyr Gln Asn Gln Gly Lys Lys
            500                 505                 510

Asp Leu Leu Gln Ala Ser Ala Glu Asp Asp Val Lys Ala Ile Lys Asp
        515                 520                 525

Leu Leu Asp Gln Thr Asn Asn Leu Leu His Lys Leu Lys Ile Phe His
    530                 535                 540

Ile Ser Gln Ser Glu Asp Lys Ala Asn Ile Leu Asp Lys Asp Glu His
545                 550                 555                 560

Phe Tyr Leu Val Phe Glu Glu Cys Tyr Phe Glu Leu Ala Asn Ile Val
                565                 570                 575
```

```
Pro Leu Tyr Asn Lys Ile Arg Asn Tyr Ile Thr Gln Lys Pro Tyr Ser
            580                 585                 590

Asp Glu Lys Phe Lys Leu Asn Phe Glu Asn Ser Thr Leu Ala Asn Gly
        595                 600                 605

Trp Asp Lys Asn Lys Glu Pro Asp Asn Thr Ala Ile Leu Phe Ile Lys
    610                 615                 620

Asp Asp Lys Tyr Tyr Leu Gly Val Met Asn Lys Lys Asn Asn Lys Ile
625                 630                 635                 640

Phe Asp Asp Lys Ala Ile Lys Glu Asn Lys Gly Glu Gly Tyr Lys Lys
                645                 650                 655

Ile Val Tyr Lys Leu Leu Pro Gly Ala Asn Lys Met Leu Pro Lys Val
            660                 665                 670

Phe Phe Ser Ala Lys Ser Ile Lys Phe Tyr Asn Pro Ser Glu Asp Ile
        675                 680                 685

Leu Arg Ile Arg Asn His Ser Thr His Thr Lys Asn Gly Ser Pro Gln
    690                 695                 700

Lys Gly Tyr Glu Lys Phe Glu Phe Asn Ile Glu Asp Cys Arg Lys Phe
705                 710                 715                 720

Ile Asp Phe Tyr Lys Gln Ser Ile Ser Lys His Pro Glu Trp Lys Asp
                725                 730                 735

Phe Gly Phe Arg Phe Ser Asp Thr Gln Arg Tyr Asn Ser Ile Asp Glu
            740                 745                 750

Phe Tyr Arg Glu Val Glu Asn Gln Gly Tyr Lys Leu Thr Phe Glu Asn
        755                 760                 765

Ile Ser Glu Ser Tyr Ile Asp Ser Val Val Asn Gln Gly Lys Leu Tyr
    770                 775                 780
```

```
Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ser Ala Tyr Ser Lys Gly Arg
785                 790                 795                 800

Pro Asn Leu His Thr Leu Tyr Trp Lys Ala Leu Phe Asp Glu Arg Asn
                805                 810                 815

Leu Gln Asp Val Val Tyr Lys Leu Asn Gly Glu Ala Glu Leu Phe Tyr
            820                 825                 830

Arg Lys Gln Ser Ile Pro Lys Lys Ile Thr His Pro Ala Lys Glu Ala
        835                 840                 845

Ile Ala Asn Lys Asn Lys Asp Asn Pro Lys Lys Glu Ser Val Phe Glu
    850                 855                 860

Tyr Asp Leu Ile Lys Asp Lys Arg Phe Thr Glu Asp Lys Phe Phe Phe
865                 870                 875                 880

His Cys Pro Ile Thr Ile Asn Phe Lys Ser Ser Gly Ala Asn Lys Phe
                885                 890                 895

Asn Asp Glu Ile Asn Leu Leu Leu Lys Glu Lys Ala Asn Asp Val His
            900                 905                 910

Ile Leu Ser Ile Asp Arg Gly Glu Arg His Leu Ala Tyr Tyr Thr Leu
        915                 920                 925

Val Asp Gly Lys Gly Asn Ile Ile Lys Gln Asp Thr Phe Asn Ile Ile
    930                 935                 940

Gly Asn Asp Arg Met Lys Thr Asn Tyr His Asp Lys Leu Ala Ala Ile
945                 950                 955                 960

Glu Lys Asp Arg Asp Ser Ala Arg Lys Asp Trp Lys Lys Ile Asn Asn
                965                 970                 975

Ile Lys Glu Met Lys Glu Gly Tyr Leu Ser Gln Val Val His Glu Ile
            980                 985                 990
```

```
Ala Lys Leu Val Ile Glu Tyr Asn  Ala Ile Val Val Phe  Glu Asp Leu
        995                 1000                1005


Asn Phe  Gly Phe Lys Arg Gly  Arg Phe Lys Val Glu  Lys Gln Val
    1010                1015                1020


Tyr Gln  Lys Leu Glu Lys Met  Leu Ile Glu Lys Leu  Asn Tyr Leu
    1025                1030                1035


Val Phe  Lys Asp Asn Glu Phe  Asp Lys Thr Gly Gly  Val Leu Arg
    1040                1045                1050


Ala Tyr  Gln Leu Thr Ala Pro  Phe Glu Thr Phe Lys  Lys Met Gly
    1055                1060                1065


Lys Gln  Thr Gly Ile Ile Tyr  Tyr Val Pro Ala Gly  Phe Thr Ser
    1070                1075                1080


Lys Ile  Cys Pro Val Thr Gly  Phe Val Asn Gln Leu  Tyr Pro Lys
    1085                1090                1095


Tyr Glu  Ser Val Ser Lys Ser  Gln Glu Phe Phe Ser  Lys Phe Asp
    1100                1105                1110


Lys Ile  Cys Tyr Asn Leu Asp  Lys Gly Tyr Phe Glu  Phe Ser Phe
    1115                1120                1125


Asp Tyr  Lys Asn Phe Gly Asp  Lys Ala Ala Lys Gly  Lys Trp Thr
    1130                1135                1140


Ile Ala  Ser Phe Gly Ser Arg  Leu Ile Asn Phe Arg  Asn Ser Asp
    1145                1150                1155


Lys Asn  His Asn Trp Asp Thr  Arg Glu Val Tyr Pro  Thr Lys Glu
    1160                1165                1170


Leu Glu  Lys Leu Leu Lys Asp  Tyr Ser Ile Glu Tyr  Gly His Gly
    1175                1180                1185
```

```
Glu Cys  Ile Lys Ala Ala Ile  Cys Gly Glu Ser Asp  Lys Lys Phe
    1190                 1195                 1200


Phe Ala  Lys Leu Thr Ser Val  Leu Asn Thr Ile Leu  Gln Met Arg
    1205                 1210                 1215


Asn Ser  Lys Thr Gly Thr Glu  Leu Asp Tyr Leu Ile  Ser Pro Val
    1220                 1225                 1230


Ala Asp  Val Asn Gly Asn Phe  Phe Asp Ser Arg Gln  Ala Pro Lys
    1235                 1240                 1245


Asn Met  Pro Gln Asp Ala Ala  Ala Asn Gly Ala Tyr  His Ile Gly
    1250                 1255                 1260


Leu Lys  Gly Leu Met Leu Leu  Gly Arg Ile Lys Asn  Asn Gln Glu
    1265                 1270                 1275


Gly Lys  Lys Leu Asn Leu Val  Ile Lys Asn Glu Glu  Tyr Phe Glu
    1280                 1285                 1290


Phe Val  Gln Asn Arg Asn Asn
    1295                 1300


<210>  20
<211>  1300
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  20

Met Ser Ile Tyr Gln Glu Phe Val Asn Lys Tyr Ser Leu Ser Lys Thr
1               5                   10                  15


Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Glu Asn Ile Lys
            20                  25                  30


Ala Arg Gly Leu Ile Leu Asp Asp Glu Lys Arg Ala Lys Asp Tyr Lys
```

```
        35                  40                  45

Lys Ala Lys Gln Ile Ile Asp Lys Tyr His Gln Phe Phe Ile Glu Glu
    50                  55                  60

Ile Leu Ser Ser Val Cys Ile Ser Glu Asp Leu Leu Gln Asn Tyr Ser
65                  70                  75                  80

Asp Val Tyr Phe Lys Leu Lys Lys Ser Asp Asp Asp Asn Leu Gln Lys
                85                  90                  95

Asp Phe Lys Ser Ala Lys Asp Thr Ile Lys Lys Gln Ile Ser Glu Tyr
            100                 105                 110

Ile Lys Asp Ser Glu Lys Phe Lys Asn Leu Phe Asn Gln Asn Leu Ile
        115                 120                 125

Asp Ala Lys Lys Gly Gln Glu Ser Asp Leu Ile Leu Trp Leu Lys Gln
    130                 135                 140

Ser Lys Asp Asn Gly Ile Glu Leu Phe Lys Ala Asn Ser Asp Ile Thr
145                 150                 155                 160

Asp Ile Asp Glu Ala Leu Glu Ile Ile Lys Ser Phe Lys Gly Trp Thr
                165                 170                 175

Thr Tyr Phe Lys Gly Phe His Glu Asn Arg Lys Asn Val Tyr Ser Ser
            180                 185                 190

Asn Asp Ile Pro Thr Ser Ile Ile Tyr Arg Ile Val Asp Asp Asn Leu
        195                 200                 205

Pro Lys Phe Leu Glu Asn Lys Ala Lys Tyr Glu Ser Leu Lys Asp Lys
    210                 215                 220

Ala Pro Glu Ala Ile Asn Tyr Glu Gln Ile Lys Lys Asp Leu Ala Glu
225                 230                 235                 240

Glu Leu Thr Phe Asp Ile Asp Tyr Lys Thr Ser Glu Val Asn Gln Arg
```

```
                245                 250                 255

Val Phe Ser Leu Asp Glu Val Phe Glu Ile Ala Asn Phe Asn Asn Tyr
            260                 265                 270

Leu Asn Gln Ser Gly Ile Thr Lys Phe Asn Thr Ile Ile Gly Gly Lys
        275                 280                 285

Phe Val Asn Gly Glu Asn Thr Lys Arg Lys Gly Ile Asn Glu Tyr Ile
    290                 295                 300

Asn Leu Tyr Ser Gln Gln Ile Asn Asp Lys Thr Leu Lys Lys Tyr Lys
305                 310                 315                 320

Met Ser Val Leu Phe Lys Gln Ile Leu Ser Asp Thr Glu Ser Lys Ser
                325                 330                 335

Phe Val Ile Asp Lys Leu Glu Asp Asp Ser Asp Val Val Thr Thr Met
            340                 345                 350

Gln Ser Phe Tyr Glu Gln Ile Ala Ala Phe Lys Thr Val Glu Glu Lys
        355                 360                 365

Ser Ile Lys Glu Thr Leu Ser Leu Leu Phe Asp Asp Leu Lys Ala Gln
    370                 375                 380

Lys Leu Asp Leu Ser Lys Ile Tyr Phe Lys Asn Asp Lys Ser Leu Thr
385                 390                 395                 400

Asp Leu Ser Gln Gln Val Phe Asp Asp Tyr Ser Val Ile Gly Thr Ala
                405                 410                 415

Val Leu Glu Tyr Ile Thr Gln Gln Ile Ala Pro Lys Asn Leu Asp Asn
            420                 425                 430

Pro Ser Lys Lys Glu Gln Glu Leu Ile Ala Lys Lys Thr Glu Lys Ala
        435                 440                 445

Lys Tyr Leu Ser Leu Glu Thr Ile Lys Leu Ala Leu Glu Glu Phe Asn
```

```
    450                 455                 460

Lys His Arg Asp Ile Asp Lys Gln Cys Arg Phe Glu Glu Ile Leu Ala
465                 470                 475                 480

Asn Phe Ala Ala Ile Pro Met Ile Phe Asp Glu Ile Ala Gln Asn Lys
                485                 490                 495

Asp Asn Leu Ala Gln Ile Ser Ile Lys Tyr Gln Asn Gln Gly Lys Lys
            500                 505                 510

Asp Leu Leu Gln Ala Ser Ala Glu Asp Asp Val Lys Ala Ile Lys Asp
        515                 520                 525

Leu Leu Asp Gln Thr Asn Asn Leu Leu His Lys Leu Lys Ile Phe His
    530                 535                 540

Ile Ser Gln Ser Glu Asp Lys Ala Asn Ile Leu Asp Lys Asp Glu His
545                 550                 555                 560

Phe Tyr Leu Val Phe Glu Glu Cys Tyr Phe Glu Leu Ala Asn Ile Val
                565                 570                 575

Pro Leu Tyr Asn Lys Ile Arg Asn Tyr Ile Thr Gln Lys Pro Tyr Ser
            580                 585                 590

Asp Glu Lys Phe Lys Leu Asn Phe Glu Asn Ser Thr Leu Ala Asn Gly
        595                 600                 605

Trp Asp Lys Asn Lys Glu Pro Asp Asn Thr Ala Ile Leu Phe Ile Lys
    610                 615                 620

Asp Asp Lys Tyr Tyr Leu Gly Val Met Asn Lys Lys Asn Asn Lys Ile
625                 630                 635                 640

Phe Asp Asp Lys Ala Ile Lys Glu Asn Lys Gly Glu Gly Tyr Lys Lys
                645                 650                 655

Ile Val Tyr Lys Leu Leu Pro Gly Ala Asn Lys Met Leu Pro Lys Val
```

660 665 670

Phe Phe Ser Ala Lys Ser Ile Lys Phe Tyr Asn Pro Ser Glu Asp Ile
675 680 685

Leu Arg Ile Arg Asn His Ser Thr His Thr Lys Asn Gly Ser Pro Gln
690 695 700

Lys Gly Tyr Glu Lys Phe Glu Phe Asn Ile Glu Asp Cys Arg Lys Phe
705 710 715 720

Ile Asp Phe Tyr Lys Gln Ser Ile Ser Lys His Pro Glu Trp Lys Asp
725 730 735

Phe Gly Phe Arg Phe Ser Asp Thr Gln Arg Tyr Asn Ser Ile Asp Glu
740 745 750

Phe Tyr Arg Glu Val Glu Asn Gln Gly Tyr Lys Leu Thr Phe Glu Asn
755 760 765

Ile Ser Glu Ser Tyr Ile Asp Ser Val Val Asn Gln Gly Lys Leu Tyr
770 775 780

Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ser Ala Tyr Ser Lys Gly Arg
785 790 795 800

Pro Asn Leu His Thr Leu Tyr Trp Lys Ala Leu Phe Asp Glu Arg Asn
805 810 815

Leu Gln Asp Val Val Tyr Lys Leu Asn Gly Glu Ala Glu Leu Phe Tyr
820 825 830

Arg Lys Gln Ser Ile Pro Lys Lys Ile Thr His Pro Ala Lys Glu Ala
835 840 845

Ile Ala Asn Lys Asn Lys Asp Asn Pro Lys Lys Glu Ser Val Phe Glu
850 855 860

Tyr Asp Leu Ile Lys Asp Lys Arg Phe Thr Glu Asp Lys Phe Phe Phe

865 870 875 880

His Cys Pro Ile Thr Ile Asn Phe Lys Ser Ser Gly Ala Asn Lys Phe
885 890 895

Asn Asp Glu Ile Asn Leu Leu Leu Lys Glu Lys Ala Asn Asp Val His
900 905 910

Ile Leu Ser Ile Ala Arg Gly Glu Arg His Leu Ala Tyr Tyr Thr Leu
915 920 925

Val Asp Gly Lys Gly Asn Ile Ile Lys Gln Asp Thr Phe Asn Ile Ile
930 935 940

Gly Asn Asp Arg Met Lys Thr Asn Tyr His Asp Lys Leu Ala Ala Ile
945 950 955 960

Glu Lys Asp Arg Asp Ser Ala Arg Lys Asp Trp Lys Lys Ile Asn Asn
965 970 975

Ile Lys Glu Met Lys Glu Gly Tyr Leu Ser Gln Val Val His Glu Ile
980 985 990

Ala Lys Leu Val Ile Glu Tyr Asn Ala Ile Val Val Phe Ala Asp Leu
995 1000 1005

Asn Phe Gly Phe Lys Arg Gly Arg Phe Lys Val Glu Lys Gln Val
1010 1015 1020

Tyr Gln Lys Leu Glu Lys Met Leu Ile Glu Lys Leu Asn Tyr Leu
1025 1030 1035

Val Phe Lys Asp Asn Glu Phe Asp Lys Thr Gly Gly Val Leu Arg
1040 1045 1050

Ala Tyr Gln Leu Thr Ala Pro Phe Glu Thr Phe Lys Lys Met Gly
1055 1060 1065

Lys Gln Thr Gly Ile Ile Tyr Tyr Val Pro Ala Gly Phe Thr Ser

```
    1070                1075                1080

Lys Ile  Cys Pro Val Thr Gly  Phe Val Asn Gln Leu  Tyr Pro Lys
    1085                1090                1095

Tyr Glu  Ser Val Ser Lys Ser  Gln Glu Phe Phe Ser  Lys Phe Asp
    1100                1105                1110

Lys Ile  Cys Tyr Asn Leu Asp  Lys Gly Tyr Phe Glu  Phe Ser Phe
    1115                1120                1125

Asp Tyr  Lys Asn Phe Gly Asp  Lys Ala Ala Lys Gly  Lys Trp Thr
    1130                1135                1140

Ile Ala  Ser Phe Gly Ser Arg  Leu Ile Asn Phe Arg  Asn Ser Asp
    1145                1150                1155

Lys Asn  His Asn Trp Asp Thr  Arg Glu Val Tyr Pro  Thr Lys Glu
    1160                1165                1170

Leu Glu  Lys Leu Leu Lys Asp  Tyr Ser Ile Glu Tyr  Gly His Gly
    1175                1180                1185

Glu Cys  Ile Lys Ala Ala Ile  Cys Gly Glu Ser Asp  Lys Lys Phe
    1190                1195                1200

Phe Ala  Lys Leu Thr Ser Val  Leu Asn Thr Ile Leu  Gln Met Arg
    1205                1210                1215

Asn Ser  Lys Thr Gly Thr Glu  Leu Asp Tyr Leu Ile  Ser Pro Val
    1220                1225                1230

Ala Asp  Val Asn Gly Asn Phe  Phe Asp Ser Arg Gln  Ala Pro Lys
    1235                1240                1245

Asn Met  Pro Gln Asp Ala Asp  Ala Asn Gly Ala Tyr  His Ile Gly
    1250                1255                1260

Leu Lys  Gly Leu Met Leu Leu  Gly Arg Ile Lys Asn  Asn Gln Glu
```

1265 1270 1275

Gly Lys Lys Leu Asn Leu Val Ile Lys Asn Glu Glu Tyr Phe Glu
1280 1285 1290

Phe Val Gln Asn Arg Asn Asn
1295 1300

<210> 21
<211> 1300
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 21

Met Ser Ile Tyr Gln Glu Phe Val Asn Lys Tyr Ser Leu Ser Lys Thr
1 5 10 15

Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Glu Asn Ile Lys
20 25 30

Ala Arg Gly Leu Ile Leu Asp Asp Glu Lys Arg Ala Lys Asp Tyr Lys
35 40 45

Lys Ala Lys Gln Ile Ile Asp Lys Tyr His Gln Phe Phe Ile Glu Glu
50 55 60

Ile Leu Ser Ser Val Cys Ile Ser Glu Asp Leu Leu Gln Asn Tyr Ser
65 70 75 80

Asp Val Tyr Phe Lys Leu Lys Lys Ser Asp Asp Asp Asn Leu Gln Lys
85 90 95

Asp Phe Lys Ser Ala Lys Asp Thr Ile Lys Lys Gln Ile Ser Glu Tyr
100 105 110

Ile Lys Asp Ser Glu Lys Phe Lys Asn Leu Phe Asn Gln Asn Leu Ile
115 120 125

```
Asp Ala Lys Lys Gly Gln Glu Ser Asp Leu Ile Leu Trp Leu Lys Gln
    130                 135                 140

Ser Lys Asp Asn Gly Ile Glu Leu Phe Lys Ala Asn Ser Asp Ile Thr
145                 150                 155                 160

Asp Ile Asp Glu Ala Leu Glu Ile Ile Lys Ser Phe Lys Gly Trp Thr
                165                 170                 175

Thr Tyr Phe Lys Gly Phe His Glu Asn Arg Lys Asn Val Tyr Ser Ser
            180                 185                 190

Asn Asp Ile Pro Thr Ser Ile Ile Tyr Arg Ile Val Asp Asp Asn Leu
        195                 200                 205

Pro Lys Phe Leu Glu Asn Lys Ala Lys Tyr Glu Ser Leu Lys Asp Lys
    210                 215                 220

Ala Pro Glu Ala Ile Asn Tyr Glu Gln Ile Lys Lys Asp Leu Ala Glu
225                 230                 235                 240

Glu Leu Thr Phe Asp Ile Asp Tyr Lys Thr Ser Glu Val Asn Gln Arg
                245                 250                 255

Val Phe Ser Leu Asp Glu Val Phe Glu Ile Ala Asn Phe Asn Asn Tyr
            260                 265                 270

Leu Asn Gln Ser Gly Ile Thr Lys Phe Asn Thr Ile Ile Gly Gly Lys
        275                 280                 285

Phe Val Asn Gly Glu Asn Thr Lys Arg Lys Gly Ile Asn Glu Tyr Ile
    290                 295                 300

Asn Leu Tyr Ser Gln Gln Ile Asn Asp Lys Thr Leu Lys Lys Tyr Lys
305                 310                 315                 320

Met Ser Val Leu Phe Lys Gln Ile Leu Ser Asp Thr Glu Ser Lys Ser
                325                 330                 335
```

```
Phe Val Ile Asp Lys Leu Glu Asp Asp Ser Asp Val Val Thr Thr Met
            340                 345                 350

Gln Ser Phe Tyr Glu Gln Ile Ala Ala Phe Lys Thr Val Glu Glu Lys
        355                 360                 365

Ser Ile Lys Glu Thr Leu Ser Leu Leu Phe Asp Asp Leu Lys Ala Gln
    370                 375                 380

Lys Leu Asp Leu Ser Lys Ile Tyr Phe Lys Asn Asp Lys Ser Leu Thr
385                 390                 395                 400

Asp Leu Ser Gln Gln Val Phe Asp Asp Tyr Ser Val Ile Gly Thr Ala
                405                 410                 415

Val Leu Glu Tyr Ile Thr Gln Gln Ile Ala Pro Lys Asn Leu Asp Asn
            420                 425                 430

Pro Ser Lys Lys Glu Gln Glu Leu Ile Ala Lys Lys Thr Glu Lys Ala
        435                 440                 445

Lys Tyr Leu Ser Leu Glu Thr Ile Lys Leu Ala Leu Glu Glu Phe Asn
    450                 455                 460

Lys His Arg Asp Ile Asp Lys Gln Cys Arg Phe Glu Glu Ile Leu Ala
465                 470                 475                 480

Asn Phe Ala Ala Ile Pro Met Ile Phe Asp Glu Ile Ala Gln Asn Lys
                485                 490                 495

Asp Asn Leu Ala Gln Ile Ser Ile Lys Tyr Gln Asn Gln Gly Lys Lys
            500                 505                 510

Asp Leu Leu Gln Ala Ser Ala Glu Asp Asp Val Lys Ala Ile Lys Asp
        515                 520                 525

Leu Leu Asp Gln Thr Asn Asn Leu Leu His Lys Leu Lys Ile Phe His
    530                 535                 540
```

```
Ile Ser Gln Ser Glu Asp Lys Ala Asn Ile Leu Asp Lys Asp Glu His
545                 550                 555                 560

Phe Tyr Leu Val Phe Glu Glu Cys Tyr Phe Glu Leu Ala Asn Ile Val
                565                 570                 575

Pro Leu Tyr Asn Lys Ile Arg Asn Tyr Ile Thr Gln Lys Pro Tyr Ser
            580                 585                 590

Asp Glu Lys Phe Lys Leu Asn Phe Glu Asn Ser Thr Leu Ala Asn Gly
        595                 600                 605

Trp Asp Lys Asn Lys Glu Pro Asp Asn Thr Ala Ile Leu Phe Ile Lys
    610                 615                 620

Asp Asp Lys Tyr Tyr Leu Gly Val Met Asn Lys Lys Asn Asn Lys Ile
625                 630                 635                 640

Phe Asp Asp Lys Ala Ile Lys Glu Asn Lys Gly Glu Gly Tyr Lys Lys
                645                 650                 655

Ile Val Tyr Lys Leu Leu Pro Gly Ala Asn Lys Met Leu Pro Lys Val
            660                 665                 670

Phe Phe Ser Ala Lys Ser Ile Lys Phe Tyr Asn Pro Ser Glu Asp Ile
        675                 680                 685

Leu Arg Ile Arg Asn His Ser Thr His Thr Lys Asn Gly Ser Pro Gln
    690                 695                 700

Lys Gly Tyr Glu Lys Phe Glu Phe Asn Ile Glu Asp Cys Arg Lys Phe
705                 710                 715                 720

Ile Asp Phe Tyr Lys Gln Ser Ile Ser Lys His Pro Glu Trp Lys Asp
                725                 730                 735

Phe Gly Phe Arg Phe Ser Asp Thr Gln Arg Tyr Asn Ser Ile Asp Glu
            740                 745                 750
```

```
Phe Tyr Arg Glu Val Glu Asn Gln Gly Tyr Lys Leu Thr Phe Glu Asn
        755                 760                 765

Ile Ser Glu Ser Tyr Ile Asp Ser Val Val Asn Gln Gly Lys Leu Tyr
    770                 775                 780

Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ser Ala Tyr Ser Lys Gly Arg
785                 790                 795                 800

Pro Asn Leu His Thr Leu Tyr Trp Lys Ala Leu Phe Asp Glu Arg Asn
                805                 810                 815

Leu Gln Asp Val Val Tyr Lys Leu Asn Gly Glu Ala Glu Leu Phe Tyr
            820                 825                 830

Arg Lys Gln Ser Ile Pro Lys Lys Ile Thr His Pro Ala Lys Glu Ala
        835                 840                 845

Ile Ala Asn Lys Asn Lys Asp Asn Pro Lys Lys Glu Ser Val Phe Glu
    850                 855                 860

Tyr Asp Leu Ile Lys Asp Lys Arg Phe Thr Glu Asp Lys Phe Phe Phe
865                 870                 875                 880

His Cys Pro Ile Thr Ile Asn Phe Lys Ser Ser Gly Ala Asn Lys Phe
                885                 890                 895

Asn Asp Glu Ile Asn Leu Leu Leu Lys Glu Lys Ala Asn Asp Val His
            900                 905                 910

Ile Leu Ser Ile Ala Arg Gly Glu Arg His Leu Ala Tyr Tyr Thr Leu
        915                 920                 925

Val Asp Gly Lys Gly Asn Ile Ile Lys Gln Asp Thr Phe Asn Ile Ile
    930                 935                 940

Gly Asn Asp Arg Met Lys Thr Asn Tyr His Asp Lys Leu Ala Ala Ile
945                 950                 955                 960
```

```
Glu Lys Asp Arg Asp Ser Ala Arg Lys Asp Trp Lys Lys Ile Asn Asn
               965                 970                 975

Ile Lys Glu Met Lys Glu Gly Tyr Leu Ser Gln Val Val His Glu Ile
           980                 985                 990

Ala Lys Leu Val Ile Glu Tyr Asn  Ala Ile Val Val Phe  Glu Asp Leu
        995                 1000                1005

Asn Phe  Gly Phe Lys Arg Gly  Arg Phe Lys Val Glu  Lys Gln Val
    1010                1015                1020

Tyr Gln  Lys Leu Glu Lys Met  Leu Ile Glu Lys Leu  Asn Tyr Leu
    1025                1030                1035

Val Phe  Lys Asp Asn Glu Phe  Asp Lys Thr Gly Gly  Val Leu Arg
    1040                1045                1050

Ala Tyr  Gln Leu Thr Ala Pro  Phe Glu Thr Phe Lys  Lys Met Gly
    1055                1060                1065

Lys Gln  Thr Gly Ile Ile Tyr  Tyr Val Pro Ala Gly  Phe Thr Ser
    1070                1075                1080

Lys Ile  Cys Pro Val Thr Gly  Phe Val Asn Gln Leu  Tyr Pro Lys
    1085                1090                1095

Tyr Glu  Ser Val Ser Lys Ser  Gln Glu Phe Phe Ser  Lys Phe Asp
    1100                1105                1110

Lys Ile  Cys Tyr Asn Leu Asp  Lys Gly Tyr Phe Glu  Phe Ser Phe
    1115                1120                1125

Asp Tyr  Lys Asn Phe Gly Asp  Lys Ala Ala Lys Gly  Lys Trp Thr
    1130                1135                1140

Ile Ala  Ser Phe Gly Ser Arg  Leu Ile Asn Phe Arg  Asn Ser Asp
    1145                1150                1155
```

```
Lys Asn  His Asn Trp Asp Thr  Arg Glu Val Tyr Pro  Thr Lys Glu
    1160                1165                1170


Leu Glu  Lys Leu Leu Lys Asp  Tyr Ser Ile Glu Tyr  Gly His Gly
    1175                1180                1185


Glu Cys  Ile Lys Ala Ala Ile  Cys Gly Glu Ser Asp  Lys Lys Phe
    1190                1195                1200


Phe Ala  Lys Leu Thr Ser Val  Leu Asn Thr Ile Leu  Gln Met Arg
    1205                1210                1215


Asn Ser  Lys Thr Gly Thr Glu  Leu Asp Tyr Leu Ile  Ser Pro Val
    1220                1225                1230


Ala Asp  Val Asn Gly Asn Phe  Phe Asp Ser Arg Gln  Ala Pro Lys
    1235                1240                1245


Asn Met  Pro Gln Asp Ala Ala  Ala Asn Gly Ala Tyr  His Ile Gly
    1250                1255                1260


Leu Lys  Gly Leu Met Leu Leu  Gly Arg Ile Lys Asn  Asn Gln Glu
    1265                1270                1275


Gly Lys  Lys Leu Asn Leu Val  Ile Lys Asn Glu Glu  Tyr Phe Glu
    1280                1285                1290


Phe Val  Gln Asn Arg Asn Asn
    1295                1300
```

<210> 22
<211> 1300
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 22

```
Met Ser Ile Tyr Gln Glu Phe Val Asn Lys Tyr Ser Leu Ser Lys Thr
```

1 5 10 15

Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Glu Asn Ile Lys
20 25 30

Ala Arg Gly Leu Ile Leu Asp Asp Glu Lys Arg Ala Lys Asp Tyr Lys
35 40 45

Lys Ala Lys Gln Ile Ile Asp Lys Tyr His Gln Phe Phe Ile Glu Glu
50 55 60

Ile Leu Ser Ser Val Cys Ile Ser Glu Asp Leu Leu Gln Asn Tyr Ser
65 70 75 80

Asp Val Tyr Phe Lys Leu Lys Lys Ser Asp Asp Asp Asn Leu Gln Lys
85 90 95

Asp Phe Lys Ser Ala Lys Asp Thr Ile Lys Lys Gln Ile Ser Glu Tyr
100 105 110

Ile Lys Asp Ser Glu Lys Phe Lys Asn Leu Phe Asn Gln Asn Leu Ile
115 120 125

Asp Ala Lys Lys Gly Gln Glu Ser Asp Leu Ile Leu Trp Leu Lys Gln
130 135 140

Ser Lys Asp Asn Gly Ile Glu Leu Phe Lys Ala Asn Ser Asp Ile Thr
145 150 155 160

Asp Ile Asp Glu Ala Leu Glu Ile Ile Lys Ser Phe Lys Gly Trp Thr
165 170 175

Thr Tyr Phe Lys Gly Phe His Glu Asn Arg Lys Asn Val Tyr Ser Ser
180 185 190

Asn Asp Ile Pro Thr Ser Ile Ile Tyr Arg Ile Val Asp Asp Asn Leu
195 200 205

Pro Lys Phe Leu Glu Asn Lys Ala Lys Tyr Glu Ser Leu Lys Asp Lys

210 215 220

Ala Pro Glu Ala Ile Asn Tyr Glu Gln Ile Lys Lys Asp Leu Ala Glu
225 230 235 240

Glu Leu Thr Phe Asp Ile Asp Tyr Lys Thr Ser Glu Val Asn Gln Arg
245 250 255

Val Phe Ser Leu Asp Glu Val Phe Glu Ile Ala Asn Phe Asn Asn Tyr
260 265 270

Leu Asn Gln Ser Gly Ile Thr Lys Phe Asn Thr Ile Ile Gly Gly Lys
275 280 285

Phe Val Asn Gly Glu Asn Thr Lys Arg Lys Gly Ile Asn Glu Tyr Ile
290 295 300

Asn Leu Tyr Ser Gln Gln Ile Asn Asp Lys Thr Leu Lys Lys Tyr Lys
305 310 315 320

Met Ser Val Leu Phe Lys Gln Ile Leu Ser Asp Thr Glu Ser Lys Ser
325 330 335

Phe Val Ile Asp Lys Leu Glu Asp Asp Ser Asp Val Val Thr Thr Met
340 345 350

Gln Ser Phe Tyr Glu Gln Ile Ala Ala Phe Lys Thr Val Glu Glu Lys
355 360 365

Ser Ile Lys Glu Thr Leu Ser Leu Leu Phe Asp Asp Leu Lys Ala Gln
370 375 380

Lys Leu Asp Leu Ser Lys Ile Tyr Phe Lys Asn Asp Lys Ser Leu Thr
385 390 395 400

Asp Leu Ser Gln Gln Val Phe Asp Asp Tyr Ser Val Ile Gly Thr Ala
405 410 415

Val Leu Glu Tyr Ile Thr Gln Gln Ile Ala Pro Lys Asn Leu Asp Asn

```
            420                 425                 430

Pro Ser Lys Lys Glu Gln Glu Leu Ile Ala Lys Lys Thr Glu Lys Ala
        435                 440                 445

Lys Tyr Leu Ser Leu Glu Thr Ile Lys Leu Ala Leu Glu Glu Phe Asn
    450                 455                 460

Lys His Arg Asp Ile Asp Lys Gln Cys Arg Phe Glu Glu Ile Leu Ala
465                 470                 475                 480

Asn Phe Ala Ala Ile Pro Met Ile Phe Asp Glu Ile Ala Gln Asn Lys
                485                 490                 495

Asp Asn Leu Ala Gln Ile Ser Ile Lys Tyr Gln Asn Gln Gly Lys Lys
            500                 505                 510

Asp Leu Leu Gln Ala Ser Ala Glu Asp Asp Val Lys Ala Ile Lys Asp
        515                 520                 525

Leu Leu Asp Gln Thr Asn Asn Leu Leu His Lys Leu Lys Ile Phe His
    530                 535                 540

Ile Ser Gln Ser Glu Asp Lys Ala Asn Ile Leu Asp Lys Asp Glu His
545                 550                 555                 560

Phe Tyr Leu Val Phe Glu Glu Cys Tyr Phe Glu Leu Ala Asn Ile Val
                565                 570                 575

Pro Leu Tyr Asn Lys Ile Arg Asn Tyr Ile Thr Gln Lys Pro Tyr Ser
            580                 585                 590

Asp Glu Lys Phe Lys Leu Asn Phe Glu Asn Ser Thr Leu Ala Asn Gly
        595                 600                 605

Trp Asp Lys Asn Lys Glu Pro Asp Asn Thr Ala Ile Leu Phe Ile Lys
    610                 615                 620

Asp Asp Lys Tyr Tyr Leu Gly Val Met Asn Lys Lys Asn Asn Lys Ile
```

625 630 635 640

Phe Asp Asp Lys Ala Ile Lys Glu Asn Lys Gly Glu Gly Tyr Lys Lys
645 650 655

Ile Val Tyr Lys Leu Leu Pro Gly Ala Asn Lys Met Leu Pro Lys Val
660 665 670

Phe Phe Ser Ala Lys Ser Ile Lys Phe Tyr Asn Pro Ser Glu Asp Ile
675 680 685

Leu Arg Ile Arg Asn His Ser Thr His Thr Lys Asn Gly Ser Pro Gln
690 695 700

Lys Gly Tyr Glu Lys Phe Glu Phe Asn Ile Glu Asp Cys Arg Lys Phe
705 710 715 720

Ile Asp Phe Tyr Lys Gln Ser Ile Ser Lys His Pro Glu Trp Lys Asp
725 730 735

Phe Gly Phe Arg Phe Ser Asp Thr Gln Arg Tyr Asn Ser Ile Asp Glu
740 745 750

Phe Tyr Arg Glu Val Glu Asn Gln Gly Tyr Lys Leu Thr Phe Glu Asn
755 760 765

Ile Ser Glu Ser Tyr Ile Asp Ser Val Val Asn Gln Gly Lys Leu Tyr
770 775 780

Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ser Ala Tyr Ser Lys Gly Arg
785 790 795 800

Pro Asn Leu His Thr Leu Tyr Trp Lys Ala Leu Phe Asp Glu Arg Asn
805 810 815

Leu Gln Asp Val Val Tyr Lys Leu Asn Gly Glu Ala Glu Leu Phe Tyr
820 825 830

Arg Lys Gln Ser Ile Pro Lys Lys Ile Thr His Pro Ala Lys Glu Ala

```
        835                 840                 845

Ile Ala Asn Lys Asn Lys Asp Asn Pro Lys Lys Glu Ser Val Phe Glu
    850                 855                 860

Tyr Asp Leu Ile Lys Asp Lys Arg Phe Thr Glu Asp Lys Phe Phe Phe
865                 870                 875                 880

His Cys Pro Ile Thr Ile Asn Phe Lys Ser Ser Gly Ala Asn Lys Phe
                885                 890                 895

Asn Asp Glu Ile Asn Leu Leu Leu Lys Glu Lys Ala Asn Asp Val His
            900                 905                 910

Ile Leu Ser Ile Asp Arg Gly Glu Arg His Leu Ala Tyr Tyr Thr Leu
        915                 920                 925

Val Asp Gly Lys Gly Asn Ile Ile Lys Gln Asp Thr Phe Asn Ile Ile
    930                 935                 940

Gly Asn Asp Arg Met Lys Thr Asn Tyr His Asp Lys Leu Ala Ala Ile
945                 950                 955                 960

Glu Lys Asp Arg Asp Ser Ala Arg Lys Asp Trp Lys Lys Ile Asn Asn
                965                 970                 975

Ile Lys Glu Met Lys Glu Gly Tyr Leu Ser Gln Val Val His Glu Ile
            980                 985                 990

Ala Lys Leu Val Ile Glu Tyr Asn  Ala Ile Val Val Phe  Ala Asp Leu
        995                 1000                1005

Asn Phe  Gly Phe Lys Arg Gly  Arg Phe Lys Val Glu  Lys Gln Val
    1010                1015                1020

Tyr Gln  Lys Leu Glu Lys Met  Leu Ile Glu Lys Leu  Asn Tyr Leu
    1025                1030                1035

Val Phe  Lys Asp Asn Glu Phe  Asp Lys Thr Gly Gly  Val Leu Arg
```

1040 1045 1050

Ala Tyr Gln Leu Thr Ala Pro Phe Glu Thr Phe Lys Lys Met Gly
1055 1060 1065

Lys Gln Thr Gly Ile Ile Tyr Tyr Val Pro Ala Gly Phe Thr Ser
1070 1075 1080

Lys Ile Cys Pro Val Thr Gly Phe Val Asn Gln Leu Tyr Pro Lys
1085 1090 1095

Tyr Glu Ser Val Ser Lys Ser Gln Glu Phe Phe Ser Lys Phe Asp
1100 1105 1110

Lys Ile Cys Tyr Asn Leu Asp Lys Gly Tyr Phe Glu Phe Ser Phe
1115 1120 1125

Asp Tyr Lys Asn Phe Gly Asp Lys Ala Ala Lys Gly Lys Trp Thr
1130 1135 1140

Ile Ala Ser Phe Gly Ser Arg Leu Ile Asn Phe Arg Asn Ser Asp
1145 1150 1155

Lys Asn His Asn Trp Asp Thr Arg Glu Val Tyr Pro Thr Lys Glu
1160 1165 1170

Leu Glu Lys Leu Leu Lys Asp Tyr Ser Ile Glu Tyr Gly His Gly
1175 1180 1185

Glu Cys Ile Lys Ala Ala Ile Cys Gly Glu Ser Asp Lys Lys Phe
1190 1195 1200

Phe Ala Lys Leu Thr Ser Val Leu Asn Thr Ile Leu Gln Met Arg
1205 1210 1215

Asn Ser Lys Thr Gly Thr Glu Leu Asp Tyr Leu Ile Ser Pro Val
1220 1225 1230

Ala Asp Val Asn Gly Asn Phe Phe Asp Ser Arg Gln Ala Pro Lys

1235 1240 1245

Asn Met Pro Gln Asp Ala Ala Ala Asn Gly Ala Tyr His Ile Gly
1250 1255 1260

Leu Lys Gly Leu Met Leu Leu Gly Arg Ile Lys Asn Asn Gln Glu
1265 1270 1275

Gly Lys Lys Leu Asn Leu Val Ile Lys Asn Glu Glu Tyr Phe Glu
1280 1285 1290

Phe Val Gln Asn Arg Asn Asn
1295 1300

<210> 23
<211> 1300
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 23

Met Ser Ile Tyr Gln Glu Phe Val Asn Lys Tyr Ser Leu Ser Lys Thr
1 5 10 15

Leu Arg Phe Glu Leu Ile Pro Gln Gly Lys Thr Leu Glu Asn Ile Lys
20 25 30

Ala Arg Gly Leu Ile Leu Asp Asp Glu Lys Arg Ala Lys Asp Tyr Lys
35 40 45

Lys Ala Lys Gln Ile Ile Asp Lys Tyr His Gln Phe Phe Ile Glu Glu
50 55 60

Ile Leu Ser Ser Val Cys Ile Ser Glu Asp Leu Leu Gln Asn Tyr Ser
65 70 75 80

Asp Val Tyr Phe Lys Leu Lys Lys Ser Asp Asp Asp Asn Leu Gln Lys
85 90 95

```
Asp Phe Lys Ser Ala Lys Asp Thr Ile Lys Lys Gln Ile Ser Glu Tyr
            100                 105                 110

Ile Lys Asp Ser Glu Lys Phe Lys Asn Leu Phe Asn Gln Asn Leu Ile
        115                 120                 125

Asp Ala Lys Lys Gly Gln Glu Ser Asp Leu Ile Leu Trp Leu Lys Gln
    130                 135                 140

Ser Lys Asp Asn Gly Ile Glu Leu Phe Lys Ala Asn Ser Asp Ile Thr
145                 150                 155                 160

Asp Ile Asp Glu Ala Leu Glu Ile Ile Lys Ser Phe Lys Gly Trp Thr
                165                 170                 175

Thr Tyr Phe Lys Gly Phe His Glu Asn Arg Lys Asn Val Tyr Ser Ser
            180                 185                 190

Asn Asp Ile Pro Thr Ser Ile Ile Tyr Arg Ile Val Asp Asp Asn Leu
        195                 200                 205

Pro Lys Phe Leu Glu Asn Lys Ala Lys Tyr Glu Ser Leu Lys Asp Lys
    210                 215                 220

Ala Pro Glu Ala Ile Asn Tyr Glu Gln Ile Lys Lys Asp Leu Ala Glu
225                 230                 235                 240

Glu Leu Thr Phe Asp Ile Asp Tyr Lys Thr Ser Glu Val Asn Gln Arg
                245                 250                 255

Val Phe Ser Leu Asp Glu Val Phe Glu Ile Ala Asn Phe Asn Asn Tyr
            260                 265                 270

Leu Asn Gln Ser Gly Ile Thr Lys Phe Asn Thr Ile Ile Gly Gly Lys
        275                 280                 285

Phe Val Asn Gly Glu Asn Thr Lys Arg Lys Gly Ile Asn Glu Tyr Ile
    290                 295                 300
```

```
Asn Leu Tyr Ser Gln Gln Ile Asn Asp Lys Thr Leu Lys Lys Tyr Lys
305                 310                 315                 320

Met Ser Val Leu Phe Lys Gln Ile Leu Ser Asp Thr Glu Ser Lys Ser
                325                 330                 335

Phe Val Ile Asp Lys Leu Glu Asp Asp Ser Asp Val Val Thr Thr Met
            340                 345                 350

Gln Ser Phe Tyr Glu Gln Ile Ala Ala Phe Lys Thr Val Glu Glu Lys
        355                 360                 365

Ser Ile Lys Glu Thr Leu Ser Leu Leu Phe Asp Asp Leu Lys Ala Gln
    370                 375                 380

Lys Leu Asp Leu Ser Lys Ile Tyr Phe Lys Asn Asp Lys Ser Leu Thr
385                 390                 395                 400

Asp Leu Ser Gln Gln Val Phe Asp Asp Tyr Ser Val Ile Gly Thr Ala
                405                 410                 415

Val Leu Glu Tyr Ile Thr Gln Gln Ile Ala Pro Lys Asn Leu Asp Asn
            420                 425                 430

Pro Ser Lys Lys Glu Gln Glu Leu Ile Ala Lys Lys Thr Glu Lys Ala
        435                 440                 445

Lys Tyr Leu Ser Leu Glu Thr Ile Lys Leu Ala Leu Glu Glu Phe Asn
    450                 455                 460

Lys His Arg Asp Ile Asp Lys Gln Cys Arg Phe Glu Glu Ile Leu Ala
465                 470                 475                 480

Asn Phe Ala Ala Ile Pro Met Ile Phe Asp Glu Ile Ala Gln Asn Lys
                485                 490                 495

Asp Asn Leu Ala Gln Ile Ser Ile Lys Tyr Gln Asn Gln Gly Lys Lys
            500                 505                 510
```

```
Asp Leu Leu Gln Ala Ser Ala Glu Asp Asp Val Lys Ala Ile Lys Asp
        515                 520                 525

Leu Leu Asp Gln Thr Asn Asn Leu Leu His Lys Leu Lys Ile Phe His
    530                 535                 540

Ile Ser Gln Ser Glu Asp Lys Ala Asn Ile Leu Asp Lys Asp Glu His
545                 550                 555                 560

Phe Tyr Leu Val Phe Glu Glu Cys Tyr Phe Glu Leu Ala Asn Ile Val
                565                 570                 575

Pro Leu Tyr Asn Lys Ile Arg Asn Tyr Ile Thr Gln Lys Pro Tyr Ser
            580                 585                 590

Asp Glu Lys Phe Lys Leu Asn Phe Glu Asn Ser Thr Leu Ala Asn Gly
        595                 600                 605

Trp Asp Lys Asn Lys Glu Pro Asp Asn Thr Ala Ile Leu Phe Ile Lys
    610                 615                 620

Asp Asp Lys Tyr Tyr Leu Gly Val Met Asn Lys Lys Asn Asn Lys Ile
625                 630                 635                 640

Phe Asp Asp Lys Ala Ile Lys Glu Asn Lys Gly Glu Gly Tyr Lys Lys
                645                 650                 655

Ile Val Tyr Lys Leu Leu Pro Gly Ala Asn Lys Met Leu Pro Lys Val
            660                 665                 670

Phe Phe Ser Ala Lys Ser Ile Lys Phe Tyr Asn Pro Ser Glu Asp Ile
        675                 680                 685

Leu Arg Ile Arg Asn His Ser Thr His Thr Lys Asn Gly Ser Pro Gln
    690                 695                 700

Lys Gly Tyr Glu Lys Phe Glu Phe Asn Ile Glu Asp Cys Arg Lys Phe
705                 710                 715                 720
```

```
Ile Asp Phe Tyr Lys Gln Ser Ile Ser Lys His Pro Glu Trp Lys Asp
                725                 730                 735

Phe Gly Phe Arg Phe Ser Asp Thr Gln Arg Tyr Asn Ser Ile Asp Glu
            740                 745                 750

Phe Tyr Arg Glu Val Glu Asn Gln Gly Tyr Lys Leu Thr Phe Glu Asn
        755                 760                 765

Ile Ser Glu Ser Tyr Ile Asp Ser Val Val Asn Gln Gly Lys Leu Tyr
    770                 775                 780

Leu Phe Gln Ile Tyr Asn Lys Asp Phe Ser Ala Tyr Ser Lys Gly Arg
785                 790                 795                 800

Pro Asn Leu His Thr Leu Tyr Trp Lys Ala Leu Phe Asp Glu Arg Asn
                805                 810                 815

Leu Gln Asp Val Val Tyr Lys Leu Asn Gly Glu Ala Glu Leu Phe Tyr
            820                 825                 830

Arg Lys Gln Ser Ile Pro Lys Lys Ile Thr His Pro Ala Lys Glu Ala
        835                 840                 845

Ile Ala Asn Lys Asn Lys Asp Asn Pro Lys Lys Glu Ser Val Phe Glu
    850                 855                 860

Tyr Asp Leu Ile Lys Asp Lys Arg Phe Thr Glu Asp Lys Phe Phe Phe
865                 870                 875                 880

His Cys Pro Ile Thr Ile Asn Phe Lys Ser Ser Gly Ala Asn Lys Phe
                885                 890                 895

Asn Asp Glu Ile Asn Leu Leu Leu Lys Glu Lys Ala Asn Asp Val His
            900                 905                 910

Ile Leu Ser Ile Ala Arg Gly Glu Arg His Leu Ala Tyr Tyr Thr Leu
        915                 920                 925
```

```
Val Asp Gly Lys Gly Asn Ile Ile Lys Gln Asp Thr Phe Asn Ile Ile
    930                 935                 940

Gly Asn Asp Arg Met Lys Thr Asn Tyr His Asp Lys Leu Ala Ala Ile
945                 950                 955                 960

Glu Lys Asp Arg Asp Ser Ala Arg Lys Asp Trp Lys Lys Ile Asn Asn
                965                 970                 975

Ile Lys Glu Met Lys Glu Gly Tyr Leu Ser Gln Val Val His Glu Ile
            980                 985                 990

Ala Lys Leu Val Ile Glu Tyr Asn  Ala Ile Val Val Phe  Ala Asp Leu
        995                 1000                1005

Asn Phe  Gly Phe Lys Arg Gly  Arg Phe Lys Val Glu  Lys Gln Val
    1010                1015                1020

Tyr Gln  Lys Leu Glu Lys Met  Leu Ile Glu Lys Leu  Asn Tyr Leu
    1025                1030                1035

Val Phe  Lys Asp Asn Glu Phe  Asp Lys Thr Gly Gly  Val Leu Arg
    1040                1045                1050

Ala Tyr  Gln Leu Thr Ala Pro  Phe Glu Thr Phe Lys  Lys Met Gly
    1055                1060                1065

Lys Gln  Thr Gly Ile Ile Tyr  Tyr Val Pro Ala Gly  Phe Thr Ser
    1070                1075                1080

Lys Ile  Cys Pro Val Thr Gly  Phe Val Asn Gln Leu  Tyr Pro Lys
    1085                1090                1095

Tyr Glu  Ser Val Ser Lys Ser  Gln Glu Phe Phe Ser  Lys Phe Asp
    1100                1105                1110

Lys Ile  Cys Tyr Asn Leu Asp  Lys Gly Tyr Phe Glu  Phe Ser Phe
    1115                1120                1125
```

```
Asp Tyr  Lys Asn Phe Gly Asp  Lys Ala Ala Lys Gly  Lys Trp Thr
    1130                1135                1140


Ile Ala  Ser Phe Gly Ser Arg  Leu Ile Asn Phe Arg  Asn Ser Asp
    1145                1150                1155


Lys Asn  His Asn Trp Asp Thr  Arg Glu Val Tyr Pro  Thr Lys Glu
    1160                1165                1170


Leu Glu  Lys Leu Leu Lys Asp  Tyr Ser Ile Glu Tyr  Gly His Gly
    1175                1180                1185


Glu Cys  Ile Lys Ala Ala Ile  Cys Gly Glu Ser Asp  Lys Lys Phe
    1190                1195                1200


Phe Ala  Lys Leu Thr Ser Val  Leu Asn Thr Ile Leu  Gln Met Arg
    1205                1210                1215


Asn Ser  Lys Thr Gly Thr Glu  Leu Asp Tyr Leu Ile  Ser Pro Val
    1220                1225                1230


Ala Asp  Val Asn Gly Asn Phe  Phe Asp Ser Arg Gln  Ala Pro Lys
    1235                1240                1245


Asn Met  Pro Gln Asp Ala Ala  Ala Asn Gly Ala Tyr  His Ile Gly
    1250                1255                1260


Leu Lys  Gly Leu Met Leu Leu  Gly Arg Ile Lys Asn  Asn Gln Glu
    1265                1270                1275


Gly Lys  Lys Leu Asn Leu Val  Ile Lys Asn Glu Glu  Tyr Phe Glu
    1280                1285                1290


Phe Val  Gln Asn Arg Asn Asn
    1295                1300


<210>  24
<211>  887
<212>  PRT
```

<213> Natronobacterium gregoryi

<400> 24

```
Met Thr Val Ile Asp Leu Asp Ser Thr Thr Thr Ala Asp Glu Leu Thr
1               5                  10                  15


Ser Gly His Thr Tyr Asp Ile Ser Val Thr Leu Thr Gly Val Tyr Asp
            20                  25                  30


Asn Thr Asp Glu Gln His Pro Arg Met Ser Leu Ala Phe Glu Gln Asp
        35                  40                  45


Asn Gly Glu Arg Arg Tyr Ile Thr Leu Trp Lys Asn Thr Thr Pro Lys
    50                  55                  60


Asp Val Phe Thr Tyr Asp Tyr Ala Thr Gly Ser Thr Tyr Ile Phe Thr
65                  70                  75                  80


Asn Ile Asp Tyr Glu Val Lys Asp Gly Tyr Glu Asn Leu Thr Ala Thr
                85                  90                  95


Tyr Gln Thr Thr Val Glu Asn Ala Thr Ala Gln Glu Val Gly Thr Thr
            100                 105                 110


Asp Glu Asp Glu Thr Phe Ala Gly Gly Glu Pro Leu Asp His His Leu
        115                 120                 125


Asp Asp Ala Leu Asn Glu Thr Pro Asp Asp Ala Glu Thr Glu Ser Asp
    130                 135                 140


Ser Gly His Val Met Thr Ser Phe Ala Ser Arg Asp Gln Leu Pro Glu
145                 150                 155                 160


Trp Thr Leu His Thr Tyr Thr Leu Thr Ala Thr Asp Gly Ala Lys Thr
                165                 170                 175


Asp Thr Glu Tyr Ala Arg Arg Thr Leu Ala Tyr Thr Val Arg Gln Glu
            180                 185                 190
```

```
Leu Tyr Thr Asp His Asp Ala Ala Pro Val Ala Thr Asp Gly Leu Met
        195                 200                 205

Leu Leu Thr Pro Glu Pro Leu Gly Glu Thr Pro Leu Asp Leu Asp Cys
    210                 215                 220

Gly Val Arg Val Glu Ala Asp Glu Thr Arg Thr Leu Asp Tyr Thr Thr
225                 230                 235                 240

Ala Lys Asp Arg Leu Leu Ala Arg Glu Leu Val Glu Glu Gly Leu Lys
                245                 250                 255

Arg Ser Leu Trp Asp Asp Tyr Leu Val Arg Gly Ile Asp Glu Val Leu
            260                 265                 270

Ser Lys Glu Pro Val Leu Thr Cys Asp Glu Phe Asp Leu His Glu Arg
        275                 280                 285

Tyr Asp Leu Ser Val Glu Val Gly His Ser Gly Arg Ala Tyr Leu His
    290                 295                 300

Ile Asn Phe Arg His Arg Phe Val Pro Lys Leu Thr Leu Ala Asp Ile
305                 310                 315                 320

Asp Asp Asp Asn Ile Tyr Pro Gly Leu Arg Val Lys Thr Thr Tyr Arg
                325                 330                 335

Pro Arg Arg Gly His Ile Val Trp Gly Leu Arg Asp Glu Cys Ala Thr
            340                 345                 350

Asp Ser Leu Asn Thr Leu Gly Asn Gln Ser Val Val Ala Tyr His Arg
        355                 360                 365

Asn Asn Gln Thr Pro Ile Asn Thr Asp Leu Leu Asp Ala Ile Glu Ala
    370                 375                 380

Ala Asp Arg Arg Val Val Glu Thr Arg Arg Gln Gly His Gly Asp Asp
385                 390                 395                 400
```

```
Ala Val Ser Phe Pro Gln Glu Leu Leu Ala Val Glu Pro Asn Thr His
                405                 410                 415

Gln Ile Lys Gln Phe Ala Ser Asp Gly Phe His Gln Gln Ala Arg Ser
            420                 425                 430

Lys Thr Arg Leu Ser Ala Ser Arg Cys Ser Glu Lys Ala Gln Ala Phe
        435                 440                 445

Ala Glu Arg Leu Asp Pro Val Arg Leu Asn Gly Ser Thr Val Glu Phe
    450                 455                 460

Ser Ser Glu Phe Phe Thr Gly Asn Asn Glu Gln Gln Leu Arg Leu Leu
465                 470                 475                 480

Tyr Glu Asn Gly Glu Ser Val Leu Thr Phe Arg Asp Gly Ala Arg Gly
                485                 490                 495

Ala His Pro Asp Glu Thr Phe Ser Lys Gly Ile Val Asn Pro Pro Glu
            500                 505                 510

Ser Phe Glu Val Ala Val Val Leu Pro Glu Gln Gln Ala Asp Thr Cys
        515                 520                 525

Lys Ala Gln Trp Asp Thr Met Ala Asp Leu Leu Asn Gln Ala Gly Ala
    530                 535                 540

Pro Pro Thr Arg Ser Glu Thr Val Gln Tyr Asp Ala Phe Ser Ser Pro
545                 550                 555                 560

Glu Ser Ile Ser Leu Asn Val Ala Gly Ala Ile Asp Pro Ser Glu Val
                565                 570                 575

Asp Ala Ala Phe Val Val Leu Pro Pro Asp Gln Glu Gly Phe Ala Asp
            580                 585                 590

Leu Ala Ser Pro Thr Glu Thr Tyr Asp Glu Leu Lys Lys Ala Leu Ala
        595                 600                 605
```

```
Asn Met Gly Ile Tyr Ser Gln Met Ala Tyr Phe Asp Arg Phe Arg Asp
    610                 615                 620

Ala Lys Ile Phe Tyr Thr Arg Asn Val Ala Leu Gly Leu Leu Ala Ala
625                 630                 635                 640

Ala Gly Gly Val Ala Phe Thr Thr Glu His Ala Met Pro Gly Asp Ala
                645                 650                 655

Asp Met Phe Ile Gly Ile Asp Val Ser Arg Ser Tyr Pro Glu Asp Gly
            660                 665                 670

Ala Ser Gly Gln Ile Asn Ile Ala Ala Thr Ala Thr Ala Val Tyr Lys
        675                 680                 685

Asp Gly Thr Ile Leu Gly His Ser Ser Thr Arg Pro Gln Leu Gly Glu
    690                 695                 700

Lys Leu Gln Ser Thr Asp Val Arg Asp Ile Met Lys Asn Ala Ile Leu
705                 710                 715                 720

Gly Tyr Gln Gln Val Thr Gly Glu Ser Pro Thr His Ile Val Ile His
                725                 730                 735

Arg Asp Gly Phe Met Asn Glu Asp Leu Asp Pro Ala Thr Glu Phe Leu
            740                 745                 750

Asn Glu Gln Gly Val Glu Tyr Asp Ile Val Glu Ile Arg Lys Gln Pro
        755                 760                 765

Gln Thr Arg Leu Leu Ala Val Ser Asp Val Gln Tyr Asp Thr Pro Val
    770                 775                 780

Lys Ser Ile Ala Ala Ile Asn Gln Asn Glu Pro Arg Ala Thr Val Ala
785                 790                 795                 800

Thr Phe Gly Ala Pro Glu Tyr Leu Ala Thr Arg Asp Gly Gly Gly Leu
                805                 810                 815
```

```
Pro Arg Pro Ile Gln Ile Glu Arg Val Ala Gly Glu Thr Asp Ile Glu
            820                 825                 830

Thr Leu Thr Arg Gln Val Tyr Leu Leu Ser Gln Ser His Ile Gln Val
        835                 840                 845

His Asn Ser Thr Ala Arg Leu Pro Ile Thr Thr Ala Tyr Ala Asp Gln
    850                 855                 860

Ala Ser Thr His Ala Thr Lys Gly Tyr Leu Val Gln Thr Gly Ala Phe
865                 870                 875                 880

Glu Ser Asn Val Gly Phe Leu
                885
```

<210> 25
<211> 1367
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 25

```
Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly
1               5                   10                  15

Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys
            20                  25                  30

Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly
        35                  40                  45

Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys
    50                  55                  60

Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr
65                  70                  75                  80

Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe
                85                  90                  95
```

```
Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His
            100                 105                 110

Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His
        115                 120                 125

Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser
    130                 135                 140

Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met
145                 150                 155                 160

Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp
                165                 170                 175

Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn
            180                 185                 190

Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300
```

```
Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Ala
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510
```

```
Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Ala Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe Ala
        675                 680                 685

Asn Arg Asn Phe Met Ala Leu Ile His Asp Asp Ser Leu Thr Phe Lys
    690                 695                 700

Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His
705                 710                 715                 720
```

```
Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800

Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
                805                 810                 815

Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp
        835                 840                 845

Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880

Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Ala Ile Thr Lys
        915                 920                 925
```

```
His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020

Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Tyr  Phe Phe Tyr
    1025                1030                1035

Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1040                1045                1050

Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Gly Glu Thr
    1055                1060                1065

Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080

Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095

Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Arg
    1100                1105                1110

Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys Asp Trp  Asp Pro Lys
    1115                1120                1125
```

```
Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val Ala Tyr  Ser Val Leu
    1130                1135                1140

Val Val  Ala Lys Val Glu Lys  Gly Lys Ser Lys Lys  Leu Lys Ser
    1145                1150                1155

Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met Glu Arg  Ser Ser Phe
    1160                1165                1170

Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala Lys Gly  Tyr Lys Glu
    1175                1180                1185

Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro Lys Tyr  Ser Leu Phe
    1190                1195                1200

Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu Ala Ser  Ala Gly Glu
    1205                1210                1215

Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro Ser Lys  Tyr Val Asn
    1220                1225                1230

Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys Leu Lys  Gly Ser Pro
    1235                1240                1245

Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val Glu Gln  His Lys His
    1250                1255                1260

Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser Glu Phe  Ser Lys Arg
    1265                1270                1275

Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys Val Leu  Ser Ala Tyr
    1280                1285                1290

Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu Gln Ala  Glu Asn Ile
    1295                1300                1305

Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly Ala Pro  Ala Ala Phe
    1310                1315                1320
```

```
Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys Arg Tyr  Thr Ser Thr
    1325                1330                1335


Lys Glu  Val Leu Asp Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly
    1340                1345                1350


Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln Leu Gly  Gly Asp
    1355                1360                1365


<210>  26
<211>  1210
<212>  PRT
<213>  Parcubacteria

<400>  26

Met Ser Lys Arg His Pro Arg Ile Ser Gly Val Lys Gly Tyr Arg Leu
1               5                   10                  15


His Ala Gln Arg Leu Glu Tyr Thr Gly Lys Ser Gly Ala Met Arg Thr
            20                  25                  30


Ile Lys Tyr Pro Leu Tyr Ser Ser Pro Ser Gly Gly Arg Thr Val Pro
        35                  40                  45


Arg Glu Ile Val Ser Ala Ile Asn Asp Asp Tyr Val Gly Leu Tyr Gly
    50                  55                  60


Leu Ser Asn Phe Asp Asp Leu Tyr Asn Ala Glu Lys Arg Asn Glu Glu
65                  70                  75                  80


Lys Val Tyr Ser Val Leu Asp Phe Trp Tyr Asp Cys Val Gln Tyr Gly
                85                  90                  95


Ala Val Phe Ser Tyr Thr Ala Pro Gly Leu Leu Lys Asn Val Ala Glu
            100                 105                 110


Val Arg Gly Gly Ser Tyr Glu Leu Thr Lys Thr Leu Lys Gly Ser His
        115                 120                 125
```

```
Leu Tyr Asp Glu Leu Gln Ile Asp Lys Val Ile Lys Phe Leu Asn Lys
    130                 135                 140

Lys Glu Ile Ser Arg Ala Asn Gly Ser Leu Asp Lys Leu Lys Lys Asp
145                 150                 155                 160

Ile Ile Asp Cys Phe Lys Ala Glu Tyr Arg Glu Arg His Lys Asp Gln
                165                 170                 175

Cys Asn Lys Leu Ala Asp Asp Ile Lys Asn Ala Lys Lys Asp Ala Gly
            180                 185                 190

Ala Ser Leu Gly Glu Arg Gln Lys Lys Leu Phe Arg Asp Phe Phe Gly
        195                 200                 205

Ile Ser Glu Gln Ser Glu Asn Asp Lys Pro Ser Phe Thr Asn Pro Leu
    210                 215                 220

Asn Leu Thr Cys Cys Leu Leu Pro Phe Asp Thr Val Asn Asn Asn Arg
225                 230                 235                 240

Asn Arg Gly Glu Val Leu Phe Asn Lys Leu Lys Glu Tyr Ala Gln Lys
                245                 250                 255

Leu Asp Lys Asn Glu Gly Ser Leu Glu Met Trp Glu Tyr Ile Gly Ile
            260                 265                 270

Gly Asn Ser Gly Thr Ala Phe Ser Asn Phe Leu Gly Glu Gly Phe Leu
        275                 280                 285

Gly Arg Leu Arg Glu Asn Lys Ile Thr Glu Leu Lys Lys Ala Met Met
    290                 295                 300

Asp Ile Thr Asp Ala Trp Arg Gly Gln Glu Gln Glu Glu Glu Leu Glu
305                 310                 315                 320

Lys Arg Leu Arg Ile Leu Ala Ala Leu Thr Ile Lys Leu Arg Glu Pro
                325                 330                 335
```

```
Lys Phe Asp Asn His Trp Gly Gly Tyr Arg Ser Asp Ile Asn Gly Lys
            340                 345                 350

Leu Ser Ser Trp Leu Gln Asn Tyr Ile Asn Gln Thr Val Lys Ile Lys
        355                 360                 365

Glu Asp Leu Lys Gly His Lys Lys Asp Leu Lys Lys Ala Lys Glu Met
    370                 375                 380

Ile Asn Arg Phe Gly Glu Ser Asp Thr Lys Glu Glu Ala Val Val Ser
385                 390                 395                 400

Ser Leu Leu Glu Ser Ile Glu Lys Ile Val Pro Asp Asp Ser Ala Asp
                405                 410                 415

Asp Glu Lys Pro Asp Ile Pro Ala Ile Ala Ile Tyr Arg Arg Phe Leu
            420                 425                 430

Ser Asp Gly Arg Leu Thr Leu Asn Arg Phe Val Gln Arg Glu Asp Val
        435                 440                 445

Gln Glu Ala Leu Ile Lys Glu Arg Leu Glu Ala Glu Lys Lys Lys Lys
    450                 455                 460

Pro Lys Lys Arg Lys Lys Lys Ser Asp Ala Glu Asp Glu Lys Glu Thr
465                 470                 475                 480

Ile Asp Phe Lys Glu Leu Phe Pro His Leu Ala Lys Pro Leu Lys Leu
                485                 490                 495

Val Pro Asn Phe Tyr Gly Asp Ser Lys Arg Glu Leu Tyr Lys Lys Tyr
            500                 505                 510

Lys Asn Ala Ala Ile Tyr Thr Asp Ala Leu Trp Lys Ala Val Glu Lys
        515                 520                 525

Ile Tyr Lys Ser Ala Phe Ser Ser Ser Leu Lys Asn Ser Phe Phe Asp
    530                 535                 540
```

```
Thr Asp Phe Asp Lys Asp Phe Phe Ile Lys Arg Leu Gln Lys Ile Phe
545                 550                 555                 560

Ser Val Tyr Arg Arg Phe Asn Thr Asp Lys Trp Lys Pro Ile Val Lys
                565                 570                 575

Asn Ser Phe Ala Pro Tyr Cys Asp Ile Val Ser Leu Ala Glu Asn Glu
            580                 585                 590

Val Leu Tyr Lys Pro Lys Gln Ser Arg Ser Arg Lys Ser Ala Ala Ile
        595                 600                 605

Asp Lys Asn Arg Val Arg Leu Pro Ser Thr Glu Asn Ile Ala Lys Ala
    610                 615                 620

Gly Ile Ala Leu Ala Arg Glu Leu Ser Val Ala Gly Phe Asp Trp Lys
625                 630                 635                 640

Asp Leu Leu Lys Lys Glu Glu His Glu Glu Tyr Ile Asp Leu Ile Glu
                645                 650                 655

Leu His Lys Thr Ala Leu Ala Leu Leu Leu Ala Val Thr Glu Thr Gln
            660                 665                 670

Leu Asp Ile Ser Ala Leu Asp Phe Val Glu Asn Gly Thr Val Lys Asp
        675                 680                 685

Phe Met Lys Thr Arg Asp Gly Asn Leu Val Leu Glu Gly Arg Phe Leu
    690                 695                 700

Glu Met Phe Ser Gln Ser Ile Val Phe Ser Glu Leu Arg Gly Leu Ala
705                 710                 715                 720

Gly Leu Met Ser Arg Lys Glu Phe Ile Thr Arg Ser Ala Ile Gln Thr
                725                 730                 735

Met Asn Gly Lys Gln Ala Glu Leu Leu Tyr Ile Pro His Glu Phe Gln
            740                 745                 750
```

```
Ser Ala Lys Ile Thr Thr Pro Lys Glu Met Ser Arg Ala Phe Leu Asp
        755                 760                 765

Leu Ala Pro Ala Glu Phe Ala Thr Ser Leu Glu Pro Glu Ser Leu Ser
    770                 775                 780

Glu Lys Ser Leu Leu Lys Leu Lys Gln Met Arg Tyr Tyr Pro His Tyr
785                 790                 795                 800

Phe Gly Tyr Glu Leu Thr Arg Thr Gly Gln Gly Ile Asp Gly Gly Val
                805                 810                 815

Ala Glu Asn Ala Leu Arg Leu Glu Lys Ser Pro Val Lys Lys Arg Glu
            820                 825                 830

Ile Lys Cys Lys Gln Tyr Lys Thr Leu Gly Arg Gly Gln Asn Lys Ile
        835                 840                 845

Val Leu Tyr Val Arg Ser Ser Tyr Tyr Gln Thr Gln Phe Leu Glu Trp
    850                 855                 860

Phe Leu His Arg Pro Lys Asn Val Gln Thr Asp Val Ala Val Ser Gly
865                 870                 875                 880

Ser Phe Leu Ile Asp Glu Lys Lys Val Lys Thr Arg Trp Asn Tyr Asp
                885                 890                 895

Ala Leu Thr Val Ala Leu Glu Pro Val Ser Gly Ser Glu Arg Val Phe
            900                 905                 910

Val Ser Gln Pro Phe Thr Ile Phe Pro Glu Lys Ser Ala Glu Glu Glu
        915                 920                 925

Gly Gln Arg Tyr Leu Gly Ile Asp Ile Gly Glu Tyr Gly Ile Ala Tyr
    930                 935                 940

Thr Ala Leu Glu Ile Thr Gly Asp Ser Ala Lys Ile Leu Asp Gln Asn
945                 950                 955                 960
```

```
Phe Ile Ser Asp Pro Gln Leu Lys Thr Leu Arg Glu Glu Val Lys Gly
               965                 970                 975


Leu Lys Leu Asp Gln Arg Arg Gly Thr Phe Ala Met Pro Ser Thr Lys
           980                 985                 990


Ile Ala Arg Ile Arg Glu Ser Leu  Val His Ser Leu Arg  Asn Arg Ile
        995                 1000                1005


His His  Leu Ala Leu Lys His  Lys Ala Lys Ile Val  Tyr Glu Leu
    1010                1015                1020


Glu Val  Ser Arg Phe Glu Glu  Gly Lys Gln Lys Ile  Lys Lys Val
    1025                1030                1035


Tyr Ala  Thr Leu Lys Lys Ala  Asp Val Tyr Ser Glu  Ile Asp Ala
    1040                1045                1050


Asp Lys  Asn Leu Gln Thr Thr  Val Trp Gly Lys Leu  Ala Val Ala
    1055                1060                1065


Ser Glu  Ile Ser Ala Ser Tyr  Thr Ser Gln Phe Cys  Gly Ala Cys
    1070                1075                1080


Lys Lys  Leu Trp Arg Ala Glu  Met Gln Val Asp Glu  Thr Ile Thr
    1085                1090                1095


Thr Gln  Glu Leu Ile Gly Thr  Val Arg Val Ile Lys  Gly Gly Thr
    1100                1105                1110


Leu Ile  Asp Ala Ile Lys Asp  Phe Met Arg Pro Pro  Ile Phe Asp
    1115                1120                1125


Glu Asn  Asp Thr Pro Phe Pro  Lys Tyr Arg Asp Phe  Cys Asp Lys
    1130                1135                1140


His His  Ile Ser Lys Lys Met  Arg Gly Asn Ser Cys  Leu Phe Ile
    1145                1150                1155
```

```
Cys Pro  Phe Cys Arg Ala Asn  Ala Asp Ala Asp Ile  Gln Ala Ser
    1160                1165                1170


Gln Thr  Ile Ala Leu Leu Arg  Tyr Val Lys Glu Glu  Lys Lys Val
    1175                1180                1185


Glu Asp  Tyr Phe Glu Arg Phe  Arg Lys Leu Lys Asn  Ile Lys Val
    1190                1195                1200


Leu Gly  Gln Met Lys Lys Ile
    1205                1210
```

<210> 27
<211> 1372
<212> PRT
<213> Streptococcus gallolyticus

<400> 27

```
Met Thr Lys Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                   10                  15


Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys
            20                  25                  30


Met Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu
        35                  40                  45


Leu Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg
    50                  55                  60


Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80


Arg Tyr Leu Gln Glu Ile Phe Ala Asn Glu Ile Ala Lys Val Asp Glu
                85                  90                  95


Ser Phe Phe Gln Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys
            100                 105                 110
```

```
Thr Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala
        115                 120                 125

Tyr His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala
    130                 135                 140

Asp Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn
                165                 170                 175

Ala Glu Asn Thr Asp Val Gln Lys Ile Phe Ala Asp Phe Val Gly Val
            180                 185                 190

Tyr Asn Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp
        195                 200                 205

Val Ala Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu
    210                 215                 220

Asn Leu Ile Lys Tyr Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly
225                 230                 235                 240

Asn Leu Ile Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn
                245                 250                 255

Phe Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala
        275                 280                 285

Asp Leu Phe Thr Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320
```

```
Ser Met Ile Lys Arg Tyr Val Glu His His Glu Asp Leu Glu Lys Leu
                325                 330                 335

Lys Glu Phe Ile Lys Ala Asn Lys Ser Glu Leu Tyr His Asp Ile Phe
            340                 345                 350

Lys Asp Lys Asn Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val
        355                 360                 365

Lys Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Ile Leu Ser Lys Ile
    370                 375                 380

Lys Ile Asp Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp
385                 390                 395                 400

Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln
                405                 410                 415

Ile His Leu Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr
            420                 425                 430

Tyr Pro Phe Leu Lys Glu Lys Gln Asp Arg Ile Glu Lys Ile Leu Thr
        435                 440                 445

Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Arg Lys Asp Ser Arg
    450                 455                 460

Phe Ala Trp Ala Glu Tyr Arg Ser Asp Glu Lys Ile Thr Pro Trp Asn
465                 470                 475                 480

Phe Asp Lys Val Ile Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr
                485                 490                 495

Arg Met Thr Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro
            500                 505                 510

Lys His Ser His Val Tyr Glu Thr Tyr Ala Val Tyr Asn Glu Leu Thr
        515                 520                 525
```

```
Lys Ile Lys Tyr Val Asn Glu Gln Gly Lys Glu Ser Phe Phe Asp Ser
    530                 535                 540

Asn Met Lys Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys
545                 550                 555                 560

Val Thr Lys Glu Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Pro Glu
                565                 570                 575

Tyr Arg Ile Lys Asp Leu Ile Gly Leu Asp Lys Glu Asn Lys Ser Phe
            580                 585                 590

Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys
        595                 600                 605

Ala Phe Leu Asp Asp Lys Val Asn Glu Glu Val Ile Glu Asp Ile Ile
    610                 615                 620

Lys Thr Leu Thr Leu Phe Glu Asp Lys Asp Met Ile His Glu Arg Leu
625                 630                 635                 640

Gln Lys Tyr Ser Asp Ile Phe Thr Ala Asn Gln Leu Lys Lys Leu Glu
                645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn
            660                 665                 670

Gly Ile Arg Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Tyr Leu Ile
        675                 680                 685

Asp Asp Gly Ser Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp
    690                 695                 700

Thr Leu Pro Phe Lys Gln Ile Ile Gln Lys Ser Gln Val Val Gly Asp
705                 710                 715                 720

Val Asp Asp Ile Glu Ala Val Val His Asp Leu Pro Gly Ser Pro Ala
                725                 730                 735
```

```
Ile Lys Lys Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Lys Val Met Gly Gly Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Asn Arg Gly Arg Ser Gln Ser Gln Gln Arg Leu
    770                 775                 780

Lys Lys Leu Gln Asn Ser Leu Lys Glu Leu Gly Ser Asn Ile Leu Asn
785                 790                 795                 800

Glu Glu Lys Pro Ser Tyr Ile Glu Asp Lys Val Glu Asn Ser His Leu
                805                 810                 815

Gln Asn Asp Gln Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp Met
            820                 825                 830

Tyr Thr Gly Asp Glu Leu Asp Ile Asp His Leu Ser Asp Tyr Asp Ile
        835                 840                 845

Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp Asn
    850                 855                 860

Arg Val Leu Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser Asp Asp Val
865                 870                 875                 880

Pro Ser Leu Asp Ile Val Arg Ala Arg Lys Ala Glu Trp Val Arg Leu
                885                 890                 895

Tyr Lys Ser Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn Leu Thr Lys
            900                 905                 910

Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Gly Phe Ile Lys
        915                 920                 925

Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile
    930                 935                 940
```

```
Leu Asp Ala Arg Phe Asn Thr Glu His Asp Glu Asn Asp Lys Val Ile
945                 950                 955                 960


Arg Asp Val Lys Val Ile Thr Leu Lys Ser Asn Leu Val Ser Gln Phe
                965                 970                 975


Arg Lys Asp Phe Glu Phe Tyr Lys Val Arg Glu Ile Asn Asp Tyr His
            980                 985                 990


His Ala His Asp Ala Tyr Leu Asn  Ala Val Val Gly Thr  Ala Leu Leu
        995                 1000                1005


Lys Lys  Tyr Pro Lys Leu Ala  Ser Glu Phe Val Tyr  Gly Glu Tyr
    1010                1015                1020


Lys Lys  Tyr Asp Ile Arg Lys  Phe Ile Thr Asn Ser  Ser Asp Lys
    1025                1030                1035


Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Leu Met  Asn Phe Phe
    1040                1045                1050


Lys Thr  Lys Val Lys Tyr Ala  Asp Gly Thr Val Phe  Glu Arg Pro
    1055                1060                1065


Ile Ile  Glu Thr Asn Ala Asp  Gly Glu Ile Ala Trp  Asn Lys Gln
    1070                1075                1080


Ile Asp  Phe Glu Lys Val Arg  Lys Val Leu Ser Tyr  Pro Gln Val
    1085                1090                1095


Asn Ile  Val Lys Lys Val Glu  Thr Gln Thr Gly Gly  Phe Ser Lys
    1100                1105                1110


Glu Ser  Ile Leu Pro Lys Gly  Asp Ser Asp Lys Leu  Ile Pro Arg
    1115                1120                1125


Lys Thr  Lys Lys Val Tyr Trp  Asp Thr Lys Lys Tyr  Gly Gly Phe
    1130                1135                1140
```

```
Asp Ser  Pro Thr Val Ala Tyr  Ser Val Phe Val Val  Ala Asp Val
    1145                1150                1155

Glu Lys  Gly Lys Ala Lys Lys  Leu Lys Thr Val Lys  Glu Leu Val
    1160                1165                1170

Gly Ile  Ser Ile Met Glu Arg  Ser Phe Phe Glu Glu  Asn Pro Val
    1175                1180                1185

Glu Phe  Leu Glu Asn Lys Gly  Tyr His Asn Ile Arg  Glu Asp Lys
    1190                1195                1200

Leu Ile  Lys Leu Pro Lys Tyr  Ser Leu Phe Glu Phe  Glu Gly Gly
    1205                1210                1215

Arg Arg  Arg Leu Leu Ala Ser  Ala Ser Glu Leu Gln  Lys Gly Asn
    1220                1225                1230

Glu Met  Val Leu Pro Gly Tyr  Leu Val Glu Leu Leu  Tyr His Ala
    1235                1240                1245

His Arg  Ala Asp Asn Phe Asn  Ser Thr Glu Tyr Leu  Asn Tyr Val
    1250                1255                1260

Ser Glu  His Lys Lys Glu Phe  Glu Lys Val Leu Ser  Cys Val Glu
    1265                1270                1275

Asp Phe  Ala Asn Leu Tyr Val  Asp Val Glu Lys Asn  Leu Ser Lys
    1280                1285                1290

Ile Arg  Ala Val Ala Asp Ser  Met Asp Asn Phe Ser  Ile Glu Glu
    1295                1300                1305

Ile Ser  Asn Ser Phe Ile Asn  Leu Leu Thr Leu Thr  Ala Leu Gly
    1310                1315                1320

Ala Pro  Ala Asp Phe Asn Phe  Leu Gly Glu Lys Ile  Pro Arg Lys
    1325                1330                1335
```

```
Arg Tyr  Thr Ser Thr Lys Glu  Cys Leu Asn Ala Thr  Leu Ile His
    1340                1345                1350


Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Lys
    1355                1360                1365


Leu Gly  Glu Glu
    1370
```

<210> 28
<211> 1370
<212> PRT
<213> Streptococcus mitis

<400> 28

```
Met Lys Lys Gly Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Phe Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Arg Phe Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Ala Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Ser Lys Val Asp Ser Ser
                85                  90                  95


Phe Phe His Arg Leu Asp Asp Ser Phe Leu Ile Pro Glu Asp Lys Arg
            100                 105                 110


Glu Ser Lys Tyr Pro Ile Phe Ala Thr Leu Thr Glu Glu Lys Glu Tyr
        115                 120                 125


His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
```

130 135 140

Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145 150 155 160

Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ala Phe Asp Ile
165 170 175

Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile Tyr
180 185 190

Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln Val
195 200 205

Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu Arg
210 215 220

Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu
225 230 235 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
245 250 255

Asp Leu Glu Asp Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp
260 265 270

Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Thr Asp
275 280 285

Leu Phe Val Ser Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
290 295 300

Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser
305 310 315 320

Met Ile Glu Arg Tyr Glu Asn His Gln Asn Asp Leu Ala Ala Leu Lys
325 330 335

Gln Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe Ser

```
            340                 345                 350

Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr
        355                 360                 365

Gln Glu Thr Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe Glu
    370                 375                 380

Gly Thr Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Asp Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp
    450                 455                 460

Leu Thr Arg Asn Ser Asp Glu Ala Ile Arg Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Ile Val Asp Lys Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln
    530                 535                 540

Lys Lys Gln Ile Val Asn Gln Leu Phe Lys Glu Asn Arg Lys Val Thr
```

```
545                 550                 555                 560

Glu Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp Asp
        595                 600                 605

Ala Lys Asn Glu Ala Ile Leu Glu Asn Ile Val His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp Ser
625                 630                 635                 640

Leu Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Cys Asp Lys
            660                 665                 670

Gln Thr Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Lys Ile
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys
    690                 695                 700

Glu Ile Ile Gln Lys Ala Gln Val Ile Gly Lys Thr Asp Asp Val Lys
705                 710                 715                 720

Gln Val Val Gln Glu Leu Ser Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His
            740                 745                 750

Ala Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
```

```
        755                 760                 765

Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp
    770                 775                 780

Ser Leu Lys Ile Leu Ala Ser Gly Leu Asp Ser Asn Ile Leu Lys Glu
785                 790                 795                 800

Asn Pro Thr Asp Asn Asn Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr
                805                 810                 815

Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile
            820                 825                 830

Asn Gln Leu Ser Ser Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe
        835                 840                 845

Ile Lys Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys Asp
    850                 855                 860

Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Glu Val Val Gln Lys
865                 870                 875                 880

Arg Lys Ala Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu
                885                 890                 895

Arg Lys Phe Asn Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp Glu
            900                 905                 910

Arg Asp Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln
        915                 920                 925

Ile Thr Lys His Val Ala Gln Ile Leu Asp Ala Arg Tyr Asn Thr Glu
    930                 935                 940

Val Asn Glu Lys Asp Lys Lys Asn Arg Thr Val Lys Ile Ile Thr Leu
945                 950                 955                 960

Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Arg Leu Tyr Lys
```

```
                965                 970                 975

Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn
            980                 985                 990

Ala Val Val Ala Lys Ala Ile Leu  Lys Lys Tyr Pro Lys  Leu Glu Pro
        995                 1000                1005

Glu Phe  Val Tyr Gly Glu Tyr  Gln Lys Tyr Asp Leu  Lys Arg Tyr
    1010                1015                1020

Ile Ser  Arg Ser Lys Asp Pro  Lys Glu Val Glu Lys  Ala Thr Glu
    1025                1030                1035

Lys Tyr  Phe Phe Tyr Ser Asn  Leu Leu Asn Phe Phe  Lys Glu Glu
    1040                1045                1050

Val His  Tyr Ala Asp Gly Thr  Ile Val Lys Arg Glu  Asn Ile Glu
    1055                1060                1065

Tyr Ser  Lys Asp Thr Gly Glu  Ile Ala Trp Asn Lys  Glu Lys Asp
    1070                1075                1080

Phe Ala  Ile Ile Lys Lys Val  Leu Ser Leu Pro Gln  Val Asn Ile
    1085                1090                1095

Val Lys  Lys Arg Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1100                1105                1110

Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu Ile Pro  Arg Lys Thr
    1115                1120                1125

Lys Asp  Ile Leu Leu Asp Thr  Thr Lys Tyr Gly Gly  Phe Asp Ser
    1130                1135                1140

Pro Val  Ile Ala Tyr Ser Ile  Leu Leu Ile Ala Asp  Ile Glu Lys
    1145                1150                1155

Gly Lys  Ala Lys Lys Leu Lys  Thr Val Lys Thr Leu  Val Gly Ile
```

```
    1160                1165                1170

Thr Ile  Met Glu Lys Ala Ala  Phe Glu Glu Asn Pro  Ile Thr Phe
    1175                1180                1185

Leu Glu  Asn Lys Gly Tyr His  Asn Val Arg Lys Glu  Asn Ile Leu
    1190                1195                1200

Cys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Arg
    1205                1210                1215

Arg Leu  Leu Ala Ser Ala Lys  Glu Leu Gln Lys Gly  Asn Glu Ile
    1220                1225                1230

Val Leu  Pro Val Tyr Leu Thr  Thr Leu Leu Tyr His  Ser Lys Asn
    1235                1240                1245

Val His  Lys Leu Asp Glu Pro  Gly His Leu Glu Tyr  Ile Gln Lys
    1250                1255                1260

His Arg  Asn Glu Phe Lys Asp  Leu Leu Asn Leu Val  Ser Glu Phe
    1265                1270                1275

Ser Gln  Lys Tyr Val Leu Ala  Asp Ala Asn Leu Glu  Lys Ile Lys
    1280                1285                1290

Ser Leu  Tyr Ala Asp Asn Glu  Gln Ala Asp Ile Glu  Ile Leu Ala
    1295                1300                1305

Asn Ser  Phe Ile Asn Leu Leu  Thr Phe Thr Ala Leu  Gly Ala Pro
    1310                1315                1320

Ala Ala  Phe Lys Phe Phe Gly  Lys Asp Ile Asp Arg  Lys Arg Tyr
    1325                1330                1335

Thr Thr  Val Ser Glu Ile Leu  Asn Ala Thr Leu Ile  His Gln Ser
    1340                1345                1350

Ile Thr  Gly Leu Tyr Glu Thr  Trp Ile Asp Leu Ser  Lys Leu Gly
```

1355 1360 1365

Glu Asp
1370

<210> 29
<211> 1056
<212> PRT
<213> Staphylococcus aureus

<400> 29

Gly Ser His Met Lys Arg Asn Tyr Ile Leu Gly Leu Asp Ile Gly Ile
1 5 10 15

Thr Ser Val Gly Tyr Gly Ile Ile Asp Tyr Glu Thr Arg Asp Val Ile
20 25 30

Asp Ala Gly Val Arg Leu Phe Lys Glu Ala Asn Val Glu Asn Asn Glu
35 40 45

Gly Arg Arg Ser Lys Arg Gly Ala Arg Arg Leu Lys Arg Arg Arg Arg
50 55 60

His Arg Ile Gln Arg Val Lys Lys Leu Leu Phe Asp Tyr Asn Leu Leu
65 70 75 80

Thr Asp His Ser Glu Leu Ser Gly Ile Asn Pro Tyr Glu Ala Arg Val
85 90 95

Lys Gly Leu Ser Gln Lys Leu Ser Glu Glu Glu Phe Ser Ala Ala Leu
100 105 110

Leu His Leu Ala Lys Arg Arg Gly Val His Asn Val Asn Glu Val Glu
115 120 125

Glu Asp Thr Gly Asn Glu Leu Ser Thr Lys Glu Gln Ile Ser Arg Asn
130 135 140

Ser Lys Ala Leu Glu Glu Lys Tyr Val Ala Glu Leu Gln Leu Glu Arg
145 150 155 160

```
Leu Lys Lys Asp Gly Glu Val Arg Gly Ser Ile Asn Arg Phe Lys Thr
                165                 170                 175

Ser Asp Tyr Val Lys Glu Ala Lys Gln Leu Leu Lys Val Gln Lys Ala
            180                 185                 190

Tyr His Gln Leu Asp Gln Ser Phe Ile Asp Thr Tyr Ile Asp Leu Leu
        195                 200                 205

Glu Thr Arg Arg Thr Tyr Tyr Glu Gly Pro Gly Glu Gly Ser Pro Phe
    210                 215                 220

Gly Trp Lys Asp Ile Lys Glu Trp Tyr Glu Met Leu Met Gly His Cys
225                 230                 235                 240

Thr Tyr Phe Pro Glu Glu Leu Arg Ser Val Lys Tyr Ala Tyr Asn Ala
                245                 250                 255

Asp Leu Tyr Asn Ala Leu Asn Asp Leu Asn Asn Leu Val Ile Thr Arg
            260                 265                 270

Asp Glu Asn Glu Lys Leu Glu Tyr Tyr Glu Lys Phe Gln Ile Ile Glu
        275                 280                 285

Asn Val Phe Lys Gln Lys Lys Lys Pro Thr Leu Lys Gln Ile Ala Lys
    290                 295                 300

Glu Ile Leu Val Asn Glu Glu Asp Ile Lys Gly Tyr Arg Val Thr Ser
305                 310                 315                 320

Thr Gly Lys Pro Glu Phe Thr Asn Leu Lys Val Tyr His Asp Ile Lys
                325                 330                 335

Asp Ile Thr Ala Arg Lys Glu Ile Ile Glu Asn Ala Glu Leu Leu Asp
            340                 345                 350

Gln Ile Ala Lys Ile Leu Thr Ile Tyr Gln Ser Ser Glu Asp Ile Gln
        355                 360                 365
```

```
Glu Glu Leu Thr Asn Leu Asn Ser Glu Leu Thr Gln Glu Glu Ile Glu
    370                 375                 380

Gln Ile Ser Asn Leu Lys Gly Tyr Thr Gly Thr His Asn Leu Ser Leu
385                 390                 395                 400

Lys Ala Ile Asn Leu Ile Leu Asp Glu Leu Trp His Thr Asn Asp Asn
                405                 410                 415

Gln Ile Ala Ile Phe Asn Arg Leu Lys Leu Val Pro Lys Lys Val Asp
            420                 425                 430

Leu Ser Gln Gln Lys Glu Ile Pro Thr Thr Leu Val Asp Asp Phe Ile
        435                 440                 445

Leu Ser Pro Val Val Lys Arg Ser Phe Ile Gln Ser Ile Lys Val Ile
    450                 455                 460

Asn Ala Ile Ile Lys Lys Tyr Gly Leu Pro Asn Asp Ile Ile Ile Glu
465                 470                 475                 480

Leu Ala Arg Glu Lys Asn Ser Lys Asp Ala Gln Lys Met Ile Asn Glu
                485                 490                 495

Met Gln Lys Arg Asn Arg Gln Thr Asn Glu Arg Ile Glu Glu Ile Ile
            500                 505                 510

Arg Thr Thr Gly Lys Glu Asn Ala Lys Tyr Leu Ile Glu Lys Ile Lys
        515                 520                 525

Leu His Asp Met Gln Glu Gly Lys Cys Leu Tyr Ser Leu Glu Ala Ile
    530                 535                 540

Pro Leu Glu Asp Leu Leu Asn Asn Pro Phe Asn Tyr Glu Val Asp His
545                 550                 555                 560

Ile Ile Pro Arg Ser Val Ser Phe Asp Asn Ser Phe Asn Asn Lys Val
                565                 570                 575
```

```
Leu Val Lys Gln Glu Glu Asn Ser Lys Lys Gly Asn Arg Thr Pro Phe
            580                 585                 590

Gln Tyr Leu Ser Ser Ser Asp Ser Lys Ile Ser Tyr Glu Thr Phe Lys
        595                 600                 605

Lys His Ile Leu Asn Leu Ala Lys Gly Lys Gly Arg Ile Ser Lys Thr
    610                 615                 620

Lys Lys Glu Tyr Leu Leu Glu Glu Arg Asp Ile Asn Arg Phe Ser Val
625                 630                 635                 640

Gln Lys Asp Phe Ile Asn Arg Asn Leu Val Asp Thr Arg Tyr Ala Thr
                645                 650                 655

Arg Gly Leu Met Asn Leu Leu Arg Ser Tyr Phe Arg Val Asn Asn Leu
            660                 665                 670

Asp Val Lys Val Lys Ser Ile Asn Gly Gly Phe Thr Ser Phe Leu Arg
        675                 680                 685

Arg Lys Trp Lys Phe Lys Lys Glu Arg Asn Lys Gly Tyr Lys His His
    690                 695                 700

Ala Glu Asp Ala Leu Ile Ile Ala Asn Ala Asp Phe Ile Phe Lys Glu
705                 710                 715                 720

Trp Lys Lys Leu Asp Lys Ala Lys Lys Val Met Glu Asn Gln Met Phe
                725                 730                 735

Glu Glu Lys Gln Ala Glu Ser Met Pro Glu Ile Glu Thr Glu Gln Glu
            740                 745                 750

Tyr Lys Glu Ile Phe Ile Thr Pro His Gln Ile Lys His Ile Lys Asp
        755                 760                 765

Phe Lys Asp Tyr Lys Tyr Ser His Arg Val Asp Lys Lys Pro Asn Arg
    770                 775                 780
```

```
Glu Leu Ile Asn Asp Thr Leu Tyr Ser Thr Arg Lys Asp Asp Lys Gly
785                 790                 795                 800

Asn Thr Leu Ile Val Asn Asn Leu Asn Gly Leu Tyr Asp Lys Asp Asn
                805                 810                 815

Asp Lys Leu Lys Lys Leu Ile Asn Lys Ser Pro Glu Lys Leu Leu Met
            820                 825                 830

Tyr His His Asp Pro Gln Thr Tyr Gln Lys Leu Lys Leu Ile Met Glu
        835                 840                 845

Gln Tyr Gly Asp Glu Lys Asn Pro Leu Tyr Lys Tyr Tyr Glu Glu Thr
    850                 855                 860

Gly Asn Tyr Leu Thr Lys Tyr Ser Lys Lys Asp Asn Gly Pro Val Ile
865                 870                 875                 880

Lys Lys Ile Lys Tyr Tyr Gly Asn Lys Leu Asn Ala His Leu Asp Ile
                885                 890                 895

Thr Asp Asp Tyr Pro Asn Ser Arg Asn Lys Val Val Lys Leu Ser Leu
            900                 905                 910

Lys Pro Tyr Arg Phe Asp Val Tyr Leu Asp Asn Gly Val Tyr Lys Phe
        915                 920                 925

Val Thr Val Lys Asn Leu Asp Val Ile Lys Lys Glu Asn Tyr Tyr Glu
    930                 935                 940

Val Asn Ser Lys Cys Tyr Glu Glu Ala Lys Lys Leu Lys Lys Ile Ser
945                 950                 955                 960

Asn Gln Ala Glu Phe Ile Ala Ser Phe Tyr Asn Asn Asp Leu Ile Lys
                965                 970                 975

Ile Asn Gly Glu Leu Tyr Arg Val Ile Gly Val Asn Asn Asp Leu Leu
            980                 985                 990
```

```
Asn Arg Ile Glu Val Asn Met Ile  Asp Ile Thr Tyr Arg  Glu Tyr Leu
        995                 1000                1005


Glu Asn  Met Asn Asp Lys Arg  Pro Pro Arg Ile Ile  Lys Thr Ile
    1010                1015                1020


Ala Ser  Lys Thr Gln Ser Ile  Lys Lys Tyr Ser Thr  Asp Ile Leu
    1025                1030                1035


Gly Asn  Leu Tyr Glu Val Lys  Ser Lys Lys His Pro  Gln Ile Ile
    1040                1045                1050


Lys Lys  Gly
    1055


<210>  30
<211>  1044
<212>  PRT
<213>  Streptococcus pyogenes

<400>  30

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
1               5                   10                  15


Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
            20                  25                  30


Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
        35                  40                  45


Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
    50                  55                  60


Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu
65                  70                  75                  80


Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
                85                  90                  95
```

```
Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
            100                 105                 110

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
        115                 120                 125

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
    130                 135                 140

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
145                 150                 155                 160

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
                165                 170                 175

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
            180                 185                 190

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
        195                 200                 205

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
    210                 215                 220

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
225                 230                 235                 240

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
                245                 250                 255

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
            260                 265                 270

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
        275                 280                 285

Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
    290                 295                 300
```

```
Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
305                 310                 315                 320


Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
                325                 330                 335


Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn
            340                 345                 350


Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
        355                 360                 365


Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser
    370                 375                 380


Leu Thr Phe Lys Glu Asp Leu Gln Lys Ala Gln Val Ser Gly Gln Gly
385                 390                 395                 400


Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile
                405                 410                 415


Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys
            420                 425                 430


Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg
        435                 440                 445


Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met
    450                 455                 460


Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys
465                 470                 475                 480


Glu Tyr Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu
                485                 490                 495


Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp
            500                 505                 510
```

```
Ile Asn Arg Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser
        515                 520                 525


Phe Leu Lys Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp
    530                 535                 540


Lys Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys
545                 550                 555                 560


Lys Met Lys Asn Tyr Trp Lys Gln Leu Leu Asn Ala Lys Leu Ile Thr
                565                 570                 575


Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser
            580                 585                 590


Glu Leu Asp Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg
        595                 600                 605


Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr
    610                 615                 620


Lys Tyr Asp Glu Asn Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr
625                 630                 635                 640


Leu Lys Ser Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr
                645                 650                 655


Lys Val Arg Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu
            660                 665                 670


Asn Ala Val Val Gly Thr Ala Leu Ile Lys Lys Tyr Pro Lys Leu Glu
        675                 680                 685


Ser Glu Phe Val Tyr Gly Asp Tyr Lys Val Tyr Asp Ile Ser Glu Gln
    690                 695                 700


Glu Ile Gly Lys Ala Thr Ala Lys Tyr Phe Phe Tyr Ser Asn Ile Met
705                 710                 715                 720
```

```
Asn Phe Phe Lys Thr Glu Ile Thr Leu Ala Asn Gly Glu Ile Arg Lys
                725                 730                 735

Arg Pro Leu Ile Glu Thr Asn Gly Glu Thr Gly Glu Ile Val Trp Asp
            740                 745                 750

Lys Gly Arg Asp Phe Ala Thr Val Arg Lys Val Leu Ser Met Pro Gln
        755                 760                 765

Val Asn Ile Val Lys Lys Thr Glu Val Gln Thr Gly Gly Phe Ser Lys
    770                 775                 780

Glu Ser Ile Leu Pro Lys Arg Asn Ser Asp Lys Leu Ile Ala Arg Lys
785                 790                 795                 800

Lys Asp Trp Asp Pro Lys Lys Tyr Gly Gly Phe Asp Ser Pro Thr Val
                805                 810                 815

Ala Tyr Ser Val Leu Val Val Ala Lys Val Glu Lys Gly Lys Ser Lys
            820                 825                 830

Lys Leu Lys Ser Val Lys Glu Leu Val Gly Ile Thr Ile Met Glu Arg
        835                 840                 845

Ser Ser Phe Glu Lys Asp Pro Val Asp Phe Leu Glu Ala Lys Gly Tyr
    850                 855                 860

Lys Glu Val Arg Lys Asp Leu Ile Ile Lys Leu Pro Lys Tyr Ser Leu
865                 870                 875                 880

Phe Glu Leu Glu Asn Gly Arg Lys Arg Met Leu Ala Ser Gly Glu Leu
                885                 890                 895

Gln Lys Gly Asn Glu Leu Ala Leu Pro Ser Lys Tyr Val Asn Phe Leu
            900                 905                 910

Tyr Leu Ala Ser His Tyr Glu Lys Leu Lys Gly Ser Pro Glu Asp Asn
        915                 920                 925
```

```
Glu Gln Lys Gln Leu Phe Val Glu Gln His Lys His Tyr Leu Asp Glu
    930                 935                 940


Ile Ile Glu Gln Ile Ser Glu Phe Ser Lys Arg Val Ile Leu Ala Asp
945                 950                 955                 960


Ala Asn Leu Asp Lys Val Leu Ser Ala Tyr Asn Lys His Arg Asp Lys
                965                 970                 975


Pro Ile Arg Glu Gln Ala Glu Asn Ile Ile His Leu Phe Thr Leu Thr
            980                 985                 990


Asn Leu Gly Ala Pro Ala Ala Phe  Lys Cys Phe Asp Thr  Thr Ile Gly
        995                 1000                1005


Arg Asn  Arg Tyr Lys Ser Ile  Lys Glu Val Leu Asp  Ala Thr Leu
    1010                1015                1020


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1025                1030                1035


Ser Gln  Leu Gly Gly Asp
    1040


<210>  31
<211>  1359
<212>  PRT
<213>  Streptococcus pyogenes

<400>  31

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255
```

```
Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460
```

```
Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480


Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495


Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510


Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525


Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540


Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560


Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575


Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590


Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605


Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620


Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640


Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655


Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670
```

```
Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880
```

```
Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895


Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910


Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925


Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940


Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960


Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975


Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990


Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005


Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020


Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050


Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065


Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080
```

```
Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275
```

```
Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Gln  Leu Gly Gly Asp
    1355
```

<210> 32
<211> 1359
<212> PRT
<213> Streptococcus pyogenes

<400> 32

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Leu
            20                  25                  30


Lys Gly Leu Gly Asn Thr Asp Arg His Gly Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
```

85 90 95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
100 105 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
115 120 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
130 135 140

Ser Thr Asp Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145 150 155 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
165 170 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
180 185 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
195 200 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
210 215 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225 230 235 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
245 250 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
260 265 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
275 280 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Thr Leu Leu Ser Asp Ile

```
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
```

```
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
```

705 710 715 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
725 730 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
740 745 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
755 760 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
770 775 780

Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro Val Glu
785 790 795 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
805 810 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
820 825 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
835 840 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
850 855 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865 870 875 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
885 890 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Val
900 905 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His

```
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
```

1115 1120 1125

Pro Thr Val Ala Tyr Ser Val Leu Val Val Ala Lys Val Glu Lys
1130 1135 1140

Gly Lys Ser Lys Lys Leu Lys Ser Val Lys Glu Leu Leu Gly Ile
1145 1150 1155

Thr Ile Met Glu Arg Ser Ser Phe Glu Lys Asp Pro Ile Asp Phe
1160 1165 1170

Leu Glu Ala Lys Gly Tyr Lys Glu Val Arg Lys Asp Leu Ile Ile
1175 1180 1185

Lys Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu Asn Gly Arg Lys
1190 1195 1200

Arg Met Leu Ala Ser Gly Glu Leu Gln Lys Gly Asn Glu Leu Ala
1205 1210 1215

Leu Pro Ser Lys Tyr Val Asn Phe Leu Tyr Leu Ala Ser His Tyr
1220 1225 1230

Glu Lys Leu Lys Gly Ser Pro Glu Asp Asn Glu Gln Lys Gln Leu
1235 1240 1245

Phe Val Glu Gln His Lys His Tyr Leu Asp Glu Ile Ile Glu Gln
1250 1255 1260

Ile Ser Glu Phe Ser Lys Arg Val Ile Leu Ala Asp Ala Asn Leu
1265 1270 1275

Asp Lys Val Leu Ser Ala Tyr Asn Lys His Arg Asp Lys Pro Ile
1280 1285 1290

Arg Glu Gln Ala Glu Asn Ile Ile His Leu Phe Thr Leu Thr Asn
1295 1300 1305

Leu Gly Ala Pro Ala Ala Phe Lys Tyr Phe Asp Thr Thr Ile Asp

1310 1315 1320

Arg Lys Arg Tyr Thr Ser Thr Lys Glu Val Leu Asp Ala Thr Leu
1325 1330 1335

Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu
1340 1345 1350

Ser Gln Leu Gly Gly Asp
1355

<210> 33
<211> 1359
<212> PRT
<213> Streptococcus pyogenes

<400> 33

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
20 25 30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
100 105 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
115 120 125

```
His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Leu Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335
```

```
Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540
```

```
Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750
```

```
Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asn Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960
```

```
Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155
```

```
Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Arg Lys Asp  Leu Ile Val
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Phe
    1325                1330                1335

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350
```

Ser Gln Leu Gly Gly Asp
    1355

<210> 34
<211> 1359
<212> PRT
<213> Streptococcus pyogenes

<400> 34

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20   25   30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100   105   110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115   120   125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130   135   140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145   150   155   160

```
Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365
```

```
Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575
```

```
Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780
```

```
Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990
```

```
Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005


Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020


Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050


Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065


Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080


Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095


Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110


Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125


Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140


Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155


Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170


Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                1180                1185
```

```
Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200


Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215


Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230


Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  35
<211>  1359
<212>  PRT
```

<213> Streptococcus pyogenes

<400> 35

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Ile Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140


Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175


Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190
```

```
Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Leu Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400
```

```
Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605
```

```
Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Val Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815
```

```
Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020
```

```
Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Arg Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215
```

```
Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230


Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Leu Gly  Ala Pro Thr Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Phe
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  36
<211>  1359
<212>  PRT
<213>  Streptococcus pyogenes

<400>  36

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
```

```
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Ile Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn Leu
```

```
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
```

```
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
```

645 650 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
660 665 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
675 680 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
690 695 700

Asp Leu Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705 710 715 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
725 730 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
740 745 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
755 760 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
770 775 780

Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro Val Glu
785 790 795 800

Thr Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
805 810 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
820 825 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
835 840 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys

```
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Lys Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Ile Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
```

```
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Val Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asp Pro  Val Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Arg Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
```

```
    1250                1255                1260


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Cys Phe Asp Thr  Thr Ile Gly
    1310                1315                1320


Arg Asn  Arg Tyr Lys Ser Ile  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  37
<211>  1358
<212>  PRT
<213>  Streptococcus pyogenes

<400>  37

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Gly Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Ile Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270
```

```
Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480
```

```
Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Ala
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Gly Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685
```

```
Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu His Glu
705                 710                 715                 720

Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His Lys
            740                 745                 750

Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Gln
        755                 760                 765

Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu Gly
    770                 775                 780

Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu Asn
785                 790                 795                 800

Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp
            820                 825                 830

Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp Ser
        835                 840                 845

Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
865                 870                 875                 880

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn
                885                 890                 895
```

```
Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn Asp
    930                 935                 940

Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val
945                 950                 955                 960

Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
            980                 985                 990

Ala Leu Ile Lys Lys Tyr Pro Lys  Leu Glu Ser Glu Phe  Val Tyr Gly
        995                 1000                1005

Asp Tyr  Lys Val Tyr Asp Val  Ser Glu Gln Glu Ile  Gly Lys Ala
    1010                1015                1020

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1025                1030                1035

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1040                1045                1050

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1055                1060                1065

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1070                1075                1080

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1085                1090                1095
```

```
Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1100                1105                1110

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1115                1120                1125

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1130                1135                1140

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1145                1150                1155

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1160                1165                1170

Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1175                1180                1185

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1190                1195                1200

Met Leu  Ala Ser Gly Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu
    1205                1210                1215

Pro Ser  Lys Tyr Val Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu
    1220                1225                1230

Lys Leu  Lys Gly Ser Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe
    1235                1240                1245

Val Glu  Gln His Lys His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile
    1250                1255                1260

Ser Glu  Phe Ser Lys Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp
    1265                1270                1275

Lys Val  Leu Ser Ala Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg
    1280                1285                1290
```

```
Glu Gln  Ala Glu Asn Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu
    1295                1300                1305


Gly Ala  Pro Ala Ala Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg
    1310                1315                1320


Lys Arg  Tyr Thr Ser Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile
    1325                1330                1335


His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser
    1340                1345                1350


Gln Leu  Gly Gly Asp
    1355


<210>  38
<211>  1359
<212>  PRT
<213>  Streptococcus pyogenes

<400>  38

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300
```

```
Leu Arg Leu Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510
```

```
Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720
```

```
His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
               725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
               805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
               885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925
```

```
Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125
```

```
Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140


Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Leu
    1145                1150                1155


Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170


Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                1180                1185


Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200


Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215


Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230


Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320
```

```
Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                 1330                 1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                 1345                 1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  39
<211>  1358
<212>  PRT
<213>  Streptococcus pyogenes

<400>  39

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Leu
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Gly Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125
```

```
His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335
```

```
Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540
```

```
Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560


Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575


Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Thr Ser Leu Gly Thr
            580                 585                 590


Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605


Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620


Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Lys Tyr Ala Asn
625                 630                 635                 640


Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr Thr
                645                 650                 655


Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670


Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685


Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700


Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu His Glu
705                 710                 715                 720


Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735


Gln Thr Val Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His Lys
            740                 745                 750
```

```
Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Gln
        755                 760                 765

Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu Gly
    770                 775                 780

Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu Asn
785                 790                 795                 800

Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp
            820                 825                 830

Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp Ser
        835                 840                 845

Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
865                 870                 875                 880

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn Asp
    930                 935                 940

Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val
945                 950                 955                 960
```

```
Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile Asn
               965                 970                 975

Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
            980                 985                 990

Ala Leu Ile Lys Lys Tyr Pro Lys  Leu Glu Ser Glu Phe  Val Tyr Gly
        995                 1000                1005

Asp Tyr  Lys Val Tyr Asp Val  Ser Glu Gln Glu Ile  Gly Lys Ala
    1010                1015                1020

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1025                1030                1035

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1040                1045                1050

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1055                1060                1065

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1070                1075                1080

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1085                1090                1095

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1100                1105                1110

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1115                1120                1125

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1130                1135                1140

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1145                1150                1155
```

```
Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1160                1165                1170

Glu Ala  Lys Gly Tyr Lys Glu  Val Arg Lys Asp Leu  Ile Ile Lys
    1175                1180                1185

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1190                1195                1200

Met Leu  Ala Ser Gly Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu
    1205                1210                1215

Pro Ser  Lys Tyr Val Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu
    1220                1225                1230

Lys Leu  Lys Gly Ser Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe
    1235                1240                1245

Val Glu  Gln His Lys His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile
    1250                1255                1260

Ser Glu  Phe Ser Lys Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp
    1265                1270                1275

Lys Val  Leu Ser Ala Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg
    1280                1285                1290

Glu Gln  Ala Lys Asn Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu
    1295                1300                1305

Gly Ala  Pro Ala Ala Phe Lys  Tyr Phe Asp Thr Thr  Ile Glu Arg
    1310                1315                1320

Asn Arg  Tyr Lys Ser Ile Lys  Glu Val Leu Asp Ala  Thr Leu Ile
    1325                1330                1335

His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser
    1340                1345                1350
```

Gln Leu Gly Gly Asp
    1355

<210> 40
<211> 1358
<212> PRT
<213> Streptococcus pyogenes

<400> 40

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Leu
            20   25   30

Lys Val Leu Gly Asn Thr Asp Arg His Gly Ile Lys Lys Asn Leu Ile
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100   105   110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115   120   125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130   135   140

Ser Thr Asp Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145   150   155   160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro

165 170 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
180 185 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
195 200 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
210 215 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225 230 235 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
245 250 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
260 265 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
275 280 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
290 295 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305 310 315 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
325 330 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
340 345 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
355 360 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly

```
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Thr Ser Leu Gly Thr
```

580 585 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
595 600 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
610 615 620

Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Lys Tyr Ala Asn
625 630 635 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr Thr
645 650 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
660 665 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
675 680 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Thr Phe Lys Glu
690 695 700

Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu His Glu
705 710 715 720

Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
725 730 735

Gln Thr Val Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His Lys
740 745 750

Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Gln
755 760 765

Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu Gly
770 775 780

Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu Asn

785 790 795 800

Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
805 810 815

Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp
820 825 830

Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp Ser
835 840 845

Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser
850 855 860

Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
865 870 875 880

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn
885 890 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala Gly
900 905 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
915 920 925

Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn Asp
930 935 940

Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val
945 950 955 960

Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile Asn
965 970 975

Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
980 985 990

Ala Leu Ile Lys Lys Tyr Pro Lys Leu Glu Ser Glu Phe Val Tyr Gly

995 1000 1005

Asp Tyr Lys Val Tyr Asp Val Ser Glu Gln Glu Ile Gly Lys Ala
1010 1015 1020

Thr Ala Lys Tyr Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe Lys
1025 1030 1035

Thr Glu Ile Thr Leu Ala Asn Gly Glu Ile Arg Lys Arg Pro Leu
1040 1045 1050

Ile Glu Thr Asn Gly Glu Thr Gly Glu Ile Val Trp Asp Lys Gly
1055 1060 1065

Arg Asp Phe Ala Thr Val Arg Lys Val Leu Ser Met Pro Gln Val
1070 1075 1080

Asn Ile Val Lys Lys Thr Glu Val Gln Thr Gly Gly Phe Ser Lys
1085 1090 1095

Glu Ser Ile Leu Pro Lys Arg Asn Ser Asp Lys Leu Ile Ala Arg
1100 1105 1110

Lys Lys Asp Trp Asp Pro Lys Lys Tyr Gly Gly Phe Asp Ser Pro
1115 1120 1125

Thr Val Ala Tyr Ser Val Leu Val Val Ala Lys Val Glu Lys Gly
1130 1135 1140

Lys Ser Lys Lys Leu Lys Ser Val Lys Glu Leu Leu Gly Ile Thr
1145 1150 1155

Ile Met Glu Arg Ser Ser Phe Glu Lys Asn Pro Ile Asp Phe Leu
1160 1165 1170

Glu Ala Lys Gly Tyr Lys Glu Val Arg Lys Asp Leu Ile Ile Lys
1175 1180 1185

Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu Asn Gly Arg Lys Arg

```
    1190                1195                1200

Met Leu  Ala Ser Gly Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu
    1205                1210                1215

Pro Ser  Lys Tyr Val Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu
    1220                1225                1230

Lys Leu  Lys Gly Ser Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe
    1235                1240                1245

Val Glu  Gln His Lys His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile
    1250                1255                1260

Ser Glu  Phe Ser Lys Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp
    1265                1270                1275

Lys Val  Leu Ser Ala Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg
    1280                1285                1290

Glu Gln  Ala Lys Asn Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu
    1295                1300                1305

Gly Ala  Pro Ala Ala Phe Lys  Tyr Phe Asp Thr Thr  Ile Glu Arg
    1310                1315                1320

Asn Arg  Tyr Lys Ser Ile Lys  Glu Val Leu Asp Ala  Thr Leu Ile
    1325                1330                1335

His Gln  Ser Ile Thr Gly Leu  Tyr Glu Ile Arg Ile  Asp Leu Ser
    1340                1345                1350

Gln Leu  Gly Gly Asp
    1355
```

<210> 41
<211> 1359
<212> PRT
<213> Streptococcus pyogenes

<400> 41

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205
```

```
Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Ser Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415
```

```
Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620
```

```
Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Leu Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830
```

```
Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035
```

```
Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Arg Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230
```

```
Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                 1240                 1245


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                 1255                 1260


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                 1270                 1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                 1285                 1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                 1300                 1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Gly
    1310                 1315                 1320


Arg Asn  Arg Tyr Lys Ser Ile  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                 1330                 1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                 1345                 1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  42
<211>  1359
<212>  PRT
<213>  Streptococcus pyogenes

<400>  42

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Arg His Gly Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240
```

```
Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Thr Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445
```

```
Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655
```

```
Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860
```

```
Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880


Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895


Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910


Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925


Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940


Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960


Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975


Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990


Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005


Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020


Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050


Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065
```

```
Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080


Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095


Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110


Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125


Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140


Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155


Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170


Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Arg Lys Asp  Leu Ile Ile
    1175                1180                1185


Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200


Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215


Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230


Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260
```

```
Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                 1270                 1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                 1285                 1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                 1300                 1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                 1315                 1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                 1330                 1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                 1345                 1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  43
<211>  1359
<212>  PRT
<213>  Streptococcus pyogenes

<400>  43

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270
```

```
Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480
```

```
Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685
```

```
Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Lys Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895
```

```
Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095
```

```
Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Arg Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290
```

```
Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Phe Gly  Ala Pro Ala Ala Phe  Ile Tyr Phe Asp Thr  Thr Ile Gly
    1310                1315                1320


Arg Asn  Arg Tyr Lys Ser Ile  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  44
<211>  1359
<212>  PRT
<213>  Streptococcus pyogenes

<400>  44

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Ile Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
```

100 105 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
115 120 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
130 135 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145 150 155 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
165 170 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
180 185 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
195 200 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
210 215 220

Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn Leu
225 230 235 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
245 250 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
260 265 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
275 280 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
290 295 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met

305 310 315 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
325 330 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
340 345 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
355 360 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
370 375 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385 390 395 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
405 410 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
420 425 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
435 440 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
450 455 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465 470 475 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
485 490 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
500 505 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr

515 520 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
530 535 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545 550 555 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
565 570 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
580 585 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
595 600 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
610 615 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625 630 635 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
645 650 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
660 665 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
675 680 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
690 695 700

Asp Leu Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705 710 715 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu

725 730 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
740 745 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
755 760 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
770 775 780

Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro Val Glu
785 790 795 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
805 810 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
820 825 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
835 840 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
850 855 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865 870 875 880

Trp Lys Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
885 890 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
900 905 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
915 920 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn

```
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Ile Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
```

1130 1135 1140

Gly Lys Ser Lys Lys Leu Lys Ser Val Lys Glu Leu Val Gly Ile
1145 1150 1155

Thr Ile Met Glu Arg Ser Ser Phe Glu Lys Asp Pro Val Asp Phe
1160 1165 1170

Leu Glu Ala Lys Gly Tyr Lys Glu Val Arg Lys Asp Leu Ile Ile
1175 1180 1185

Lys Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu Asn Gly Arg Lys
1190 1195 1200

Arg Met Leu Ala Ser Gly Glu Leu Gln Lys Gly Asn Glu Leu Ala
1205 1210 1215

Leu Pro Ser Lys Tyr Val Asn Phe Leu Tyr Leu Ala Ser His Tyr
1220 1225 1230

Glu Lys Leu Lys Gly Ser Pro Glu Asp Asn Glu Gln Lys Gln Leu
1235 1240 1245

Phe Val Glu Gln His Lys His Tyr Leu Asp Glu Ile Ile Glu Gln
1250 1255 1260

Ile Ser Glu Phe Ser Lys Arg Val Ile Leu Ala Asp Ala Asn Leu
1265 1270 1275

Asp Lys Val Leu Ser Ala Tyr Asn Lys His Arg Asp Lys Pro Ile
1280 1285 1290

Arg Glu Gln Ala Glu Asn Ile Ile His Leu Phe Thr Leu Thr Asn
1295 1300 1305

Leu Gly Ala Pro Ala Ala Phe Lys Tyr Phe Asp Thr Thr Ile Gly
1310 1315 1320

Arg Asn Arg Tyr Lys Ser Ile Lys Glu Val Leu Asp Ala Thr Leu

1325 1330 1335

Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu
1340 1345 1350

Ser Gln Leu Gly Gly Asp
1355

<210> 45
<211> 1359
<212> PRT
<213> Streptococcus pyogenes

<400> 45

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
20 25 30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Ile Ala Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
100 105 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
115 120 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
130 135 140

```
Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gly Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350
```

```
Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560
```

```
Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Leu Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765
```

```
Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Lys Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975
```

```
Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Ile Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Val Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asp Pro  Val Asp Phe
    1160                1165                1170
```

```
Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Arg Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Gly
    1310                1315                1320

Arg Asn  Arg Tyr Lys Ser Ile  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350

Ser Gln  Leu Gly Gly Asp
    1355
```

<210> 46
<211> 1359
<212> PRT
<213> Streptococcus pyogenes

<400> 46

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140


Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175
```

```
Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Asn Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380
```

```
Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590
```

```
Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800
```

```
Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005
```

```
Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200
```

```
Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                 1210                 1215


Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                 1225                 1230


Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                 1240                 1245


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                 1255                 1260


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                 1270                 1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                 1285                 1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                 1300                 1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                 1315                 1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                 1330                 1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                 1345                 1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  47
<211>  1359
<212>  PRT
<213>  Streptococcus pyogenes

<400>  47
```

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205
```

```
Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Leu Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415
```

```
Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620
```

```
Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Lys Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830
```

```
Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Lys Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Arg Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035
```

```
Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Arg Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230
```

```
Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  48
<211>  1359
<212>  PRT
<213>  Streptococcus pyogenes

<400>  48

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
```

```
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Ile Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
```

245 250 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
260 265 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
275 280 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
290 295 300

Leu Arg Leu Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305 310 315 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
325 330 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
340 345 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
355 360 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
370 375 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Lys Asp Leu Leu Arg Lys
385 390 395 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
405 410 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
420 425 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
435 440 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met

```
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
```

660 665 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
675 680 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
690 695 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705 710 715 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
725 730 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
740 745 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
755 760 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
770 775 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785 790 795 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
805 810 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
820 825 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp
835 840 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
850 855 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr

865 870 875 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
885 890 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
900 905 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
915 920 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
930 935 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945 950 955 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
965 970 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
980 985 990

Thr Ala Leu Ile Lys Lys Tyr Pro Lys Leu Glu Ser Glu Phe Val Tyr
995 1000 1005

Gly Asp Tyr Lys Val Tyr Asp Val Ser Glu Gln Glu Ile Gly Lys
1010 1015 1020

Ala Thr Ala Lys Tyr Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe
1025 1030 1035

Lys Thr Glu Ile Thr Leu Ala Asn Gly Glu Ile Arg Lys Arg Pro
1040 1045 1050

Leu Ile Glu Thr Asn Gly Glu Thr Gly Glu Ile Val Trp Asp Lys
1055 1060 1065

Gly Arg Asp Phe Ala Thr Val Arg Lys Val Leu Ser Met Pro Gln

```
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Arg Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
```

1265 1270 1275

Asp Lys Val Leu Ser Ala Tyr Asn Lys His Arg Asp Lys Pro Ile
1280 1285 1290

Arg Glu Gln Ala Glu Asn Ile Ile His Leu Phe Thr Leu Thr Asn
1295 1300 1305

Leu Gly Ala Pro Thr Ala Phe Lys Tyr Phe Asp Thr Thr Ile Asp
1310 1315 1320

Arg Lys Arg Tyr Thr Ser Thr Lys Glu Val Leu Asp Ala Thr Phe
1325 1330 1335

Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu
1340 1345 1350

Ser Gln Leu Gly Gly Asp
1355

<210> 49
<211> 1184
<212> PRT
<213> Streptococcus pyogenes

<400> 49

Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr
1 5 10 15

Tyr Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala
20 25 30

Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn
35 40 45

Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn
50 55 60

Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe
65 70 75 80

```
Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp
                85                  90                  95

Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
            100                 105                 110

Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
        115                 120                 125

Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser
    130                 135                 140

Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys
145                 150                 155                 160

Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe
                165                 170                 175

Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser
            180                 185                 190

Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp
        195                 200                 205

Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg
    210                 215                 220

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
225                 230                 235                 240

Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe
                245                 250                 255

Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
            260                 265                 270

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp
        275                 280                 285
```

```
Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu
    290                 295                 300

Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr
305                 310                 315                 320

Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
                325                 330                 335

Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
            340                 345                 350

Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln
        355                 360                 365

Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr
    370                 375                 380

Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp
385                 390                 395                 400

Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly
                405                 410                 415

Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp
            420                 425                 430

Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr
        435                 440                 445

Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala
    450                 455                 460

His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr
465                 470                 475                 480

Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp
                485                 490                 495
```

```
Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala
            500                 505                 510

Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys
        515                 520                 525

Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His
    530                 535                 540

Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
545                 550                 555                 560

Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg
                565                 570                 575

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
            580                 585                 590

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
        595                 600                 605

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
    610                 615                 620

Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
625                 630                 635                 640

Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
                645                 650                 655

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp
            660                 665                 670

Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
        675                 680                 685

Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
    690                 695                 700
```

```
Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
705                 710                 715                 720

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
                725                 730                 735

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
            740                 745                 750

His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
        755                 760                 765

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
    770                 775                 780

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
785                 790                 795                 800

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
                805                 810                 815

Gly Thr Ala Leu Ile Lys Lys Tyr Pro Lys Leu Glu Ser Glu Phe Val
            820                 825                 830

Tyr Gly Asp Tyr Lys Val Tyr Asp Val Ser Glu Gln Glu Ile Gly Lys
        835                 840                 845

Ala Thr Ala Lys Tyr Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe Lys
    850                 855                 860

Thr Glu Ile Thr Leu Ala Asn Gly Glu Ile Arg Lys Arg Pro Leu Ile
865                 870                 875                 880

Glu Thr Asn Gly Glu Thr Gly Glu Ile Val Trp Asp Lys Gly Arg Asp
                885                 890                 895

Phe Ala Thr Val Arg Lys Val Leu Ser Met Pro Gln Val Asn Ile Val
            900                 905                 910
```

```
Lys Lys Thr Glu Val Gln Thr Gly Gly Phe Ser Lys Glu Ser Ile Leu
        915                 920                 925

Pro Lys Arg Asn Ser Asp Lys Leu Ile Ala Arg Lys Lys Asp Trp Asp
    930                 935                 940

Pro Lys Lys Tyr Gly Gly Phe Asp Ser Pro Thr Val Ala Tyr Ser Val
945                 950                 955                 960

Leu Val Val Ala Lys Val Glu Lys Gly Lys Ser Lys Lys Leu Lys Ser
                965                 970                 975

Val Lys Glu Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Ser Phe Glu
            980                 985                 990

Lys Asn Pro Ile Asp Phe Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys
        995                 1000                1005

Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu
    1010                1015                1020

Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys
    1025                1030                1035

Gly Asn  Glu Leu Ala Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr
    1040                1045                1050

Leu Ala  Ser His Tyr Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn
    1055                1060                1065

Glu Gln  Lys Gln Leu Phe Val  Glu Gln His Lys His  Tyr Leu Asp
    1070                1075                1080

Glu Ile  Ile Glu Gln Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu
    1085                1090                1095

Ala Asp  Ala Asn Leu Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His
    1100                1105                1110
```

```
Arg Asp  Lys Pro Ile Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu
    1115                1120                1125


Phe Thr  Leu Thr Asn Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe
    1130                1135                1140


Asp Thr  Thr Ile Asp Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val
    1145                1150                1155


Leu Asp  Ala Thr Leu Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu
    1160                1165                1170


Thr Arg  Ile Asp Leu Ser Gln  Leu Gly Gly Asp
    1175                1180
```

<210> 50
<211> 1359
<212> PRT
<213> Streptococcus pyogenes

<400> 50

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Thr Leu Leu Ser Asp Ile
    290                 295                 300
```

```
Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510
```

```
Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720
```

```
His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
               725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925
```

```
Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125
```

```
Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140


Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155


Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170


Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Arg Lys Asp  Leu Ile Ile
    1175                1180                1185


Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200


Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215


Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230


Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320
```

```
Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  51
<211>  1358
<212>  PRT
<213>  Streptococcus pyogenes

<400>  51

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125
```

```
His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Thr Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335
```

```
Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540
```

```
Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560


Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575


Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Thr Ser Leu Gly Thr
            580                 585                 590


Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605


Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620


Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Lys Tyr Ala Asn
625                 630                 635                 640


Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr Thr
                645                 650                 655


Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670


Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685


Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700


Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu His Glu
705                 710                 715                 720


Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735


Gln Thr Val Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His Lys
            740                 745                 750
```

```
Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Gln
        755                 760                 765

Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu Gly
    770                 775                 780

Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu Asn
785                 790                 795                 800

Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp
            820                 825                 830

Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp Ser
        835                 840                 845

Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
865                 870                 875                 880

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn Asp
    930                 935                 940

Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val
945                 950                 955                 960
```

```
Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile Asn
               965                 970                 975

Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
            980                 985                 990

Ala Leu Ile Lys Lys Tyr Pro Lys  Leu Glu Ser Glu Phe  Val Tyr Gly
        995                 1000                1005

Asp Tyr  Lys Val Tyr Asp Val  Ser Glu Gln Glu Ile  Gly Lys Ala
    1010                1015                1020

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1025                1030                1035

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1040                1045                1050

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1055                1060                1065

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1070                1075                1080

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1085                1090                1095

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1100                1105                1110

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1115                1120                1125

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1130                1135                1140

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1145                1150                1155
```

```
Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1160                1165                1170

Glu Ala  Lys Gly Tyr Lys Glu  Val Arg Lys Asp Leu  Ile Ile Lys
    1175                1180                1185

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1190                1195                1200

Met Leu  Ala Ser Gly Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu
    1205                1210                1215

Pro Ser  Lys Tyr Val Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu
    1220                1225                1230

Lys Leu  Lys Gly Ser Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe
    1235                1240                1245

Val Glu  Gln His Lys His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile
    1250                1255                1260

Ser Glu  Phe Ser Lys Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp
    1265                1270                1275

Lys Val  Leu Ser Ala Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg
    1280                1285                1290

Glu Gln  Ala Lys Asn Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu
    1295                1300                1305

Gly Ala  Pro Ala Ala Phe Lys  Tyr Phe Asp Thr Thr  Ile Glu Arg
    1310                1315                1320

Asn Arg  Tyr Lys Ser Ile Lys  Glu Val Leu Asp Ala  Thr Leu Ile
    1325                1330                1335

His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser
    1340                1345                1350
```

Gln Leu Gly Gly Asp
    1355

<210> 52
<211> 1359
<212> PRT
<213> Streptococcus pyogenes

<400> 52

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20   25   30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100   105   110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115   120   125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130   135   140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145   150   155   160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro

165 170 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
180 185 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
195 200 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
210 215 220

Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn Leu
225 230 235 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
245 250 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
260 265 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
275 280 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
290 295 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305 310 315 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
325 330 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
340 345 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
355 360 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly

370 375 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385 390 395 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
405 410 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
420 425 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
435 440 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
450 455 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465 470 475 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
485 490 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
500 505 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
515 520 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
530 535 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545 550 555 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
565 570 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr

580 585 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
595 600 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
610 615 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625 630 635 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
645 650 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
660 665 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
675 680 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
690 695 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705 710 715 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
725 730 735

Gln Thr Val Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Arg His
740 745 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
755 760 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
770 775 780

Gly Ile Lys Glu Leu Gly Ser Asp Ile Leu Lys Glu Tyr Pro Val Glu

785 790 795 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
805 810 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
820 825 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
835 840 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
850 855 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865 870 875 880

Trp Lys Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
885 890 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
900 905 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
915 920 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
930 935 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945 950 955 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
965 970 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
980 985 990

Thr Ala Leu Ile Lys Lys Tyr Pro Lys Leu Glu Ser Glu Phe Val Tyr

995 1000 1005

Gly Asp Tyr Lys Val Tyr Asp Val Ser Glu Gln Glu Ile Gly Lys
1010 1015 1020

Ala Thr Ala Lys Tyr Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe
1025 1030 1035

Lys Thr Glu Ile Thr Leu Ala Asn Gly Glu Ile Arg Lys Arg Pro
1040 1045 1050

Leu Ile Glu Thr Asn Gly Glu Thr Gly Glu Ile Val Trp Asp Lys
1055 1060 1065

Gly Arg Asp Phe Ala Thr Val Arg Lys Val Leu Ser Met Pro Gln
1070 1075 1080

Val Asn Ile Val Lys Lys Thr Glu Val Gln Thr Gly Gly Phe Ser
1085 1090 1095

Lys Glu Ser Ile Leu Pro Lys Arg Asn Ser Asp Lys Leu Ile Ala
1100 1105 1110

Arg Lys Lys Asp Trp Asp Pro Lys Lys Tyr Gly Gly Phe Asp Ser
1115 1120 1125

Pro Thr Val Ala Tyr Ser Val Leu Val Val Ala Lys Val Glu Lys
1130 1135 1140

Gly Lys Ser Lys Lys Leu Lys Ser Val Lys Glu Leu Leu Gly Ile
1145 1150 1155

Thr Ile Met Glu Arg Ser Ser Phe Glu Lys Asn Pro Ile Asp Phe
1160 1165 1170

Leu Glu Ala Lys Gly Tyr Lys Glu Val Arg Lys Asp Leu Ile Ile
1175 1180 1185

Lys Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu Asn Gly Arg Lys

```
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Gly
    1310                1315                1320

Arg Asn  Arg Tyr Lys Ser Ile  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350

Ser Gln  Leu Gly Gly Asp
    1355


<210>  53
<211>  1270
<212>  PRT
<213>  Streptococcus pyogenes
```

<400> 53

```
Met Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe
1               5                  10                  15

Leu Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn
            20                  25                  30

Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His
        35                  40                  45

Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu
    50                  55                  60

Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu
65                  70                  75                  80

Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe
                85                  90                  95

Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Ile Asn
            100                 105                 110

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
        115                 120                 125

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
    130                 135                 140

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
145                 150                 155                 160

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
                165                 170                 175

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
            180                 185                 190

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
        195                 200                 205
```

```
Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
    210                 215                 220

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
225                 230                 235                 240

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
                245                 250                 255

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
            260                 265                 270

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
        275                 280                 285

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
    290                 295                 300

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
305                 310                 315                 320

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
                325                 330                 335

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
            340                 345                 350

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
        355                 360                 365

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
    370                 375                 380

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
385                 390                 395                 400

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
                405                 410                 415
```

```
Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
            420                 425                 430

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
        435                 440                 445

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
    450                 455                 460

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
465                 470                 475                 480

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
                485                 490                 495

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
            500                 505                 510

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
        515                 520                 525

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
    530                 535                 540

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
545                 550                 555                 560

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
                565                 570                 575

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
            580                 585                 590

Leu Lys Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp
        595                 600                 605

Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly
    610                 615                 620
```

```
Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro
625                 630                 635                 640

Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu
                645                 650                 655

Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu Met
            660                 665                 670

Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu
        675                 680                 685

Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile
    690                 695                 700

Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu
705                 710                 715                 720

Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr Val Asp Gln Glu
                725                 730                 735

Leu Asp Ile Asn Arg Leu Ser Asp Tyr Asp Val Asp His Ile Val Pro
            740                 745                 750

Gln Ser Phe Leu Lys Asp Asp Ser Ile Asp Asn Lys Val Leu Thr Arg
        755                 760                 765

Ser Asp Lys Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val
    770                 775                 780

Val Lys Lys Met Lys Asn Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu
785                 790                 795                 800

Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly
                805                 810                 815

Leu Ser Glu Leu Asp Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu
            820                 825                 830
```

```
Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ser Arg Met
        835                 840                 845

Asn Thr Lys Tyr Asp Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val
    850                 855                 860

Ile Thr Leu Lys Ser Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln
865                 870                 875                 880

Phe Tyr Lys Val Arg Glu Ile Asn Asn Tyr His His Ala His Asp Ala
                885                 890                 895

Tyr Leu Asn Ala Val Val Gly Thr Ala Leu Ile Lys Lys Tyr Pro Lys
            900                 905                 910

Leu Glu Ser Glu Phe Val Tyr Gly Asp Tyr Lys Val Tyr Asp Val Ser
        915                 920                 925

Glu Gln Glu Ile Gly Lys Ala Thr Ala Lys Tyr Phe Phe Tyr Ser Asn
    930                 935                 940

Ile Met Asn Phe Phe Lys Thr Glu Ile Thr Leu Ala Asn Gly Glu Ile
945                 950                 955                 960

Arg Lys Arg Pro Leu Ile Glu Thr Asn Gly Glu Thr Gly Glu Ile Val
                965                 970                 975

Trp Asp Lys Gly Arg Asp Phe Ala Thr Val Arg Lys Val Leu Ser Met
            980                 985                 990

Pro Gln Val Asn Ile Val Lys Lys  Thr Glu Val Gln Thr  Gly Gly Phe
        995                 1000                1005

Ser Lys  Glu Ser Ile Leu Pro  Lys Arg Asn Ser Asp  Lys Leu Ile
    1010                1015                1020

Ala Arg  Lys Lys Asp Trp Asp  Pro Lys Lys Tyr Gly  Gly Phe Asp
    1025                1030                1035
```

```
Ser Pro  Thr Val Ala Tyr Ser  Val Leu Val Val Ala  Lys Val Glu
    1040                1045                1050

Lys Gly  Lys Ser Lys Lys Leu  Lys Ser Val Lys Glu  Leu Leu Gly
    1055                1060                1065

Ile Thr  Ile Met Glu Arg Ser  Ser Phe Glu Lys Asn  Pro Ile Asp
    1070                1075                1080

Phe Leu  Glu Ala Lys Gly Tyr  Lys Glu Val Lys Lys  Asp Leu Ile
    1085                1090                1095

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Gly Arg
    1100                1105                1110

Lys Arg  Met Leu Ala Ser Gly  Glu Leu Gln Lys Gly  Asn Glu Leu
    1115                1120                1125

Ala Leu  Pro Ser Lys Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His
    1130                1135                1140

Tyr Glu  Lys Leu Lys Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln
    1145                1150                1155

Leu Phe  Val Glu Gln His Lys  His Tyr Leu Asp Glu  Ile Ile Glu
    1160                1165                1170

Gln Ile  Ser Glu Phe Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn
    1175                1180                1185

Leu Asp  Lys Val Leu Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro
    1190                1195                1200

Ile Arg  Glu Gln Ala Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr
    1205                1210                1215

Asn Leu  Gly Ala Pro Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile
    1220                1225                1230
```

```
Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr
    1235                 1240                 1245


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1250                 1255                 1260


Leu Ser  Gln Leu Gly Gly Asp
    1265                 1270


<210>  54
<211>  536
<212>  PRT
<213>  Streptococcus pyogenes

<400>  54

Gln Glu Leu Asp Ile Asn Arg Leu Ser Gly Tyr Asp Val Asp His Ile
1               5                   10                  15


Val Pro Gln Ser Phe Leu Lys Asp Asp Ser Ile Asp Asn Lys Val Leu
            20                  25                  30


Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Glu
        35                  40                  45


Glu Val Val Lys Lys Met Lys Asn Tyr Trp Arg Gln Leu Leu Asn Ala
    50                  55                  60


Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg
65                  70                  75                  80


Gly Gly Leu Ser Glu Leu Asp Lys Val Gly Phe Ile Lys Arg Gln Leu
                85                  90                  95


Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile Leu Asp Ser
            100                 105                 110


Arg Met Asn Thr Lys Tyr Asp Glu Asn Asp Lys Leu Ile Arg Glu Val
        115                 120                 125
```

```
Arg Val Ile Thr Leu Lys Ser Lys Leu Val Ser Asp Phe Arg Lys Asp
    130                 135                 140

Phe Gln Phe Tyr Lys Val Arg Glu Ile Asn Asn Tyr His His Ala His
145                 150                 155                 160

Asp Ala Tyr Leu Asn Ala Val Val Gly Thr Ala Leu Ile Lys Lys Tyr
                165                 170                 175

Pro Lys Leu Glu Ser Glu Phe Val Tyr Gly Asp Tyr Lys Val Tyr Asp
            180                 185                 190

Val Ser Glu Gln Glu Ile Gly Lys Ala Thr Ala Lys Tyr Phe Phe Tyr
        195                 200                 205

Ser Asn Ile Met Asn Phe Phe Lys Thr Glu Ile Thr Leu Ala Asn Gly
    210                 215                 220

Glu Ile Arg Lys Arg Pro Leu Ile Glu Thr Asn Gly Glu Thr Gly Glu
225                 230                 235                 240

Ile Val Trp Asp Lys Gly Arg Asp Phe Ala Thr Val Arg Lys Val Leu
                245                 250                 255

Ser Met Pro Gln Val Asn Ile Val Lys Lys Thr Glu Val Gln Thr Gly
            260                 265                 270

Gly Phe Ser Lys Glu Ser Ile Leu Pro Lys Arg Asn Ser Asp Lys Leu
        275                 280                 285

Ile Ala Arg Lys Lys Asp Trp Asp Pro Lys Lys Tyr Gly Gly Phe Asp
    290                 295                 300

Ser Pro Thr Val Ala Tyr Ser Val Leu Val Val Ala Lys Val Glu Lys
305                 310                 315                 320

Gly Lys Ser Lys Lys Leu Lys Ser Val Lys Glu Leu Leu Gly Ile Thr
                325                 330                 335
```

```
Ile Met Glu Arg Ser Ser Phe Glu Lys Asp Pro Ile Asp Phe Leu Glu
            340                 345                 350

Ala Lys Gly Tyr Lys Glu Val Arg Lys Asp Leu Ile Ile Lys Leu Pro
        355                 360                 365

Lys Tyr Ser Leu Phe Glu Leu Glu Asn Gly Arg Lys Arg Met Leu Ala
    370                 375                 380

Ser Gly Glu Leu Gln Lys Gly Asn Glu Leu Ala Leu Pro Ser Lys Tyr
385                 390                 395                 400

Val Asn Phe Leu Tyr Leu Ala Ser His Tyr Glu Lys Leu Lys Gly Ser
                405                 410                 415

Pro Glu Asp Asn Glu Gln Lys Gln Leu Phe Val Glu Gln His Lys His
            420                 425                 430

Tyr Leu Asp Glu Ile Ile Glu Gln Ile Ser Glu Phe Ser Lys Arg Val
        435                 440                 445

Ile Leu Ala Asp Ala Asn Leu Asp Lys Val Leu Ser Ala Tyr Asn Lys
    450                 455                 460

His Arg Asp Lys Pro Ile Arg Glu Gln Ala Glu Asn Ile Ile His Leu
465                 470                 475                 480

Phe Thr Leu Thr Asn Leu Gly Ala Pro Ala Ala Phe Lys Tyr Phe Asp
                485                 490                 495

Thr Thr Ile Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu Val Leu Asp
            500                 505                 510

Ala Thr Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile
        515                 520                 525

Asp Leu Ser Gln Leu Gly Gly Asp
    530                 535
```

<210> 55
<211> 305
<212> PRT
<213> Streptococcus pyogenes

<400> 55

```
Ile Glu Thr Asn Gly Glu Thr Gly Glu Ile Val Trp Asp Lys Gly Arg
1               5                  10                  15


Asp Phe Ala Thr Val Arg Lys Val Leu Ser Met Pro Gln Val Asn Ile
            20                  25                  30


Val Lys Lys Thr Glu Val Gln Thr Gly Gly Phe Ser Lys Glu Ser Ile
        35                  40                  45


Leu Pro Lys Arg Asn Ser Asp Lys Leu Ile Ala Arg Lys Lys Asp Trp
    50                  55                  60


Asp Pro Lys Lys Tyr Gly Gly Phe Asp Ser Pro Thr Val Ala Tyr Ser
65                  70                  75                  80


Val Leu Val Val Ala Lys Val Glu Lys Gly Lys Ser Lys Lys Leu Lys
                85                  90                  95


Ser Val Lys Glu Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Ser Phe
            100                 105                 110


Glu Lys Asp Pro Ile Asp Phe Leu Glu Ala Lys Gly Tyr Lys Glu Val
        115                 120                 125


Arg Lys Asp Leu Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Glu Leu
    130                 135                 140


Glu Asn Gly Arg Lys Arg Met Leu Ala Ser Gly Glu Leu Gln Lys Gly
145                 150                 155                 160


Asn Glu Leu Ala Leu Pro Ser Lys Tyr Val Asn Phe Leu Tyr Leu Ala
                165                 170                 175
```

```
Ser His Tyr Glu Lys Leu Lys Gly Ser Pro Glu Asp Asn Glu Gln Lys
            180                 185                 190


Gln Leu Phe Val Glu Gln His Lys His Tyr Leu Asp Glu Ile Ile Glu
        195                 200                 205


Gln Ile Ser Glu Phe Ser Lys Arg Val Ile Leu Ala Asp Ala Asn Leu
    210                 215                 220


Asp Lys Val Leu Ser Ala Tyr Asn Lys His Arg Asp Lys Pro Ile Arg
225                 230                 235                 240


Glu Gln Ala Glu Asn Ile Ile His Leu Phe Thr Leu Thr Asn Leu Gly
                245                 250                 255


Ala Pro Ala Ala Phe Lys Tyr Phe Asp Thr Thr Ile Asp Arg Lys Arg
            260                 265                 270


Tyr Thr Ser Thr Lys Glu Val Leu Asp Ala Thr Leu Ile His Gln Ser
        275                 280                 285


Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ser Gln Leu Gly Gly
    290                 295                 300


Asp
305


<210>  56
<211>  1359
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  56

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Ile Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240
```

```
Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Leu Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445
```

```
Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655
```

```
Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860
```

```
Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065
```

```
Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Arg Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260
```

```
Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Leu Gly  Ala Pro Thr Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Phe
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  57
<211>  1341
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  57

Met Asp Gln Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Gln Ser Ile Lys Lys Asn Leu Leu
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Asn Lys Val Asp Glu Asn
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Asp Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Ile Ala Ala Glu Val Lys Tyr
        115                 120                 125

His Asp Asp Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ile Ser Gln Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asn Val Gln Ala Leu Phe Lys Asp Phe Val Glu Val Tyr
            180                 185                 190

Asp Lys Thr Val Glu Glu Ser His Leu Ser Glu Met Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala His Tyr Pro Ala Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255
```

```
Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Gly Leu Leu Gly Glu Ile Gly Asp Glu Tyr Ala Asp
        275                 280                 285

Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Glu Glu His Gln Lys Asp Leu Lys Lys Leu Lys
                325                 330                 335

Asp Phe Ile Lys Val Asn Ala Pro Asp Gln Tyr Asn Ala Ile Phe Lys
            340                 345                 350

Asp Lys Asn Lys Lys Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Gly Ile Leu Leu Gln Ile Asn
    370                 375                 380

Gly Ser Gly Asp Phe Leu Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Glu Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp
    450                 455                 460
```

```
Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465                 470                 475                 480


Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495


Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510


Leu Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525


Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Ala Asn Met Lys
    530                 535                 540


Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560


Asp Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575


Val Asn Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ser Ser
            580                 585                 590


Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Ser Phe Leu
        595                 600                 605


Asp Asp Lys Ala Asn Glu Lys Thr Ile Glu Asp Ile Ile Gln Thr Leu
    610                 615                 620


Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr
625                 630                 635                 640


Ser Asp Ile Phe Thr Lys Ala Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655


Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670
```

```
Asn Lys Glu Asn Lys Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Arg Ala Gln Ile Ile Gly Asp Val Asp Asp
705                 710                 715                 720

Ile Ala Asn Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly His Asn Pro Ala Asn Ile Ile Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Met Thr Asp Lys Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu
    770                 775                 780

Gln Asp Ser Leu Lys Pro Val Asn Ile Lys Asn Val Glu Asn Gln Gln
785                 790                 795                 800

Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp
                805                 810                 815

Met Tyr Thr Gly Glu Thr Leu Asp Ile Asn Asn Leu Ser Gln Tyr Asp
            820                 825                 830

Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Leu Asp
        835                 840                 845

Asn Arg Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser Asp Asp
    850                 855                 860

Val Pro Ser Ile Glu Val Val His Glu Met Lys Ser Phe Trp Ser Lys
865                 870                 875                 880
```

```
Leu Leu Ser Val Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr
                885                 890                 895


Lys Ala Glu Arg Gly Gly Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile
            900                 905                 910


Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln
        915                 920                 925


Ile Leu Asp Glu Arg Phe Asn Thr Glu Phe Asp Gly Asn Lys Arg Arg
    930                 935                 940


Ile Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val Ser Asn
945                 950                 955                 960


Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr
                965                 970                 975


His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Asn Ala Leu
            980                 985                 990


Leu Leu Lys Tyr Pro Gln Leu Glu  Pro Glu Phe Val Tyr  Gly Glu Tyr
        995                 1000                1005


Pro Lys  Tyr Asn Ser Tyr Arg  Ser Arg Lys Ser Ala  Thr Glu Lys
    1010                1015                1020


Phe Leu  Phe Tyr Ser Asn Ile  Leu Arg Phe Phe Lys  Lys Glu Asp
    1025                1030                1035


Ile Gln  Thr Asn Glu Asp Gly  Glu Ile Ala Trp Asn  Lys Glu Lys
    1040                1045                1050


His Ile  Lys Ile Leu Arg Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1055                1060                1065


Ile Val  Lys Lys Thr Glu Glu  Gln Thr Gly Gly Phe  Ser Lys Glu
    1070                1075                1080
```

```
Ser Ile  Leu Pro Lys Gly Glu  Ser Asp Lys Leu Ile  Pro Arg Lys
    1085                1090                1095

Thr Lys  Asn Ser Tyr Trp Asn  Pro Lys Lys Tyr Gly  Gly Phe Asp
    1100                1105                1110

Ser Pro  Val Val Ala Tyr Ser  Ile Leu Val Phe Ala  Asp Val Glu
    1115                1120                1125

Lys Gly  Lys Ser Lys Lys Leu  Arg Lys Val Gln Asp  Met Val Gly
    1130                1135                1140

Ile Thr  Ile Met Glu Lys Lys  Arg Phe Glu Lys His  Pro Val Asp
    1145                1150                1155

Phe Leu  Glu Gln Arg Gly Tyr  Arg Asn Val Arg Leu  Glu Lys Ile
    1160                1165                1170

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Lys Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Arg Glu Leu Gln Lys  Gly Asn Glu
    1190                1195                1200

Leu Val  Ile Pro Gln Arg Phe  Thr Thr Leu Leu Tyr  His Ser Tyr
    1205                1210                1215

Gln Ile  Glu Lys Asn Tyr Glu  Pro Glu His Arg Glu  Tyr Val Glu
    1220                1225                1230

Lys His  Lys Asp Glu Phe Lys  Glu Leu Leu Glu Tyr  Ile Ser Val
    1235                1240                1245

Phe Ser  Arg Lys Tyr Val Leu  Ala Asp Asn Asn Leu  Thr Lys Ile
    1250                1255                1260

Glu Met  Leu Phe Ser Lys Asn  Lys Asp Ala Glu Val  Ser Ser Leu
    1265                1270                1275
```

Ala Lys Ser Phe Ile Ser Leu Leu Thr Phe Thr Ala Phe Gly Ala
    1280   1285   1290

Pro Ala Ala Phe Asn Phe Phe Gly Glu Asn Ile Asp Arg Lys Arg
    1295   1300   1305

Tyr Thr Ser Val Thr Glu Cys Leu Asn Ala Thr Leu Ile His Gln
    1310   1315   1320

Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ser Lys Leu
    1325   1330   1335

Gly Glu Asp
    1340

<210> 58
<211> 1356
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 58

Met Thr Lys Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1   5   10   15

Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys
            20   25   30

Met Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu
        35   40   45

Leu Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg
    50   55   60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65   70   75   80

Arg Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Thr Lys Val Asp Glu
                85   90   95

```
Ser Phe Phe Gln Arg Leu Asp Glu Ser Phe Leu Arg Trp Asp Asp Asp
            100                 105                 110

Asn Lys Lys Leu Gly Arg Tyr Pro Ile Phe Gly Asn Lys Ala Asp Val
        115                 120                 125

Val Lys Tyr His Gln Glu Phe Pro Thr Ile Tyr His Leu Arg Lys His
    130                 135                 140

Leu Ala Asp Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala
145                 150                 155                 160

Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu
                165                 170                 175

Leu Asn Ala Glu Asn Thr Asp Val Gln Lys Ile Phe Ala Asp Phe Val
            180                 185                 190

Gly Val Tyr Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr
        195                 200                 205

Val Asp Ala Ala Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg
    210                 215                 220

Leu Glu Asn Leu Ile Lys Tyr Tyr Pro Thr Glu Lys Lys Asn Thr Leu
225                 230                 235                 240

Phe Gly Asn Leu Ile Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys
                245                 250                 255

Met Asn Phe Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp
            260                 265                 270

Ser Tyr Glu Glu Asp Leu Gly Glu Leu Leu Gly Lys Ile Gly Asp Asp
        275                 280                 285

Tyr Ala Asp Leu Phe Thr Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu
    290                 295                 300
```

```
Leu Ser Gly Ile Leu Ile Val Asp Asp Asn Ser Thr Lys Ala Pro Leu
305                 310                 315                 320

Ser Ala Ser Met Ile Lys Arg Tyr Val Glu His Gln Glu Asp Leu Glu
                325                 330                 335

Lys Leu Lys Glu Phe Ile Lys Ala Asn Lys Ser Glu Leu Tyr His Asp
            340                 345                 350

Ile Phe Lys Asp Lys Asn Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn
        355                 360                 365

Gly Val Lys Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser
    370                 375                 380

Lys Ile Ala Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp
385                 390                 395                 400

Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln
                405                 410                 415

Ile His Leu Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr
            420                 425                 430

Tyr Pro Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr
        435                 440                 445

Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asp Ser Arg
    450                 455                 460

Phe Ser Trp Ala Glu Tyr His Ser Asp Glu Lys Ile Thr Pro Trp Asn
465                 470                 475                 480

Phe Asp Lys Val Ile Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr
                485                 490                 495

Arg Met Thr Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro
            500                 505                 510
```

```
Lys His Ser His Val Tyr Glu Thr Tyr Ala Val Tyr Asn Glu Leu Thr
        515                 520                 525

Lys Ile Lys Tyr Val Asn Glu Gln Gly Lys Asp Ser Phe Phe Asp Ser
    530                 535                 540

Asn Met Lys Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys
545                 550                 555                 560

Val Thr Lys Glu Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Pro Glu
                565                 570                 575

Tyr Arg Ile Lys Asp Leu Ile Gly Leu Asp Lys Glu Asn Lys Ser Phe
            580                 585                 590

Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys
        595                 600                 605

Ala Phe Leu Asp Asp Lys Val Asn Glu Glu Val Ile Glu Asp Ile Ile
    610                 615                 620

Lys Thr Leu Thr Leu Phe Glu Asp Lys Asp Met Ile His Glu Arg Leu
625                 630                 635                 640

Gln Lys Tyr Ser Asp Ile Phe Thr Ala Asp Gln Leu Lys Lys Leu Glu
                645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn
            660                 665                 670

Gly Ile Arg Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Tyr Leu Ile
        675                 680                 685

Asp Asp Gly Ser Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp
    690                 695                 700

Thr Leu Pro Phe Lys Gln Ile Ile Gln Lys Ser Gln Val Val Gly Asp
705                 710                 715                 720
```

```
Val Asp Asp Ile Glu Ala Val Val His Asp Leu Pro Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Lys Val Met Gly Asp Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Asn Arg Gly Arg Ser Gln Ser Gln Gln Arg Leu
    770                 775                 780

Lys Lys Leu Gln Asn Ser Leu Lys Pro Ser Tyr Ile Glu Asp Lys Val
785                 790                 795                 800

Glu Asn Ser His Leu Gln Asn Asp Gln Leu Phe Leu Tyr Tyr Ile Gln
                805                 810                 815

Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Asp Ile Asp His Leu
            820                 825                 830

Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp
        835                 840                 845

Asp Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Ala Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asp Val Pro Ser Leu Asp Ile Val Arg Ala Arg Lys Ala
865                 870                 875                 880

Glu Trp Val Arg Leu Tyr Lys Ser Gly Leu Ile Ser Lys Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925
```

```
His Val Ala Gln Ile Leu Asp Ala Arg Phe Asn Thr Glu Ser Asp Glu
    930                 935                 940

Asn Asp Lys Val Ile Arg Asp Val Lys Val Ile Thr Leu Lys Ser Asn
945                 950                 955                 960

Leu Val Ser Gln Phe Arg Lys Asp Phe Glu Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Leu Lys Lys Tyr  Pro Lys Leu Ala Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Glu Tyr Lys Lys Tyr  Asp Ile Ser Ser Asp  Lys Ala Thr
    1010                1015                1020

Ala Lys  Tyr Phe Phe Tyr Ser  Asn Leu Met Asn Phe  Phe Lys Arg
    1025                1030                1035

Val Ile  Arg Tyr Ser Asn Gly  Lys Val Ile Val Arg  Pro Val Val
    1040                1045                1050

Glu Tyr  Ser Lys Asp Thr Glu  Asp Ile Ala Trp Asp  Lys Lys Ser
    1055                1060                1065

Asn Phe  Arg Thr Ile Cys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1070                1075                1080

Ile Val  Lys Lys Val Glu Thr  Gln Thr Gly Gly Phe  Ser Lys Glu
    1085                1090                1095

Ser Ile  Leu Pro Lys Gly Asp  Ser Asp Lys Leu Ile  Pro Arg Lys
    1100                1105                1110

Thr Lys  Lys Ala Tyr Trp Asp  Thr Lys Lys Tyr Gly  Gly Phe Asp
    1115                1120                1125
```

```
Ser Pro  Thr Val Ala Tyr Ser  Val Phe Val Val Ala  Asp Val Glu
    1130                1135                1140

Lys Gly  Lys Ala Lys Lys Leu  Lys Thr Val Lys Glu  Leu Val Gly
    1145                1150                1155

Ile Ser  Ile Met Glu Arg Ser  Phe Phe Glu Glu Asn  Pro Val Glu
    1160                1165                1170

Phe Leu  Glu Asn Lys Gly Tyr  His Asn Ile Arg Glu  Asp Lys Leu
    1175                1180                1185

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Phe Glu  Gly Gly Lys
    1190                1195                1200

Arg Arg  Leu Leu Ala Ser Ala  Ser Glu Leu Gln Lys  Gly Asn Glu
    1205                1210                1215

Met Val  Ile Pro Gly His Leu  Val Lys Leu Leu Tyr  His Ala Gln
    1220                1225                1230

Arg Ile  Asn Ser Phe Asn Ser  Thr Lys Tyr Leu Asp  Tyr Val Ser
    1235                1240                1245

Ala His  Lys Lys Glu Phe Glu  Lys Val Leu Ser Cys  Val Glu Asp
    1250                1255                1260

Phe Ala  Asn Leu Tyr Val Asp  Val Glu Lys Asn Leu  Ser Lys Ile
    1265                1270                1275

Arg Ala  Val Ala Asp Ser Met  Asp Asn Phe Ser Ile  Glu Glu Ile
    1280                1285                1290

Ser Asn  Ser Phe Ile Asn Leu  Leu Thr Leu Thr Ala  Leu Gly Ala
    1295                1300                1305

Pro Ala  Asp Phe Asn Phe Leu  Gly Glu Lys Ile Pro  Arg Lys Arg
    1310                1315                1320
```

```
Tyr Thr  Ser Thr Lys Glu Cys  Leu Asn Ala Thr Leu  Ile His Gln
    1325                1330                1335


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Ile
    1340                1345                1350


Gly Glu  Glu
    1355


<210>  59
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  59

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Ile
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Tyr Tyr
        115                 120                 125
```

```
His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asp Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335
```

```
Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Val
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
    530                 535                 540
```

```
Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Asp Ile Tyr Lys Asp
625                 630                 635                 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
            660                 665                 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys
    690                 695                 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705                 710                 715                 720

Glu Val Ile Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750
```

```
Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Leu Ser Arg Ser Arg Gln Arg Leu Thr Thr Leu Arg Glu
    770                 775                 780

Ser Leu Ala Asn Leu Lys Ser Glu Lys Lys Pro Lys Tyr Val Lys Asp
785                 790                 795                 800

Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960
```

```
Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Val Phe Tyr Lys Ile
               965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
           980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155
```

```
Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Thr
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Phe Gln Ile Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Arg Leu Tyr  Gln Asp Asn
    1280                1285                1290

Lys Glu  Asn Ile Pro Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305

Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320

Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335

Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350
```

```
Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365
```

<210> 60
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 60

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Gln Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160
```

```
Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365
```

```
Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575
```

```
Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780
```

```
Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800


Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815


Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830


Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845


Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860


Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880


Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895


Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910


Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925


Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940


Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960


Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975


Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990
```

```
Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Leu Tyr Arg  Arg Lys Lys Leu Ser  Lys Ile Val
    1010                1015                1020


Arg Ala  Thr Arg Lys Met Phe  Phe Tyr Ser Asn Leu  Met Asn Met
    1025                1030                1035


Phe Lys  Arg Val Val Arg Leu  Ala Asp Gly Ser Ile  Val Val Arg
    1040                1045                1050


Pro Val  Ile Glu Thr Gly Arg  Tyr Met Gly Lys Thr  Ala Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155


Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Lys Phe  Glu Lys Asn
    1160                1165                1170


Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185
```

```
Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200


Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230


Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245


Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly Glu Asp
    1355                1360                1365
```

<210> 61
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 61

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Ile Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
```

195 200 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
210 215 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225 230 235 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
245 250 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
260 265 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
275 280 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
290 295 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305 310 315 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
325 330 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
340 345 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
355 360 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
370 375 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385 390 395 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His

405 410 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
420 425 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
435 440 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
450 455 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465 470 475 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
485 490 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
500 505 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
515 520 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
530 535 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545 550 555 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
565 570 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
580 585 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
595 600 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr

610 615 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625 630 635 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
645 650 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
660 665 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
675 680 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
690 695 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705 710 715 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
725 730 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
740 745 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
770 775 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785 790 795 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
805 810 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp

820 825 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
835 840 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
850 855 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865 870 875 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
885 890 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
900 905 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
915 920 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
930 935 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945 950 955 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
965 970 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
980 985 990

Val Val Ala Lys Ala Ile Leu Thr Lys Tyr Pro Gln Leu Glu Pro Glu
995 1000 1005

Phe Val Tyr Gly Asp Tyr Pro Lys Tyr Asn Ser Tyr Lys Thr Arg
1010 1015 1020

Lys Ala Thr Glu Lys Leu Phe Phe Tyr Ser Asn Ile Met Asn Phe

```
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
```

```
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290

Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305

Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320

Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335

Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350

Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  62
<211>  1369
<212>  PRT
<213>  Streptococcus agalactiae

<400>  62

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Ile Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240
```

```
Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445
```

```
Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655
```

```
His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860
```

```
Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880


Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895


Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910


Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925


Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940


Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960


Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975


Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065
```

```
Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Thr Ile Asp
    1205                1210                1215

Arg Leu  Gln Lys Gly Asn Glu  Leu Ala Leu Pro Thr  Gln Phe Met
    1220                1225                1230

Lys Phe  Leu Tyr Leu Ala Ser  Arg Tyr Asn Glu Ser  Lys Gly Lys
    1235                1240                1245

Pro Glu  Glu Ile Glu Lys Lys  Gln Glu Phe Val Asn  Gln His Val
    1250                1255                1260
```

```
Ser Tyr  Phe Asp Asp Ile Leu  Gln Leu Ile Asn Asp  Phe Ser Lys
    1265                1270                1275


Arg Val  Ile Leu Ala Asp Ala  Asn Leu Glu Lys Ile  Asn Lys Leu
    1280                1285                1290


Tyr Gln  Asp Asn Lys Glu Asn  Ile Ser Val Asp Glu  Leu Ala Asn
    1295                1300                1305


Asn Ile  Ile Asn Leu Phe Thr  Phe Thr Ser Leu Gly  Ala Pro Ala
    1310                1315                1320


Ala Phe  Lys Phe Phe Asp Lys  Ile Val Asp Arg Lys  Arg Tyr Thr
    1325                1330                1335


Ser Thr  Lys Glu Val Leu Asn  Ser Thr Leu Ile His  Gln Ser Ile
    1340                1345                1350


Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu Gly Lys  Leu Gly Glu
    1355                1360                1365


Asp
```

<210> 63
<211> 1363
<212> PRT
<213> Streptococcus agalactiae

<400> 63

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255
```

```
Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460
```

```
Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Ile Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670
```

```
Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880
```

```
Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Lys
            900                 905                 910

Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu Asp Ser
    930                 935                 940

Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys Ser Asn
945                 950                 955                 960

Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile Arg Glu
                965                 970                 975

Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Ala Lys Ala Ile Leu Thr Lys Tyr  Pro Gln Leu Glu Pro  Glu Phe Val
        995                 1000                1005

Tyr Gly  Asp Tyr Pro Lys Tyr  Asn Ser Tyr Lys Thr  Arg Lys Ala
    1010                1015                1020

Thr Glu  Lys Leu Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1025                1030                1035

Thr Lys  Val Thr Leu Ala Asp  Gly Thr Val Val Val  Lys Asp Asp
    1040                1045                1050

Ile Glu  Val Asn Asn Asp Thr  Gly Glu Ile Val Trp  Asp Lys Lys
    1055                1060                1065

Lys His  Phe Ala Thr Val Arg  Lys Val Leu Ser Tyr  Pro Gln Asn
    1070                1075                1080
```

```
Asn Ile  Val Lys Lys Thr Glu  Ile Gln Thr Gly Gly  Phe Ser Lys
    1085                1090                1095

Glu Ser  Ile Leu Ala His Gly  Asn Ser Asp Lys Leu  Ile Pro Arg
    1100                1105                1110

Lys Thr  Lys Asp Ile Tyr Leu  Asp Pro Lys Lys Tyr  Gly Gly Phe
    1115                1120                1125

Asp Ser  Pro Ile Val Ala Tyr  Ser Val Leu Val Val  Ala Asp Ile
    1130                1135                1140

Lys Lys  Gly Lys Ala Gln Lys  Leu Lys Thr Val Thr  Glu Leu Leu
    1145                1150                1155

Gly Ile  Thr Ile Met Glu Arg  Ser Arg Phe Glu Lys  Asn Pro Ser
    1160                1165                1170

Ala Phe  Leu Glu Ser Lys Gly  Tyr Leu Asn Ile Arg  Ala Asp Lys
    1175                1180                1185

Leu Ile  Ile Leu Pro Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly
    1190                1195                1200

Arg Arg  Arg Leu Leu Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn
    1205                1210                1215

Glu Leu  Ala Leu Pro Thr Gln  Phe Met Lys Phe Leu  Tyr Leu Ala
    1220                1225                1230

Ser Arg  Tyr Asn Glu Ser Lys  Gly Lys Pro Glu Glu  Ile Glu Lys
    1235                1240                1245

Lys Gln  Glu Phe Val Asn Gln  His Val Ser Tyr Phe  Asp Asp Ile
    1250                1255                1260

Leu Gln  Leu Ile Asn Asp Phe  Ser Lys Arg Val Ile  Leu Ala Asp
    1265                1270                1275
```

```
Ala Asn  Leu Glu Lys Ile Asn  Lys Leu Tyr Gln Asp  Asn Lys Glu
    1280                1285                1290


Asn Ile  Ser Val Asp Glu Leu  Ala Asn Asn Ile Ile  Asn Leu Phe
    1295                1300                1305


Thr Phe  Thr Ser Leu Gly Ala  Pro Ala Ala Phe Lys  Phe Phe Asp
    1310                1315                1320


Lys Ile  Val Asp Arg Lys Arg  Tyr Thr Ser Thr Lys  Glu Val Leu
    1325                1330                1335


Asn Ser  Thr Leu Ile His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr
    1340                1345                1350


Arg Ile  Asp Leu Gly Lys Leu  Gly Glu Asp
    1355                1360


<210>  64
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  64

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285
```

```
Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495
```

```
Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700
```

```
Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720


Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735


Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750


Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765


Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780


Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800


Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815


Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830


Asp Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845


Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860


Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880


Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895


Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910
```

```
Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925


Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940


Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960


Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975


Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110
```

```
Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155


Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170


Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185


Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200


Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230


Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245


Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305
```

```
Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365
```

<210> 65
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 65

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
```

115 120 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
130 135 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145 150 155 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
165 170 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
180 185 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
195 200 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
210 215 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225 230 235 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
245 250 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
260 265 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
275 280 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
290 295 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305 310 315 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu

325 330 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
340 345 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
355 360 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
370 375 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385 390 395 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
405 410 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
420 425 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
435 440 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
450 455 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465 470 475 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
485 490 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
500 505 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
515 520 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile

```
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
```

740 745 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
770 775 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785 790 795 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
805 810 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
820 825 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
835 840 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
850 855 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865 870 875 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
885 890 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
900 905 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
915 920 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
930 935 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys

945 950 955 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
965 970 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
980 985 990

Val Val Ala Lys Ala Ile Leu Thr Lys Tyr Pro Gln Leu Glu Pro Glu
995 1000 1005

Phe Val Tyr Gly Asp Tyr Pro Lys Tyr Asn Ser Tyr Lys Thr Arg
1010 1015 1020

Lys Ala Thr Glu Lys Leu Phe Phe Tyr Ser Asn Ile Met Asn Phe
1025 1030 1035

Phe Lys Thr Lys Val Thr Leu Ala Asp Gly Thr Val Val Val Lys
1040 1045 1050

Asp Asp Ile Glu Val Asn Asn Asp Thr Gly Glu Ile Val Trp Asp
1055 1060 1065

Lys Lys Lys His Phe Ala Thr Val Arg Lys Val Leu Ser Tyr Pro
1070 1075 1080

Gln Asn Asn Ile Val Lys Lys Thr Glu Ile Gln Thr Gly Gly Phe
1085 1090 1095

Ser Lys Glu Ser Ile Leu Ala His Gly Asn Ser Asp Lys Leu Ile
1100 1105 1110

Pro Arg Lys Thr Lys Asp Ile Tyr Leu Asp Pro Lys Lys Tyr Gly
1115 1120 1125

Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Val Leu Val Val Ala
1130 1135 1140

Asp Ile Lys Lys Gly Lys Ala Gln Lys Leu Lys Thr Val Thr Glu

1145 1150 1155

Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Arg Phe Glu Lys Asn
1160 1165 1170

Pro Ser Ala Phe Leu Glu Ser Lys Gly Tyr Leu Asn Ile Arg Ala
1175 1180 1185

Asp Lys Leu Ile Ile Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu
1190 1195 1200

Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Gly Glu Leu Gln Lys
1205 1210 1215

Gly Asn Glu Leu Ala Leu Pro Thr Gln Phe Met Lys Phe Leu Tyr
1220 1225 1230

Leu Ala Ser Arg Tyr Asn Glu Ser Lys Gly Lys Pro Glu Glu Ile
1235 1240 1245

Glu Lys Lys Gln Glu Phe Val Asn Gln His Val Ser Tyr Phe Asp
1250 1255 1260

Asp Ile Leu Gln Leu Ile Asn Asp Phe Ser Lys Arg Val Ile Leu
1265 1270 1275

Ala Asp Ala Asn Leu Glu Lys Ile Asn Lys Leu Tyr Gln Asp Asn
1280 1285 1290

Lys Glu Asn Ile Ser Val Asp Glu Leu Ala Asn Asn Ile Ile Asn
1295 1300 1305

Leu Phe Thr Phe Thr Ser Leu Gly Ala Pro Ala Ala Phe Lys Phe
1310 1315 1320

Phe Asp Lys Ile Val Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu
1325 1330 1335

Val Leu Asn Ser Thr Leu Ile His Gln Ser Ile Thr Gly Leu Tyr

1340 1345 1350

Glu Thr Arg Ile Asp Leu Gly Lys Leu Gly Glu Asp
1355 1360 1365

<210> 66
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 66

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
100 105 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
115 120 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
130 135 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145 150 155 160

```
Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365
```

```
Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575
```

```
Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780
```

```
Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990
```

```
Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155


Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170


Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185
```

```
Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290

Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305

Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320

Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335

Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350

Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Gly Asp
    1355                1360                1365
```

<210> 67
<211> 1365

<212> PRT
<213> Streptococcus agalactiae

<400> 67

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190
```

```
Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400
```

```
Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605
```

```
Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815
```

```
Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020
```

```
Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185

Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215
```

```
Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                 1225                 1230


Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                 1240                 1245


Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                 1255                 1260


Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                 1270                 1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                 1285                 1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                 1300                 1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                 1315                 1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                 1330                 1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                 1345                 1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                 1360                 1365


<210>  68
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  68

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15
```

```
Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220
```

```
Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240


Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255


Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270


Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285


Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300


Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320


Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335


Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350


Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365


Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380


Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400


Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415


Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430
```

```
Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640
```

```
Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Val Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845
```

```
Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050
```

```
Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245
```

```
Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  69
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  69

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
```

50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
100 105 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
115 120 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
130 135 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145 150 155 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
165 170 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
180 185 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
195 200 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
210 215 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225 230 235 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
245 250 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr

```
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Arg Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
```

```
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
```

675 680 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
690 695 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705 710 715 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
725 730 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
740 745 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
770 775 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785 790 795 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
805 810 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
820 825 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
835 840 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
850 855 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865 870 875 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg

885 890 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
900 905 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
915 920 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
930 935 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945 950 955 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
965 970 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
980 985 990

Val Val Ala Lys Ala Ile Leu Thr Lys Tyr Pro Gln Leu Glu Pro Glu
995 1000 1005

Phe Val Tyr Gly Asp Tyr Pro Lys Tyr Asn Ser Tyr Lys Thr Arg
1010 1015 1020

Lys Ala Thr Glu Lys Leu Phe Phe Tyr Ser Asn Ile Met Asn Phe
1025 1030 1035

Phe Lys Thr Lys Val Thr Leu Ala Asp Gly Thr Val Val Val Lys
1040 1045 1050

Asp Asp Ile Glu Val Asn Asn Asp Thr Gly Glu Ile Val Trp Asp
1055 1060 1065

Lys Lys Lys His Phe Ala Thr Val Arg Lys Val Leu Ser Tyr Pro
1070 1075 1080

Gln Asn Asn Ile Val Lys Lys Thr Glu Ile Gln Thr Gly Gly Phe

1085 1090 1095

Ser Lys Glu Ser Ile Leu Ala His Gly Asn Ser Asp Lys Leu Ile
1100 1105 1110

Pro Arg Lys Thr Lys Asp Ile Tyr Leu Asp Pro Lys Lys Tyr Gly
1115 1120 1125

Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Val Leu Val Val Ala
1130 1135 1140

Asp Ile Lys Lys Gly Lys Ala Gln Lys Leu Lys Thr Val Thr Glu
1145 1150 1155

Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Arg Phe Glu Lys Asn
1160 1165 1170

Pro Ser Ala Phe Leu Glu Ser Lys Gly Tyr Leu Asn Ile Arg Ala
1175 1180 1185

Asp Lys Leu Ile Ile Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu
1190 1195 1200

Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Gly Glu Leu Gln Lys
1205 1210 1215

Gly Asn Glu Leu Ala Leu Pro Thr Gln Phe Met Lys Phe Leu Tyr
1220 1225 1230

Leu Ala Ser Arg Tyr Asn Glu Ser Lys Gly Lys Pro Glu Glu Ile
1235 1240 1245

Glu Lys Lys Gln Glu Phe Val Asn Gln His Val Ser Tyr Phe Asp
1250 1255 1260

Asp Ile Leu Gln Leu Ile Asn Asp Phe Ser Lys Arg Val Ile Leu
1265 1270 1275

Ala Asp Ala Asn Leu Glu Lys Ile Asn Lys Leu Tyr Gln Asp Asn

1280 1285 1290

Lys Glu Asn Ile Ser Val Asp Glu Leu Ala Asn Asn Ile Ile Asn
1295 1300 1305

Leu Phe Thr Phe Thr Ser Leu Gly Ala Pro Ala Ala Phe Lys Phe
1310 1315 1320

Phe Asp Lys Ile Val Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu
1325 1330 1335

Val Leu Asn Ser Thr Leu Ile His Gln Ser Ile Thr Gly Leu Tyr
1340 1345 1350

Glu Thr Arg Ile Asp Leu Gly Lys Leu Gly Glu Asp
1355 1360 1365

<210> 70
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 70

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

```
Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Ser Phe Glu Asn Asn His Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300
```

```
Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Tyr Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510
```

```
Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Val
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Gln Leu Leu Asp Phe Leu Ala Lys Glu Phe Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Ile Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Arg Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ser Gly Ser His Ser Asp
705                 710                 715                 720
```

```
Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Glu Asp Gly Val Lys Asn Leu Ala Ser Asp Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Ile Asp Ile Val Lys Ala Arg
865                 870                 875                 880

Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Ile Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Pro Asp
            900                 905                 910

Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925
```

```
Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Lys Val
    930                 935                 940

Asp Asp Asn Asn Lys Pro Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Glu Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Glu Thr Gly Glu Ile  Ala Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Val Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Ser Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125
```

```
Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Leu Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Lys Glu
    1145                1150                1155

Leu Ile  Gly Ile Thr Ile Met  Glu Arg Glu Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Thr
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Ile Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Ser Asp Asn
    1280                1285                1290

Lys Asp  Asn Thr Pro Val Asp  Glu Leu Ala Lys Asn  Ile Ile Asn
    1295                1300                1305

Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320
```

```
Phe Asp  Lys Ser Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                 1330                 1335


Val Leu  Asp Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                 1345                 1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                 1360                 1365


<210>  71
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  71

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125
```

```
His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Arg Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln His Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335
```

```
Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
    530                 535                 540
```

```
Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Asp Ile Tyr Lys Asp
625                 630                 635                 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
            660                 665                 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys
    690                 695                 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705                 710                 715                 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750
```

```
Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Leu Ser Arg Ser Arg Gln Arg Leu Thr Thr Leu Arg Glu
    770                 775                 780

Ser Leu Ala Asn Leu Lys Ser Glu Lys Lys Pro Lys Tyr Val Lys Asp
785                 790                 795                 800

Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Val Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960
```

```
Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
               965                 970                 975


Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
           980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155
```

```
Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185

Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290

Lys Glu  Asn Ile Pro Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305

Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320

Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335

Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350
```

```
Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  72
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  72

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125


His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140


Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160
```

```
Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Arg Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365
```

```
Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
    530                 535                 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575
```

```
Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Asp Ile Tyr Lys Asp
625                 630                 635                 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Glu Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
            660                 665                 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys
    690                 695                 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Leu Asp Asn Leu Lys
705                 710                 715                 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Leu Ser Arg Ser Arg Gln Arg Leu Thr Thr Leu Arg Glu
    770                 775                 780
```

```
Ser Leu Ala Asn Leu Lys Ser Glu Lys Lys Pro Lys Tyr Val Lys Asp
785                 790                 795                 800


Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu Phe Leu Tyr Tyr
                805                 810                 815


Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu Leu Asp Ile Asp
            820                 825                 830


Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845


Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860


Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880


Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895


Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910


Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925


Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940


Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960


Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975


Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990
```

```
Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Val  Asn Ile Val Lys Lys  Thr Glu Val Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155


Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170


Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Thr
    1175                1180                1185
```

```
Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200


Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr Met Lys  Phe Leu Tyr
    1220                1225                1230


Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245


Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Pro Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Gly
    1355                1360                1365
```

<210> 73
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 73

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
```

195 200 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
210 215 220

Arg Ile Leu Ala Arg Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225 230 235 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
245 250 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
260 265 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
275 280 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
290 295 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305 310 315 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
325 330 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
340 345 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
355 360 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
370 375 380

Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385 390 395 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His

405 410 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
420 425 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
435 440 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
450 455 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465 470 475 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
485 490 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
500 505 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
515 520 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
530 535 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545 550 555 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
565 570 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
580 585 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
595 600 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu

610 615 620

Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Asp Ile Tyr Lys Asp
625 630 635 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
645 650 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
660 665 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
675 680 685

Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys
690 695 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Leu Asp Asn Leu Lys
705 710 715 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
725 730 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
740 745 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
755 760 765

Ala Lys Gly Leu Ser Arg Ser Arg Gln Arg Leu Thr Thr Leu Arg Glu
770 775 780

Ser Leu Ala Asn Leu Lys Ser Glu Lys Lys Pro Lys Tyr Val Lys Asp
785 790 795 800

Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu Phe Leu Tyr Tyr
805 810 815

Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu Leu Asp Ile Asp

```
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
```

1025 1030 1035

Phe Lys Thr Lys Val Thr Leu Ala Asp Gly Thr Val Val Val Lys
1040 1045 1050

Asp Asp Ile Glu Val Asn Asn Asp Thr Gly Glu Ile Val Trp Asp
1055 1060 1065

Lys Lys Lys His Phe Ala Thr Val Arg Lys Val Leu Ser Tyr Pro
1070 1075 1080

Gln Val Asn Ile Val Lys Lys Thr Glu Val Gln Thr Gly Gly Phe
1085 1090 1095

Ser Lys Glu Ser Ile Leu Ala His Gly Asn Ser Asp Lys Leu Ile
1100 1105 1110

Pro Arg Lys Thr Lys Asp Ile Tyr Leu Asp Pro Lys Lys Tyr Gly
1115 1120 1125

Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Val Leu Val Val Ala
1130 1135 1140

Asp Ile Lys Lys Gly Lys Ala Gln Lys Leu Lys Thr Val Thr Glu
1145 1150 1155

Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Arg Phe Glu Lys Asn
1160 1165 1170

Pro Ser Ala Phe Leu Glu Ser Lys Gly Tyr Leu Asn Ile Arg Thr
1175 1180 1185

Asp Lys Leu Ile Ile Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu
1190 1195 1200

Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Gly Glu Leu Gln Lys
1205 1210 1215

Gly Asn Glu Leu Ala Leu Pro Thr Gln Tyr Met Lys Phe Leu Tyr

1220 1225 1230

Leu Ala Ser Arg Tyr Asn Glu Leu Lys Gly Lys Pro Glu Glu Ile
1235 1240 1245

Glu Gln Lys Gln Glu Phe Val Val Gln His Val Ser Tyr Phe Asp
1250 1255 1260

Asp Ile Leu Gln Ile Ile Asn Asp Phe Ser Asn Arg Val Ile Leu
1265 1270 1275

Ala Asp Ala Asn Leu Glu Lys Ile Asn Lys Leu Tyr Gln Asp Asn
1280 1285 1290

Lys Glu Asn Ile Pro Val Asp Glu Leu Ala Asn Asn Ile Ile Asn
1295 1300 1305

Leu Phe Thr Phe Thr Ser Leu Gly Ala Pro Ala Ala Phe Lys Phe
1310 1315 1320

Phe Asp Lys Ile Val Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu
1325 1330 1335

Val Leu Asn Ser Thr Leu Ile His Gln Ser Ile Thr Gly Leu Tyr
1340 1345 1350

Glu Thr Arg Ile Asp Leu Gly Lys Leu Gly Glu Gly
1355 1360 1365

<210> 74
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 74

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

```
Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Arg Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240
```

```
Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445
```

```
Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
    530                 535                 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Asp Ile Tyr Lys Asp
625                 630                 635                 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
                645                 650                 655
```

```
Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
            660                 665                 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys
    690                 695                 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705                 710                 715                 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Leu Ser Arg Leu Arg Gln Arg Leu Thr Thr Leu Arg Glu
    770                 775                 780

Ser Leu Ala Asn Leu Lys Ser Glu Lys Lys Pro Lys Tyr Val Lys Asp
785                 790                 795                 800

Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860
```

```
Arg Gly Lys Ser Asp Asp Val Pro Ser Val Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065
```

```
Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185

Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Asp Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260
```

```
Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Pro Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365
```

<210> 75
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 75

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Arg Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270
```

```
Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480
```

```
Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
    530                 535                 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Asp Ile Tyr Lys Asp
625                 630                 635                 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
            660                 665                 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
        675                 680                 685
```

```
Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys
    690                 695                 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705                 710                 715                 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Leu Ser Arg Ser Arg Gln Arg Leu Thr Thr Leu Arg Glu
    770                 775                 780

Ser Leu Ala Asn Leu Lys Ser Glu Lys Lys Pro Lys Tyr Val Lys Asp
785                 790                 795                 800

Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Val Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895
```

```
Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095
```

```
Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185

Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290
```

```
Lys Glu  Asn Ile Pro Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                 1300                 1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                 1315                 1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                 1330                 1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                 1345                 1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                 1360                 1365


<210>  76
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  76

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Arg Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300
```

```
Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320


Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335


Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350


Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365


Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380


Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400


Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415


Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430


Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445


Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460


Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480


Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495


Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510
```

```
Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
    530                 535                 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Asp Ile Tyr Lys Asp
625                 630                 635                 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
            660                 665                 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys
    690                 695                 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705                 710                 715                 720
```

```
Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Leu Ser Arg Ser Arg Gln Arg Leu Thr Thr Leu Arg Glu
    770                 775                 780

Ser Leu Ala Asn Leu Lys Ser Glu Lys Lys Pro Lys Tyr Val Lys Asp
785                 790                 795                 800

Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Val Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925
```

```
Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125
```

```
Gly Phe  Asp Ser Pro Lys Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155


Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170


Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185


Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200


Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230


Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245


Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Pro Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320
```

Phe Asp Lys Ile Val Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu
1325 1330 1335

Val Leu Asn Ser Thr Leu Ile His Lys Ser Ile Thr Gly Leu Tyr
1340 1345 1350

Glu Thr Arg Ile Asp Leu Gly Lys Leu Gly Glu Asp
1355 1360 1365

<210> 77
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 77

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
100 105 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
115 120 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp

130 135 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145 150 155 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
165 170 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
180 185 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
195 200 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
210 215 220

Arg Ile Leu Ala Arg Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225 230 235 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
245 250 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
260 265 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
275 280 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
290 295 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305 310 315 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
325 330 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe

340 345 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
355 360 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
370 375 380

Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385 390 395 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
405 410 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
420 425 430

Leu Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
435 440 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
450 455 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465 470 475 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
485 490 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
500 505 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
515 520 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
530 535 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val

```
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Asp Ile Tyr Lys Asp
625                 630                 635                 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
            660                 665                 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys
    690                 695                 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705                 710                 715                 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
```

```
        755                 760                 765

Ala Lys Gly Leu Ser Arg Ser Arg Gln Arg Leu Thr Thr Leu Arg Glu
    770                 775                 780

Ser Leu Ala Asn Leu Lys Ser Glu Lys Lys Pro Lys Tyr Val Lys Asp
785                 790                 795                 800

Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Val Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
```

965 970 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
980 985 990

Val Val Ala Lys Ala Ile Leu Thr Lys Tyr Pro Gln Leu Glu Pro Glu
995 1000 1005

Phe Val Tyr Gly Asp Tyr Pro Lys Tyr Asn Ser Tyr Lys Thr Arg
1010 1015 1020

Lys Ala Thr Glu Lys Leu Phe Phe Tyr Ser Asn Ile Met Asn Phe
1025 1030 1035

Phe Lys Thr Lys Val Thr Leu Ala Asp Gly Thr Val Val Val Lys
1040 1045 1050

Asp Asp Ile Glu Val Asn Asn Asp Thr Gly Glu Ile Val Trp Asp
1055 1060 1065

Lys Lys Lys His Phe Ala Thr Val Arg Lys Val Leu Ser Tyr Pro
1070 1075 1080

Gln Val Asn Ile Val Lys Lys Thr Glu Ile Gln Thr Gly Gly Phe
1085 1090 1095

Ser Lys Glu Ser Ile Leu Ala His Gly Asn Ser Asp Lys Leu Ile
1100 1105 1110

Pro Arg Lys Thr Lys Asp Ile Tyr Leu Asp Pro Lys Lys Tyr Gly
1115 1120 1125

Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Val Leu Val Val Ala
1130 1135 1140

Asp Ile Lys Lys Gly Lys Ala Gln Lys Leu Lys Thr Val Thr Glu
1145 1150 1155

Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Arg Phe Glu Lys Asn

1160 1165 1170

Pro Ser Ala Phe Leu Glu Ser Lys Gly Tyr Leu Asp Ile Arg Asp
1175 1180 1185

Asp Lys Leu Met Ile Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu
1190 1195 1200

Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Gly Glu Leu Gln Lys
1205 1210 1215

Gly Asn Glu Leu Ala Leu Pro Thr Gln Phe Met Lys Phe Leu Tyr
1220 1225 1230

Leu Ala Ser Arg Tyr Asn Glu Leu Lys Gly Lys Pro Glu Glu Ile
1235 1240 1245

Glu Gln Lys Gln Glu Phe Val Val Gln His Val Ser Tyr Phe Asp
1250 1255 1260

Asp Ile Leu Gln Ile Ile Asn Asp Phe Ser Asn Arg Val Ile Leu
1265 1270 1275

Ala Asp Ala Asn Leu Glu Lys Ile Asn Lys Leu Tyr Gln Asp Asn
1280 1285 1290

Lys Glu Asn Ile Pro Val Asp Glu Leu Ala Asn Asn Ile Ile Asn
1295 1300 1305

Leu Phe Thr Phe Thr Ser Leu Gly Ala Pro Ala Ala Phe Lys Phe
1310 1315 1320

Phe Asp Lys Ile Val Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu
1325 1330 1335

Val Leu Asn Ser Thr Leu Ile His Gln Ser Ile Thr Gly Leu Tyr
1340 1345 1350

Glu Thr Arg Ile Asp Leu Gly Lys Leu Gly Glu Asp

1355 1360 1365

<210> 78
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<220>
<221> misc_feature
<222> (117)..(117)
<223> Xaa can be any naturally occurring amino acid

<400> 78

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
100 105 110

Gly Ser Lys Tyr Xaa Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
115 120 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
130 135 140

```
Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175


Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190


Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205


Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220


Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240


Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255


Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270


Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285


Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300


Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320


Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335


Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350
```

```
Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560
```

```
Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765
```

```
Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975
```

```
Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155


Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170
```

```
Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185


Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200


Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230


Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245


Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365
```

<210> 79
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 79

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ser Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125


His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140


Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175


Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
```

```
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
```

385 390 395 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
405 410 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
420 425 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
435 440 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
450 455 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465 470 475 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
485 490 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
500 505 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
515 520 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
530 535 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545 550 555 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
565 570 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
580 585 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe

595 600 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
610 615 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625 630 635 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
645 650 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
660 665 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
675 680 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
690 695 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705 710 715 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
725 730 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
740 745 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
770 775 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785 790 795 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr

```
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
```

1010 1015 1020

Lys Ala Thr Glu Lys Leu Phe Phe Tyr Ser Asn Ile Met Asn Phe
1025 1030 1035

Phe Lys Thr Lys Val Thr Leu Ala Asp Gly Thr Val Val Val Lys
1040 1045 1050

Asp Asp Ile Glu Val Asn Asn Asp Thr Gly Glu Ile Val Trp Asp
1055 1060 1065

Lys Lys Lys His Phe Ala Thr Val Arg Lys Val Leu Ser Tyr Pro
1070 1075 1080

Gln Asn Asn Ile Val Lys Lys Thr Glu Ile Gln Thr Gly Gly Phe
1085 1090 1095

Ser Lys Glu Ser Ile Leu Ala His Gly Asn Ser Asp Lys Leu Ile
1100 1105 1110

Pro Arg Lys Thr Lys Asp Ile Tyr Leu Asp Pro Lys Lys Tyr Gly
1115 1120 1125

Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Val Leu Val Val Ala
1130 1135 1140

Asp Ile Lys Lys Gly Lys Ala Gln Lys Leu Lys Thr Val Thr Glu
1145 1150 1155

Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Arg Phe Glu Lys Asn
1160 1165 1170

Pro Ser Ala Phe Leu Glu Ser Lys Gly Tyr Leu Asn Ile Arg Ala
1175 1180 1185

Asp Lys Leu Ile Ile Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu
1190 1195 1200

Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Gly Glu Leu Gln Lys

1205 1210 1215

Gly Asn Glu Leu Ala Leu Pro Thr Gln Phe Met Lys Phe Leu Tyr
1220 1225 1230

Leu Ala Ser Arg Tyr Asn Glu Ser Lys Gly Lys Pro Glu Glu Ile
1235 1240 1245

Glu Lys Lys Gln Glu Phe Val Asn Gln His Val Ser Tyr Phe Asp
1250 1255 1260

Asp Ile Leu Gln Leu Ile Asn Asp Phe Ser Lys Arg Val Ile Leu
1265 1270 1275

Ala Asp Ala Asn Leu Glu Lys Ile Asn Lys Leu Tyr Gln Asp Asn
1280 1285 1290

Lys Glu Asn Ile Ser Val Asp Glu Leu Ala Asn Asn Ile Ile Asn
1295 1300 1305

Leu Phe Thr Phe Thr Ser Leu Gly Ala Pro Ala Ala Phe Lys Phe
1310 1315 1320

Phe Asp Lys Ile Val Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu
1325 1330 1335

Val Leu Asn Ser Thr Leu Ile His Gln Ser Ile Thr Gly Leu Tyr
1340 1345 1350

Glu Thr Arg Ile Asp Leu Gly Lys Leu Gly Glu Asp
1355 1360 1365

<210> 80
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 80

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

```
Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Cys Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asn Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
        195                 200                 205

Val Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220
```

```
Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430
```

```
Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640
```

```
Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Pro Ile Ile Asp Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Val Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Thr Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Glu Glu Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile
        835                 840                 845
```

```
Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Asp Ile Val Lys Ala Arg
865                 870                 875                 880

Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050
```

```
Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Phe Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185

Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245
```

```
Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  81
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  81

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
        195                 200                 205

Val Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255
```

```
Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460
```

```
Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670
```

```
Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Pro Ile Ile Asp Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Val Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Thr Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Glu Glu Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Asp Ile Val Lys Ala Arg
865                 870                 875                 880
```

```
Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
               885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
               965                 970                 975

Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080
```

```
Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Phe Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185

Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275
```

```
Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                 1285                 1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                 1300                 1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                 1315                 1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                 1330                 1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                 1345                 1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                 1360                 1365


<210>  82
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  82

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
        195                 200                 205

Val Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285
```

```
Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495
```

```
Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700
```

```
Ser Phe Lys Pro Ile Ile Asp Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720


Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735


Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750


Met Gly Tyr Glu Pro Glu Gln Val Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765


Gln Thr Thr Asn Gln Gly Arg Arg Asn Thr Arg Gln Arg Tyr Lys Leu
    770                 775                 780


Leu Glu Glu Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800


Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815


Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Thr Leu Asp Ile Asp
            820                 825                 830


Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile
        835                 840                 845


Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860


Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Asp Ile Val Lys Ala Arg
865                 870                 875                 880


Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895


Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910
```

```
Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925


Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940


Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960


Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975


Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Arg Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110
```

```
Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155


Leu Leu  Gly Ile Thr Ile Met  Glu Arg Phe Arg Phe  Glu Lys Asn
    1160                1165                1170


Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185


Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200


Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr Met Lys  Phe Leu Tyr
    1220                1225                1230


Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245


Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305
```

```
Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365
```

<210> 83
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 83

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
```

115 120 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
130 135 140

Lys Lys Glu Lys Ala Asn Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
165 170 175

Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
180 185 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
195 200 205

Val Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
210 215 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225 230 235 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
245 250 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
260 265 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
275 280 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
290 295 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305 310 315 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu

325 330 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
340 345 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
355 360 365

Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
370 375 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385 390 395 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
405 410 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
420 425 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
435 440 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
450 455 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465 470 475 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
485 490 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
500 505 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
515 520 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile

```
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Pro Ile Ile Asp Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
```

740 745 750

Met Gly Tyr Glu Pro Glu Gln Val Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Thr Arg Gln Arg Tyr Lys Leu
770 775 780

Leu Glu Glu Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785 790 795 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
805 810 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
820 825 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile
835 840 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
850 855 860

Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Asp Ile Val Lys Ala Arg
865 870 875 880

Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
885 890 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
900 905 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
915 920 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
930 935 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys

```
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
```

1145 1150 1155

Leu Leu Gly Ile Thr Ile Met Glu Arg Phe Arg Phe Glu Lys Asn
1160 1165 1170

Pro Ser Ala Phe Leu Glu Ser Lys Gly Tyr Leu Asn Ile Arg Asp
1175 1180 1185

Asp Lys Leu Met Ile Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu
1190 1195 1200

Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Gly Glu Leu Gln Lys
1205 1210 1215

Gly Asn Glu Leu Ala Leu Pro Thr Gln Tyr Met Lys Phe Leu Tyr
1220 1225 1230

Leu Ala Ser Arg Tyr Asn Glu Leu Lys Gly Lys Pro Glu Glu Ile
1235 1240 1245

Glu Gln Lys Gln Glu Phe Val Val Gln His Val Ser Tyr Phe Asp
1250 1255 1260

Asp Ile Leu Gln Ile Ile Asn Asp Phe Ser Asn Arg Val Ile Leu
1265 1270 1275

Ala Asp Ala Asn Leu Glu Lys Ile Asn Lys Leu Tyr Gln Asp Asn
1280 1285 1290

Lys Glu Asn Ile Ser Val Asp Glu Leu Ala Asn Asn Ile Ile Asn
1295 1300 1305

Leu Phe Thr Phe Thr Ser Leu Gly Ala Pro Ala Ala Phe Lys Phe
1310 1315 1320

Phe Asp Lys Ile Val Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu
1325 1330 1335

Val Leu Asn Ser Thr Leu Ile His Gln Phe Ile Thr Gly Leu Tyr

1340 1345 1350

Glu Thr Arg Ile Asp Leu Gly Lys Leu Gly Glu Asp
1355 1360 1365

<210> 84
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 84

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
100 105 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
115 120 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
130 135 140

Lys Lys Glu Lys Ala Asn Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

```
Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
        195                 200                 205

Val Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365
```

```
Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575
```

```
Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Pro Ile Ile Asp Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Val Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Thr Arg Gln Arg Tyr Lys Leu
    770                 775                 780
```

```
Leu Glu Glu Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Asp Ile Val Lys Ala Arg
865                 870                 875                 880

Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990
```

```
Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155


Leu Leu  Gly Ile Thr Ile Met  Glu Arg Phe Arg Phe  Glu Lys Asn
    1160                1165                1170


Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185
```

```
Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290

Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305

Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320

Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335

Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350

Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365
```

<210> 85
<211> 1365

<212> PRT
<213> Streptococcus agalactiae

<400> 85

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190
```

```
Phe Asp Thr Ser Phe Glu Asn Asn His Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400
```

```
Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Val
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Gln Leu Leu Asp Phe Leu Ala Lys Glu Phe Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605
```

```
Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Ile Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Arg Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ser Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Glu Asp Gly Val Lys Asn Leu Ala Ser Asp Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815
```

```
Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Ile Asp Ile Val Lys Ala Arg
865                 870                 875                 880

Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Ile Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Pro Asp
            900                 905                 910

Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Lys Val
    930                 935                 940

Asp Asp Asn Asn Lys Pro Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020
```

```
Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Glu Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Glu Thr Gly Glu Ile  Ala Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Val Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Ser Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Leu Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Lys Glu
    1145                1150                1155

Leu Ile  Gly Ile Thr Ile Met  Glu Arg Glu Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Thr
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215
```

```
Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr Met Lys  Phe Leu Tyr
    1220                 1225                 1230


Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                 1240                 1245


Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                 1255                 1260


Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                 1270                 1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Ser Asp Asn
    1280                 1285                 1290


Lys Asp  Asn Thr Pro Val Asp  Glu Leu Ala Lys Asn  Ile Ile Asn
    1295                 1300                 1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                 1315                 1320


Phe Asp  Lys Ser Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                 1330                 1335


Val Leu  Asp Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                 1345                 1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                 1360                 1365


<210>  86
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  86

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15
```

```
Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220
```

```
Arg Ile Leu Ala Arg Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240


Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255


Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270


Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285


Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300


Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320


Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335


Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350


Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365


Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380


Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400


Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415


Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430
```

```
Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
    530                 535                 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545                 550                 555                 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
                565                 570                 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
            580                 585                 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
        595                 600                 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Asp Ile Tyr Lys Asp
625                 630                 635                 640
```

```
Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
            660                 665                 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys
    690                 695                 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705                 710                 715                 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
            740                 745                 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Leu Ser Arg Leu Arg Gln Arg Leu Thr Thr Leu Arg Glu
    770                 775                 780

Ser Leu Ala Asn Leu Lys Ser Glu Lys Lys Pro Lys Tyr Val Lys Asp
785                 790                 795                 800

Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp Leu Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845
```

```
Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Val Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050
```

```
Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185

Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Asp Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245
```

```
Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Pro Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  87
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  87

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
```

50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
100 105 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
115 120 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
130 135 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Phe Tyr Leu Ala Leu Ala His
145 150 155 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
165 170 175

Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
180 185 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
195 200 205

Ile Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
210 215 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225 230 235 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
245 250 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr

```
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
```

```
465                 470                 475                 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
```

675 680 685

Gly Lys Ser Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
690 695 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705 710 715 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
725 730 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
740 745 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
770 775 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785 790 795 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
805 810 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Lys Ala Leu Asp Ile Asp
820 825 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
835 840 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
850 855 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865 870 875 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg

885 890 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
900 905 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
915 920 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
930 935 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945 950 955 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
965 970 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
980 985 990

Val Val Ala Lys Ala Ile Leu Thr Lys Tyr Pro Gln Leu Glu Pro Glu
995 1000 1005

Phe Val Tyr Gly Asp Tyr Pro Lys Tyr Asn Ser Tyr Lys Thr Arg
1010 1015 1020

Lys Ala Thr Glu Lys Leu Phe Phe Tyr Ser Asn Ile Met Asn Phe
1025 1030 1035

Phe Lys Thr Lys Val Thr Leu Ala Asp Gly Thr Val Val Val Lys
1040 1045 1050

Asp Asp Ile Glu Val Asn Asn Asp Thr Gly Glu Ile Val Trp Asp
1055 1060 1065

Lys Lys Lys His Phe Ala Thr Val Arg Lys Val Leu Ser Tyr Pro
1070 1075 1080

Gln Val Asn Ile Val Lys Lys Thr Glu Ile Gln Thr Gly Gly Phe

1085 1090 1095

Ser Lys Glu Ser Ile Leu Ala His Gly Asn Ser Asp Lys Leu Ile
1100 1105 1110

Pro Arg Lys Thr Lys Asp Ile Tyr Leu Asp Pro Lys Lys Tyr Gly
1115 1120 1125

Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Val Leu Val Val Ala
1130 1135 1140

Asp Ile Lys Lys Gly Lys Ala Gln Lys Leu Lys Thr Val Thr Glu
1145 1150 1155

Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Arg Phe Glu Lys Asn
1160 1165 1170

Pro Ser Ala Phe Leu Glu Ser Lys Gly Tyr Leu Asn Ile Arg Asp
1175 1180 1185

Asp Lys Leu Met Ile Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu
1190 1195 1200

Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Gly Glu Leu Gln Lys
1205 1210 1215

Gly Asn Glu Leu Ala Leu Pro Thr Gln Phe Met Lys Phe Leu Tyr
1220 1225 1230

Leu Ala Ser Arg Tyr Asn Glu Leu Lys Gly Lys Pro Glu Glu Ile
1235 1240 1245

Glu Gln Lys Gln Glu Phe Val Val Gln His Val Ser Tyr Phe Asp
1250 1255 1260

Asp Ile Leu Gln Ile Ile Asn Asp Phe Ser Asn Arg Val Ile Leu
1265 1270 1275

Ala Asp Ala Asn Leu Glu Lys Ile Asn Lys Leu Tyr Gln Asp Asn

1280 1285 1290

Lys Glu Asn Ile Ser Val Asp Glu Leu Ala Asn Asn Ile Ile Asn
1295 1300 1305

Leu Phe Thr Phe Thr Ser Leu Gly Ala Pro Ala Ala Phe Lys Phe
1310 1315 1320

Phe Asp Lys Ile Val Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu
1325 1330 1335

Val Leu Asn Ser Thr Leu Ile His Gln Ser Ile Thr Gly Leu Tyr
1340 1345 1350

Glu Thr Arg Ile Asp Leu Gly Lys Leu Gly Glu Asp
1355 1360 1365

<210> 88
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 88

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

```
Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Phe Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
        195                 200                 205

Val Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300
```

```
Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510
```

```
Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Lys Ser Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720
```

```
Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Lys Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925
```

```
Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125
```

```
Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185

Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290

Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305

Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320
```

```
Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  89
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  89

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125
```

```
His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335
```

```
Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540
```

```
Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750
```

```
Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960
```

```
Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
               965                 970                 975


Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
           980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155
```

```
Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290

Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305

Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320

Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335

Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350
```

```
Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  90
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  90

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125


His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140


Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160
```

```
Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
        195                 200                 205

Val Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Ala Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365
```

```
Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575
```

```
Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Pro Ile Ile Asp Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Val Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Thr Arg Gln Arg Tyr Lys Leu
    770                 775                 780
```

```
Leu Glu Glu Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800


Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815


Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830


Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile
        835                 840                 845


Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860


Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Asp Ile Val Lys Ala Arg
865                 870                 875                 880


Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895


Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910


Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925


Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940


Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960


Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975


Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990
```

```
Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155


Leu Leu  Gly Ile Thr Ile Met  Glu Arg Phe Arg Phe  Glu Lys Asn
    1160                1165                1170


Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185
```

```
Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200


Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr Met Lys  Phe Leu Tyr
    1220                1225                1230


Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245


Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365
```

<210> 91
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 91

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
```

195 200 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
210 215 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225 230 235 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
245 250 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
260 265 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
275 280 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
290 295 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305 310 315 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
325 330 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
340 345 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
355 360 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
370 375 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385 390 395 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His

405 410 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
420 425 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
435 440 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
450 455 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465 470 475 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
485 490 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
500 505 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
515 520 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
530 535 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545 550 555 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
565 570 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
580 585 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
595 600 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr

610 615 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625 630 635 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
645 650 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
660 665 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
675 680 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
690 695 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705 710 715 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
725 730 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
740 745 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
770 775 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785 790 795 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
805 810 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp

820 825 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
835 840 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
850 855 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865 870 875 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
885 890 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
900 905 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
915 920 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
930 935 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945 950 955 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
965 970 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
980 985 990

Val Val Ala Lys Ala Ile Leu Thr Lys Tyr Pro Gln Leu Glu Pro Glu
995 1000 1005

Phe Val Tyr Gly Asp Tyr Pro Lys Tyr Asn Ser Tyr Lys Thr Arg
1010 1015 1020

Lys Ala Thr Glu Lys Leu Phe Phe Tyr Ser Asn Ile Met Asn Phe

1025 1030 1035

Phe Lys Thr Lys Val Thr Leu Ala Asp Gly Thr Val Val Val Lys
1040 1045 1050

Asp Asp Ile Glu Val Asn Asn Asp Thr Gly Glu Ile Val Trp Asp
1055 1060 1065

Lys Lys Lys His Phe Ala Thr Val Arg Lys Val Leu Ser Tyr Pro
1070 1075 1080

Gln Asn Asn Ile Val Lys Lys Thr Glu Ile Gln Thr Gly Gly Phe
1085 1090 1095

Ser Lys Glu Ser Ile Leu Ala His Gly Asn Ser Asp Lys Leu Ile
1100 1105 1110

Pro Arg Lys Thr Lys Asp Ile Tyr Leu Asp Pro Lys Lys Tyr Gly
1115 1120 1125

Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Val Leu Val Ala Ala
1130 1135 1140

Asp Ile Lys Lys Gly Lys Ala Gln Lys Leu Lys Thr Val Thr Glu
1145 1150 1155

Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Arg Phe Glu Lys Asn
1160 1165 1170

Pro Ser Ala Phe Leu Glu Ser Lys Gly Tyr Leu Asn Ile Arg Ala
1175 1180 1185

Asp Lys Leu Ile Ile Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu
1190 1195 1200

Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Gly Glu Leu Gln Lys
1205 1210 1215

Gly Asn Glu Leu Ala Leu Pro Thr Gln Phe Met Lys Phe Leu Tyr

1220 1225 1230

Leu Ala Ser Arg Tyr Asn Glu Ser Lys Gly Lys Pro Glu Glu Ile
1235 1240 1245

Glu Lys Lys Gln Glu Phe Val Asn Gln His Val Ser Tyr Phe Asp
1250 1255 1260

Asp Ile Leu Gln Leu Ile Asn Asp Phe Ser Lys Arg Val Ile Leu
1265 1270 1275

Ala Asp Ala Asn Leu Glu Lys Ile Asn Lys Leu Tyr Gln Asp Asn
1280 1285 1290

Lys Glu Asn Ile Ser Val Asp Glu Leu Ala Asn Asn Ile Ile Asn
1295 1300 1305

Leu Phe Thr Phe Thr Ser Leu Gly Ala Pro Ala Ala Phe Lys Phe
1310 1315 1320

Phe Asp Lys Ile Val Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu
1325 1330 1335

Val Leu Asn Ser Thr Leu Ile His Gln Ser Ile Thr Gly Leu Tyr
1340 1345 1350

Glu Thr Arg Ile Asp Leu Gly Lys Leu Gly Glu Asp
1355 1360 1365

<210> 92
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 92

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

```
Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240
```

```
Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Ser Leu Ser Asp
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445
```

```
Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655
```

```
His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860
```

```
Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880


Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895


Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910


Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925


Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940


Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960


Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975


Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065
```

```
Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260
```

```
Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                 1270                 1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                 1285                 1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                 1300                 1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                 1315                 1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                 1330                 1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                 1345                 1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                 1360                 1365


<210>  93
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  93

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270
```

```
Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480
```

```
Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685
```

```
Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895
```

```
Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Ile Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095
```

```
Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290
```

```
Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  94
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  94

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300
```

```
Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320


Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335


Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350


Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365


Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380


Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400


Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415


Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430


Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445


Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460


Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480


Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495


Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510
```

```
Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720
```

```
Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925
```

```
Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Val Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125
```

```
Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155


Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170


Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185


Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200


Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230


Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245


Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320
```

```
Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                 1330                 1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                 1345                 1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                 1360                 1365


<210>  95
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  95

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125


His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
```

130 135 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145 150 155 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
165 170 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
180 185 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
195 200 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
210 215 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225 230 235 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
245 250 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
260 265 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
275 280 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
290 295 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305 310 315 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
325 330 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe

```
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
```

545 550 555 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
565 570 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
580 585 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
595 600 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
610 615 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625 630 635 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
645 650 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
660 665 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
675 680 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
690 695 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705 710 715 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
725 730 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
740 745 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn

```
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Leu Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
```

965 970 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
980 985 990

Val Val Ala Lys Ala Ile Leu Thr Lys Tyr Pro Gln Leu Glu Pro Glu
995 1000 1005

Phe Val Tyr Gly Asp Tyr Pro Lys Tyr Asn Ser Tyr Lys Thr Arg
1010 1015 1020

Lys Ala Thr Glu Lys Leu Phe Phe Tyr Ser Asn Ile Met Asn Phe
1025 1030 1035

Phe Lys Thr Lys Val Thr Leu Ala Asp Gly Thr Val Val Val Lys
1040 1045 1050

Asp Asp Ile Glu Val Asn Asn Asp Thr Gly Glu Ile Val Trp Asp
1055 1060 1065

Lys Lys Lys His Phe Ala Thr Val Arg Lys Val Leu Ser Tyr Pro
1070 1075 1080

Gln Asn Asn Ile Val Lys Lys Thr Glu Ile Gln Thr Gly Gly Phe
1085 1090 1095

Ser Lys Glu Ser Ile Leu Ala His Gly Asn Ser Asp Lys Leu Ile
1100 1105 1110

Pro Arg Lys Thr Lys Asp Ile Tyr Leu Asp Pro Lys Lys Tyr Gly
1115 1120 1125

Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Val Leu Val Val Ala
1130 1135 1140

Asp Ile Lys Lys Gly Lys Ala Gln Lys Leu Lys Thr Val Thr Glu
1145 1150 1155

Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Arg Phe Glu Lys Asn

1160 1165 1170

Pro Ser Ala Phe Leu Glu Ser Lys Gly Tyr Leu Asn Ile Arg Ala
1175 1180 1185

Asp Lys Leu Ile Ile Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu
1190 1195 1200

Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Gly Glu Leu Gln Lys
1205 1210 1215

Gly Asn Glu Leu Ala Leu Pro Thr Gln Phe Met Lys Phe Leu Tyr
1220 1225 1230

Leu Ala Ser Arg Tyr Asn Glu Ser Lys Gly Lys Pro Glu Glu Ile
1235 1240 1245

Glu Lys Lys Gln Glu Phe Val Asn Gln His Val Ser Tyr Phe Asp
1250 1255 1260

Asp Ile Leu Gln Leu Ile Asn Asp Phe Ser Lys Arg Val Ile Leu
1265 1270 1275

Ala Asp Ala Asn Leu Glu Lys Ile Asn Lys Leu Tyr Gln Asp Asn
1280 1285 1290

Lys Glu Asn Ile Ser Val Asp Glu Leu Ala Asn Asn Ile Ile Asn
1295 1300 1305

Leu Phe Thr Phe Thr Ser Leu Gly Ala Pro Ala Ala Phe Lys Phe
1310 1315 1320

Phe Asp Lys Ile Val Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu
1325 1330 1335

Val Leu Asn Ser Thr Leu Ile His Gln Ser Ile Thr Gly Leu Tyr
1340 1345 1350

Glu Thr Arg Ile Asp Leu Gly Lys Leu Gly Gly Asp

1355 1360 1365

<210> 96
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 96

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
100 105 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
115 120 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
130 135 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145 150 155 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
165 170 175

```
Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380
```

```
Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590
```

```
Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800
```

```
Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005
```

```
Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200
```

```
Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                 1210                 1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                 1225                 1230


Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                 1240                 1245


Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                 1255                 1260


Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                 1270                 1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                 1285                 1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                 1300                 1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                 1315                 1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                 1330                 1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                 1345                 1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                 1360                 1365


<210>  97
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  97
```

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asn Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
        195                 200                 205
```

```
Val Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415
```

```
Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620
```

```
Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Pro Ile Ile Asp Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Val Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Lys Gly Arg Arg Asn Thr Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Glu Glu Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830
```

```
Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile
        835                 840                 845


Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860


Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Asp Ile Val Lys Ala Arg
865                 870                 875                 880


Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895


Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910


Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925


Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940


Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960


Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975


Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035
```

```
Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Phe Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185

Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr Met Lys  Phe Leu Tyr
    1220                1225                1230
```

```
Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245


Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  98
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  98

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Arg Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240
```

```
Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445
```

```
Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655
```

```
His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670


Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685


Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700


Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720


Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735


Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750


Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765


Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780


Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800


Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815


Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830


Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845


Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860
```

```
Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880


Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895


Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910


Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925


Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940


Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960


Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975


Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065
```

```
Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260
```

```
Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  99
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  99

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
```

```
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Tyr Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Arg Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
```

```
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
```

485 490 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
500 505 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
515 520 525

Arg Phe Leu Ala Glu Gly Phe Lys Asp Phe Gln Phe Leu Asn Arg Lys
530 535 540

Gln Lys Glu Thr Ile Phe Asn Ser Leu Phe Lys Glu Lys Arg Lys Val
545 550 555 560

Thr Glu Lys Asp Ile Ile Ser Phe Leu Asn Lys Val Asp Gly Tyr Glu
565 570 575

Gly Ile Ala Ile Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser
580 585 590

Thr Tyr His Asp Leu Lys Lys Ile Leu Gly Lys Asp Phe Leu Asp Asn
595 600 605

Thr Asp Asn Glu Leu Ile Leu Glu Asp Ile Val Gln Thr Leu Thr Leu
610 615 620

Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Asp Ile Tyr Lys Asp
625 630 635 640

Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg His Tyr Thr
645 650 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asn Lys
660 665 670

Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Ser Ala
675 680 685

Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu Ser Phe Lys

690 695 700

Pro Ile Ile Asp Lys Ala Arg Thr Gly Ser His Ser Asp Asn Leu Lys
705 710 715 720

Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
725 730 735

Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr
740 745 750

Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
755 760 765

Ala Lys Gly Leu Ser Arg Ser Arg Gln Arg Leu Thr Thr Leu Arg Glu
770 775 780

Ser Leu Ala Asn Leu Lys Ser Glu Lys Lys Pro Lys Tyr Val Lys Asp
785 790 795 800

Gln Val Glu Asn His His Leu Ser Asp Asp Arg Leu Phe Leu Tyr Tyr
805 810 815

Leu Gln Asn Gly Lys Asp Met Tyr Thr Asp Asp Glu Leu Asp Ile Asp
820 825 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
835 840 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
850 855 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Val Glu Ile Val Lys Asp Cys
865 870 875 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
885 890 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp

900 905 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
915 920 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
930 935 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945 950 955 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
965 970 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
980 985 990

Val Val Ala Lys Ala Ile Leu Thr Lys Tyr Pro Gln Leu Glu Pro Glu
995 1000 1005

Phe Val Tyr Gly Asp Tyr Pro Lys Tyr Asn Ser Tyr Lys Thr Arg
1010 1015 1020

Lys Ala Thr Glu Lys Leu Phe Phe Tyr Ser Asn Ile Met Asn Phe
1025 1030 1035

Phe Lys Thr Lys Val Thr Leu Ala Asp Gly Thr Val Val Val Lys
1040 1045 1050

Asp Asp Ile Glu Val Asn Asn Asp Thr Gly Glu Ile Val Trp Asp
1055 1060 1065

Lys Lys Lys His Phe Ala Thr Val Arg Lys Val Leu Ser Tyr Pro
1070 1075 1080

Gln Val Asn Ile Val Lys Lys Thr Glu Ile Gln Thr Gly Gly Phe
1085 1090 1095

Ser Lys Glu Ser Ile Leu Ala His Gly Asn Ser Asp Lys Leu Ile

1100 1105 1110

Pro Arg Lys Thr Lys Asp Ile Tyr Leu Asp Pro Lys Lys Tyr Gly
1115 1120 1125

Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Val Leu Val Val Ala
1130 1135 1140

Asp Ile Lys Lys Gly Lys Ala Gln Lys Leu Lys Thr Val Thr Glu
1145 1150 1155

Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Arg Phe Glu Lys Asn
1160 1165 1170

Pro Ser Ala Phe Leu Glu Ser Lys Gly Tyr Leu Asn Ile Arg Asp
1175 1180 1185

Asp Lys Leu Met Ile Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu
1190 1195 1200

Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Gly Glu Leu Gln Lys
1205 1210 1215

Gly Asn Glu Leu Ala Leu Pro Thr Gln Phe Met Lys Phe Leu Tyr
1220 1225 1230

Leu Ala Ser Arg Tyr Asn Glu Leu Lys Gly Lys Pro Glu Glu Ile
1235 1240 1245

Glu Gln Lys Gln Glu Phe Val Val Gln His Val Ser Tyr Phe Asp
1250 1255 1260

Asp Ile Leu Gln Ile Ile Asn Asp Phe Ser Asn Arg Val Ile Leu
1265 1270 1275

Ala Asp Ala Asn Leu Glu Lys Ile Asn Lys Leu Tyr Gln Asp Asn
1280 1285 1290

Lys Glu Asn Ile Pro Val Asp Glu Leu Ala Asn Asn Ile Ile Asn

1295 1300 1305

Leu Phe Thr Phe Thr Ser Leu Gly Ala Pro Ala Ala Phe Lys Phe
1310 1315 1320

Phe Asp Lys Ile Val Asp Arg Lys Arg Tyr Thr Ser Thr Lys Glu
1325 1330 1335

Val Leu Asn Ser Thr Leu Ile His Lys Ser Ile Thr Gly Leu Tyr
1340 1345 1350

Glu Thr Arg Ile Asp Leu Gly Lys Leu Gly Glu Asp
1355 1360 1365

<210> 100
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 100

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
100 105 110

```
Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320
```

```
Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525
```

```
Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735
```

```
Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940
```

```
Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960


Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975


Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Ile Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140
```

```
Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290

Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305

Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320

Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335
```

```
Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  101
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  101

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125


His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140
```

```
Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350
```

```
Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560
```

```
Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765
```

```
Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Ser Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975
```

```
Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155


Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170
```

```
Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185


Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200


Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230


Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245


Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365
```

<210> 102
<211> 1365
<212> PRT
<213> Streptococcus agalactiae

<400> 102

```
Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ser Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Asp Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125


His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140


Lys Lys Glu Lys Ala Asn Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175
```

```
Val Arg Asn Thr Asp Ile Gln Arg Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Ile Asp
        195                 200                 205

Val Glu Gly Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Val Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Thr Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Ser Lys Thr
        355                 360                 365

Asn Gln Gly Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380
```

```
Glu Gly Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400


Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415


Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430


Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445


Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460


Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480


Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495


Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510


Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525


Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540


Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560


Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575


Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590
```

```
Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Pro Ile Ile Asp Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Val Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Thr Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Glu Glu Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800
```

```
Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Asp Ile Val Lys Ala Arg
865                 870                 875                 880

Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005
```

```
Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Phe Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Asp
    1175                1180                1185

Asp Lys  Leu Met Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200
```

```
Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                 1210                 1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr Met Lys  Phe Leu Tyr
    1220                 1225                 1230


Leu Ala  Ser Arg Tyr Asn Glu  Leu Lys Gly Lys Pro  Glu Glu Ile
    1235                 1240                 1245


Glu Gln  Lys Gln Glu Phe Val  Val Gln His Val Ser  Tyr Phe Asp
    1250                 1255                 1260


Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                 1270                 1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                 1285                 1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                 1300                 1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                 1315                 1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                 1330                 1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                 1345                 1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                 1360                 1365


<210>  103
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  103

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
```

```
1               5                   10                  15

Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
```

```
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
```

```
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
```

625 630 635 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
645 650 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
660 665 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
675 680 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
690 695 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705 710 715 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
725 730 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
740 745 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
770 775 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785 790 795 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
805 810 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
820 825 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile

835 840 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
850 855 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865 870 875 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
885 890 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
900 905 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
915 920 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
930 935 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945 950 955 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
965 970 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
980 985 990

Val Val Ala Lys Ala Ile Leu Thr Lys Tyr Pro Gln Leu Glu Pro Glu
995 1000 1005

Phe Val Tyr Gly Asp Tyr Pro Lys Tyr Asn Ser Tyr Lys Thr Arg
1010 1015 1020

Lys Ala Thr Glu Lys Leu Phe Phe Tyr Ser Asn Ile Met Asn Phe
1025 1030 1035

Phe Lys Thr Lys Val Thr Leu Ala Asp Gly Thr Val Val Val Lys

1040 1045 1050

Asp Asp Ile Glu Val Asn Asn Asp Thr Gly Glu Ile Val Trp Asp
1055 1060 1065

Lys Lys Lys His Phe Ala Thr Val Arg Lys Val Leu Ser Tyr Pro
1070 1075 1080

Gln Asn Asn Ile Val Lys Lys Thr Glu Ile Gln Thr Gly Gly Phe
1085 1090 1095

Ser Lys Glu Ser Ile Leu Ala His Gly Asn Ser Asp Lys Leu Ile
1100 1105 1110

Pro Arg Lys Thr Lys Asp Ile Tyr Leu Asp Pro Lys Lys Tyr Gly
1115 1120 1125

Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Val Leu Val Val Ala
1130 1135 1140

Asp Ile Lys Lys Gly Lys Ala Gln Lys Leu Lys Thr Val Thr Glu
1145 1150 1155

Leu Leu Gly Ile Thr Ile Met Glu Arg Ser Arg Phe Glu Lys Asn
1160 1165 1170

Leu Ser Ala Phe Leu Glu Ser Lys Gly Tyr Leu Asn Ile Arg Ala
1175 1180 1185

Asp Lys Leu Ile Ile Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu
1190 1195 1200

Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Gly Glu Leu Gln Lys
1205 1210 1215

Gly Asn Glu Leu Ala Leu Pro Thr Gln Phe Met Lys Phe Leu Tyr
1220 1225 1230

Leu Ala Ser Arg Tyr Asn Glu Ser Lys Gly Lys Pro Glu Glu Ile

```
    1235                1240                1245


Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ile Ile Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  104
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  104

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255
```

```
Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Asp Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460
```

```
Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670
```

```
Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720

Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880
```

```
Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080
```

```
Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275
```

```
Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                 1285                 1290


Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                 1300                 1305


Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                 1315                 1320


Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                 1330                 1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                 1345                 1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                 1360                 1365


<210>  105
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  105

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Met Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Ser Phe Glu Asn Asn His Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285
```

```
Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Tyr Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495
```

```
Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Val
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Gln Leu Leu Asp Phe Leu Ala Lys Glu Phe Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Ile Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Arg Glu Ser Gln Lys Ile Ile Leu Asp Tyr Leu Ile Ser Asp
        675                 680                 685

Gly Arg Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700
```

```
Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ser Gly Ser His Ser Asp
705                 710                 715                 720


Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735


Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750


Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765


Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780


Leu Glu Asp Gly Val Lys Asn Leu Ala Ser Asp Ile Leu Lys Glu Tyr
785                 790                 795                 800


Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815


Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830


Ser Leu Ser Gln Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile
        835                 840                 845


Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860


Arg Gly Lys Ser Asp Asp Val Pro Ser Ile Asp Ile Val Lys Ala Arg
865                 870                 875                 880


Lys Ala Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Ile Ser Gln Arg
                885                 890                 895


Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Pro Asp
            900                 905                 910
```

```
Asp Lys Ala Gly Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925


Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Lys Val
    930                 935                 940


Asp Asp Asn Asn Lys Pro Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960


Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975


Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Glu Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Glu Thr Gly Glu Ile  Ala Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Val  Asn Ile Val Lys Lys  Thr Glu Val Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Ser Asn Ser Asp  Lys Leu Ile
    1100                1105                1110
```

```
Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Leu Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Lys Glu
    1145                1150                1155


Leu Ile  Gly Ile Thr Ile Met  Glu Arg Glu Arg Phe  Glu Lys Asn
    1160                1165                1170


Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Thr
    1175                1180                1185


Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200


Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215


Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Tyr Met Lys  Phe Leu Tyr
    1220                1225                1230


Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245


Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260


Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275


Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Ser Asp Asn
    1280                1285                1290


Lys Asp  Asn Thr Pro Val Asp  Glu Leu Ala Lys Asn  Ile Ile Asn
    1295                1300                1305
```

```
Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320


Phe Asp  Lys Ser Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asp Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  106
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae


<220>
<221>  misc_feature
<222>  (9)..(9)
<223>  Xaa can be any naturally occurring amino acid

<400>  106

Met Asn Lys Pro Tyr Ser Ile Gly Xaa Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125

His Glu Lys Phe Ser Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Ile Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Ser Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Ser Lys Gln Tyr Gln Asp Phe Leu Glu Ile
            180                 185                 190

Phe Asn Thr Thr Phe Glu Asn Asn Asp Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asn Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys Tyr
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300
```

```
Gly Ile Leu Thr Val Ile Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335

Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Asp Ser Glu Asn Phe Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Lys Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Asp Leu Val Asp Lys Glu Lys Ser Ala Glu Ala Phe Ile His Arg Met
                485                 490                 495

Thr Asn Asn Asp Phe Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510
```

```
Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540

Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu His Arg Lys Val Ser
545                 550                 555                 560

Lys Lys Lys Leu Leu Asp Phe Leu Ala Lys Glu Tyr Glu Glu Phe Arg
                565                 570                 575

Ile Val Asp Val Ile Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Asp Lys Asp Phe
        595                 600                 605

Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Glu Asn
625                 630                 635                 640

Tyr Lys Asp Leu Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asp Lys Glu Ser Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Arg Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu
    690                 695                 700

Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ala Gly Ser His Ser Asp
705                 710                 715                 720
```

```
Asn Leu Lys Glu Val Val Gly Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Tyr Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925
```

```
Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960

Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
                965                 970                 975

Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
            980                 985                 990

Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005

Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020

Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050

Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125
```

```
Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140

Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155

Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Ala
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Leu Ile Asn  Asp Phe Ser Lys Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290

Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305

Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320
```

```
Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335


Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350


Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  107
<211>  1365
<212>  PRT
<213>  Streptococcus agalactiae

<400>  107

Met Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Ile Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Arg Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Gly Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Ile Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Lys Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Asp Tyr
        115                 120                 125
```

```
His Glu Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Lys Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Asp Asp Arg Phe Asp
                165                 170                 175

Val Arg Asn Thr Asp Ile Gln Lys Gln Tyr Gln Ala Phe Leu Glu Ile
            180                 185                 190

Phe Asp Thr Thr Phe Glu Asn Asn His Leu Leu Ser Gln Asn Val Asp
        195                 200                 205

Val Glu Ala Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp
    210                 215                 220

Arg Ile Leu Ala Gln Tyr Pro Asp Gln Lys Ser Thr Gly Ile Phe Ala
225                 230                 235                 240

Glu Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His
                245                 250                 255

Phe Asn Leu Glu Asp Lys Thr Pro Leu Gln Phe Ala Lys Asp Ser Tyr
            260                 265                 270

Asp Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Glu Phe Ala
        275                 280                 285

Asp Leu Phe Ser Ala Ala Lys Lys Leu Tyr Asp Ser Val Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Thr Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Gln Arg Tyr Asp Glu His Arg Glu Asp Leu Lys Gln Leu
                325                 330                 335
```

```
Lys Gln Phe Val Lys Ala Ser Leu Pro Glu Lys Tyr Gln Glu Ile Phe
            340                 345                 350

Ala Asp Ser Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr
        355                 360                 365

Asn Gln Glu Ala Phe Tyr Lys Tyr Leu Ser Lys Leu Leu Thr Lys Gln
    370                 375                 380

Glu Gly Ser Glu Tyr Leu Leu Glu Lys Ile Lys Asn Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Thr Glu Leu Arg Ala Ile Ile Arg Arg Gln Ser Glu Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Leu Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Glu Lys Ser Asp Phe Ala
    450                 455                 460

Trp Met Thr Arg Lys Thr Asp Asp Ser Ile Arg Pro Trp Asn Phe Glu
465                 470                 475                 480

Glu Leu Val Asp Lys Glu Ala Ser Ala Glu Ala Phe Ile His Cys Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Ile Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Lys Asn Glu Gln Gly Glu Thr Tyr Phe Phe Asp Ser Asn Ile
    530                 535                 540
```

```
Lys Gln Glu Ile Phe Asp Gly Val Phe Lys Glu Tyr Arg Lys Val Ser
545                 550                 555                 560


Lys Lys Gln Leu Leu Asp Phe Leu Ala Lys Glu Phe Glu Glu Phe Arg
                565                 570                 575


Ile Val Asp Val Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala
            580                 585                 590


Ser Leu Gly Thr Tyr His Asp Leu Glu Lys Ile Leu Gly Lys Asp Phe
        595                 600                 605


Leu Asp Asn Pro Asp Asn Glu Ser Ile Leu Glu Asp Ile Val Gln Thr
    610                 615                 620


Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Lys Arg Leu Asp Ile
625                 630                 635                 640


Tyr Lys Asp Phe Phe Thr Glu Ser Gln Leu Lys Lys Leu Tyr Arg Arg
                645                 650                 655


His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile
            660                 665                 670


Arg Asn Lys Glu Asn Gln Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685


Gly Ser Ala Asn Arg Asn Phe Met Gln Leu Ile Lys Asp Ala Gly Leu
    690                 695                 700


Ser Phe Lys Ser Ile Ile Ser Lys Ala Gln Ser Gly Ser His Ser Asp
705                 710                 715                 720


Asn Leu Lys Glu Val Val Ser Glu Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735


Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750
```

```
Met Gly Tyr Lys Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Gln Gly Arg Arg Asn Ser Arg Gln Arg Tyr Lys Leu
    770                 775                 780

Leu Asp Asp Gly Val Arg Asn Leu Ala Ser Asn Ile Leu Lys Glu Tyr
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Glu Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Glu Lys Ala Leu Asp Ile Asp
            820                 825                 830

Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asp Ser Ile Asp Asn Arg Val Leu Val Ser Ser Ala Lys Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val Lys Asp Cys
865                 870                 875                 880

Lys Val Phe Trp Lys Lys Leu Leu Asp Ala Lys Leu Met Ser Gln Arg
                885                 890                 895

Lys Tyr Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Ser Asp
            900                 905                 910

Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Asn Glu Leu
    930                 935                 940

Asp Ser Lys Gly Arg Arg Ile Arg Lys Val Lys Ile Val Thr Leu Lys
945                 950                 955                 960
```

```
Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile
               965                 970                 975


Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala
           980                 985                 990


Val Val Ala Lys Ala Ile Leu Thr  Lys Tyr Pro Gln Leu  Glu Pro Glu
        995                 1000                1005


Phe Val  Tyr Gly Asp Tyr Pro  Lys Tyr Asn Ser Tyr  Lys Thr Arg
    1010                1015                1020


Lys Ala  Thr Glu Lys Leu Phe  Phe Tyr Ser Asn Ile  Met Asn Phe
    1025                1030                1035


Phe Lys  Thr Lys Val Thr Leu  Ala Asp Gly Thr Val  Val Val Lys
    1040                1045                1050


Asp Asp  Ile Glu Val Asn Asn  Asp Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Lys His Phe Ala Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Asn  Asn Ile Val Lys Lys  Thr Glu Ile Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Ala  His Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Lys Asp Ile  Tyr Leu Asp Pro Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Ile Val  Ala Tyr Ser Val Leu  Val Val Ala
    1130                1135                1140


Asp Ile  Lys Lys Gly Lys Ala  Gln Lys Leu Lys Thr  Val Thr Glu
    1145                1150                1155
```

```
Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Arg Phe  Glu Lys Asn
    1160                1165                1170

Pro Ser  Ala Phe Leu Glu Ser  Lys Gly Tyr Leu Asn  Ile Arg Thr
    1175                1180                1185

Asp Lys  Leu Ile Ile Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Leu Ala Leu Pro  Thr Gln Phe Met Lys  Phe Leu Tyr
    1220                1225                1230

Leu Ala  Ser Arg Tyr Asn Glu  Ser Lys Gly Lys Pro  Glu Glu Ile
    1235                1240                1245

Glu Lys  Lys Gln Glu Phe Val  Asn Gln His Val Ser  Tyr Phe Asp
    1250                1255                1260

Asp Ile  Leu Gln Ile Ile Asn  Asp Phe Ser Asn Arg  Val Ile Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Asn Lys Leu Tyr  Gln Asp Asn
    1280                1285                1290

Lys Glu  Asn Ile Ser Val Asp  Glu Leu Ala Asn Asn  Ile Ile Asn
    1295                1300                1305

Leu Phe  Thr Phe Thr Ser Leu  Gly Ala Pro Ala Ala  Phe Lys Phe
    1310                1315                1320

Phe Asp  Lys Ile Val Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu
    1325                1330                1335

Val Leu  Asn Ser Thr Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr
    1340                1345                1350
```

```
Glu Thr  Arg Ile Asp Leu Gly  Lys Leu Gly Glu Asp
    1355                1360                1365


<210>  108
<211>  1351
<212>  PRT
<213>  Streptococcus anginosus

<400>  108

Met Asn Gln Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Gln Ser Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Met Gln Val Asp Glu Ser
                85                  90                  95


Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Asp Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Ile Ala Ala Glu Val Lys Tyr
        115                 120                 125


His Asp Glu Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140


Ile Ser Gln Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160
```

```
Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asn Val Gln Ala Leu Phe Lys Asp Phe Val Glu Val Tyr
            180                 185                 190

Asp Lys Thr Val Glu Glu Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala His Tyr Pro Ala Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Phe Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Gly Leu Leu Gly Glu Val Gly Asp Glu Tyr Ala Asp
        275                 280                 285

Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Glu Glu His Gln Lys Asp Leu Lys Lys Phe Glu
                325                 330                 335

Asp Phe Ile Lys Val Asn Ala Leu Asp Gln Tyr Asn Ala Ile Phe Lys
            340                 345                 350

Asp Lys Asn Lys Lys Gly Tyr Ala Gly Tyr Ile Glu Ser Gly Val Lys
        355                 360                 365
```

```
Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Gly Ile Leu Leu Gln Ile Asn
    370                 375                 380

Gly Ser Gly Asp Phe Leu Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465                 470                 475                 480

Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495

Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575
```

```
Val Asn Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ser Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asn Lys Ser Phe Leu
        595                 600                 605

Asp Asn Lys Glu Asn Ala Gln Ile Ile Glu Asp Ile Ile Gln Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr
625                 630                 635                 640

Ser Asp Ile Phe Thr Lys Ala Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asn Lys Glu Asn Lys Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Ile Ile Gly Asp Val Asp Asp
705                 710                 715                 720

Ile Ala Asn Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly His Asn Pro Ala Asn Ile Ile Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Asp Arg Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu
    770                 775                 780
```

```
Gln Asp Ser Leu Lys Pro Val Asn Ile Lys Asn Val Glu Asn Gln Gln
785                 790                 795                 800


Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp
                805                 810                 815


Met Tyr Thr Gly Glu Thr Leu Asp Ile Asn Asn Leu Ser Gln Tyr Asp
            820                 825                 830


Ile Asp His Ile Ile Pro Gln Ala Tyr Ile Lys Asp Asp Ser Phe Asp
        835                 840                 845


Asn Arg Val Leu Thr Ser Ser Ser Glu Asn Arg Gly Lys Ser Asp Asn
    850                 855                 860


Val Pro Ser Ile Glu Val Val Cys Ala Arg Lys Ala Asp Trp Met Arg
865                 870                 875                 880


Leu Arg Lys Ala Gly Leu Ile Ser Gln Arg Lys Phe Asp Asn Leu Thr
                885                 890                 895


Lys Ala Glu Arg Gly Gly Leu Thr Glu Asn Asp Lys Ala Gly Phe Ile
            900                 905                 910


Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln
        915                 920                 925


Val Leu Asp Ala Arg Phe Asn Ala Lys His Asp Glu Asn Lys Lys Val
    930                 935                 940


Ile Arg Asp Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val Ser Gln
945                 950                 955                 960


Phe Arg Lys Asp Phe Lys Phe Tyr Lys Val Arg Glu Ile Asn Asp Tyr
                965                 970                 975


His His Ala His Asp Ala Tyr Leu Asn Ala Val Ile Gly Thr Ala Leu
            980                 985                 990
```

```
Leu Lys Lys Tyr Pro Lys Leu Ala  Ser Glu Phe Val Tyr  Gly Glu Phe
        995                 1000                1005


Lys Lys  Tyr Asp Val Ser Asp  Lys Glu Ile Gly Lys  Ala Thr Ala
    1010                1015                1020


Lys Tyr  Phe Phe Tyr Ser Asn  Leu Met Asn Phe Phe  Lys Lys Glu
    1025                1030                1035


Val Lys  Phe Ala Asp Gly Thr  Val Val Glu Arg Pro  Asp Ile Glu
    1040                1045                1050


Thr Ser  Glu Asp Gly Glu Ile  Ala Trp Asn Lys Gln  Thr Asp Phe
    1055                1060                1065


Lys Ile  Val Arg Lys Val Leu  Ser Tyr Pro Gln Val  Asn Ile Val
    1070                1075                1080


Lys Lys  Thr Glu Val Gln Thr  His Gly Leu Asp Arg  Pro Ser Pro
    1085                1090                1095


Lys Pro  Lys Pro Asp Ser Ser  Glu Asn Leu Val Gly  Val Lys Arg
    1100                1105                1110


Asn Leu  Asp Pro Lys Lys Tyr  Gly Gly Tyr Ala Gly  Ile Ser Asn
    1115                1120                1125


Ser Tyr  Ala Val Leu Val Lys  Ala Ile Ile Glu Lys  Gly Val Lys
    1130                1135                1140


Lys Lys  Glu Thr Met Val Leu  Glu Phe Gln Gly Ile  Ser Ile Leu
    1145                1150                1155


Asp Arg  Ile Thr Phe Glu Lys  Asp Lys Arg Ala Phe  Leu Leu Gly
    1160                1165                1170


Lys Gly  Tyr Lys Asp Ile Lys  Lys Ile Ile Glu Leu  Pro Lys Tyr
    1175                1180                1185
```

```
Ser Leu  Phe Glu Leu Lys Asp  Gly Ser Arg Arg Met  Leu Ala Ser
    1190                1195                1200


Arg Gly  Glu Ile His Lys Gly  Asn Glu Leu Phe Val  Pro Gln Lys
    1205                1210                1215


Phe Thr  Thr Leu Leu Tyr His  Ala Lys Arg Ile Asn  Asn Pro Ile
    1220                1225                1230


Asn Lys  Asp His Ile Glu Tyr  Val Lys Lys His Arg  Asp Asp Phe
    1235                1240                1245


Lys Glu  Leu Leu Asn Tyr Val  Leu Glu Phe Asn Glu  Lys Tyr Val
    1250                1255                1260


Gly Ala  Thr Lys Asn Gly Glu  Arg Leu Lys Glu Ala  Val Ala Asp
    1265                1270                1275


Phe Asp  Ser Lys Ser Asn Glu  Glu Ile Cys Thr Ser  Phe Leu Gly
    1280                1285                1290


Leu Phe  Glu Leu Thr Ser Leu  Gly Ser Ala Ser Asp  Phe Glu Phe
    1295                1300                1305


Leu Gly  Val Lys Ile Pro Arg  Tyr Arg Asp Tyr Thr  Pro Ser Ser
    1310                1315                1320


Leu Leu  Lys Asp Ser Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1325                1330                1335


Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu Gly Glu  Asp
    1340                1345                1350


<210>  109
<211>  1341
<212>  PRT
<213>  Streptococcus anginosus

<400>  109

Met Lys Lys Glu Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
```

```
1               5                   10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Gln Ser Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Thr Glu Glu Met Asn Lys Val Asp Glu Asn
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Glu Glu Asp Lys Gln
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Gly Thr Leu Lys Glu Glu Lys Glu Tyr
        115                 120                 125

His Lys Lys Phe Lys Thr Ile Tyr His Leu Arg Glu Glu Leu Ala Asn
    130                 135                 140

Ser Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Tyr Glu Gly Asp Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Ala Leu Phe Lys Asp Phe Val Glu Glu Tyr
            180                 185                 190

Asp Lys Thr Ile Glu Glu Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Ser Arg Leu Glu Asn
```

210 215 220

Leu Ile Ala His Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225 230 235 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
245 250 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
260 265 270

Glu Asp Leu Glu Glu Leu Leu Gly Glu Ile Gly Asp Glu Tyr Ala Asp
275 280 285

Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
290 295 300

Ile Leu Ala Val Asp Asp Asn Thr Thr Lys Ala Pro Leu Ser Ala Ser
305 310 315 320

Met Val Lys Arg Tyr Glu Glu His Gln Lys Asp Leu Lys Lys Leu Lys
325 330 335

Asp Phe Ile Lys Val Asn Ala Pro Asp Gln Tyr Asn Ala Ile Phe Lys
340 345 350

Asp Lys Asn Lys Lys Gly Tyr Ala Gly Tyr Ile Glu Ser Gly Val Glu
355 360 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Gly Ile Leu Leu Lys Ile Asn
370 375 380

Gly Ser Gly Asp Phe Leu Asp Lys Ile Asp Cys Glu Asp Phe Leu Arg
385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe

420 425 430

Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp
450 455 460

Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465 470 475 480

Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
485 490 495

Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
500 505 510

Pro Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
515 520 525

Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Thr Asn Met Lys
530 535 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545 550 555 560

Asp Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile
565 570 575

Val Asn Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ser Ser
580 585 590

Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Ser Phe Leu
595 600 605

Asp Asp Lys Ala Asn Glu Lys Thr Ile Glu Asp Ile Ile Gln Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr

625 630 635 640

Ser Asp Ile Phe Thr Lys Ala Gln Leu Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
660 665 670

Asn Lys Glu Asn Lys Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Arg Ala Gln Ile Ile Gly Asp Val Asp Asp
705 710 715 720

Ile Ala Asn Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
740 745 750

Gly His Asn Pro Ala Asn Ile Ile Ile Glu Met Ala Arg Glu Asn Gln
755 760 765

Thr Thr Asp Lys Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu
770 775 780

Gln Asp Ser Leu Lys Pro Val Asn Ile Lys Asn Val Glu Asn Gln Gln
785 790 795 800

Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp
805 810 815

Met Tyr Thr Gly Glu Thr Leu Asp Ile Asn Asn Leu Ser Gln Tyr Asp
820 825 830

Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Leu Asp

```
        835                 840                 845

Asn Arg Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser Asp Asp
    850                 855                 860

Val Pro Ser Ile Glu Val Val His Glu Met Lys Ser Phe Trp Ser Lys
865                 870                 875                 880

Leu Leu Ser Val Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr
                885                 890                 895

Lys Ala Glu Arg Gly Gly Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile
            900                 905                 910

Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln
        915                 920                 925

Ile Leu Asp Glu Arg Phe Asn Thr Glu Phe Asp Gly Ala Gln Arg Arg
    930                 935                 940

Ile Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val Ser Asn
945                 950                 955                 960

Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr
                965                 970                 975

His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Asn Ala Leu
            980                 985                 990

Leu Leu Lys Tyr Pro Gln Leu Glu  Pro Glu Phe Val Tyr  Gly Glu Tyr
        995                 1000                1005

Pro Lys  Tyr Asn Ser Tyr Arg  Ser Arg Lys Ser Ala  Thr Glu Lys
    1010                1015                1020

Phe Leu  Phe Tyr Ser Asn Ile  Leu Arg Phe Phe Lys  Lys Glu Asp
    1025                1030                1035

Ile Gln  Thr Asn Glu Asp Gly  Glu Ile Ala Trp Asn  Lys Glu Lys
```

1040 1045 1050

His Ile Lys Ile Leu Arg Lys Val Leu Ser Tyr Pro Gln Val Asn
1055 1060 1065

Ile Val Lys Lys Thr Glu Glu Gln Thr Gly Gly Phe Ser Lys Glu
1070 1075 1080

Ser Ile Leu Pro Lys Gly Glu Ser Asp Lys Leu Ile Pro Arg Lys
1085 1090 1095

Thr Lys Asn Ser Tyr Trp Asn Pro Lys Lys Tyr Gly Gly Phe Asp
1100 1105 1110

Ser Pro Val Val Ala Tyr Ser Ile Leu Val Phe Ala Asp Val Glu
1115 1120 1125

Lys Gly Lys Ser Lys Lys Leu Arg Lys Val Gln Asp Met Val Gly
1130 1135 1140

Ile Thr Ile Met Glu Lys Lys Arg Phe Glu Lys Asn Pro Val Asp
1145 1150 1155

Phe Leu Glu Gln Arg Gly Tyr Arg Asn Val Arg Leu Glu Lys Ile
1160 1165 1170

Ile Lys Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu Asn Lys Arg
1175 1180 1185

Arg Arg Leu Leu Ala Ser Ala Arg Glu Leu Gln Lys Gly Asn Glu
1190 1195 1200

Leu Val Ile Pro Gln Arg Phe Thr Thr Leu Leu Tyr His Ser Tyr
1205 1210 1215

Gln Ile Glu Lys Asn Tyr Glu Pro Glu His Arg Glu Tyr Val Glu
1220 1225 1230

Lys His Lys Asp Glu Phe Lys Glu Leu Leu Glu Tyr Ile Ser Val

1235 1240 1245

Phe Ser Arg Lys Tyr Val Leu Ala Asp Asn Asn Leu Thr Lys Ile
1250 1255 1260

Glu Met Leu Phe Ser Lys Asn Lys Asp Ala Glu Val Ser Ser Leu
1265 1270 1275

Ala Lys Ser Phe Ile Ser Leu Leu Thr Phe Thr Ala Phe Gly Ala
1280 1285 1290

Pro Ala Ala Phe Asn Phe Phe Gly Glu Asn Ile Asp Arg Lys Arg
1295 1300 1305

Tyr Thr Ser Val Thr Glu Cys Leu Asn Ala Thr Leu Ile His Gln
1310 1315 1320

Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ser Lys Leu
1325 1330 1335

Gly Glu Asp
1340

<210> 110
<211> 1341
<212> PRT
<213> Streptococcus anginosus

<400> 110

Met Lys Lys Glu Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Lys Val Leu Gly Asn Thr Asp Lys Gln Ser Ile Lys Lys Asn Leu Leu
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
50 55 60

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Met Gln Val Asp Glu Ser
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Arg Tyr Pro Ile Phe Gly Asn Ile Ala Ala Glu Val Lys Tyr
        115                 120                 125

His Asp Asp Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Val Asp
    130                 135                 140

Ile Ser Gln Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asn Val Gln Ala Leu Phe Lys Asp Phe Val Glu Val Tyr
            180                 185                 190

Asp Lys Thr Val Glu Glu Ser His Leu Ser Glu Met Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Val Glu Cys Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270
```

```
Glu Asp Leu Glu Gly Leu Leu Gly Glu Ile Gly Asp Glu Tyr Ala Asp
        275                 280                 285

Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Ala Val Asp Asp Asn Thr Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Glu Glu His Gln Lys Asp Leu Lys Lys Leu Lys
                325                 330                 335

Asp Phe Ile Lys Val Asn Ala Pro Ala Gln Tyr Asp Asp Ile Phe Lys
            340                 345                 350

Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Asp
    370                 375                 380

Gly Ser Asp Tyr Phe Leu Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465                 470                 475                 480
```

```
Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495

Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Pro Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Thr Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575

Val Asn Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Ser Phe Leu
        595                 600                 605

Asp Asp Lys Val Asn Glu Lys Ile Ile Glu Asp Ile Ile Gln Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr
625                 630                 635                 640

Ser Asp Ile Phe Thr Thr Gln Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asn Lys Glu Asn Lys Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685
```

```
Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Arg Ala Gln Ile Ile Gly Asp Val Asp Asp
705                 710                 715                 720

Ile Ala Asn Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly His Asn Pro Ala Asn Ile Ile Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Asp Lys Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu
    770                 775                 780

Gln Asp Ser Leu Lys Pro Val Asn Ile Lys Asn Val Glu Asn Gln Gln
785                 790                 795                 800

Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp
                805                 810                 815

Met Tyr Thr Gly Glu Thr Leu Asp Ile Asn Asn Leu Ser Gln Tyr Asp
            820                 825                 830

Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Leu Asp
        835                 840                 845

Asn Arg Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser Asp Asp
    850                 855                 860

Val Pro Ser Ile Glu Val Val His Glu Met Lys Ser Phe Trp Ser Lys
865                 870                 875                 880

Leu Leu Ser Val Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr
                885                 890                 895
```

```
Lys Ala Glu Arg Gly Gly Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile
            900                 905                 910

Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln
        915                 920                 925

Ile Leu Asp Glu Arg Phe Asn Thr Glu Phe Asp Gly Ala Gln Arg Arg
    930                 935                 940

Ile Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val Ser Asn
945                 950                 955                 960

Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr
                965                 970                 975

His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Asn Ala Leu
            980                 985                 990

Leu Leu Lys Tyr Pro Gln Leu Glu  Pro Glu Phe Val Tyr  Gly Glu Tyr
        995                 1000                1005

Pro Lys  Tyr Asn Ser Tyr Arg  Ser Arg Lys Ser Ala  Thr Glu Lys
    1010                1015                1020

Phe Leu  Phe Tyr Ser Asn Ile  Leu Arg Phe Phe Lys  Lys Glu Asp
    1025                1030                1035

Ile Gln  Thr Asn Glu Asp Gly  Glu Ile Ala Trp Asn  Lys Glu Lys
    1040                1045                1050

His Ile  Lys Ile Leu Arg Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1055                1060                1065

Ile Val  Lys Lys Thr Glu Glu  Gln Thr Gly Gly Phe  Ser Lys Glu
    1070                1075                1080

Ser Ile  Leu Pro Lys Gly Glu  Ser Asp Lys Leu Ile  Pro Arg Lys
    1085                1090                1095
```

```
Thr Lys  Asn Ser Tyr Trp Asn  Pro Lys Lys Tyr Gly  Gly Phe Asp
    1100                1105                1110

Ser Pro  Val Val Ala Tyr Ser  Ile Leu Val Phe Ala  Asp Val Glu
    1115                1120                1125

Lys Gly  Lys Ser Lys Lys Leu  Arg Lys Val Gln Asp  Met Val Gly
    1130                1135                1140

Ile Thr  Ile Met Glu Lys Lys  Arg Phe Glu Lys His  Pro Val Asp
    1145                1150                1155

Phe Leu  Glu Gln Arg Gly Tyr  Arg Asn Val Arg Leu  Glu Lys Ile
    1160                1165                1170

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Lys Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Arg Glu Leu Gln Lys  Gly Asn Glu
    1190                1195                1200

Leu Val  Ile Pro Gln Arg Phe  Thr Thr Leu Leu Tyr  His Ser Tyr
    1205                1210                1215

Arg Ile  Glu Lys Asp Tyr Glu  Pro Glu His Arg Glu  Tyr Val Glu
    1220                1225                1230

Lys His  Lys Asp Glu Phe Lys  Glu Leu Leu Glu Tyr  Ile Ser Val
    1235                1240                1245

Phe Ser  Arg Lys Tyr Val Leu  Ala Asp Asn Asn Leu  Thr Lys Ile
    1250                1255                1260

Glu Met  Leu Phe Ser Lys Asn  Lys Asp Ala Glu Val  Ser Ser Leu
    1265                1270                1275

Ala Lys  Ser Phe Ile Ser Leu  Leu Thr Phe Thr Ala  Phe Gly Ala
    1280                1285                1290
```

```
Pro Ala  Ala Phe Asn Phe Phe  Gly Glu Asn Ile Asp  Arg Lys Arg
    1295                 1300                 1305


Tyr Thr  Ser Val Thr Glu Cys  Leu Asn Ala Thr Leu  Ile His Gln
    1310                 1315                 1320


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu
    1325                 1330                 1335


Gly Glu  Asp
    1340
```

<210> 111
<211> 1341
<212> PRT
<213> Streptococcus anginosus

<400> 111

```
Met Lys Lys Glu Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Gln Ser Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Thr Glu Glu Met Asn Lys Val Asp Glu Asn
                85                  90                  95


Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Glu Glu Asp Lys Gln
            100                 105                 110
```

```
Gly Ser Lys Tyr Pro Ile Phe Gly Thr Leu Lys Glu Glu Lys Glu Tyr
        115                 120                 125

His Lys Lys Phe Lys Thr Ile Tyr His Leu Arg Glu Glu Leu Ala Asn
    130                 135                 140

Ser Lys Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Tyr Glu Gly Asp Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Ala Leu Phe Lys Asp Phe Val Glu Glu Tyr
            180                 185                 190

Asp Lys Thr Ile Glu Glu Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Ser Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala His Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Glu Ile Gly Asp Glu Tyr Ala Asp
        275                 280                 285

Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Ala Val Asp Asp Asn Thr Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320
```

```
Met Val Lys Arg Tyr Glu Glu His Gln Lys Asp Leu Lys Lys Leu Lys
                325                 330                 335

Asp Phe Ile Lys Val Asn Ala Pro Asp Gln Tyr Asn Ala Ile Phe Lys
            340                 345                 350

Asp Lys Asn Lys Lys Gly Tyr Ala Gly Tyr Ile Glu Ser Gly Val Glu
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Gly Ile Leu Leu Lys Ile Asn
    370                 375                 380

Gly Ser Gly Asp Phe Leu Asp Lys Ile Asp Cys Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465                 470                 475                 480

Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495

Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Pro Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525
```

```
Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Thr Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575

Val Asn Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ser Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Ser Phe Leu
        595                 600                 605

Asp Asp Lys Ala Asn Glu Lys Thr Ile Glu Asp Ile Ile Gln Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr
625                 630                 635                 640

Ser Asp Ile Phe Thr Lys Ala Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asn Lys Glu Asn Lys Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Arg Ala Gln Ile Ile Gly Asp Val Asp Asp
705                 710                 715                 720

Ile Ala Asn Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735
```

```
Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly His Asn Pro Ala Asn Ile Ile Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Asp Lys Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu
    770                 775                 780

Gln Asp Ser Leu Lys Pro Val Asn Ile Lys Asn Val Glu Asn Gln Gln
785                 790                 795                 800

Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp
                805                 810                 815

Met Tyr Thr Gly Glu Thr Leu Asp Ile Asn Asn Leu Ser Gln Tyr Asp
            820                 825                 830

Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Leu Asp
        835                 840                 845

Asn Arg Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser Asp Asp
    850                 855                 860

Val Pro Ser Ile Glu Val Val His Glu Met Lys Ser Phe Trp Ser Lys
865                 870                 875                 880

Leu Leu Ser Val Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr
                885                 890                 895

Lys Ala Glu Arg Gly Gly Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile
            900                 905                 910

Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln
        915                 920                 925

Ile Leu Asp Glu Arg Phe Asn Thr Glu Phe Asp Gly Ala Gln Arg Arg
    930                 935                 940
```

```
Ile Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val Ser Asn
945                 950                 955                 960


Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr
                965                 970                 975


His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Asn Ala Leu
            980                 985                 990


Leu Leu Lys Tyr Pro Gln Leu Glu  Pro Glu Phe Val Tyr  Gly Glu Tyr
        995                 1000                1005


Pro Lys  Tyr Asn Ser Tyr Arg  Ser Arg Lys Ser Ala  Thr Glu Lys
    1010                1015                1020


Phe Leu  Phe Tyr Ser Asn Ile  Leu Arg Phe Phe Lys  Lys Glu Asp
    1025                1030                1035


Ile Gln  Thr Asn Glu Asp Gly  Glu Ile Ala Trp Asn  Lys Glu Lys
    1040                1045                1050


His Ile  Lys Ile Leu Arg Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1055                1060                1065


Ile Val  Lys Lys Thr Glu Glu  Gln Thr Gly Gly Phe  Ser Lys Glu
    1070                1075                1080


Ser Ile  Leu Pro Lys Gly Glu  Ser Asp Lys Leu Ile  Pro Arg Lys
    1085                1090                1095


Thr Lys  Asn Ser Tyr Trp Asn  Pro Lys Lys Tyr Gly  Gly Phe Asp
    1100                1105                1110


Ser Pro  Val Val Ala Tyr Ser  Ile Leu Val Phe Ala  Asp Val Glu
    1115                1120                1125


Lys Gly  Lys Ser Lys Lys Leu  Arg Lys Val Gln Asp  Met Val Gly
    1130                1135                1140
```

```
Ile Thr  Ile Met Glu Lys Lys  Arg Phe Glu Lys Asn  Pro Val Asp
    1145                1150                1155

Phe Leu  Glu Gln Arg Gly Tyr  Arg Asn Val Arg Leu  Glu Lys Ile
    1160                1165                1170

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Lys Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Arg Glu Leu Gln Lys  Gly Asn Glu
    1190                1195                1200

Leu Val  Ile Pro Gln Arg Phe  Thr Thr Leu Leu Tyr  His Ser Tyr
    1205                1210                1215

Gln Ile  Glu Lys Asn Tyr Glu  Pro Glu His Arg Glu  Tyr Val Glu
    1220                1225                1230

Lys His  Lys Asp Glu Phe Lys  Glu Leu Leu Glu Tyr  Ile Ser Val
    1235                1240                1245

Phe Ser  Arg Lys Tyr Val Leu  Ala Asp Asn Asn Leu  Thr Lys Ile
    1250                1255                1260

Glu Met  Leu Phe Ser Lys Asn  Lys Asp Ala Glu Val  Ser Ser Leu
    1265                1270                1275

Ala Lys  Ser Phe Ile Ser Leu  Leu Thr Phe Thr Ala  Phe Gly Ala
    1280                1285                1290

Pro Ala  Ala Phe Asn Phe Phe  Gly Glu Asn Ile Asp  Arg Lys Arg
    1295                1300                1305

Tyr Thr  Ser Val Thr Glu Cys  Leu Asn Ala Thr Leu  Ile His Gln
    1310                1315                1320

Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu
    1325                1330                1335
```

Gly Glu Asp
    1340

<210> 112
<211> 1360
<212> PRT
<213> Streptococcus caballi

<400> 112

Met Thr Lys Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1   5   10   15

Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys
            20   25   30

Met Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu
        35   40   45

Leu Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg
    50   55   60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65   70   75   80

Arg Tyr Leu Gln Asp Ile Phe Thr Glu Glu Met Ala Lys Val Asp Asp
                85   90   95

Ser Phe Phe Gln Arg Leu Asp Glu Ser Phe Leu Thr Asp Asn Asp Lys
            100   105   110

Asn Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala
        115   120   125

Tyr His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala
    130   135   140

Asp Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala
145   150   155   160

```
His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn
                165                 170                 175

Ala Glu Asn Thr Asp Val Gln Lys Leu Phe Thr Asp Phe Val Gly Val
            180                 185                 190

Tyr Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp
        195                 200                 205

Ala Ala Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu
    210                 215                 220

Asn Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Gly
225                 230                 235                 240

Asn Leu Ile Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn
                245                 250                 255

Phe Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala
        275                 280                 285

Asp Leu Phe Thr Ser Ser Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Lys Arg Tyr Val Glu His His Glu Asp Leu Glu Lys Leu
                325                 330                 335

Lys Glu Phe Ile Lys Ala Asn Lys Ser Glu Leu Tyr His Asp Ile Phe
            340                 345                 350

Lys Asp Lys Thr Gln Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val
        355                 360                 365
```

```
Lys Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Gly Ile Leu Thr Lys Ile
    370                 375                 380

Asn Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Glu Glu Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asp Ser Arg Phe Ala
    450                 455                 460

Trp Ala Glu Tyr Arg Ser Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp
465                 470                 475                 480

Lys Val Ile Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met
                485                 490                 495

Thr Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser His Val Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Lys Tyr Val Asn Glu Gln Gly Lys Asp Ser Phe Phe Asp Ser Asn Met
    530                 535                 540

Lys Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr
545                 550                 555                 560

Lys Glu Lys Leu Leu Asn Tyr Leu Asp Lys Glu Phe Pro Glu Tyr Arg
                565                 570                 575
```

```
Ile Gln Asp Leu Val Gly Leu Asp Lys Glu Asn Lys Ser Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Ser Phe
        595                 600                 605

Leu Asp Asp Lys Val Asn Glu Glu Val Ile Glu Asp Ile Ile Lys Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Gln Gln Arg Leu Gln Lys
625                 630                 635                 640

Tyr Ser Asp Ile Phe Thr Lys Gln Gln Leu Lys Lys Leu Glu Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Ser Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu
    690                 695                 700

Ser Phe Lys Gln Ile Ile Gln Glu Ala Gln Val Val Gly Asp Val Asp
705                 710                 715                 720

Asp Ile Glu Thr Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Ile Lys Val
            740                 745                 750

Met Gly Asp Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Arg Gly Arg Ser Gln Ser Gln Gln Arg Leu Lys Lys
    770                 775                 780
```

```
Leu Gln Asn Ser Leu Lys Pro Ser Tyr Ile Glu Asp Lys Val Glu Asn
785                 790                 795                 800


Ser His Leu Gln Asn Asp Gln Leu Phe Leu Tyr Tyr Ile Gln Asn Gly
                805                 810                 815


Lys Asp Met Tyr Thr Gly Asp Glu Leu Asp Ile Asp His Leu Ser Asp
            820                 825                 830


Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser
        835                 840                 845


Ile Asp Asn Arg Val Leu Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser
    850                 855                 860


Asp Asp Val Pro Ser Leu Gly Ile Val Arg Ala Arg Lys Ala Glu Trp
865                 870                 875                 880


Val Arg Leu Tyr Lys Ser Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn
                885                 890                 895


Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Gly
            900                 905                 910


Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925


Ala Gln Ile Leu Asp Ala Arg Phe Asn Thr Glu Arg Asp Glu Asn Asp
    930                 935                 940


Lys Val Ile Arg Asp Val Lys Val Ile Thr Leu Lys Ser Asn Leu Val
945                 950                 955                 960


Ser Gln Phe Arg Lys Glu Phe Lys Phe Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975


Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
            980                 985                 990
```

```
Ala Leu Leu Lys Lys Tyr Pro Lys  Leu Ala Pro Glu Phe  Val Tyr Gly
        995                 1000                1005


Glu Tyr  Lys Lys Tyr Asp Val  Ser Ser Asp Asp His  Ser Glu Met
    1010                1015                1020


Gly Lys  Ala Thr Ala Lys Tyr  Phe Phe Tyr Ser Asn  Leu Met Asn
    1025                1030                1035


Phe Phe  Lys Arg Val Ile Arg  Tyr Ser Asn Gly Lys  Val Ile Val
    1040                1045                1050


Arg Pro  Val Val Glu Tyr Ser  Lys Asp Thr Gly Glu  Ile Ala Trp
    1055                1060                1065


Asn Lys  Arg Thr Asp Phe Glu  Lys Val Arg Lys Val  Leu Ser Tyr
    1070                1075                1080


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Thr Gln  Thr Gly Gly
    1085                1090                1095


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1100                1105                1110


Ile Pro  Arg Lys Thr Lys Lys  Val Leu Trp Glu Pro  Lys Lys Tyr
    1115                1120                1125


Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr Ser Val  Leu Val Val
    1130                1135                1140


Ala Asp  Val Glu Lys Gly Lys  Thr Lys Lys Leu Lys  Thr Val Lys
    1145                1150                1155


Glu Leu  Val Gly Ile Ser Ile  Met Glu Arg Ser Phe  Phe Glu Lys
    1160                1165                1170


Asn Pro  Val Glu Phe Leu Lys  Asn Lys Gly Tyr Gln  Asn Val Gln
    1175                1180                1185
```

```
Glu Asp  Lys Leu Met Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Phe
    1190                1195                1200


Glu Gly  Gly Arg Arg Arg Leu  Leu Ala Ser Ala Thr  Glu Leu Gln
    1205                1210                1215


Lys Gly  Asn Glu Ile Met Leu  Ser Ala His Leu Val  Ala Leu Leu
    1220                1225                1230


Tyr His  Ala His Arg Ile Gly  Asn Phe Asn Ser Ala  Glu His Leu
    1235                1240                1245


Lys Tyr  Val Ser Glu His Lys  Lys Glu Phe Glu Glu  Val Leu Ser
    1250                1255                1260


Cys Val  Glu Asn Phe Ala Asn  Val Tyr Val Asp Val  Glu Lys Asn
    1265                1270                1275


Leu Ser  Lys Ile Arg Ala Ala  Ala Asp Ser Met Asp  Asn Phe Ser
    1280                1285                1290


Ile Glu  Glu Ile Ser Asp Ser  Phe Ile Asn Leu Leu  Thr Leu Thr
    1295                1300                1305


Ala Leu  Gly Ala Pro Ala Asp  Phe Asn Phe Leu Gly  Glu Lys Ile
    1310                1315                1320


Pro Arg  Lys Arg Tyr Asn Ser  Thr Lys Glu Cys Leu  Asn Ala Thr
    1325                1330                1335


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1340                1345                1350


Leu Ser  Lys Leu Gly Glu Glu
    1355                1360


<210>  113
<211>  1355
<212>  PRT
<213>  Streptococcus canis
```

<400> 113

```
Met Glu Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asn Arg Lys Ser Ile Lys Lys Asn Leu Met
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Asn Glu Met Ala Lys Leu Asp Asp Ser
                85                  90                  95

Phe Phe Gln Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

Asn Glu Arg His Pro Ile Phe Gly Asn Leu Ala Asp Glu Val Ala Tyr
        115                 120                 125

His Arg Asn Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Pro Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Leu Asn Ala
                165                 170                 175

Glu Asn Ser Asp Val Ala Lys Leu Phe Tyr Gln Leu Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Ser Leu Asp Glu Ile Glu Val Asp Ala Lys
```

195 200 205

Gly Ile Leu Ser Ala Arg Leu Ser Lys Ser Lys Arg Leu Glu Lys Leu
210 215 220

Ile Ala Val Phe Pro Asn Glu Lys Lys Asn Gly Leu Phe Gly Asn Ile
225 230 235 240

Ile Ala Leu Ala Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
245 250 255

Leu Thr Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
260 265 270

Asp Leu Asp Glu Leu Leu Gly Gln Ile Gly Asp Gln Tyr Ala Asp Leu
275 280 285

Phe Ser Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
290 295 300

Leu Arg Ser Asn Ser Glu Val Thr Lys Ala Pro Leu Ser Ala Ser Met
305 310 315 320

Val Lys Arg Tyr Asp Glu His His Gln Asp Leu Ala Leu Leu Lys Thr
325 330 335

Leu Val Arg Gln Gln Phe Pro Glu Lys Tyr Ala Glu Ile Phe Lys Asp
340 345 350

Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Val Gly Ile Gly Ala Thr Gln
355 360 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
370 375 380

Ala Glu Glu Leu Leu Ala Lys Leu Asn Arg Asp Asp Leu Leu Arg Lys
385 390 395 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Lys

405 410 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Glu Phe Tyr Pro Phe Leu
420 425 430

Lys Glu Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
435 440 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Leu
450 455 460

Thr Arg Lys Ser Glu Glu Ala Ile Thr Pro Trp Asn Phe Glu Glu Val
465 470 475 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
485 490 495

Phe Asp Glu Gln Leu Pro Asn Lys Lys Val Leu Pro Lys His Ser Leu
500 505 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
515 520 525

Val Thr Glu Arg Met Arg Lys Pro Glu Phe Leu Ser Gly Glu Gln Lys
530 535 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545 550 555 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
565 570 575

Val Glu Ile Ile Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
580 585 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
595 600 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu

```
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Met Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ser Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Glu Ile Glu Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

Gln Ile Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His Lys
            740                 745                 750

Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Thr
        755                 760                 765

Lys Gly Leu Gln Gln Ser Arg Glu Arg Lys Lys Arg Ile Glu Glu Gly
    770                 775                 780

Ile Lys Glu Leu Glu Ser Gln Ile Leu Lys Glu Asn Pro Val Glu Asn
785                 790                 795                 800

Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp
```

820 825 830

Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp Ser
835 840 845

Ile Asp Asn Lys Val Leu Thr Arg Ser Val Glu Asn Arg Gly Lys Ser
850 855 860

Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
865 870 875 880

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn
885 890 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Ala Asp Lys Ala Gly
900 905 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
915 920 925

Ala Arg Ile Leu Asp Ser Arg Met Asn Thr Lys Arg Asp Lys Asn Asp
930 935 940

Lys Pro Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val
945 950 955 960

Ser Asp Phe Arg Lys Asp Phe Gln Leu Tyr Lys Val Arg Asp Ile Asn
965 970 975

Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
980 985 990

Ala Leu Ile Lys Lys Tyr Pro Lys Leu Glu Ser Glu Phe Val Tyr Gly
995 1000 1005

Asp Tyr Lys Val Tyr Asp Val Ser Glu Gln Glu Ile Gly Lys Ala
1010 1015 1020

Thr Ala Lys Arg Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe Lys

```
    1025                1030                1035

Thr Glu  Val Lys Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1040                1045                1050

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Val Val Trp  Asn Lys Glu
    1055                1060                1065

Lys Asp  Phe Ala Thr Val Arg  Lys Val Leu Ala Met  Pro Gln Val
    1070                1075                1080

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1085                1090                1095

Glu Ser  Ile Leu Ser Lys Arg  Glu Ser Ala Lys Leu  Ile Pro Arg
    1100                1105                1110

Lys Lys  Gly Trp Asp Thr Arg  Lys Tyr Gly Gly Phe  Gly Ser Pro
    1115                1120                1125

Thr Val  Ala Tyr Ser Ile Leu  Val Val Ala Lys Val  Glu Lys Gly
    1130                1135                1140

Lys Ala  Lys Lys Leu Lys Ser  Val Lys Val Leu Val  Gly Ile Thr
    1145                1150                1155

Ile Met  Glu Lys Gly Ser Tyr  Glu Lys Asp Pro Ile  Gly Phe Leu
    1160                1165                1170

Glu Ala  Lys Gly Tyr Lys Asp  Ile Lys Lys Glu Leu  Ile Phe Lys
    1175                1180                1185

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg
    1190                1195                1200

Met Leu  Ala Ser Glu Leu Gln  Lys Ala Asn Glu Leu  Val Leu Pro
    1205                1210                1215

Gln His  Leu Val Arg Leu Leu  Tyr Tyr Thr Gln Asn  Ile Ser Ala
```

```
    1220                1225                1230

Thr Thr  Gly Ser Asn Asn Leu  Gly Tyr Ile Glu Gln  His Arg Glu
    1235                1240                1245

Glu Phe  Lys Glu Ile Phe Glu  Lys Ile Ile Asp Phe  Ser Glu Lys
    1250                1255                1260

Tyr Ile  Leu Lys Asn Lys Val  Asn Ser Asn Leu Lys  Ser Ser Phe
    1265                1270                1275

Asp Glu  Gln Phe Ala Val Ser  Asp Ser Ile Leu Leu  Ser Asn Ser
    1280                1285                1290

Phe Val  Ser Leu Leu Lys Tyr  Thr Ser Phe Gly Ala  Ser Gly Gly
    1295                1300                1305

Phe Thr  Phe Leu Asp Leu Asp  Val Lys Gln Gly Arg  Leu Arg Tyr
    1310                1315                1320

Gln Thr  Val Thr Glu Val Leu  Asp Ala Thr Leu Ile  Tyr Gln Ser
    1325                1330                1335

Ile Thr  Gly Leu Tyr Glu Thr  Arg Thr Asp Leu Ser  Gln Leu Gly
    1340                1345                1350

Gly Asp
    1355


<210>  114
<211>  1341
<212>  PRT
<213>  Streptococcus constellatus

<400>  114

Met Gly Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Lys Gln Ser Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Thr Gly Glu Met Asn Lys Val Asp Glu Asn
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Asp Glu Asp Lys Arg
            100                 105                 110

Gly Glu His His Pro Ile Phe Gly Asn Ile Ala Ala Glu Val Lys Tyr
        115                 120                 125

His Asp Asp Phe Pro Thr Ile Tyr His Leu Arg Arg His Leu Ala Asp
    130                 135                 140

Thr Ser Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Tyr Glu Gly Asp Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Ala Leu Phe Lys Asp Phe Val Glu Glu Tyr
            180                 185                 190

Asp Lys Thr Ile Glu Glu Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Ser Arg Leu Glu Asn
    210                 215                 220

Leu Ile Ala His Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240
```

```
Leu Ile Ala Leu Ser Leu Asp Leu His Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Gly Phe Leu Gly Glu Val Gly Asp Glu Tyr Ala Asp
        275                 280                 285

Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Glu Glu His Gln Lys Asp Leu Lys Lys Leu Lys
                325                 330                 335

Asp Phe Ile Lys Val Asn Ala Pro Asp Gln Tyr Asn Ala Ile Phe Lys
            340                 345                 350

Asp Lys Asn Lys Lys Gly Tyr Ala Ser Tyr Ile Glu Ser Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Gly Ile Leu Leu Lys Ile Asn
    370                 375                 380

Gly Ser Gly Asp Phe Leu Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465                 470                 475                 480

Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495

Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Pro Leu Tyr Glu Ala Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Thr Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575

Val Asn Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ser Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Ser Phe Leu
        595                 600                 605

Asp Asp Lys Ala Asn Glu Lys Thr Ile Glu Asp Ile Ile Gln Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr
625                 630                 635                 640

Ser Asp Ile Phe Thr Lys Ala Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655
```

```
Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asn Lys Glu Asn Lys Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Arg Ala Gln Ile Ile Asp Asp Val Asp Asp
705                 710                 715                 720

Ile Ala Asn Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly His Asn Pro Ala Asn Ile Ile Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Asp Lys Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu
    770                 775                 780

Gln Asp Ser Leu Lys Pro Val Asn Ile Lys Asn Val Glu Asn Gln Gln
785                 790                 795                 800

Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp
                805                 810                 815

Met Tyr Thr Gly Glu Thr Leu Asp Ile Asn Asn Leu Ser Gln Tyr Asp
            820                 825                 830

Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Leu Asp
        835                 840                 845

Asn Arg Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser Asp Asp
    850                 855                 860
```

```
Val Pro Ser Ile Glu Val Val His Glu Met Lys Ser Phe Trp Ser Lys
865                 870                 875                 880

Leu Leu Ser Val Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr
                885                 890                 895

Lys Ala Glu Arg Gly Gly Leu Thr Glu Glu Asp Lys Ala Gly Phe Ile
            900                 905                 910

Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln
        915                 920                 925

Ile Leu Asp Glu Arg Phe Asn Thr Glu Phe Asp Gly Asn Lys Arg Arg
    930                 935                 940

Ile Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val Ser Asn
945                 950                 955                 960

Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr
                965                 970                 975

His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Asn Ala Leu
            980                 985                 990

Leu Leu Lys Tyr Pro Gln Leu Glu  Pro Glu Phe Val Tyr  Gly Glu Tyr
        995                 1000                1005

Pro Lys  Tyr Asn Ser Tyr Arg  Ser Arg Lys Ser Ala  Thr Glu Lys
    1010                1015                1020

Phe Leu  Phe Tyr Ser Asn Ile  Leu Arg Phe Phe Lys  Lys Glu Asp
    1025                1030                1035

Ile Gln  Thr Asn Glu Asp Gly  Glu Ile Ala Trp Asn  Lys Glu Lys
    1040                1045                1050

His Ile  Lys Ile Leu Arg Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1055                1060                1065
```

```
Ile Val  Lys Lys Thr Glu Glu  Gln Thr Gly Gly Phe  Ser Lys Glu
    1070                1075                1080

Ser Ile  Leu Pro Lys Gly Glu  Ser Asp Lys Leu Ile  Pro Arg Lys
    1085                1090                1095

Thr Lys  Asn Ser Tyr Trp Asp  Pro Lys Lys Tyr Gly  Gly Phe Asp
    1100                1105                1110

Ser Pro  Val Val Ala Tyr Ser  Ile Leu Val Phe Ala  Asp Val Glu
    1115                1120                1125

Lys Gly  Lys Ser Lys Lys Leu  Arg Lys Val Gln Asp  Met Val Gly
    1130                1135                1140

Ile Thr  Ile Met Glu Lys Lys  Arg Phe Glu Lys Asn  Pro Val Asp
    1145                1150                1155

Phe Leu  Glu Gln Arg Gly Tyr  Arg Asn Val Arg Leu  Glu Lys Ile
    1160                1165                1170

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Lys Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Leu Gln Lys  Gly Asn Glu
    1190                1195                1200

Leu Val  Ile Pro Gln Arg Phe  Thr Thr Leu Leu Tyr  His Ser Tyr
    1205                1210                1215

Arg Ile  Glu Lys Asp Tyr Glu  Pro Glu His Arg Glu  Tyr Val Glu
    1220                1225                1230

Lys His  Lys Asp Glu Phe Lys  Glu Leu Leu Glu Tyr  Ile Ser Val
    1235                1240                1245

Phe Ser  Arg Lys Tyr Val Leu  Ala Asp Asn Asn Leu  Thr Lys Ile
    1250                1255                1260
```

```
Glu Met  Leu Phe Ser Lys Asn  Lys Asp Ala Glu Val  Ser Ser Leu
    1265                1270                1275


Ala Lys  Ser Phe Ile Ser Leu  Leu Thr Phe Thr Ala  Phe Gly Ala
    1280                1285                1290


Pro Ala  Ala Phe Asn Phe Phe  Gly Glu Asn Ile Asp  Arg Lys Arg
    1295                1300                1305


Tyr Thr  Ser Val Thr Glu Cys  Leu Asn Ala Thr Leu  Ile His Gln
    1310                1315                1320


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu
    1325                1330                1335


Gly Glu  Asp
    1340
```

<210> 115
<211> 1355
<212> PRT
<213> Streptococcus constellatus

<400> 115

```
Met Thr Gln Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Ile Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Ile Leu Gly Asn Thr Asn Lys Gln Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Lys Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ile Glu Glu Met Asn Lys Val Asp Glu Asn
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Gly Thr Leu Lys Glu Glu Lys Glu Tyr
        115                 120                 125

Tyr Lys Glu Phe Glu Thr Ile Tyr His Leu Arg Lys Arg Leu Ala Asp
    130                 135                 140

Ser Thr Gly Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Thr Leu Phe Asn Asp Phe Val Glu Val Tyr
            180                 185                 190

Asp Lys Thr Ile Glu Glu Ser His Leu Ala Glu Ile Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Val Lys Cys Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285
```

```
Leu Phe Thr Ser Ala Lys Asn Leu Tyr Asp Thr Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Ala Val Asp Asp Asn Ser Thr Lys Ala Leu Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Glu Glu His Gln Lys Asp Leu Lys Lys Leu Lys
                325                 330                 335

Asp Phe Ile Lys Val Asn Ala Pro Ala Gln Tyr Asp Asp Ile Phe Lys
            340                 345                 350

Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Asp
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Val Arg Lys Gly Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465                 470                 475                 480

Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495
```

```
Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Ile Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Pro Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Leu Asn Tyr Leu Asp Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Ser Phe Leu
        595                 600                 605

Asp Asp Lys Ala Asn Glu Lys Thr Ile Glu Asp Ile Ile Gln Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr
625                 630                 635                 640

Ser Asp Ile Phe Thr Lys Ala Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asn Lys Glu Asn Asn Lys Thr Ile Leu Glu Tyr Leu Val Asp Asp Gly
        675                 680                 685

Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Thr Leu Pro
    690                 695                 700
```

```
Phe Lys Gln Ile Ile Lys Asp Ala Gln Ala Ile Asp Asp Val Asp Asp
705                 710                 715                 720


Ile Glu Leu Ile Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735


Gly Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750


Gly Tyr Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765


Thr Thr Thr Lys Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu
    770                 775                 780


Gln Asp Ser Leu Thr Pro Val Ser Ile Lys Asn Val Glu Asn Gln Gln
785                 790                 795                 800


Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp
                805                 810                 815


Met Tyr Thr Gly Glu Glu Leu Asp Ile His His Leu Ser Asp Tyr Asp
            820                 825                 830


Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser Ile Asp
        835                 840                 845


Asn Arg Val Leu Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser Asp Asn
    850                 855                 860


Val Pro Asn Leu Glu Val Val Cys Asp Arg Lys Ala Asp Trp Ile Arg
865                 870                 875                 880


Leu Arg Glu Ala Gly Leu Ile Ser Gln Arg Lys Phe Asp Asn Leu Thr
                885                 890                 895


Lys Ala Glu Arg Gly Gly Leu Thr Glu Asn Asp Lys Ala Gly Phe Ile
            900                 905                 910
```

```
His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln
        915                 920                 925


Ile Leu Asp Ala Arg Phe Asn Pro Lys Arg Asp Asp Asn Lys Lys Val
    930                 935                 940


Ile Arg Asp Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val Ser Gln
945                 950                 955                 960


Phe Arg Arg Asp Phe Lys Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr
                965                 970                 975


His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr Ala Leu
            980                 985                 990


Leu Lys Lys Tyr Pro Lys Leu Thr  Ser Glu Phe Val Tyr  Gly Glu Tyr
        995                 1000                1005


Lys Lys  Tyr Asp Val Ser Asp  Asn Asp Glu Ile Gly  Lys Ala Thr
    1010                1015                1020


Ala Lys  Tyr Phe Phe Tyr Ser  Asn Leu Met Asn Phe  Phe Lys Thr
    1025                1030                1035


Glu Val  Lys Phe Ala Asp Gly  Thr Val Val Glu Arg  Pro Asp Ile
    1040                1045                1050


Glu Thr  Ser Glu Asp Gly Glu  Ile Ala Trp Asn Lys  Gln Thr Asp
    1055                1060                1065


Phe Lys  Ile Val Arg Lys Val  Leu Ser Tyr Pro Gln  Val Asn Ile
    1070                1075                1080


Val Lys  Lys Val Glu Lys Gln  Thr Gly Arg Phe Ser  Lys Glu Ser
    1085                1090                1095


Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu Ile Ala  Arg Lys Thr
    1100                1105                1110
```

```
Lys Glu  Asn Tyr Trp Asp Thr  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Asp  Ile Lys Lys
    1130                1135                1140

Gly Lys  Ala Lys Lys Leu Lys  Thr Val Lys Glu Leu  Val Gly Ile
    1145                1150                1155

Ser Ile  Met Glu Arg Pro Phe  Phe Glu Lys Asn Pro  Ile Met Phe
    1160                1165                1170

Leu Glu  Ser Lys Gly Tyr Arg  Asn Ile Gln Lys Asp  Lys Leu Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Phe Glu Gly  Gly Arg Arg
    1190                1195                1200

Arg Leu  Leu Ala Ser Ala Val  Glu Leu Gln Lys Gly  Asn Glu Met
    1205                1210                1215

Val Leu  Pro Gln Tyr Leu Asn  Asn Leu Leu Tyr His  Ala His Arg
    1220                1225                1230

Ile Asp  Asn Ser Asp Asn Ser  Glu His Leu Lys Tyr  Ile Thr Glu
    1235                1240                1245

His Lys  Glu Glu Phe Gly Lys  Leu Leu Ser Tyr Ile  Glu Asn Phe
    1250                1255                1260

Ala Lys  Ser Tyr Val Asp Val  Asp Lys Asn Leu Glu  Lys Ile Gln
    1265                1270                1275

Leu Ala  Val Glu Lys Ile Asp  Ser Phe Ser Val Lys  Glu Ile Ser
    1280                1285                1290

Asn Ser  Phe Ile His Leu Leu  Thr Leu Thr Ala Leu  Gly Ala Pro
    1295                1300                1305
```

```
Ala Asp  Phe Asn Phe Leu Gly  Glu Lys Ile Pro Arg  Lys Arg Tyr
    1310                1315                1320


Thr Ser  Thr Lys Glu Cys Leu  Asn Ala Thr Leu Ile  His Gln Ser
    1325                1330                1335


Ile Thr  Gly Leu Tyr Glu Thr  Gln Thr Asp Leu Ser  Lys Leu Gly
    1340                1345                1350


Glu Asp
    1355
```

<210> 116
<211> 1356
<212> PRT
<213> Streptococcus dysgalactiae

<400> 116

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Ser Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110
```

```
His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Met Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320
```

```
Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525
```

```
Val Thr Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Gly Lys Gln Lys
    530                 535                 540

Glu Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Lys Tyr Ala Asn
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu His Glu
705                 710                 715                 720

Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735
```

```
Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly His Lys
            740                 745                 750

Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Gln
        755                 760                 765

Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu Gly
    770                 775                 780

Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu Asn
785                 790                 795                 800

Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp
            820                 825                 830

Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp Ser
        835                 840                 845

Ile Asp Asn Lys Ile Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
865                 870                 875                 880

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn Asp
    930                 935                 940
```

```
Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val
945                 950                 955                 960


Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975


Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
            980                 985                 990


Ala Leu Ile Lys Lys Tyr Thr Lys  Leu Glu Ser Glu Phe  Val Tyr Gly
        995                 1000                1005


Asp Tyr  Lys Val Tyr Asp Val  Ser Glu Gln Glu Ile  Gly Lys Ala
    1010                1015                1020


Thr Ala  Lys Arg Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1025                1030                1035


Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1040                1045                1050


Ile Glu  Thr Asn Glu Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1055                1060                1065


Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1070                1075                1080


Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Ala  Leu Thr Asn
    1085                1090                1095


Glu Ser  Ile Tyr Ala Arg Gly  Ser Phe Asp Lys Leu  Ile Ser Arg
    1100                1105                1110


Lys His  Arg Phe Glu Ser Ser  Lys Tyr Gly Gly Phe  Gly Ser Pro
    1115                1120                1125


Thr Val  Thr Tyr Ser Val Leu  Val Val Ala Lys Ser  Lys Val Gln
    1130                1135                1140
```

```
Asp Gly  Lys Val Lys Lys Ile  Lys Thr Gly Lys Glu  Leu Ile Gly
    1145                1150                1155

Met Thr  Leu Leu Asp Lys Leu  Val Phe Glu Lys Asn  Pro Leu Lys
    1160                1165                1170

Phe Ile  Glu Asp Lys Gly Tyr  Gly Asn Val Gln Ile  Asp Lys Cys
    1175                1180                1185

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Phe Glu  Asn Gly Thr
    1190                1195                1200

Arg Arg  Met Leu Ala Ser Arg  Gly Asp Leu Gln Lys  Ala Asn Glu
    1205                1210                1215

Met Phe  Leu Pro Ala Lys Leu  Val Thr Leu Leu Tyr  His Ala His
    1220                1225                1230

Lys Ile  Glu Ser Ser Lys Glu  Leu Glu His Glu Ala  Tyr Ile Leu
    1235                1240                1245

Asp His  Tyr Asn Asp Leu Tyr  Gln Leu Leu Ser Tyr  Ile Glu Arg
    1250                1255                1260

Phe Ala  Ser Leu Tyr Val Asp  Val Glu Lys Asn Ile  Ser Lys Val
    1265                1270                1275

Lys Glu  Leu Phe Ser Asn Ile  Glu Ser Tyr Ser Ile  Ser Glu Ile
    1280                1285                1290

Cys Ser  Ser Val Ile Asn Leu  Leu Thr Leu Thr Ala  Ser Gly Ala
    1295                1300                1305

Pro Ala  Asp Phe Lys Phe Leu  Gly Thr Thr Ile Pro  Arg Lys Arg
    1310                1315                1320

Tyr Gly  Ser Pro Gln Ser Ile  Leu Ser Ser Thr Leu  Ile His Gln
    1325                1330                1335
```

```
Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu
    1340                1345                1350


Gly Gly  Asp
    1355
```

<210> 117
<211> 1356
<212> PRT
<213> Streptococcus dysgalactiae

<400> 117

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Ser Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140


Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
```

```
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Lys Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Lys Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asn Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
```

```
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Gly Lys Gln Lys
    530                 535                 540

Glu Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
```

565 570 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
580 585 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
595 600 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
610 615 620

Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Lys Tyr Ala Asn
625 630 635 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr Thr
645 650 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
660 665 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
675 680 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Thr Phe Lys Glu
690 695 700

Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu His Glu
705 710 715 720

Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
725 730 735

Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly His Lys
740 745 750

Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Gln
755 760 765

Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu Gly

```
    770                 775                 780

Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu Asn
785                 790                 795                 800

Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp
            820                 825                 830

Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp Ser
        835                 840                 845

Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
865                 870                 875                 880

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn Asp
    930                 935                 940

Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val
945                 950                 955                 960

Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
```

```
           980                 985                 990

Ala Leu Ile Lys Lys Tyr Pro Lys  Leu Glu Ser Glu Phe  Val Tyr Gly
        995                1000                1005

Asp Tyr  Lys Val Tyr Asp Val  Ser Glu Gln Glu Ile  Gly Lys Ala
    1010                1015                1020

Thr Ala  Lys Arg Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1025                1030                1035

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1040                1045                1050

Ile Glu  Thr Asn Glu Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1055                1060                1065

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1070                1075                1080

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Ala  Leu Thr Asn
    1085                1090                1095

Glu Ser  Ile Tyr Ala Arg Gly  Ser Phe Asp Lys Leu  Ile Ser Arg
    1100                1105                1110

Lys His  Arg Phe Glu Ser Ser  Lys Tyr Gly Gly Phe  Gly Ser Pro
    1115                1120                1125

Thr Val  Thr Tyr Ser Val Leu  Val Val Ala Lys Ser  Lys Val Gln
    1130                1135                1140

Asp Gly  Lys Val Lys Lys Ile  Lys Thr Gly Lys Glu  Leu Ile Gly
    1145                1150                1155

Ile Thr  Leu Leu Asp Lys Leu  Val Phe Glu Lys Asn  Pro Leu Lys
    1160                1165                1170

Phe Ile  Glu Asp Lys Gly Tyr  Gly Asn Val Gln Ile  Asp Lys Cys
```

```
    1175                1180                1185

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Phe Glu  Asn Gly Thr
    1190                1195                1200

Arg Arg  Met Leu Ala Ser Arg  Gly Asp Leu Gln Lys  Ala Asn Glu
    1205                1210                1215

Met Phe  Leu Pro Ala Lys Leu  Val Thr Leu Leu Tyr  His Ala His
    1220                1225                1230

Lys Ile  Glu Ser Ser Lys Glu  Leu Glu His Glu Ala  Tyr Ile Leu
    1235                1240                1245

Asp His  Tyr Asn Asp Leu Tyr  Gln Leu Leu Ser Tyr  Ile Glu Arg
    1250                1255                1260

Phe Ala  Ser Leu Tyr Val Asp  Val Glu Lys Asn Ile  Ser Lys Val
    1265                1270                1275

Lys Glu  Leu Phe Ser Asn Ile  Glu Ser Tyr Ser Ile  Ser Glu Ile
    1280                1285                1290

Cys Ser  Ser Val Ile Asn Leu  Leu Thr Leu Thr Ala  Ser Gly Ala
    1295                1300                1305

Pro Ala  Asp Phe Lys Phe Leu  Gly Thr Thr Ile Pro  Arg Lys Arg
    1310                1315                1320

Tyr Gly  Ser Pro Gln Ser Ile  Leu Ser Ser Thr Leu  Ile His Gln
    1325                1330                1335

Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu
    1340                1345                1350

Gly Gly  Asp
    1355
```

<210> 118

<211> 1356
<212> PRT
<213> Streptococcus dysgalactiae

<400> 118

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Ser Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140


Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175


Asp Asn Ser Asp Met Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190
```

```
Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400
```

```
Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Gly Lys Gln Lys
    530                 535                 540

Glu Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605
```

```
Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Ile Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu His Glu
705                 710                 715                 720

Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly His Lys
            740                 745                 750

Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Gln
        755                 760                 765

Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu Gly
    770                 775                 780

Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu Asn
785                 790                 795                 800

Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815
```

```
Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp
            820                 825                 830

Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp Ser
        835                 840                 845

Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asp Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
865                 870                 875                 880

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn Asp
    930                 935                 940

Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val
945                 950                 955                 960

Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
            980                 985                 990

Ala Leu Ile Lys Lys Tyr Pro Lys  Leu Glu Ser Glu Phe  Val Tyr Gly
        995                 1000                1005

Asp Tyr  Lys Val Tyr Asp Val  Ser Glu Gln Glu Ile  Gly Lys Ala
    1010                1015                1020
```

```
Thr Ala  Lys Arg Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1025                1030                1035

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1040                1045                1050

Ile Glu  Thr Asn Glu Glu Thr  Gly Glu Ile Val Trp  Asn Lys Gly
    1055                1060                1065

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1070                1075                1080

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Ala  Leu Thr Asn
    1085                1090                1095

Glu Ser  Ile Tyr Ala Arg Gly  Ser Phe Asp Lys Leu  Ile Ser Arg
    1100                1105                1110

Lys His  Arg Phe Glu Ser Ser  Lys Tyr Gly Gly Phe  Gly Ser Pro
    1115                1120                1125

Thr Val  Thr Tyr Ser Val Leu  Val Val Ala Lys Ser  Lys Val Gln
    1130                1135                1140

Asp Gly  Lys Val Lys Lys Ile  Lys Thr Gly Lys Glu  Leu Ile Gly
    1145                1150                1155

Ile Thr  Leu Leu Asp Lys Leu  Val Phe Glu Lys Asn  Pro Leu Lys
    1160                1165                1170

Phe Ile  Glu Asp Lys Gly Tyr  Gly Asn Val Gln Ile  Asp Lys Cys
    1175                1180                1185

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Phe Glu  Asn Gly Thr
    1190                1195                1200

Arg Arg  Met Leu Ala Ser Arg  Gly Asp Leu Gln Lys  Ala Asn Glu
    1205                1210                1215
```

```
Met Phe  Leu Pro Ala Lys Leu  Val Thr Leu Leu Tyr  His Ala His
    1220                1225                1230


Lys Ile  Glu Ser Ser Lys Glu  Leu Glu His Glu Ala  Tyr Ile Leu
    1235                1240                1245


Asp His  Tyr Asn Asp Leu Tyr  Gln Leu Leu Ser Tyr  Ile Glu Arg
    1250                1255                1260


Phe Ala  Ser Leu Tyr Val Asp  Val Glu Lys Asn Ile  Ser Lys Val
    1265                1270                1275


Lys Glu  Leu Phe Ser Asn Ile  Glu Ser Tyr Ser Ile  Ser Glu Ile
    1280                1285                1290


Cys Ser  Ser Val Ile Asn Leu  Leu Thr Leu Thr Ala  Ser Gly Ala
    1295                1300                1305


Pro Ala  Asp Phe Lys Phe Leu  Gly Thr Thr Ile Pro  Arg Lys Arg
    1310                1315                1320


Tyr Gly  Ser Pro Gln Ser Ile  Leu Ser Ser Thr Leu  Ile His Gln
    1325                1330                1335


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu
    1340                1345                1350


Gly Gly  Asp
    1355


<210>  119
<211>  1356
<212>  PRT
<213>  Streptococcus dysgalactiae

<400>  119

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15
```

```
Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Ser Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Met Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220
```

```
Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430
```

```
Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Gly Lys Gln Lys
    530                 535                 540

Glu Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Lys Tyr Ala Asn
625                 630                 635                 640
```

```
Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu His Glu
705                 710                 715                 720

Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly His Lys
            740                 745                 750

Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Gln
        755                 760                 765

Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu Gly
    770                 775                 780

Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu Asn
785                 790                 795                 800

Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp
            820                 825                 830

Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp Ser
        835                 840                 845
```

```
Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
865                 870                 875                 880

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn Asp
    930                 935                 940

Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val
945                 950                 955                 960

Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
            980                 985                 990

Ala Leu Ile Lys Lys Tyr Pro Lys  Leu Glu Ser Glu Phe  Val Tyr Gly
        995                 1000                1005

Asp Tyr  Lys Val Tyr Asp Val  Ser Glu Gln Glu Ile  Gly Lys Ala
    1010                1015                1020

Thr Ala  Lys Arg Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1025                1030                1035

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1040                1045                1050
```

```
Ile Glu  Thr Asn Glu Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1055                1060                1065

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1070                1075                1080

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Ala  Leu Thr Asn
    1085                1090                1095

Glu Ser  Ile Tyr Ala Arg Gly  Ser Phe Asp Lys Leu  Ile Ser Arg
    1100                1105                1110

Lys His  Arg Phe Glu Ser Ser  Lys Tyr Gly Gly Phe  Gly Ser Pro
    1115                1120                1125

Thr Val  Thr Tyr Ser Val Leu  Val Val Ala Lys Ser  Lys Val Gln
    1130                1135                1140

Asp Gly  Lys Val Lys Lys Ile  Lys Thr Gly Lys Glu  Leu Ile Gly
    1145                1150                1155

Ile Thr  Leu Leu Asp Lys Leu  Val Phe Glu Lys Asn  Pro Leu Lys
    1160                1165                1170

Phe Ile  Glu Asp Lys Gly Tyr  Gly Asn Val Gln Ile  Asp Lys Cys
    1175                1180                1185

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Phe Glu  Asn Gly Thr
    1190                1195                1200

Arg Arg  Met Leu Ala Ser Arg  Gly Asp Leu Gln Lys  Ala Asn Glu
    1205                1210                1215

Met Phe  Leu Pro Ala Lys Leu  Val Thr Leu Leu Tyr  His Ala His
    1220                1225                1230

Lys Ile  Glu Ser Ser Lys Glu  Leu Glu His Glu Ala  Tyr Ile Leu
    1235                1240                1245
```

```
Asp His  Tyr Asn Asp Leu Tyr  Gln Leu Leu Ser Tyr  Ile Glu Arg
    1250                 1255                 1260


Phe Ala  Ser Leu Tyr Val Asp  Val Glu Lys Asn Ile  Ser Lys Val
    1265                 1270                 1275


Lys Glu  Leu Phe Ser Asn Ile  Glu Ser Tyr Ser Ile  Ser Glu Ile
    1280                 1285                 1290


Cys Ser  Ser Val Ile Asn Leu  Leu Thr Leu Thr Ala  Ser Gly Ala
    1295                 1300                 1305


Pro Ala  Asp Phe Lys Phe Leu  Gly Thr Thr Ile Pro  Arg Lys Arg
    1310                 1315                 1320


Tyr Gly  Ser Pro Gln Ser Ile  Leu Ser Ser Thr Leu  Ile His Gln
    1325                 1330                 1335


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu
    1340                 1345                 1350


Gly Gly  Asp
    1355


<210>  120
<211>  1356
<212>  PRT
<213>  Streptococcus dysgalactiae

<400>  120

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Ser Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Met Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255
```

```
Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460
```

```
Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480


Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495


Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510


Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525


Val Thr Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Gly Lys Gln Lys
    530                 535                 540


Glu Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560


Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575


Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590


Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605


Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620


Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640


Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr Thr
                645                 650                 655


Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670
```

```
Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Ile Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu His Glu
705                 710                 715                 720

Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly His Lys
            740                 745                 750

Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Gln
        755                 760                 765

Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu Gly
    770                 775                 780

Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu Asn
785                 790                 795                 800

Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp
            820                 825                 830

Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp Ser
        835                 840                 845

Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asp Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
865                 870                 875                 880
```

```
Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn Asp
    930                 935                 940

Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val
945                 950                 955                 960

Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
            980                 985                 990

Ala Leu Ile Lys Lys Tyr Pro Lys  Leu Glu Ser Glu Phe  Val Tyr Gly
        995                 1000                1005

Asp Tyr  Lys Val Tyr Asp Val  Ser Glu Gln Glu Ile  Gly Lys Ala
    1010                1015                1020

Thr Ala  Lys Arg Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1025                1030                1035

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1040                1045                1050

Ile Glu  Thr Asn Glu Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1055                1060                1065

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1070                1075                1080
```

```
Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Ala  Leu Thr Asn
    1085                1090                1095

Glu Ser  Ile Tyr Ala Arg Gly  Ser Phe Asp Lys Leu  Ile Ser Arg
    1100                1105                1110

Lys His  Arg Phe Glu Ser Ser  Lys Tyr Gly Gly Phe  Gly Ser Pro
    1115                1120                1125

Thr Val  Thr Tyr Ser Val Leu  Val Val Ala Lys Cys  Lys Val Gln
    1130                1135                1140

Asp Gly  Lys Val Lys Lys Ile  Lys Thr Gly Lys Glu  Leu Ile Gly
    1145                1150                1155

Ile Thr  Leu Leu Asp Lys Leu  Val Phe Glu Lys Asn  Pro Leu Lys
    1160                1165                1170

Phe Ile  Glu Asp Lys Gly Tyr  Gly Asn Val Gln Ile  Asp Lys Cys
    1175                1180                1185

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Phe Glu  Asn Gly Thr
    1190                1195                1200

Arg Arg  Met Leu Ala Ser Arg  Gly Asp Leu Gln Lys  Ala Asn Glu
    1205                1210                1215

Met Phe  Leu Pro Ala Lys Leu  Val Thr Leu Leu Tyr  His Ala His
    1220                1225                1230

Lys Ile  Glu Ser Ser Lys Glu  Leu Glu His Glu Ala  Tyr Ile Leu
    1235                1240                1245

Asp His  Tyr Asn Asp Leu Tyr  Gln Leu Leu Ser Tyr  Ile Glu Arg
    1250                1255                1260

Phe Ala  Ser Leu Tyr Val Asp  Val Glu Lys Asn Ile  Ser Lys Val
    1265                1270                1275
```

```
Lys Glu  Leu Phe Ser Asn Ile  Glu Ser Tyr Ser Ile  Ser Glu Ile
    1280                1285                1290


Cys Ser  Ser Val Ile Asn Leu  Leu Thr Leu Thr Ala  Ser Gly Ala
    1295                1300                1305


Pro Ala  Asp Phe Lys Phe Leu  Gly Thr Thr Ile Pro  Arg Lys Arg
    1310                1315                1320


Tyr Gly  Ser Pro Gln Ser Ile  Leu Ser Ser Thr Leu  Ile His Gln
    1325                1330                1335


Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu
    1340                1345                1350


Gly Gly  Asp
    1355
```

<210> 121
<211> 1356
<212> PRT
<213> Streptococcus dysgalactiae

<400> 121

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Ser Glu Met Ser Lys Val Asp Asp Ser
```

85 90 95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
100 105 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
115 120 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
130 135 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145 150 155 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
165 170 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
180 185 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Arg Val Asp Ala Lys
195 200 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
210 215 220

Ile Ala Gln Leu Pro Gly Glu Lys Arg Asn Gly Leu Phe Gly Asn Leu
225 230 235 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
245 250 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
260 265 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
275 280 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile

```
    290                 295                 300

Leu Arg Val Asn Ser Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Ala Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
```

```
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Lys Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Ile Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Ala Ile Gln Lys Ala Gln Val Ser Gly Gln Gly His Ser Leu His Glu
```

```
705                 710                 715                 720

Gln Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Ser Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly His Lys
            740                 745                 750

Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Gln
        755                 760                 765

Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu Gly
    770                 775                 780

Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu Asn
785                 790                 795                 800

Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp
            820                 825                 830

Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Ile Lys Asp Asp Ser
        835                 840                 845

Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
865                 870                 875                 880

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
```

915 920 925

Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn Asp
930 935 940

Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu Val
945 950 955 960

Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile Asn
965 970 975

Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
980 985 990

Ala Leu Ile Lys Lys Tyr Pro Lys Leu Glu Ser Glu Phe Val Tyr Gly
995 1000 1005

Asp Tyr Lys Val Tyr Asp Val Ser Glu Gln Glu Ile Gly Lys Ala
1010 1015 1020

Thr Ala Lys Arg Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe Lys
1025 1030 1035

Thr Glu Ile Thr Leu Ala Asn Gly Glu Ile Arg Lys Arg Pro Leu
1040 1045 1050

Ile Glu Thr Asn Glu Glu Thr Gly Glu Ile Val Trp Asp Lys Gly
1055 1060 1065

Arg Asp Phe Ala Thr Val Arg Lys Val Leu Ser Met Pro Gln Val
1070 1075 1080

Asn Ile Val Lys Lys Thr Glu Val Gln Thr Gly Ala Leu Thr Asn
1085 1090 1095

Glu Ser Ile Tyr Ala Arg Gly Ser Phe Asp Lys Leu Ile Ser Arg
1100 1105 1110

Lys His Arg Phe Glu Ser Ser Lys Tyr Gly Gly Phe Gly Ser Pro

1115 1120 1125

Thr Val Thr Tyr Ser Val Leu Val Val Ala Lys Ser Lys Val Gln
1130 1135 1140

Asp Gly Lys Val Lys Lys Ile Lys Thr Gly Lys Glu Leu Ile Gly
1145 1150 1155

Ile Thr Leu Leu Asp Lys Leu Val Phe Glu Lys Asn Pro Leu Lys
1160 1165 1170

Phe Ile Glu Asp Lys Gly Tyr Gly Asn Val Gln Ile Asp Lys Cys
1175 1180 1185

Ile Lys Leu Pro Lys Tyr Ser Leu Phe Glu Phe Glu Asn Gly Thr
1190 1195 1200

Arg Arg Met Leu Ala Ser Arg Gly Asp Leu Gln Lys Ala Asn Glu
1205 1210 1215

Met Phe Leu Pro Ala Lys Leu Val Thr Leu Leu Tyr His Ala His
1220 1225 1230

Lys Ile Glu Ser Ser Lys Glu Leu Glu His Glu Ala Tyr Ile Leu
1235 1240 1245

Asp His Tyr Asn Asp Leu Tyr Gln Leu Leu Ser Tyr Ile Glu Arg
1250 1255 1260

Phe Ala Ser Leu Tyr Val Asp Val Glu Lys Asn Ile Ser Lys Val
1265 1270 1275

Lys Glu Leu Phe Ser Asn Ile Glu Ser Tyr Ser Ile Ser Glu Ile
1280 1285 1290

Cys Ser Ser Val Ile Asn Leu Leu Thr Leu Thr Ala Ser Gly Ala
1295 1300 1305

Pro Ala Asp Phe Lys Phe Leu Gly Thr Thr Ile Pro Arg Lys Arg

1310 1315 1320

Tyr Gly Ser Pro Gln Ser Ile Leu Ser Ser Thr Leu Ile His Gln
1325 1330 1335

Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ser Gln Leu
1340 1345 1350

Gly Gly Asp
1355

<210> 122
<211> 1345
<212> PRT
<213> Streptococcus equi

<400> 122

Met Lys Lys Pro Tyr Thr Ile Ala Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Val Val Val Thr Asp Asp Tyr Arg Val Pro Thr Lys Lys Met
20 25 30

Lys Val Leu Gly Asn Thr Glu Arg Lys Thr Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Asp Thr Ala Glu Gly Thr Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65 70 75 80

Tyr Leu Lys Glu Ile Phe Thr Glu Glu Met Ala Lys Val Asp Asp Gly
85 90 95

Phe Phe Gln Arg Leu Glu Asp Ser Phe Tyr Val Leu Glu Asp Lys Glu
100 105 110

Gly Asn Lys His Pro Ile Phe Ala Asn Leu Ala Asp Glu Val Ala Tyr
115 120 125

```
His Lys Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Val Asp
    130                 135                 140

Asn Pro Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Val Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Thr Leu Ser Ser
                165                 170                 175

Lys Asn Asn Asn Leu Gln Lys Ser Phe Asp His Leu Val Asp Thr Tyr
            180                 185                 190

Asn Leu Leu Phe Glu Glu Gln Leu Leu Thr Glu Gly Ile Asn Ala Lys
        195                 200                 205

Glu Leu Leu Ser Ala Ala Leu Ser Lys Ser Lys Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ser Leu Ile Pro Gly Gln Lys Lys Thr Gly Ile Phe Gly Asn Ile
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ala Asn Phe Gly
                245                 250                 255

Leu Ser Lys Asp Val Lys Leu Gln Leu Ala Lys Asp Thr Tyr Ala Asp
            260                 265                 270

Asp Leu Asp Ser Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Thr Glu Ser Asp Glu Ile Thr Arg Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Val Lys Arg Tyr Arg Glu His His Lys Asp Leu Val Thr Leu Lys Thr
                325                 330                 335
```

```
Leu Ile Lys Asp Gln Leu Pro Glu Lys Tyr Gln Glu Ile Phe Leu Asp
            340                 345                 350

Lys Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Gly Gln Val Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Tyr Leu Lys Pro Ile Leu Ala Arg Leu Asp Gly
    370                 375                 380

Ser Glu Pro Leu Leu Leu Lys Ile Asp Arg Glu Asp Phe Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Glu
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Val Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Lys Lys Ile Glu Ser Leu Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly His Ser Arg Phe Ala Trp Val
    450                 455                 460

Lys Arg Lys Phe Asp Gly Ala Ile Arg Pro Trp Asn Phe Glu Glu Ile
465                 470                 475                 480

Val Asp Glu Glu Ala Ser Ala Gln Ile Phe Ile Glu Lys Met Thr Lys
                485                 490                 495

Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Ala Thr Glu Gly Met Thr Arg Pro Gln Phe Leu Ser Ala Asp Gln Lys
    530                 535                 540
```

```
Gln Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asn Tyr Phe Lys Lys Ile Glu Cys Trp Asp Ser
                565                 570                 575

Val Glu Ile Thr Gly Val Glu Asp Ser Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Gln Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Pro Asp Asn Gln Lys Ile Ile Glu Asp Ile Ile Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Lys Lys Met Ile Ser Lys Arg Leu Asp Gln Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Lys Val Val Leu Asn Lys Leu Glu Arg His His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Gly Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Ser Glu Leu Ser Phe Ile Asp
    690                 695                 700

Glu Ile Ala Lys Ala Gln Val Ile Gly Lys Thr Glu Tyr Ser Lys Asp
705                 710                 715                 720

Leu Val Gly Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Ser
                725                 730                 735

Gln Thr Ile Lys Ile Val Asp Glu Leu Val Lys Ile Met Gly Tyr Leu
            740                 745                 750
```

```
Pro Gln Gln Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Ala
        755                 760                 765

Gln Gly Ile Lys Asn Ala Arg Gln Arg Met Arg Lys Leu Glu Glu Thr
    770                 775                 780

Ala Lys Lys Leu Gly Ser Asn Ile Leu Lys Glu His Pro Val Asp Asn
785                 790                 795                 800

Ser Gln Leu Gln Asn Asp Lys Arg Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Lys Asp Met Tyr Thr Gly Asp Asp Leu Asp Ile Asp Tyr Leu Ser Ser
            820                 825                 830

Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Lys Asn Asn Ser
        835                 840                 845

Ile Asp Asn Lys Val Leu Thr Ser Gln Gly Ala Asn Arg Gly Lys Leu
    850                 855                 860

Asp Asn Val Pro Ser Glu Ala Ile Val Arg Lys Met Lys Gly Tyr Trp
865                 870                 875                 880

Gln Ser Leu Leu Arg Ala Gly Ala Ile Ser Lys Gln Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Gln Val Asp Lys Ala Gly
            900                 905                 910

Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Phe Asn Thr Glu Phe Asp Asp His Asn
    930                 935                 940

Lys Arg Ile Arg Lys Val His Ile Ile Thr Leu Lys Ser Lys Leu Val
945                 950                 955                 960
```

```
Ser Asp Phe Arg Lys Glu Phe Gly Leu Tyr Lys Ile Arg Asp Ile Asn
               965                 970                 975

His Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala Lys
           980                 985                 990

Ala Ile Leu Gly Lys Tyr Pro Gln  Leu Ala Pro Glu Phe  Val Tyr Gly
        995                 1000                1005

Asp Tyr  Pro Lys Tyr Asn Ser  Phe Lys Glu Arg Gln  Lys Ala Thr
    1010                1015                1020

Gln Lys  Met Leu Phe Tyr Ser  Asn Ile Leu Lys Phe  Phe Lys Asp
    1025                1030                1035

Gln Glu  Ser Leu His Val Asn  Ser Asp Gly Glu Glu  Ile Trp Asn
    1040                1045                1050

Ala Asn  Lys His Leu Pro Ile  Ile Lys Asn Val Leu  Ser Ile Pro
    1055                1060                1065

Gln Val  Asn Ile Val Lys Lys  Thr Glu Val Gln Thr  Gly Gly Phe
    1070                1075                1080

Tyr Lys  Glu Ser Ile Leu Ser  Lys Gly Asn Ser Asp  Lys Leu Ile
    1085                1090                1095

Pro Arg  Lys Asn Asn Trp Asp  Thr Arg Lys Tyr Gly  Gly Phe Asp
    1100                1105                1110

Ser Pro  Thr Val Ala Tyr Ser  Val Leu Val Ile Ala  Lys Met Glu
    1115                1120                1125

Lys Gly  Lys Ala Lys Val Leu  Lys Pro Val Lys Glu  Met Val Gly
    1130                1135                1140

Ile Thr  Ile Met Glu Arg Thr  Ala Phe Glu Glu Asn  Pro Val Val
    1145                1150                1155
```

```
Phe Leu  Glu Ala Arg Gly Tyr  Arg Glu Ile Gln Glu  His Leu Ile
    1160                1165                1170

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Gly Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ser  Glu Leu Gln Lys Gly  Asn Glu Leu
    1190                1195                1200

Phe Leu  Pro Val Asp Tyr Met  Thr Phe Leu Tyr Leu  Ala Ala His
    1205                1210                1215

Tyr His  Glu Leu Thr Gly Ser  Ser Glu Asp Val Leu  Arg Lys Lys
    1220                1225                1230

Tyr Phe  Val Asp Arg His Leu  His Tyr Phe Asp Asp  Ile Ile Gln
    1235                1240                1245

Met Ile  Asn Asp Phe Ala Glu  Arg His Ile Leu Ala  Ser Ser Asn
    1250                1255                1260

Leu Glu  Lys Ile Asn His Thr  Tyr His Asn Asn Ser  Asp Leu Pro
    1265                1270                1275

Val Asn  Glu Arg Ala Glu Asn  Ile Ile Asn Val Phe  Thr Phe Val
    1280                1285                1290

Ala Leu  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Ala Thr Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu Val Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Val Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Gln Leu Gly Glu Asn
    1340                1345
```

<210> 123
<211> 1345
<212> PRT
<213> Streptococcus equi

<400> 123

```
Met Lys Lys Pro Tyr Thr Ile Ala Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Val Val Val Thr Asp Asp Tyr Arg Val Pro Thr Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Glu Arg Lys Thr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asp Thr Ala Glu Gly Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Lys Glu Ile Phe Thr Glu Glu Met Ala Lys Val Asp Asp Gly
                85                  90                  95

Phe Phe Gln Arg Leu Glu Asp Ser Phe Tyr Val Leu Glu Asp Lys Glu
            100                 105                 110

Gly Asn Lys His Pro Ile Phe Ala Asn Leu Ala Asp Glu Val Ala Tyr
        115                 120                 125

His Lys Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Val Asp
    130                 135                 140

Asn Pro Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Val Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Thr Leu Ser Ser
                165                 170                 175
```

```
Lys Asn Asn Asn Leu Gln Lys Ser Phe Asp His Leu Val Asp Thr Tyr
            180                 185                 190

Asn Leu Leu Phe Glu Glu Gln Leu Leu Thr Glu Gly Ile Asn Ala Lys
        195                 200                 205

Glu Leu Leu Ser Ala Ala Leu Ser Lys Ser Lys Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ser Leu Ile Pro Gly Gln Lys Lys Thr Gly Ile Phe Gly Asn Ile
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ala Asn Phe Gly
                245                 250                 255

Leu Ser Lys Asp Val Lys Leu Gln Leu Ala Lys Asp Thr Tyr Ala Asp
            260                 265                 270

Asp Leu Asp Ser Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Thr Glu Ser Asp Glu Ile Thr Arg Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Val Lys Arg Tyr Arg Glu His His Lys Asp Leu Val Thr Leu Lys Thr
                325                 330                 335

Leu Ile Lys Asp Gln Leu Pro Glu Lys Tyr Gln Glu Ile Phe Leu Asp
            340                 345                 350

Lys Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Gly Gln Val Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Tyr Leu Lys Pro Ile Leu Ala Arg Leu Asp Gly
    370                 375                 380
```

```
Ser Glu Pro Leu Leu Leu Lys Ile Asp Arg Glu Asp Phe Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Glu
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Val Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Lys Lys Ile Glu Ser Leu Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly His Ser Arg Phe Ala Trp Val
    450                 455                 460

Lys Arg Lys Phe Asp Gly Ala Ile Arg Pro Trp Asn Phe Glu Glu Ile
465                 470                 475                 480

Val Asp Glu Glu Ala Ser Ala Gln Ile Phe Ile Glu Lys Met Thr Lys
                485                 490                 495

Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Ala Thr Glu Gly Met Thr Arg Pro Gln Phe Leu Ser Ala Asp Gln Lys
    530                 535                 540

Gln Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asn Tyr Phe Lys Lys Ile Glu Cys Trp Asp Ser
                565                 570                 575

Val Glu Ile Thr Gly Val Glu Asp Ser Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590
```

```
Tyr His Asp Leu Leu Lys Ile Ile Gln Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Pro Asp Asn Gln Lys Ile Ile Glu Asp Ile Ile Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Lys Lys Met Ile Ser Lys Arg Leu Asp Gln Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Lys Val Val Leu Asn Lys Leu Glu Arg His His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Gly Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Ser Glu Leu Ser Phe Ile Asp
    690                 695                 700

Glu Ile Ala Lys Ala Gln Val Ile Gly Lys Thr Glu Tyr Ser Lys Asp
705                 710                 715                 720

Leu Val Gly Asn Leu Ala Ser Ser Pro Ala Ile Lys Lys Gly Ile Ser
                725                 730                 735

Gln Thr Ile Lys Ile Val Asp Glu Leu Val Lys Ile Met Gly Tyr Leu
            740                 745                 750

Pro Gln Gln Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Ala
        755                 760                 765

Gln Gly Ile Lys Asn Ala Arg Gln Arg Met Arg Lys Leu Glu Glu Thr
    770                 775                 780

Ala Lys Lys Leu Gly Ser Asn Ile Leu Lys Glu His Pro Val Asp Asn
785                 790                 795                 800
```

```
Ser Gln Leu Gln Asn Asp Lys Arg Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Lys Asp Met Tyr Thr Gly Asp Asp Leu Asp Ile Asp Tyr Leu Ser Ser
            820                 825                 830

Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Lys Asn Asn Ser
        835                 840                 845

Ile Asp Asn Lys Val Leu Thr Ser Gln Gly Ala Asn Arg Gly Lys Leu
    850                 855                 860

Asp Asn Val Pro Ser Glu Ala Ile Val Arg Lys Met Lys Gly Tyr Trp
865                 870                 875                 880

Gln Ser Leu Leu Arg Ala Gly Ala Ile Ser Lys Gln Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Gln Val Asp Lys Ala Gly
            900                 905                 910

Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Phe Asn Thr Glu Phe Asp Asp His Asn
    930                 935                 940

Lys Arg Ile Arg Lys Val His Ile Ile Thr Leu Lys Ser Lys Leu Val
945                 950                 955                 960

Ser Asp Phe Arg Lys Glu Phe Gly Leu Tyr Lys Ile Arg Asp Ile Asn
                965                 970                 975

His Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala Lys
            980                 985                 990

Ala Ile Leu Gly Lys Tyr Pro Gln  Leu Ala Pro Glu Phe  Val Tyr Gly
        995                 1000                1005
```

```
Asp Tyr  Pro Lys Tyr Asn Ser  Phe Lys Glu Arg Gln  Lys Ala Thr
    1010                1015                1020

Gln Lys  Thr Leu Phe Tyr Ser  Asn Ile Leu Lys Phe  Phe Lys Asp
    1025                1030                1035

Gln Glu  Ser Leu His Val Asn  Ser Asp Gly Glu Glu  Ile Trp Asn
    1040                1045                1050

Ala Asn  Lys His Leu Pro Ile  Ile Lys Asn Val Leu  Ser Ile Pro
    1055                1060                1065

Gln Val  Asn Ile Val Lys Lys  Thr Glu Val Gln Thr  Gly Gly Phe
    1070                1075                1080

Tyr Lys  Glu Ser Ile Leu Ser  Lys Gly Asn Ser Asp  Lys Leu Ile
    1085                1090                1095

Pro Arg  Lys Asn Asn Trp Asp  Thr Arg Lys Tyr Gly  Gly Phe Asp
    1100                1105                1110

Ser Pro  Thr Val Ala Tyr Ser  Val Leu Val Ile Ala  Lys Met Glu
    1115                1120                1125

Lys Gly  Lys Ala Lys Val Leu  Lys Pro Val Lys Glu  Met Val Gly
    1130                1135                1140

Ile Thr  Ile Met Glu Arg Ile  Ala Phe Glu Glu Asn  Pro Val Val
    1145                1150                1155

Phe Leu  Glu Ala Lys Gly Tyr  Arg Glu Ile Gln Glu  His Leu Ile
    1160                1165                1170

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Gly Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ser  Glu Leu Gln Lys Gly  Asn Glu Leu
    1190                1195                1200
```

```
Phe Leu  Pro Val Asp Tyr Met  Thr Phe Leu Tyr Leu  Ala Ala His
    1205                 1210                 1215


Tyr His  Glu Leu Thr Gly Ser  Ser Glu Asp Val Leu  Arg Lys Lys
    1220                 1225                 1230


Tyr Phe  Val Glu Arg His Leu  His Tyr Phe Asp Asp  Ile Ile Gln
    1235                 1240                 1245


Met Ile  Asn Asp Phe Ala Glu  Arg His Ile Leu Ala  Ser Ser Asn
    1250                 1255                 1260


Leu Glu  Lys Ile Asn His Thr  Tyr His Asn Asn Ser  Asp Leu Pro
    1265                 1270                 1275


Ile Asn  Glu Arg Ala Glu Asn  Ile Ile Asn Val Phe  Thr Phe Val
    1280                 1285                 1290


Ala Leu  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Ala Thr Ile
    1295                 1300                 1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu Val Leu  Asn Ala Thr
    1310                 1315                 1320


Leu Ile  His Gln Ser Val Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Ser  Gln Leu Gly Glu Asn
    1340                 1345


<210>  124
<211>  1345
<212>  PRT
<213>  Streptococcus equi

<400>  124

Met Lys Lys Pro Tyr Thr Ile Ala Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15
```

```
Gly Trp Val Val Val Thr Asp Asp Tyr Arg Val Pro Thr Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Glu Arg Lys Thr Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asp Thr Ala Glu Gly Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Pro Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80

Phe Leu Lys Glu Ile Phe Thr Glu Glu Met Ala Lys Val Asp Asp Gly
                85                  90                  95

Phe Phe Gln Arg Leu Glu Asp Ser Phe Tyr Val Leu Glu Asp Lys Glu
            100                 105                 110

Gly Asn Lys His Pro Ile Phe Ala Asn Leu Ala Asp Glu Val Ala Tyr
        115                 120                 125

His Lys Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Val Asp
    130                 135                 140

Asn Pro Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Val Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Thr Leu Ser Ser
                165                 170                 175

Lys Asn Asn Asn Leu Gln Lys Ser Phe Asp His Leu Val Asp Thr Tyr
            180                 185                 190

Asn Leu Leu Phe Glu Glu Gln Leu Leu Thr Glu Gly Ile Asn Ala Lys
        195                 200                 205

Glu Leu Leu Ser Ala Ala Leu Ser Lys Ser Lys Arg Leu Glu Asn Leu
    210                 215                 220
```

```
Ile Ser Leu Ile Pro Gly Gln Lys Lys Thr Gly Ile Phe Gly Asn Ile
225                 230                 235                 240


Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ala Asn Phe Gly
                245                 250                 255


Leu Ser Lys Asp Val Lys Leu Gln Leu Ala Lys Asp Thr Tyr Ala Asp
            260                 265                 270


Asp Leu Asp Ser Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285


Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300


Leu Thr Glu Ser Asp Glu Ile Thr Arg Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320


Val Lys Arg Tyr Arg Glu His His Lys Asp Leu Val Thr Leu Lys Thr
                325                 330                 335


Leu Ile Lys Asp Gln Leu Pro Glu Lys Tyr Gln Glu Ile Phe Leu Asp
            340                 345                 350


Lys Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Gly Gln Val Ser Gln
        355                 360                 365


Glu Glu Phe Tyr Lys Tyr Leu Lys Pro Ile Leu Ala Arg Leu Asp Gly
    370                 375                 380


Ser Glu Pro Leu Leu Leu Lys Ile Asp Arg Glu Asp Phe Leu Arg Lys
385                 390                 395                 400


Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Glu
                405                 410                 415


Glu Leu His Ala Ile Leu Arg Arg Gln Glu Val Phe Tyr Pro Phe Leu
            420                 425                 430
```

```
Lys Asp Asn Arg Lys Lys Ile Glu Ser Leu Leu Thr Phe Arg Ile Pro
        435                 440                 445


Tyr Tyr Val Gly Pro Leu Ala Arg Gly His Ser Arg Phe Ala Trp Val
    450                 455                 460


Lys Arg Lys Phe Asp Gly Ala Ile Arg Pro Trp Asn Phe Glu Glu Ile
465                 470                 475                 480


Val Asp Glu Glu Ala Ser Ala Gln Ile Phe Ile Glu Lys Met Thr Lys
                485                 490                 495


Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510


Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525


Ala Thr Glu Gly Met Thr Arg Pro Gln Phe Leu Ser Ala Asp Gln Lys
    530                 535                 540


Gln Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560


Lys Gln Leu Lys Glu Asn Tyr Phe Lys Lys Ile Glu Cys Trp Asp Ser
                565                 570                 575


Val Glu Ile Thr Gly Val Glu Asp Ser Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590


Tyr His Asp Leu Leu Lys Ile Ile Gln Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605


Pro Asp Asn Gln Lys Ile Ile Glu Asp Ile Ile Leu Thr Leu Thr Leu
    610                 615                 620


Phe Glu Asp Lys Lys Met Ile Ser Lys Arg Leu Asp Gln Tyr Ala His
625                 630                 635                 640
```

```
Leu Phe Asp Lys Val Val Leu Asn Lys Leu Glu Arg His His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Gly Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Ser Glu Leu Ser Phe Ile Asp
    690                 695                 700

Glu Ile Ala Lys Ala Gln Val Ile Gly Lys Thr Glu Tyr Ser Lys Asp
705                 710                 715                 720

Leu Val Gly Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Ser
                725                 730                 735

Gln Thr Ile Lys Ile Val Asp Glu Leu Val Lys Ile Met Gly Tyr Leu
            740                 745                 750

Pro Gln Gln Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Ala
        755                 760                 765

Gln Gly Ile Lys Asn Ala Arg Gln Arg Met Arg Lys Leu Glu Glu Thr
    770                 775                 780

Ala Lys Lys Leu Gly Ser Asn Ile Leu Lys Glu His Pro Val Asp Asn
785                 790                 795                 800

Ser Gln Leu Gln Asn Asp Lys Arg Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Lys Asp Met Tyr Thr Gly Asp Asp Leu Asp Ile Asp Tyr Leu Ser Ser
            820                 825                 830

Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Lys Asn Asn Ser
        835                 840                 845
```

```
Ile Asp Asn Lys Val Leu Thr Ser Gln Gly Ala Asn Arg Gly Lys Leu
    850                 855                 860

Asp Asn Val Pro Ser Glu Ala Ile Val Arg Lys Met Lys Gly Tyr Trp
865                 870                 875                 880

Gln Ser Leu Leu Arg Ala Gly Ala Ile Ser Lys Gln Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Gln Val Asp Lys Ala Gly
            900                 905                 910

Phe Ile Gln Leu Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Phe Asn Thr Glu Phe Asp Asp His Asn
    930                 935                 940

Lys Arg Ile Arg Lys Val His Ile Ile Thr Leu Lys Ser Lys Leu Val
945                 950                 955                 960

Ser Asp Phe Arg Lys Glu Phe Gly Leu Tyr Lys Ile Arg Asp Ile Asn
                965                 970                 975

His Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala Lys
            980                 985                 990

Ala Ile Leu Gly Lys Tyr Pro Gln  Leu Ala Pro Glu Phe  Val Tyr Gly
        995                 1000                1005

Asp Tyr  Pro Lys Tyr Asn Ser  Phe Lys Glu Arg Gln  Lys Ala Thr
    1010                1015                1020

Gln Lys  Thr Leu Phe Tyr Ser  Asn Ile Leu Lys Phe  Phe Lys Asp
    1025                1030                1035

Gln Glu  Ser Leu His Val Asn  Ser Asp Gly Glu Glu  Ile Trp Asn
    1040                1045                1050
```

```
Ala Asn  Lys His Leu Pro Ile  Ile Lys Asn Val Leu  Ser Ile Pro
    1055                1060                1065

Gln Val  Asn Ile Val Lys Lys  Thr Glu Val Gln Thr  Gly Gly Phe
    1070                1075                1080

Tyr Lys  Glu Ser Ile Leu Ser  Lys Gly Asn Ser Asp  Lys Leu Ile
    1085                1090                1095

Pro Arg  Lys Asn Asn Trp Asp  Thr Arg Lys Tyr Gly  Gly Phe Asp
    1100                1105                1110

Ser Pro  Thr Val Ala Tyr Ser  Val Leu Val Ile Ala  Lys Met Glu
    1115                1120                1125

Lys Gly  Lys Ala Lys Val Leu  Lys Pro Val Lys Glu  Met Val Gly
    1130                1135                1140

Ile Thr  Ile Met Glu Arg Ile  Ala Phe Glu Glu Asn  Pro Val Val
    1145                1150                1155

Phe Leu  Glu Ala Lys Gly Tyr  Arg Glu Ile Gln Glu  His Leu Ile
    1160                1165                1170

Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu Leu Glu  Asn Gly Arg
    1175                1180                1185

Arg Arg  Leu Leu Ala Ser Ser  Glu Leu Gln Lys Gly  Asn Glu Leu
    1190                1195                1200

Phe Leu  Pro Val Asp Tyr Met  Thr Phe Leu Tyr Leu  Ala Ala His
    1205                1210                1215

Tyr His  Glu Leu Thr Gly Ser  Ser Glu Asp Val Leu  Arg Lys Lys
    1220                1225                1230

Tyr Phe  Val Glu Arg His Leu  His Tyr Phe Asp Asp  Ile Ile Gln
    1235                1240                1245
```

```
Met Ile  Asn Asp Phe Ala Glu  Arg His Ile Leu Ala  Ser Ser Asn
    1250                1255                1260


Leu Glu  Lys Ile Asn His Thr  Tyr His Asn Asn Ser  Asp Leu Pro
    1265                1270                1275


Val Asn  Glu Arg Ala Glu Asn  Ile Ile Asn Val Phe  Thr Phe Val
    1280                1285                1290


Ala Leu  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Ala Thr Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Lys Glu Val Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Val Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Gln Leu Gly Glu Asn
    1340                1345
```

<210> 125
<211> 1360
<212> PRT
<213> Streptococcus equinus

<400> 125

```
Met Glu Lys Thr Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Ala Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
```

65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Lys Glu Met Ala Lys Val Asp Glu Ser
85 90 95

Phe Phe Gln Arg Leu Glu Glu Ser Phe Leu Thr Asp Asp Asp Lys Thr
100 105 110

Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Thr Tyr
115 120 125

His Gln Glu Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
130 135 140

Ser Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Asn Ala
165 170 175

Glu Asn Thr Asp Val Gln Lys Ile Phe Ala Asp Phe Val Gly Val Tyr
180 185 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
195 200 205

Ala Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Asn
210 215 220

Leu Ile Lys Gln Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225 230 235 240

Leu Val Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
245 250 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Asp
260 265 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp

275 280 285

Leu Phe Thr Ala Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
290 295 300

Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305 310 315 320

Met Ile Lys Arg Tyr Glu Glu His His Glu Asp Leu Glu Lys Leu Lys
325 330 335

Thr Phe Ile Lys Val Asn Asn Phe Asp Lys Tyr His Glu Ile Phe Lys
340 345 350

Asp Lys Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
355 360 365

Gln Asp Ile Phe Tyr Lys His Leu Lys Ser Ile Ile Ser Glu Lys Asn
370 375 380

Gly Gly Gln Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro Tyr Gln Ile His Leu
405 410 415

Gln Glu Met Arg Thr Ile Leu Arg Arg Gln Gly Glu Tyr Tyr Pro Phe
420 425 430

Leu Lys Glu Asn Gln Ala Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala Trp
450 455 460

Ala Lys Tyr His Ser Asp Glu Pro Ile Thr Pro Trp Asn Phe Asp Glu
465 470 475 480

Val Val Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr

485 490 495

Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
500 505 510

Tyr Val Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Ile Lys
515 520 525

Tyr Val Asn Glu Gln Gly Lys Ser Phe Phe Phe Asp Ala Asn Met Lys
530 535 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545 550 555 560

Ala Lys Leu Leu Ser Tyr Leu Asn Asn Glu Phe Glu Glu Phe Arg Ile
565 570 575

Asn Asp Leu Ile Gly Leu Asp Lys Asp Ser Lys Ser Phe Asn Ala Ser
580 585 590

Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Ser Phe Leu
595 600 605

Asp Asp Lys Thr Asn Glu Gln Ile Ile Glu Asp Ile Val Leu Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Asp Met Ile His Glu Arg Leu Gln Lys Tyr
625 630 635 640

Ser Asp Ile Phe Thr Ser Gln Gln Leu Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
660 665 670

Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Phe Leu Ile Asp Asp Gly
675 680 685

Asp Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu Ser

690 695 700

Phe Lys Thr Thr Ile Gln Glu Ala Gln Val Val Gly Asp Val Asp Asp
705 710 715 720

Ile Glu Ala Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
740 745 750

Gly His Asn Pro Gln Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
755 760 765

Ile Thr Gly Tyr Gly Arg Asn Arg Ser Asn Gln Arg Leu Lys Arg Leu
770 775 780

Gln Asp Ser Leu Lys Pro Ser Tyr Val Asp Ser Lys Val Glu Asn Ser
785 790 795 800

His Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys
805 810 815

Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp His Leu Ser Asp Tyr
820 825 830

Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Ile
835 840 845

Asp Asn Arg Val Leu Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser Asp
850 855 860

Asp Val Pro Ser Ile Glu Ile Val Arg Asn Arg Lys Ser Tyr Trp Tyr
865 870 875 880

Lys Leu Tyr Lys Ser Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn Leu
885 890 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Thr Asp Lys Ala Gly Phe

900 905 910

Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala
915 920 925

Gln Ile Leu Asp Ala Arg Phe Asn Thr Lys Cys Asp Glu Asn Asp Lys
930 935 940

Val Ile Arg Asp Val Lys Val Ile Thr Leu Lys Ser Ser Leu Val Ser
945 950 955 960

Gln Phe Arg Lys Glu Phe Lys Phe Tyr Lys Val Arg Glu Ile Asn Asp
965 970 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr Ala
980 985 990

Leu Leu Lys Lys Tyr Pro Lys Leu Ala Pro Glu Phe Val Tyr Gly Glu
995 1000 1005

Tyr Lys Lys Tyr Asp Val Ser Ser Asp Asn His Ser Glu Leu Gly
1010 1015 1020

Lys Ala Thr Ala Lys Tyr Phe Phe Tyr Ser Asn Leu Met Asn Phe
1025 1030 1035

Phe Lys Thr Glu Val Lys Tyr Ala Asp Gly Arg Val Phe Glu Arg
1040 1045 1050

Pro Asp Ile Glu Thr Asn Ala Asp Gly Glu Val Val Trp Asn Lys
1055 1060 1065

Gln Arg Asp Phe Asn Ile Val Arg Lys Val Leu Ser Tyr Pro Gln
1070 1075 1080

Val Asn Ile Val Lys Lys Val Glu Val Gln Thr Gly Gly Phe Ser
1085 1090 1095

Lys Glu Ser Ile Leu Pro Lys Gly Asp Ser Asp Lys Leu Ile Pro

1100 1105 1110

Arg Lys Thr Lys Lys Leu Gln Trp Glu Thr Gln Lys Tyr Gly Gly
1115 1120 1125

Phe Asp Ser Pro Thr Val Ala Tyr Ser Val Leu Val Val Ala Asp
1130 1135 1140

Val Glu Lys Gly Lys Thr Arg Lys Leu Lys Thr Val Lys Glu Leu
1145 1150 1155

Val Gly Ile Ser Ile Met Glu Arg Ser Ser Phe Glu Glu Asn Pro
1160 1165 1170

Val Ser Phe Leu Glu Lys Lys Gly Tyr His Asn Val Gln Glu Asp
1175 1180 1185

Lys Leu Ile Lys Leu Pro Lys Tyr Ser Leu Phe Glu Phe Glu Gly
1190 1195 1200

Gly Arg Arg Arg Leu Leu Ala Ser Ala Thr Glu Leu Gln Lys Gly
1205 1210 1215

Asn Glu Val Val Leu Pro Gln Tyr Met Val Asn Leu Leu Tyr His
1220 1225 1230

Ser Gln His Val Asn Asn Ser His Lys Pro Glu His Leu Asn Tyr
1235 1240 1245

Val Lys Gln His Lys Asp Glu Phe Lys Asp Ile Phe Asn Leu Ile
1250 1255 1260

Ile Ser Ile Ala Arg Ile Asn Ile Leu Lys Pro Lys Val Val Asp
1265 1270 1275

Asn Leu Ile Asn Glu Phe Thr Glu Tyr Gly Gln Glu Asp Ile Ser
1280 1285 1290

Ser Leu Ser Glu Ser Phe Ile Asn Leu Leu Lys Phe Ile Ser Phe

1295 1300 1305

Gly Ala Pro Gly Ala Phe Lys Phe Leu Lys Leu Asp Val Lys Gln
1310 1315 1320

Ser Asn Leu Arg Tyr Lys Ser Thr Thr Glu Ala Leu Ser Ala Thr
1325 1330 1335

Leu Ile His Gln Ser Val Thr Gly Leu Tyr Glu Thr Arg Ile Asp
1340 1345 1350

Leu Ser Lys Leu Gly Glu Glu
1355 1360

<210> 126
<211> 1353
<212> PRT
<213> Streptococcus gallolyticus

<400> 126

Met Thr Lys Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1 5 10 15

Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys
20 25 30

Met Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu
35 40 45

Leu Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg
50 55 60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65 70 75 80

Arg Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Thr Lys Val Asp Glu
85 90 95

Ser Phe Phe Tyr Arg Leu Asp Glu Ser Phe Leu Thr Thr Asp Glu Lys
100 105 110

```
Asp Phe Glu Arg His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala
        115                 120                 125

Tyr His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Asn Tyr Leu Ala
    130                 135                 140

Asp Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Asn
                165                 170                 175

Ala Glu Asn Thr Asp Val Gln Lys Leu Phe Thr Asp Phe Val Gly Val
            180                 185                 190

Tyr Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp
        195                 200                 205

Val Ala Ser Thr Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu
    210                 215                 220

Asn Leu Ile Lys Tyr Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly
225                 230                 235                 240

Asn Leu Ile Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Met Asn
                245                 250                 255

Phe Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala
        275                 280                 285

Asp Leu Phe Thr Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320
```

```
Ser Met Ile Lys Arg Tyr Val Glu His His Glu Asp Leu Glu Lys Leu
                325                 330                 335

Lys Glu Phe Ile Lys Ala Asn Lys Ser Glu Leu Tyr His Asp Ile Phe
            340                 345                 350

Lys Asp Lys Asn Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val
        355                 360                 365

Lys Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile
    370                 375                 380

Asp Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Lys Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Val Arg Lys Asp Ser Arg Phe Ala
    450                 455                 460

Trp Ala Glu Tyr Arg Ser Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp
465                 470                 475                 480

Lys Val Ile Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met
                485                 490                 495

Thr Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser His Val Tyr Glu Thr Tyr Ala Val Tyr Asn Glu Leu Thr Lys Ile
        515                 520                 525
```

```
Lys Tyr Val Asn Glu Gln Gly Lys Glu Ser Phe Phe Asp Ser Asn Met
    530                 535                 540

Lys Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr
545                 550                 555                 560

Lys Glu Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Pro Glu Tyr Arg
                565                 570                 575

Ile Lys Asp Leu Ile Gly Leu Asp Lys Glu Asn Lys Ser Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Ala Phe
        595                 600                 605

Leu Asp Asp Lys Val Asn Glu Glu Val Ile Glu Asp Ile Ile Lys Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Lys Asp Met Ile His Glu Arg Leu Gln Lys
625                 630                 635                 640

Tyr Ser Asp Ile Phe Thr Ala Asn Gln Leu Lys Lys Leu Glu Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Ser Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Thr Leu
    690                 695                 700

Pro Phe Lys Gln Ile Ile Gln Lys Ser Gln Val Val Gly Asp Val Asp
705                 710                 715                 720

Asp Ile Glu Ala Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys
                725                 730                 735
```

```
Lys Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Asp Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Arg Gly Arg Ser Gln Ser Gln Gln Arg Leu Lys Lys
    770                 775                 780

Leu Gln Ser Ser Leu Lys Pro Ser Tyr Ile Glu Asp Lys Val Glu Asn
785                 790                 795                 800

Ser His Leu Gln Asn Asp Gln Leu Phe Leu Tyr Tyr Ile Gln Asn Gly
                805                 810                 815

Lys Asp Met Tyr Thr Gly Asp Glu Leu Asp Ile Asp His Leu Ser Asp
            820                 825                 830

Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser
        835                 840                 845

Ile Asp Asn Arg Val Leu Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asp Val Pro Ser Leu Asp Ile Val Arg Ala Arg Lys Ala Glu Trp
865                 870                 875                 880

Val Arg Leu Tyr Lys Ser Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ala Arg Phe Asn Thr Glu His Asp Glu Asn Asp
    930                 935                 940
```

```
Lys Val Ile Arg Asp Val Lys Val Ile Thr Leu Lys Ser Asn Leu Val
945                 950                 955                 960


Ser Gln Phe Arg Lys Asp Phe Glu Phe Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975


Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
            980                 985                 990


Ala Leu Leu Lys Lys Tyr Pro Lys  Leu Ala Ser Glu Phe  Val Tyr Gly
        995                 1000                1005


Glu Tyr  Lys Lys Tyr Asp Ile  Ser Ser Asp Lys Ala  Thr Ala Lys
    1010                1015                1020


Tyr Phe  Phe Tyr Ser Asn Leu  Met Asn Phe Phe Lys  Thr Lys Val
    1025                1030                1035


Lys Tyr  Ala Asp Gly Thr Val  Phe Glu Arg Pro Ile  Ile Glu Thr
    1040                1045                1050


Asn Ala  Asp Gly Glu Ile Ala  Trp Asn Lys Gln Ile  Asp Phe Glu
    1055                1060                1065


Lys Val  Arg Lys Val Leu Ser  Tyr Pro Gln Val Asn  Ile Val Lys
    1070                1075                1080


Lys Val  Glu Thr Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1085                1090                1095


Pro Lys  Gly Asp Ser Asp Lys  Leu Ile Pro Arg Lys  Thr Lys Lys
    1100                1105                1110


Val Tyr  Trp Asp Thr Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr
    1115                1120                1125


Val Ala  Tyr Ser Val Phe Val  Val Ala Asp Val Glu  Lys Gly Lys
    1130                1135                1140
```

```
Ala Lys  Lys Leu Lys Thr Val  Lys Glu Leu Val Gly  Ile Ser Ile
    1145                1150                1155

Met Glu  Arg Ser Phe Phe Glu  Glu Asn Pro Val Glu  Phe Leu Glu
    1160                1165                1170

Asn Lys  Gly Tyr His Asn Ile  Arg Glu Asp Lys Leu  Ile Lys Leu
    1175                1180                1185

Pro Lys  Tyr Ser Leu Phe Glu  Phe Glu Gly Gly Arg  Arg Arg Leu
    1190                1195                1200

Leu Ala  Ser Ala Ser Glu Leu  Gln Lys Gly Asn Glu  Met Val Leu
    1205                1210                1215

Pro Gly  Tyr Leu Val Glu Leu  Leu Tyr His Ala His  Arg Ala Asp
    1220                1225                1230

Asn Phe  Asn Ser Thr Glu Tyr  Leu Asn Tyr Val Ser  Glu His Lys
    1235                1240                1245

Lys Glu  Phe Glu Lys Val Leu  Ser Cys Val Glu Asp  Phe Ala Asn
    1250                1255                1260

Leu Tyr  Val Asp Val Glu Lys  Asn Leu Ser Lys Ile  Arg Ala Val
    1265                1270                1275

Ala Asp  Ser Met Asp Asn Phe  Ser Ile Glu Glu Ile  Ser Asn Ser
    1280                1285                1290

Phe Ile  Asn Leu Leu Thr Leu  Thr Ala Leu Gly Ala  Pro Ala Asp
    1295                1300                1305

Phe Asn  Phe Leu Gly Glu Lys  Ile Pro Arg Lys Arg  Tyr Thr Ser
    1310                1315                1320

Thr Lys  Glu Cys Leu Thr Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1325                1330                1335
```

Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ser Lys Leu Gly Glu Glu
    1340   1345   1350

<210> 127
<211> 1354
<212> PRT
<213> Streptococcus gallolyticus

<400> 127

Met Thr Glu Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1   5   10   15

Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys
            20   25   30

Met Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu
        35   40   45

Leu Gly Ala Leu Leu Phe Asp Asn Gly Glu Thr Ala Glu Ala Thr Arg
    50   55   60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65   70   75   80

Arg Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ala Lys Val Asp Glu
                85   90   95

Ser Phe Phe Tyr Arg Leu Asp Glu Ser Phe Leu Thr Thr Asp Asp Lys
            100   105   110

Asp Phe Glu Arg His Pro Ile Phe Gly Asn Lys Ala Asp Glu Ile Lys
        115   120   125

Tyr His Gln Glu Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala
    130   135   140

Asp Ser His Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala
145   150   155   160

```
His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn
                165                 170                 175

Ala Glu Asn Thr Asp Val Gln Lys Leu Phe Glu Ala Phe Val Glu Val
            180                 185                 190

Tyr Asp Arg Thr Phe Asp Asp Ser Asn Leu Ser Glu Ile Thr Val Asp
        195                 200                 205

Ala Ser Ser Ile Leu Thr Glu Lys Phe Ser Lys Ser Arg Arg Leu Glu
    210                 215                 220

Asn Leu Ile Lys His Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly
225                 230                 235                 240

Asn Leu Val Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Ser
                245                 250                 255

Phe Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Glu Leu Ile Gly Lys Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Asp Leu Phe Thr Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Ala Asp Asn Thr Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Lys Arg Tyr Asn Glu His Gln Val Asp Leu Lys Lys Leu
                325                 330                 335

Lys Glu Phe Ile Lys Asn Asn Ala Ser Asp Lys Tyr Asp Glu Ile Phe
            340                 345                 350

Asn Asp Lys Asp Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val
        355                 360                 365
```

```
Lys Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Thr Thr Leu Ser Lys Ile
    370                 375                 380

Asp Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
                405                 410                 415

Leu Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Ala
            420                 425                 430

Phe Leu Lys Glu Asn Gln Ala Lys Ile Glu Lys Ile Leu Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala
    450                 455                 460

Trp Ala Glu Tyr His Ser Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp
465                 470                 475                 480

Glu Ile Ile Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met
                485                 490                 495

Thr Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Val Tyr Glu Thr Tyr Thr Val Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Lys Tyr Val Asn Glu Gln Gly Lys Ser Asn Phe Phe Asp Ala Asn Met
    530                 535                 540

Lys Gln Glu Ile Phe Glu His Val Phe Lys Glu Asn Arg Lys Val Thr
545                 550                 555                 560

Lys Asp Lys Phe Leu Asn Tyr Leu Asn Lys Glu Phe Pro Glu Tyr Arg
                565                 570                 575
```

```
Ile Gln Asp Leu Ile Gly Leu Asp Lys Glu Asn Lys Ser Phe Asn Ala
            580                 585                 590

Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Ser Phe
        595                 600                 605

Leu Asp Asp Lys Thr Asn Glu Thr Ile Ile Glu Asp Ile Ile Gln Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Asp Met Ile Arg Gln Arg Leu Gln Lys
625                 630                 635                 640

Tyr Ser Asp Ile Phe Thr Pro Gln Gln Leu Lys Lys Leu Glu Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile
            660                 665                 670

Arg Asn Lys Glu Asn Gly Lys Ser Ile Leu Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Gly Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Ser Asp Asp Thr Leu
    690                 695                 700

Pro Phe Lys Gln Ile Ile Lys Asp Ala Gln Ile Ile Gly Asp Ile Asp
705                 710                 715                 720

Asp Val Thr Ser Val Val Arg Glu Leu Pro Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly His Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Asn Arg Gly Arg Asn Gln Ser Gln Gln Arg Leu Lys Lys
    770                 775                 780
```

```
Leu Gln Asp Ser Leu Lys Pro Ser Tyr Ile Glu Gly Lys Val Glu Asn
785                 790                 795                 800

Asn His Leu Gln Asp Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly
                805                 810                 815

Lys Asp Met Tyr Thr Gly Asp Glu Leu Asp Ile Asp His Leu Ser Asp
            820                 825                 830

Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser
        835                 840                 845

Ile Asp Asn Arg Val Leu Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asp Val Pro Ser Leu Asp Ile Val His Asp Arg Lys Ala Asp Trp
865                 870                 875                 880

Ile Arg Leu Tyr Lys Ser Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Asn Asp Lys Ala Gly
            900                 905                 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Gln Ile Leu Asp Ser Arg Phe Asn Thr Glu Arg Asp Glu Asn Asp
    930                 935                 940

Lys Val Ile Arg Asn Val Lys Val Ile Thr Leu Lys Ser Asn Leu Val
945                 950                 955                 960

Ser Gln Phe Arg Lys Asp Phe Lys Phe Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr
            980                 985                 990
```

```
Ala Leu Leu Lys Lys Tyr Pro Lys  Leu Ala Pro Glu Phe  Val Tyr Gly
        995                 1000                1005


Glu Tyr  Lys Lys Tyr Asp Ile  Ser Gly Asp Lys Ala  Thr Ala Lys
    1010                1015                1020


Tyr Phe  Phe Tyr Ser Asn Leu  Met Asn Phe Phe Lys  Arg Val Ile
    1025                1030                1035


Arg Tyr  Ser Asn Gly Lys Val  Val Val Arg Pro Val  Ile Glu Cys
    1040                1045                1050


Ser Lys  Asp Thr Gly Glu Ile  Ala Trp Asn Lys Gln  Thr Asp Phe
    1055                1060                1065


Glu Lys  Val Arg Arg Val Leu  Ser Tyr Pro Gln Val  Asn Ile Val
    1070                1075                1080


Lys Lys  Val Glu Thr Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile
    1085                1090                1095


Leu Pro  Lys Gly Asn Ser Asp  Lys Leu Ile Pro Arg  Lys Thr Lys
    1100                1105                1110


Lys Phe  Arg Trp Asp Thr Pro  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1115                1120                1125


Asn Ile  Ala Tyr Ser Val Phe  Val Ile Ala Asp Val  Glu Lys Gly
    1130                1135                1140


Lys Ala  Lys Lys Leu Lys Thr  Val Lys Glu Leu Val  Gly Ile Ser
    1145                1150                1155


Ile Met  Glu Arg Ser Ser Phe  Glu Glu Asn Pro Val  Val Phe Leu
    1160                1165                1170


Glu Lys  Lys Gly Tyr Gln Asn  Val Gln Glu Asp Asn  Leu Ile Lys
    1175                1180                1185
```

```
Leu Pro  Lys Tyr Ser Leu Phe  Glu Phe Glu Gly Gly  Arg Arg Arg
    1190                1195                1200


Leu Leu  Ala Ser Ala Ser Glu  Leu Gln Lys Gly Asn  Glu Val Val
    1205                1210                1215


Leu Ser  Arg His Leu Val Glu  Leu Leu Tyr His Ala  His Arg Val
    1220                1225                1230


Asn Ser  Phe Asn Asn Ser Glu  His Leu Lys Tyr Val  Ser Glu His
    1235                1240                1245


Lys Lys  Glu Phe Gly Glu Val  Leu Ser Cys Val Glu  Asn Phe Ala
    1250                1255                1260


Lys Ser  Tyr Val Asp Val Glu  Lys Asn Leu Gly Lys  Ile Arg Ala
    1265                1270                1275


Val Ala  Asp Lys Ile Asp Thr  Phe Ser Ile Glu Asp  Ile Ser Ile
    1280                1285                1290


Ser Phe  Val Asn Leu Leu Thr  Leu Thr Ala Leu Gly  Ala Pro Ala
    1295                1300                1305


Asp Phe  Asn Phe Leu Gly Glu  Lys Ile Pro Arg Lys  Arg Tyr Thr
    1310                1315                1320


Ser Thr  Lys Glu Cys Leu Asn  Ala Thr Leu Ile His  Gln Ser Ile
    1325                1330                1335


Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu Ser Lys  Leu Gly Glu
    1340                1345                1350


Glu
```

<210> 128
<211> 1355
<212> PRT

<213> Streptococcus gallolyticus

<400> 128

```
Met Thr Lys Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser
1               5                  10                  15

Val Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys
            20                  25                  30

Met Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu
        35                  40                  45

Leu Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg
    50                  55                  60

Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu
65                  70                  75                  80

Arg Tyr Leu Gln Glu Ile Phe Ala Asn Glu Ile Ala Lys Val Asp Glu
                85                  90                  95

Ser Phe Phe Gln Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys
            100                 105                 110

Thr Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala
        115                 120                 125

Tyr His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala
    130                 135                 140

Asp Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala
145                 150                 155                 160

His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn
                165                 170                 175

Ala Glu Asn Thr Asp Val Gln Lys Ile Phe Ala Asp Phe Val Gly Val
            180                 185                 190
```

```
Tyr Asn Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp
        195                 200                 205

Val Ala Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu
    210                 215                 220

Asn Leu Ile Lys Tyr Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly
225                 230                 235                 240

Asn Leu Ile Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn
                245                 250                 255

Phe Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala
        275                 280                 285

Asp Leu Phe Thr Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser
    290                 295                 300

Gly Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Lys Arg Tyr Val Glu His His Glu Asp Leu Glu Lys Leu
                325                 330                 335

Lys Glu Phe Ile Lys Ala Asn Lys Ser Glu Leu Tyr His Asp Ile Phe
            340                 345                 350

Lys Asp Lys Asn Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val
        355                 360                 365

Lys Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Ile Leu Ser Lys Ile
    370                 375                 380

Lys Ile Asp Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp
385                 390                 395                 400
```

```
Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln
                405                 410                 415

Ile His Leu Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr
            420                 425                 430

Tyr Pro Phe Leu Lys Glu Lys Gln Asp Arg Ile Glu Lys Ile Leu Thr
        435                 440                 445

Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Val Arg Lys Asp Ser Arg
    450                 455                 460

Phe Ala Trp Ala Glu Tyr Arg Ser Asp Glu Lys Ile Thr Pro Trp Asn
465                 470                 475                 480

Phe Asp Lys Val Ile Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr
                485                 490                 495

Arg Met Thr Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro
            500                 505                 510

Lys His Ser His Val Tyr Glu Thr Tyr Ala Val Tyr Asn Glu Leu Thr
        515                 520                 525

Lys Ile Lys Tyr Val Asn Glu Gln Gly Lys Glu Ser Phe Phe Asp Ser
    530                 535                 540

Asn Met Lys Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys
545                 550                 555                 560

Val Thr Lys Glu Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Pro Glu
                565                 570                 575

Tyr Arg Ile Lys Asp Leu Ile Gly Leu Asp Lys Glu Asn Lys Ser Phe
            580                 585                 590

Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys
        595                 600                 605
```

```
Ala Phe Leu Asp Asp Lys Val Asn Glu Glu Val Ile Glu Asp Ile Ile
    610                 615                 620

Lys Thr Leu Thr Leu Phe Glu Asp Lys Asp Met Ile His Glu Arg Leu
625                 630                 635                 640

Gln Lys Tyr Ser Asp Ile Phe Thr Ala Asn Gln Leu Lys Lys Leu Glu
                645                 650                 655

Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn
            660                 665                 670

Gly Ile Arg Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Tyr Leu Ile
        675                 680                 685

Asp Asp Gly Ser Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp
    690                 695                 700

Thr Leu Pro Phe Lys Gln Ile Ile Gln Lys Ser Gln Val Val Gly Asp
705                 710                 715                 720

Val Asp Asp Ile Glu Ala Val Val His Asp Leu Pro Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Lys Val Met Gly Gly Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Asn Arg Gly Arg Ser Gln Ser Gln Gln Arg Leu
    770                 775                 780

Lys Lys Leu Gln Asn Ser Leu Lys Pro Ser Tyr Ile Glu Asp Lys Val
785                 790                 795                 800

Glu Asn Ser His Leu Gln Asn Asp Gln Leu Phe Leu Tyr Tyr Ile Gln
                805                 810                 815
```

```
Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Asp Ile Asp His Leu
            820                 825                 830

Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp
        835                 840                 845

Asp Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Ala Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asp Val Pro Ser Leu Asp Ile Val Arg Ala Arg Lys Ala
865                 870                 875                 880

Glu Trp Val Arg Leu Tyr Lys Ser Gly Leu Ile Ser Lys Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ala Arg Phe Asn Thr Glu His Asp Glu
    930                 935                 940

Asn Asp Lys Val Ile Arg Asp Val Lys Val Ile Thr Leu Lys Ser Asn
945                 950                 955                 960

Leu Val Ser Gln Phe Arg Lys Asp Phe Glu Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Leu Lys Lys Tyr  Pro Lys Leu Ala Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Glu Tyr Lys Lys Tyr  Asp Ile Ser Ser Asp  Lys Ala Thr
    1010                1015                1020
```

```
Ala Lys  Tyr Phe Phe Tyr Ser  Asn Leu Met Asn Phe  Phe Lys Thr
    1025                1030                1035

Lys Val  Lys Tyr Ala Asp Gly  Thr Val Phe Glu Arg  Pro Ile Ile
    1040                1045                1050

Glu Thr  Asn Ala Asp Gly Glu  Ile Ala Trp Asn Lys  Gln Ile Asp
    1055                1060                1065

Phe Glu  Lys Val Arg Lys Val  Leu Ser Tyr Pro Gln  Val Asn Ile
    1070                1075                1080

Val Lys  Lys Val Glu Thr Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1085                1090                1095

Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu Ile Pro  Arg Lys Thr
    1100                1105                1110

Lys Lys  Val Tyr Trp Asp Thr  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Phe Val Val Ala Asp  Val Glu Lys
    1130                1135                1140

Gly Lys  Ala Lys Lys Leu Lys  Thr Val Lys Glu Leu  Val Gly Ile
    1145                1150                1155

Ser Ile  Met Glu Arg Ser Phe  Phe Glu Glu Asn Pro  Val Glu Phe
    1160                1165                1170

Leu Glu  Asn Lys Gly Tyr His  Asn Ile Arg Glu Asp  Lys Leu Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Phe Glu Gly  Gly Arg Arg
    1190                1195                1200

Arg Leu  Leu Ala Ser Ala Ser  Glu Leu Gln Lys Gly  Asn Glu Met
    1205                1210                1215
```

```
Val Leu  Pro Gly Tyr Leu Val  Glu Leu Leu Tyr His  Ala His Arg
    1220                1225                1230


Ala Asp  Asn Phe Asn Ser Thr  Glu Tyr Leu Asn Tyr  Val Ser Glu
    1235                1240                1245


His Lys  Lys Glu Phe Glu Lys  Val Leu Ser Cys Val  Glu Asp Phe
    1250                1255                1260


Ala Asn  Leu Tyr Val Asp Val  Glu Lys Asn Leu Ser  Lys Ile Arg
    1265                1270                1275


Ala Val  Ala Asp Ser Met Asp  Asn Phe Ser Ile Glu  Glu Ile Ser
    1280                1285                1290


Asn Ser  Phe Ile Asn Leu Leu  Thr Leu Thr Ala Leu  Gly Ala Pro
    1295                1300                1305


Ala Asp  Phe Asn Phe Leu Gly  Glu Lys Ile Pro Arg  Lys Arg Tyr
    1310                1315                1320


Thr Ser  Thr Lys Glu Cys Leu  Asn Ala Thr Leu Ile  His Gln Ser
    1325                1330                1335


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Lys Leu Gly
    1340                1345                1350


Glu Glu
    1355
```

<210> 129
<211> 1358
<212> PRT
<213> Streptococcus infantarius

<400> 129

```
Met Glu Lys Ser Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
```

20 25 30

Lys Val Leu Gly Asn Thr Asp Lys Lys Tyr Ile Lys Lys Asn Leu Leu
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Val Thr Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Lys Glu Met Thr Lys Val Asp Glu Ser
85 90 95

Phe Phe Gln Arg Leu Glu Glu Ser Phe Leu Thr Asp Asp Asp Lys Thr
100 105 110

Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
115 120 125

His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
130 135 140

Ser Gln Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

Met Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
165 170 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Asn Val Phe Val Glu Thr Tyr
180 185 190

Asp Lys Ile Val Asp Glu Ser His Leu Ser Glu Ile Glu Val Asp Ala
195 200 205

Ser Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
210 215 220

Leu Ile Lys Gln Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn

225 230 235 240

Leu Ile Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
245 250 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
260 265 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Val Gly Asp Asp Tyr Ala Asp
275 280 285

Leu Phe Ile Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
290 295 300

Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305 310 315 320

Met Ile Lys Arg Tyr Val Glu His His Glu Asp Leu Glu Lys Leu Lys
325 330 335

Glu Phe Ile Lys Ile Asn Lys Leu Lys Leu Tyr His Asp Ile Phe Lys
340 345 350

Asp Lys Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Asn Gly Val Lys
355 360 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Thr Ile Leu Thr Lys Ile Asp
370 375 380

Asp Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Asp Asp Phe Leu Arg
385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met His Ser Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
420 425 430

Leu Lys Glu Asn Gln Ala Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile

```
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asp Ser Arg Phe Ala Trp
    450                 455                 460

Ala Asn Tyr His Ser Asp Glu Pro Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Val Val Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495

Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

His Val Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Ile Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Glu Ser Phe Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560

Ala Lys Leu Leu Ser Tyr Leu Asn Asn Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575

Asn Asp Leu Ile Gly Leu Asp Lys Asp Ser Lys Ser Phe Asn Ala Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Leu Asp Lys Ser Phe Leu
        595                 600                 605

Asp Asp Lys Thr Asn Gly Gln Ile Ile Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Asp Met Ile His Glu Arg Leu Gln Lys Tyr
625                 630                 635                 640

Ser Asp Phe Phe Thr Ser Gln Gln Leu Lys Lys Leu Glu Arg Arg His
```

645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
660 665 670

Asn Lys Glu Asn Asn Lys Thr Ile Leu Asp Phe Leu Ile Asp Asp Gly
675 680 685

His Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Glu Ser Leu Ser
690 695 700

Phe Lys Thr Ile Ile Gln Glu Ala Gln Val Val Gly Asp Val Asp Asp
705 710 715 720

Ile Glu Ala Val Val His Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Val Lys Ile Val Asp Glu Leu Val Lys Val Met
740 745 750

Gly Asp Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
755 760 765

Thr Thr Gly Tyr Gly Arg Asn Lys Ser Asn Gln Arg Leu Lys Arg Leu
770 775 780

Gln Asp Ser Leu Lys Pro Ser Tyr Val Asp Ser Lys Val Glu Asn Ser
785 790 795 800

His Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys
805 810 815

Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Arg Leu Ser Asp Tyr
820 825 830

Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Ile
835 840 845

Asp Asn Lys Val Leu Thr Ser Ser Ala Lys Asn Arg Gly Lys Ser Asp

```
    850                 855                 860

Asp Val Pro Ser Ile Glu Ile Val Arg Asn Arg Arg Ser Tyr Trp Tyr
865                 870                 875                 880

Lys Leu Tyr Lys Ser Gly Leu Ile Ser Lys Arg Lys Phe Asp Asn Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Gly Phe
            900                 905                 910

Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala
        915                 920                 925

Gln Ile Leu Asp Ala Arg Phe Asn Thr Lys Arg Asp Glu Asn Asp Lys
    930                 935                 940

Val Ile Arg Asp Val Lys Val Ile Thr Leu Lys Ser Asn Leu Val Ser
945                 950                 955                 960

Gln Phe Arg Lys Glu Phe Lys Phe Tyr Lys Val Arg Glu Ile Asn Asp
                965                 970                 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr Ala
            980                 985                 990

Leu Leu Lys Lys Tyr Pro Lys Leu  Thr Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005

Tyr Lys  Lys Tyr Asp Val Ser  Ser Asp Asp Tyr Ser  Glu Met Gly
    1010                1015                1020

Lys Ala  Thr Ala Lys Tyr Phe  Phe Tyr Ser Asn Leu  Met Asn Phe
    1025                1030                1035

Phe Lys  Thr Glu Val Lys Tyr  Ala Asp Gly Arg Val  Phe Glu Arg
    1040                1045                1050

Pro Asp  Ile Glu Thr Asn Ala  Asp Gly Glu Val Val  Trp Asn Lys
```

1055 1060 1065

Gln Lys Asp Phe Asp Ile Val Arg Lys Val Leu Ser Tyr Pro Gln
1070 1075 1080

Val Asn Ile Val Lys Lys Val Glu Ala Gln Thr Gly Gly Phe Ser
1085 1090 1095

Lys Glu Ser Ile Leu Ser Lys Gly Asp Ser Asp Lys Leu Ile Pro
1100 1105 1110

Arg Lys Thr Lys Lys Val Tyr Trp Asn Thr Lys Lys Tyr Gly Gly
1115 1120 1125

Phe Asp Ser Pro Thr Val Ala Tyr Ser Val Leu Val Val Ala Asp
1130 1135 1140

Ile Glu Lys Gly Lys Ala Lys Lys Leu Lys Thr Val Lys Glu Leu
1145 1150 1155

Val Gly Ile Ser Ile Met Glu Arg Ser Phe Phe Glu Glu Asn Pro
1160 1165 1170

Val Ser Phe Leu Glu Lys Lys Gly Tyr His Asn Val Gln Glu Asp
1175 1180 1185

Lys Leu Ile Lys Leu Pro Lys Tyr Ser Leu Phe Glu Phe Glu Gly
1190 1195 1200

Gly Arg Arg Arg Leu Leu Ala Ser Ala Thr Glu Leu Gln Lys Gly
1205 1210 1215

Asn Glu Val Met Leu Pro Ala His Leu Val Glu Leu Leu Tyr His
1220 1225 1230

Ala His Arg Ile Asp Ser Phe Asn Ser Thr Glu His Leu Lys Tyr
1235 1240 1245

Val Ser Glu His Lys Lys Glu Phe Glu Lys Val Leu Ser Cys Val

```
    1250                1255                1260


Glu Asn  Phe Ser Asn Leu Tyr  Val Asp Val Glu Lys  Asn Leu Ser
    1265                1270                1275


Lys Val  Arg Ala Ala Ala Glu  Ser Met Thr Asn Phe  Ser Leu Glu
    1280                1285                1290


Glu Ile  Ser Ala Ser Phe Ile  Asn Leu Leu Thr Leu  Thr Ala Leu
    1295                1300                1305


Gly Ala  Pro Ala Asp Phe Asn  Phe Leu Gly Glu Lys  Ile Pro Arg
    1310                1315                1320


Lys Arg  Tyr Thr Ser Thr Lys  Glu Cys Leu Ser Ala  Thr Leu Ile
    1325                1330                1335


His Gln  Ser Val Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser
    1340                1345                1350


Lys Leu  Gly Glu Glu
    1355


<210>  130
<211>  1358
<212>  PRT
<213>  Streptococcus iniae

<400>  130

Met Arg Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Arg Ile Gln Gly Thr Thr Asp Arg Thr Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Asn Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Thr Arg Arg Arg Tyr Thr Arg Arg Lys Tyr Arg Ile Lys
65                  70                  75                  80

Glu Leu Gln Lys Ile Phe Ser Ser Glu Met Asn Glu Leu Asp Ile Ala
                85                  90                  95

Phe Phe Pro Arg Leu Ser Glu Ser Phe Leu Val Ser Asp Asp Lys Glu
            100                 105                 110

Phe Glu Asn His Pro Ile Phe Gly Asn Leu Lys Asp Glu Ile Thr Tyr
        115                 120                 125

His Asn Asp Tyr Pro Thr Ile Tyr His Leu Arg Gln Thr Leu Ala Asp
    130                 135                 140

Ser Asp Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asn Leu Asp Ser
                165                 170                 175

Glu Asn Thr Asp Val His Val Leu Phe Leu Asn Leu Val Asn Ile Tyr
            180                 185                 190

Asn Asn Leu Phe Glu Glu Asp Val Glu Thr Ala Ser Ile Asp Ala Glu
        195                 200                 205

Lys Ile Leu Thr Ser Lys Thr Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Glu Ile Pro Asn Gln Lys Arg Asn Met Leu Phe Gly Asn Leu
225                 230                 235                 240

Val Ser Leu Ala Leu Gly Leu Thr Pro Asn Phe Lys Thr Asn Phe Glu
                245                 250                 255

Leu Leu Glu Asp Ala Lys Leu Gln Ile Ser Lys Asp Ser Tyr Glu Glu
            260                 265                 270
```

```
Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Ile Ala Ala Lys Lys Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Ile Thr Val Lys Gly Ala Ser Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Val Gln Arg Tyr Glu Glu His Gln Gln Asp Leu Ala Leu Leu Lys Asn
                325                 330                 335

Leu Val Lys Lys Gln Ile Pro Glu Lys Tyr Lys Glu Ile Phe Asp Asn
            340                 345                 350

Lys Glu Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Tyr Ile Lys Pro Ile Leu Leu Lys Leu Asp Gly
    370                 375                 380

Thr Glu Lys Leu Ile Ser Lys Leu Glu Arg Glu Asp Phe Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Asn
                405                 410                 415

Glu Leu Lys Ala Ile Ile Arg Arg Gln Glu Lys Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Glu Asn Gln Lys Lys Ile Glu Lys Leu Phe Thr Phe Lys Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Asn Gly Gln Ser Ser Phe Ala Trp Leu
    450                 455                 460

Lys Arg Gln Ser Asn Glu Ser Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480
```

```
Val Asp Gln Glu Ala Ser Ala Arg Ala Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Thr Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser Pro
            500                 505                 510

Leu Tyr Glu Met Phe Met Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Gln Thr Glu Gly Met Lys Arg Pro Val Phe Leu Ser Ser Glu Asp Lys
    530                 535                 540

Glu Glu Ile Val Asn Leu Leu Phe Lys Lys Glu Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Glu Tyr Phe Ser Lys Met Lys Cys Phe His Thr
                565                 570                 575

Val Thr Ile Leu Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Phe Lys Asp Lys Ala Phe Leu Asp Asp
        595                 600                 605

Glu Ala Asn Gln Asp Ile Leu Glu Glu Ile Val Trp Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Gln Ala Met Ile Glu Arg Arg Leu Val Lys Tyr Ala Asp
625                 630                 635                 640

Val Phe Glu Lys Ser Val Leu Lys Lys Leu Lys Lys Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Gln Lys Leu Ile Asn Gly Ile Lys Asp Lys
            660                 665                 670

Gln Thr Gly Lys Thr Ile Leu Gly Phe Leu Lys Asp Gly Val Ala Asn
        675                 680                 685
```

```
Arg Asn Phe Met Gln Leu Ile Asn Asp Ser Ser Leu Asp Phe Ala Lys
    690                 695                 700

Ile Ile Lys Asn Glu Gln Glu Lys Thr Ile Lys Asn Glu Ser Leu Glu
705                 710                 715                 720

Glu Thr Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Ile Val Lys Ile Met Gly Gln
            740                 745                 750

Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Ser Thr
        755                 760                 765

Met Gln Gly Ile Lys Asn Ser Arg Gln Arg Leu Arg Lys Leu Glu Glu
    770                 775                 780

Val His Lys Asn Thr Gly Ser Lys Ile Leu Lys Glu Tyr Asn Val Ser
785                 790                 795                 800

Asn Thr Gln Leu Gln Ser Asp Arg Leu Tyr Leu Tyr Leu Leu Gln Asp
                805                 810                 815

Gly Lys Asp Met Tyr Thr Gly Lys Glu Leu Asp Tyr Asp Asn Leu Ser
            820                 825                 830

Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Lys Asp Asn
        835                 840                 845

Ser Ile Asp Asn Thr Val Leu Thr Thr Gln Ala Ser Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Asn Ile Glu Thr Val Asn Lys Met Lys Ser Phe
865                 870                 875                 880

Trp Tyr Lys Gln Leu Lys Ser Gly Ala Ile Ser Gln Arg Lys Phe Asp
                885                 890                 895
```

```
His Leu Thr Lys Ala Glu Arg Gly Ala Leu Ser Asp Phe Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Phe Asn Ser Asn Leu Thr Glu Asp
    930                 935                 940

Ser Lys Ser Asn Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Lys Met
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gly Phe Tyr Lys Leu Arg Glu Val
                965                 970                 975

Asn Asp Tyr His His Ala Gln Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Leu Lys Lys Tyr Pro  Lys Leu Glu Ala Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys His Tyr Asp  Leu Pro Asp Ser Ser  Leu Gly Lys
    1010                1015                1020

Ala Thr  Thr Arg Met Phe Phe  Tyr Ser Asn Leu Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Glu Ile Lys Leu Ala  Asp Asp Thr Ile Phe  Thr Arg Pro
    1040                1045                1050

Gln Ile  Glu Val Asn Thr Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Val Lys  Asp Met Gln Thr Ile  Arg Lys Val Met Ser  Tyr Pro Gln
    1070                1075                1080

Val Asn  Ile Val Met Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095
```

```
Lys Glu  Ser Ile Trp Pro Lys  Gly Asp Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Ser Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Ile  Ile Ala Tyr Ser Val  Leu Val Val Ala Lys  Ile Ala Lys
    1130                1135                1140

Gly Lys  Thr Gln Lys Leu Lys  Thr Ile Lys Glu Leu  Val Gly Ile
    1145                1150                1155

Lys Ile  Met Glu Gln Asp Glu  Phe Glu Lys Asp Pro  Ile Ala Phe
    1160                1165                1170

Leu Glu  Lys Lys Gly Tyr Gln  Asp Ile Gln Thr Ser  Ser Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Leu  Leu Ala Ser Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu
    1205                1210                1215

Pro Asn  Lys Tyr Val Lys Phe  Leu Tyr Leu Ala Ser  His Tyr Thr
    1220                1225                1230

Lys Phe  Thr Gly Lys Glu Glu  Asp Arg Glu Lys Lys  Arg Ser Tyr
    1235                1240                1245

Val Glu  Ser His Leu Tyr Tyr  Phe Asp Glu Ile Met  Gln Ile Ile
    1250                1255                1260

Val Glu  Tyr Ser Asn Arg Tyr  Ile Leu Ala Asp Ser  Asn Leu Ile
    1265                1270                1275

Lys Ile  Gln Asn Leu Tyr Lys  Glu Lys Asp Asn Phe  Ser Ile Glu
    1280                1285                1290
```

```
Glu Gln  Ala Ile Asn Met Leu  Asn Leu Phe Thr Phe  Thr Asp Leu
    1295                1300                1305


Gly Ala  Pro Ser Ala Phe Lys  Phe Phe Asn Gly Asp  Ile Asp Arg
    1310                1315                1320


Lys Arg  Tyr Ser Ser Thr Asn  Glu Ile Ile Asn Ser  Thr Leu Ile
    1325                1330                1335


Tyr Gln  Ser Pro Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser
    1340                1345                1350


Lys Leu  Gly Gly Lys
    1355


<210>  131
<211>  1263
<212>  PRT
<213>  Streptococcus iniae


<220>
<221>  misc_feature
<222>  (1257)..(1257)
<223>  Xaa can be any naturally occurring amino acid

<400>  131

Met Arg Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Arg Ile Gln Gly Thr Thr Asp Arg Thr Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Asn Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Thr Arg Arg Arg Tyr Thr Arg Arg Lys Tyr Arg Ile Lys
```

```
65                  70                  75                  80

Glu Leu Gln Lys Ile Phe Ser Ser Glu Met Asn Glu Leu Asp Ile Ala
                85                  90                  95

Phe Phe Pro Arg Leu Ser Glu Ser Phe Leu Val Ser Asp Asp Lys Glu
            100                 105                 110

Phe Glu Asn His Pro Ile Phe Gly Asn Leu Lys Asp Glu Ile Thr Tyr
        115                 120                 125

His Asn Asp Tyr Pro Thr Ile Tyr His Leu Arg Gln Thr Leu Ala Asp
    130                 135                 140

Ser Asp Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asn Leu Asp Ser
                165                 170                 175

Glu Asn Thr Asp Val His Val Leu Phe Leu Asn Leu Val Asn Ile Tyr
            180                 185                 190

Asn Asn Leu Phe Glu Glu Asp Val Glu Thr Ala Ser Ile Asp Ala Glu
        195                 200                 205

Lys Ile Leu Thr Ser Lys Thr Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Glu Ile Pro Asn Gln Lys Arg Asn Met Leu Phe Gly Asn Leu
225                 230                 235                 240

Val Ser Leu Ala Leu Gly Leu Thr Pro Asn Phe Lys Thr Asn Phe Glu
                245                 250                 255

Leu Leu Glu Asp Ala Lys Leu Gln Ile Ser Lys Asp Ser Tyr Glu Glu
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
```

```
        275                 280                 285

Phe Ile Ala Ala Lys Lys Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Ile Thr Val Lys Gly Ala Ser Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Val Gln Arg Tyr Glu Glu His Gln Gln Asp Leu Ala Leu Leu Lys Asn
                325                 330                 335

Leu Val Lys Lys Gln Ile Pro Glu Lys Tyr Lys Glu Ile Phe Asp Asn
            340                 345                 350

Lys Glu Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Tyr Ile Lys Pro Ile Leu Leu Lys Leu Asp Gly
    370                 375                 380

Thr Glu Lys Leu Ile Ser Lys Leu Glu Arg Glu Asp Phe Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Asn
                405                 410                 415

Glu Leu Lys Ala Ile Ile Arg Arg Gln Glu Lys Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Glu Asn Gln Lys Lys Ile Glu Lys Leu Phe Thr Phe Lys Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Asn Gly Gln Ser Ser Phe Ala Trp Leu
    450                 455                 460

Lys Arg Gln Ser Asn Glu Ser Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Gln Glu Ala Ser Ala Arg Ala Phe Ile Glu Arg Met Thr Asn
```

485 490 495

Phe Asp Thr Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser Pro
500 505 510

Leu Tyr Glu Met Phe Met Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
515 520 525

Gln Thr Glu Gly Met Lys Arg Pro Val Phe Leu Ser Ser Glu Asp Lys
530 535 540

Glu Glu Ile Val Asn Leu Leu Phe Lys Lys Glu Arg Lys Val Thr Val
545 550 555 560

Lys Gln Leu Lys Glu Glu Tyr Phe Ser Lys Met Lys Cys Phe His Thr
565 570 575

Val Thr Ile Leu Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
580 585 590

Tyr His Asp Leu Leu Lys Ile Phe Lys Asp Lys Ala Phe Leu Asp Asp
595 600 605

Glu Ala Asn Gln Asp Ile Leu Glu Glu Ile Val Trp Thr Leu Thr Leu
610 615 620

Phe Glu Asp Gln Ala Met Ile Glu Arg Arg Leu Val Lys Tyr Ala Asp
625 630 635 640

Val Phe Glu Lys Ser Val Leu Lys Lys Leu Lys Lys Arg His Tyr Thr
645 650 655

Gly Trp Gly Arg Leu Ser Gln Lys Leu Ile Asn Gly Ile Lys Asp Lys
660 665 670

Gln Thr Gly Lys Thr Ile Leu Gly Phe Leu Lys Asp Gly Val Ala Asn
675 680 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Ser Ser Leu Asp Phe Ala Lys

690 695 700

Ile Ile Lys Asn Glu Gln Glu Lys Thr Ile Lys Asn Glu Ser Leu Glu
705 710 715 720

Glu Thr Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
725 730 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Ile Val Lys Ile Met Gly Gln
740 745 750

Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Ser Thr
755 760 765

Met Gln Gly Ile Lys Asn Ser Arg Gln Arg Leu Arg Lys Leu Glu Glu
770 775 780

Val His Lys Asn Thr Gly Ser Lys Ile Leu Lys Glu Tyr Asn Val Ser
785 790 795 800

Asn Thr Gln Leu Gln Ser Asp Arg Leu Tyr Leu Tyr Leu Leu Gln Asp
805 810 815

Gly Lys Asp Met Tyr Thr Gly Lys Glu Leu Asp Tyr Asp Asn Leu Ser
820 825 830

Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Lys Asp Asn
835 840 845

Ser Ile Asp Asn Thr Val Leu Thr Thr Gln Ala Ser Asn Arg Gly Lys
850 855 860

Ser Asp Asn Val Pro Asn Ile Glu Thr Val Asn Lys Met Lys Ser Phe
865 870 875 880

Trp Tyr Lys Gln Leu Lys Ser Gly Ala Ile Ser Gln Arg Lys Phe Asp
885 890 895

His Leu Thr Lys Ala Glu Arg Gly Ala Leu Ser Asp Phe Asp Lys Ala

```
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Phe Asn Ser Asn Leu Thr Glu Asp
    930                 935                 940

Ser Lys Ser Asn Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Lys Met
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gly Phe Tyr Lys Leu Arg Glu Val
                965                 970                 975

Asn Asp Tyr His His Ala Gln Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Leu Lys Lys Tyr Pro  Lys Leu Glu Ala Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys His Tyr Asp  Leu Pro Asp Ser Ser  Leu Gly Lys
    1010                1015                1020

Ala Thr  Thr Arg Met Phe Phe  Tyr Ser Asn Leu Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Glu Ile Lys Leu Ala  Asp Asp Thr Ile Phe  Thr Arg Pro
    1040                1045                1050

Gln Ile  Glu Val Asn Thr Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Val Lys  Asp Met Gln Thr Ile  Arg Lys Val Met Ser  Tyr Pro Gln
    1070                1075                1080

Val Asn  Ile Val Met Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Trp Pro Lys  Gly Asp Ser Asp Lys  Leu Ile Ala
```

```
    1100                1105                1110

Arg Lys  Lys Ser Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Ile  Ile Ala Tyr Ser Val  Leu Val Val Ala Lys  Ile Ala Lys
    1130                1135                1140

Gly Lys  Thr Gln Lys Leu Lys  Thr Ile Lys Glu Leu  Val Gly Ile
    1145                1150                1155

Lys Ile  Met Glu Gln Asp Glu  Phe Glu Lys Asp Pro  Ile Ala Phe
    1160                1165                1170

Leu Glu  Lys Lys Gly Tyr Gln  Asp Ile Gln Thr Ser  Ser Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Leu  Leu Ala Ser Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu
    1205                1210                1215

Pro Asn  Lys Tyr Val Lys Phe  Leu Tyr Leu Ala Ser  His Tyr Thr
    1220                1225                1230

Lys Phe  Thr Gly Lys Glu Glu  Asp Arg Glu Lys Lys  Arg Ser Tyr
    1235                1240                1245

Val Glu  Ser His Leu Tyr Tyr  Phe Xaa Glu Val Lys  Ser Ser Phe
    1250                1255                1260


<210>  132
<211>  1257
<212>  PRT
<213>  Streptococcus iniae


<220>
<221>  misc_feature
<222>  (1255)..(1255)
```

<223> Xaa can be any naturally occurring amino acid

<220>
<221> misc_feature
<222> (1257)..(1257)
<223> Xaa can be any naturally occurring amino acid

<400> 132

Met Arg Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
20 25 30

Arg Ile Gln Gly Thr Thr Asp Arg Thr Ser Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Asn Gly Glu Thr Ala Glu Ala Thr Arg Leu
50 55 60

Lys Arg Thr Thr Arg Arg Arg Tyr Thr Arg Arg Lys Tyr Arg Ile Lys
65 70 75 80

Glu Leu Gln Lys Ile Phe Ser Ser Glu Met Asn Glu Leu Asp Ile Ala
85 90 95

Phe Phe Pro Arg Leu Ser Glu Ser Phe Leu Val Ser Asp Asp Lys Glu
100 105 110

Phe Glu Asn His Pro Ile Phe Gly Asn Leu Lys Asp Glu Ile Thr Tyr
115 120 125

His Asn Asp Tyr Pro Thr Ile Tyr His Leu Arg Gln Thr Leu Ala Asp
130 135 140

Ser Asp Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145 150 155 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asn Leu Asp Ser
165 170 175

```
Glu Asn Thr Asp Val His Val Leu Phe Leu Asn Leu Val Asn Ile Tyr
            180                 185                 190

Asn Asn Leu Phe Glu Glu Asp Val Glu Thr Ala Ser Ile Asp Ala Glu
        195                 200                 205

Lys Ile Leu Thr Ser Lys Thr Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Glu Ile Pro Asn Gln Lys Arg Asn Met Leu Phe Gly Asn Leu
225                 230                 235                 240

Val Ser Leu Ala Leu Gly Leu Thr Pro Asn Phe Lys Thr Asn Phe Glu
                245                 250                 255

Leu Leu Glu Asp Ala Lys Leu Gln Ile Ser Lys Asp Ser Tyr Glu Glu
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Ile Ala Ala Lys Lys Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Ile Thr Val Lys Gly Ala Ser Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Val Gln Arg Tyr Glu Glu His Gln Gln Asp Leu Ala Leu Leu Lys Asn
                325                 330                 335

Leu Val Lys Lys Gln Ile Pro Glu Lys Tyr Lys Glu Ile Phe Asp Asn
            340                 345                 350

Lys Glu Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Tyr Ile Lys Pro Ile Leu Leu Lys Leu Asp Gly
    370                 375                 380
```

```
Thr Glu Lys Leu Ile Ser Lys Leu Glu Arg Glu Asp Phe Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Asn
                405                 410                 415

Glu Leu Lys Ala Ile Ile Arg Arg Gln Glu Lys Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Glu Asn Gln Lys Lys Ile Glu Lys Leu Phe Thr Phe Lys Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Asn Gly Gln Ser Ser Phe Ala Trp Leu
    450                 455                 460

Lys Arg Gln Ser Asn Glu Ser Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Gln Glu Ala Ser Ala Arg Ala Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Thr Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser Pro
            500                 505                 510

Leu Tyr Glu Met Phe Met Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Gln Thr Glu Gly Met Lys Arg Pro Val Phe Leu Ser Ser Glu Asp Lys
    530                 535                 540

Glu Glu Ile Val Asn Leu Leu Phe Lys Lys Glu Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Glu Tyr Phe Ser Lys Met Lys Cys Phe His Thr
                565                 570                 575

Val Thr Ile Leu Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590
```

```
Tyr His Asp Leu Leu Lys Ile Phe Lys Asp Lys Ala Phe Leu Asp Asp
        595                 600                 605

Glu Ala Asn Gln Asp Ile Leu Glu Glu Ile Val Trp Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Gln Ala Met Ile Glu Arg Arg Leu Val Lys Tyr Ala Asp
625                 630                 635                 640

Val Phe Glu Lys Ser Val Leu Lys Lys Leu Lys Lys Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Gln Lys Leu Ile Asn Gly Ile Lys Asp Lys
            660                 665                 670

Gln Thr Gly Lys Thr Ile Leu Gly Phe Leu Lys Asp Gly Val Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Ser Ser Leu Asp Phe Ala Lys
    690                 695                 700

Ile Ile Lys Asn Glu Gln Glu Lys Thr Ile Lys Asn Glu Ser Leu Glu
705                 710                 715                 720

Glu Thr Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Ile Val Lys Ile Met Gly Gln
            740                 745                 750

Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Ser Thr
        755                 760                 765

Met Gln Gly Ile Lys Asn Ser Arg Gln Arg Leu Arg Lys Leu Glu Glu
    770                 775                 780

Val His Lys Asn Thr Gly Ser Lys Ile Leu Lys Glu Tyr Asn Val Ser
785                 790                 795                 800
```

```
Asn Thr Gln Leu Gln Ser Asp Arg Leu Tyr Leu Tyr Leu Leu Gln Asp
                805                 810                 815

Gly Lys Asp Met Tyr Thr Gly Lys Glu Leu Asp Tyr Asp Asn Leu Ser
            820                 825                 830

Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Lys Asp Asn
        835                 840                 845

Ser Ile Asp Asn Thr Val Leu Thr Thr Gln Ala Ser Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Asn Ile Glu Thr Val Asn Lys Met Lys Ser Phe
865                 870                 875                 880

Trp Tyr Lys Gln Leu Lys Ser Gly Ala Ile Ser Gln Arg Lys Phe Asp
                885                 890                 895

His Leu Thr Lys Ala Glu Arg Gly Ala Leu Ser Asp Phe Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Phe Asn Ser Asn Leu Thr Glu Asp
    930                 935                 940

Ser Lys Ser Asn Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Lys Met
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gly Phe Tyr Lys Leu Arg Glu Val
                965                 970                 975

Asn Asp Tyr His His Ala Gln Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Leu Lys Lys Tyr Pro  Lys Leu Glu Ala Glu  Phe Val Tyr
        995                 1000                1005
```

```
Gly Asp  Tyr Lys His Tyr Asp  Leu Pro Asp Ser Ser  Leu Gly Lys
    1010                1015                1020

Ala Thr  Thr Arg Met Phe Phe  Tyr Ser Asn Leu Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Glu Ile Lys Leu Ala  Asp Asp Thr Ile Phe  Thr Arg Pro
    1040                1045                1050

Gln Ile  Glu Val Asn Thr Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Val Lys  Asp Met Gln Thr Ile  Arg Lys Val Met Ser  Tyr Pro Gln
    1070                1075                1080

Val Asn  Ile Val Met Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Trp Pro Lys  Gly Asp Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Ser Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Ile  Ile Ala Tyr Ser Val  Leu Val Val Ala Lys  Ile Ala Lys
    1130                1135                1140

Gly Lys  Thr Gln Lys Leu Lys  Thr Ile Lys Glu Leu  Val Gly Ile
    1145                1150                1155

Lys Ile  Met Glu Gln Asp Glu  Phe Glu Lys Asp Pro  Ile Ala Phe
    1160                1165                1170

Leu Glu  Lys Lys Gly Tyr Gln  Asp Ile Gln Thr Ser  Ser Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200
```

```
Arg Leu  Leu Ala Ser Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu
    1205                 1210                 1215


Pro Asn  Lys Tyr Val Lys Phe  Leu Tyr Leu Ala Ser  His Tyr Thr
    1220                 1225                 1230


Lys Phe  Thr Gly Lys Glu Glu  Asp Arg Glu Lys Lys  Arg Ser Tyr
    1235                 1240                 1245


Val Glu  Ser His Leu Tyr Xaa  Phe Xaa
    1250                 1255
```

<210> 133
<211> 199
<212> PRT
<213> Streptococcus iniae

<400> 133

```
Met Glu Gln Asp Glu Phe Glu Lys Asp Pro Ile Ala Phe Leu Glu Lys
1               5                  10                  15


Lys Gly Tyr Gln Asp Ile Gln Thr Ser Ser Ile Ile Lys Leu Pro Lys
            20                  25                  30


Tyr Ser Leu Phe Glu Leu Glu Asn Gly Arg Lys Arg Leu Leu Ala Ser
        35                  40                  45


Lys Glu Leu Gln Lys Gly Asn Glu Leu Ala Leu Pro Asn Lys Tyr Val
    50                  55                  60


Lys Phe Leu Tyr Leu Ala Ser His Tyr Thr Lys Phe Thr Gly Lys Glu
65                  70                  75                  80


Glu Asp Arg Glu Lys Lys Arg Ser Tyr Val Glu Ser His Leu Tyr Tyr
                85                  90                  95


Phe Asp Glu Ile Met Gln Ile Ile Val Glu Tyr Ser Asn Arg Tyr Ile
            100                 105                 110
```

```
Leu Ala Asp Ser Asn Leu Ile Lys Ile Gln Asn Leu Tyr Lys Glu Lys
        115                 120                 125


Asp Asn Phe Ser Ile Glu Glu Gln Ala Ile Asn Met Leu Asn Leu Phe
    130                 135                 140


Thr Phe Thr Asp Leu Gly Ala Pro Ser Ala Phe Lys Phe Phe Asn Gly
145                 150                 155                 160


Asp Ile Asp Arg Lys Arg Tyr Ser Ser Thr Asn Glu Ile Ile Asn Ser
                165                 170                 175


Thr Leu Ile Tyr Gln Ser Pro Thr Gly Leu Tyr Glu Thr Arg Ile Asp
            180                 185                 190


Leu Ser Lys Leu Gly Gly Lys
        195


<210>  134
<211>  1271
<212>  PRT
<213>  Streptococcus iniae

<400>  134

Met Arg Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Arg Ile Gln Gly Thr Thr Asp Arg Thr Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Asn Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Thr Arg Arg Arg Tyr Thr Arg Arg Lys Tyr Arg Ile Lys
65                  70                  75                  80


Glu Leu Gln Lys Ile Phe Ser Ser Glu Met Asn Glu Leu Asp Ile Ala
```

```
                85                  90                  95

Phe Phe Pro Arg Leu Ser Glu Ser Phe Leu Val Ser Asp Asp Lys Glu
            100                 105                 110

Phe Glu Asn His Pro Ile Phe Gly Asn Leu Lys Asp Glu Ile Thr Tyr
        115                 120                 125

His Asn Asp Tyr Pro Thr Ile Tyr His Leu Arg Gln Thr Leu Ala Asp
    130                 135                 140

Ser Asp Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asn Leu Asp Ser
                165                 170                 175

Glu Asn Thr Asp Val His Val Leu Phe Leu Asn Leu Val Asn Ile Tyr
            180                 185                 190

Asn Asn Leu Phe Glu Glu Asp Val Glu Thr Ala Ser Ile Asp Ala Glu
        195                 200                 205

Lys Ile Leu Thr Ser Lys Thr Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Glu Ile Pro Asn Gln Lys Arg Asn Met Leu Phe Gly Asn Leu
225                 230                 235                 240

Val Ser Leu Ala Leu Gly Leu Thr Pro Asn Phe Lys Thr Asn Phe Glu
                245                 250                 255

Leu Leu Glu Asp Ala Lys Leu Gln Ile Ser Lys Asp Ser Tyr Glu Glu
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Ile Ala Ala Lys Lys Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
```

290 295 300

Ile Thr Val Lys Gly Ala Ser Thr Lys Ala Pro Leu Ser Ala Ser Met
305 310 315 320

Val Gln Arg Tyr Glu Glu His Gln Gln Asp Leu Ala Leu Leu Lys Asn
325 330 335

Leu Val Lys Lys Gln Ile Pro Glu Lys Tyr Lys Glu Ile Phe Asp Asn
340 345 350

Lys Glu Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Ser Gln
355 360 365

Glu Glu Phe Tyr Lys Tyr Ile Lys Pro Ile Leu Leu Lys Leu Asp Gly
370 375 380

Thr Glu Lys Leu Ile Ser Lys Leu Glu Arg Glu Asp Phe Leu Arg Lys
385 390 395 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Asn
405 410 415

Glu Leu Lys Ala Ile Ile Arg Arg Gln Glu Lys Phe Tyr Pro Phe Leu
420 425 430

Lys Glu Asn Gln Lys Lys Ile Glu Lys Leu Phe Thr Phe Lys Ile Pro
435 440 445

Tyr Tyr Val Gly Pro Leu Ala Asn Gly Gln Ser Ser Phe Ala Trp Leu
450 455 460

Lys Arg Gln Ser Asn Glu Ser Ile Thr Pro Trp Asn Phe Glu Glu Val
465 470 475 480

Val Asp Gln Glu Ala Ser Ala Arg Ala Phe Ile Glu Arg Met Thr Asn
485 490 495

Phe Asp Thr Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser Pro

```
            500                 505                 510

Leu Tyr Glu Met Phe Met Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Gln Thr Glu Gly Met Lys Arg Pro Val Phe Leu Ser Ser Glu Asp Lys
    530                 535                 540

Glu Glu Ile Val Asn Leu Leu Phe Lys Lys Glu Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Glu Tyr Phe Ser Lys Met Lys Cys Phe His Thr
                565                 570                 575

Val Thr Ile Leu Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Phe Lys Asp Lys Ala Phe Leu Asp Asp
        595                 600                 605

Glu Ala Asn Gln Asp Ile Leu Glu Glu Ile Val Trp Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Gln Ala Met Ile Glu Arg Arg Leu Val Lys Tyr Ala Asp
625                 630                 635                 640

Val Phe Glu Lys Ser Val Leu Lys Lys Leu Lys Lys Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Gln Lys Leu Ile Asn Gly Ile Lys Asp Lys
            660                 665                 670

Gln Thr Gly Lys Thr Ile Leu Gly Phe Leu Lys Asp Gly Val Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Ser Ser Leu Asp Phe Ala Lys
    690                 695                 700

Ile Ile Lys Asn Glu Gln Glu Lys Thr Ile Lys Asn Glu Ser Leu Glu
```

705 710 715 720

Glu Thr Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
725 730 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Ile Val Lys Ile Met Gly Gln
740 745 750

Asn Pro Asp Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Ser Thr
755 760 765

Met Gln Gly Ile Lys Asn Ser Arg Gln Arg Leu Arg Lys Leu Glu Glu
770 775 780

Val His Lys Asn Thr Gly Ser Lys Ile Leu Lys Glu Tyr Asn Val Ser
785 790 795 800

Asn Thr Gln Leu Gln Ser Asp Arg Leu Tyr Leu Tyr Leu Leu Gln Asp
805 810 815

Gly Lys Asp Met Tyr Thr Gly Lys Glu Leu Asp Tyr Asp Asn Leu Ser
820 825 830

Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Lys Asp Asn
835 840 845

Ser Ile Asp Asn Thr Val Leu Thr Thr Gln Ala Ser Asn Arg Gly Lys
850 855 860

Ser Asp Asn Val Pro Asn Ile Glu Thr Val Asn Lys Met Lys Ser Phe
865 870 875 880

Trp Tyr Lys Gln Leu Lys Ser Gly Ala Ile Ser Gln Arg Lys Phe Asp
885 890 895

His Leu Thr Lys Ala Glu Arg Gly Ala Leu Ser Asp Phe Asp Lys Ala
900 905 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His

915 920 925

Val Ala Gln Ile Leu Asp Ser Arg Phe Asn Ser Asn Leu Thr Glu Asp
930 935 940

Ser Lys Ser Asn Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Lys Met
945 950 955 960

Val Ser Asp Phe Arg Lys Asp Phe Gly Phe Tyr Lys Leu Arg Glu Val
965 970 975

Asn Asp Tyr His His Ala Gln Asp Ala Tyr Leu Asn Ala Val Val Gly
980 985 990

Thr Ala Leu Leu Lys Lys Tyr Pro Lys Leu Glu Ala Glu Phe Val Tyr
995 1000 1005

Gly Asp Tyr Lys His Tyr Asp Leu Pro Asp Ser Ser Leu Gly Lys
1010 1015 1020

Ala Thr Thr Arg Met Phe Phe Tyr Ser Asn Leu Met Asn Phe Phe
1025 1030 1035

Lys Lys Glu Ile Lys Leu Ala Asp Asp Thr Ile Phe Thr Arg Pro
1040 1045 1050

Gln Ile Glu Val Asn Thr Glu Thr Gly Glu Ile Val Trp Asp Lys
1055 1060 1065

Val Lys Asp Met Gln Thr Ile Arg Lys Val Met Ser Tyr Pro Gln
1070 1075 1080

Val Asn Ile Val Met Lys Thr Glu Val Gln Thr Gly Gly Phe Ser
1085 1090 1095

Lys Glu Ser Ile Trp Pro Lys Gly Asp Ser Asp Lys Leu Ile Ala
1100 1105 1110

Arg Lys Lys Ser Trp Asp Pro Lys Lys Tyr Gly Gly Phe Asp Ser

1115 1120 1125

Pro Ile Ile Ala Tyr Ser Val Leu Val Val Ala Lys Ile Ala Lys
1130 1135 1140

Gly Lys Thr Gln Lys Leu Lys Thr Ile Lys Glu Leu Val Gly Ile
1145 1150 1155

Lys Ile Met Glu Gln Asp Glu Phe Glu Lys Asp Pro Ile Ala Phe
1160 1165 1170

Leu Glu Lys Lys Gly Tyr Gln Asp Ile Gln Thr Ser Ser Ile Ile
1175 1180 1185

Lys Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu Asn Gly Arg Lys
1190 1195 1200

Arg Leu Leu Ala Ser Glu Leu Gln Lys Gly Asn Glu Leu Ala Leu
1205 1210 1215

Pro Asn Lys Tyr Val Lys Phe Leu Tyr Leu Ala Ser His Tyr Thr
1220 1225 1230

Lys Phe Thr Gly Lys Glu Glu Asp Arg Glu Lys Lys Arg Ser Tyr
1235 1240 1245

Val Glu Ser His Leu Tyr Tyr Phe Asp Val Arg Leu Ser Gln Val
1250 1255 1260

Phe Arg Val Thr Asn Val Glu Phe
1265 1270

<210> 135
<211> 1345
<212> PRT
<213> Streptococcus intermedius

<400> 135

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

```
Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220
```

```
Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Glu Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430
```

```
Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Ile Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ser Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Arg His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640
```

```
Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Asn Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845
```

```
Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050
```

```
Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asn  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Leu Val Lys
    1130                1135                1140

Asp Leu  Val Gly Ile Thr Ile  Met Glu Arg Thr Ile  Phe Glu Lys
    1145                1150                1155

Asn Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Val Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu
    1175                1180                1185

Glu Asn  Gly Arg Arg Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Met Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Lys Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245
```

```
Val Val  Ser Asn Phe Ser Lys  Lys Asn Ile Leu Ala  Glu Ser Asn
    1250                 1255                 1260


Leu Glu  Lys Ile Glu Glu Leu  Tyr Ala Gln Asn Asn  Asn Lys Asp
    1265                 1270                 1275


Ile Thr  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                 1285                 1290


Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Asn Asn Ile
    1295                 1300                 1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                 1315                 1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Ser  Arg Leu Gly Gly Asp
    1340                 1345


<210>  136
<211>  1333
<212>  PRT
<213>  Streptococcus massiliensis

<400>  136

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Met Glu Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Gln Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Val Glu Arg Arg Leu
    50                  55                  60
```

```
Asn Arg Thr Thr Ser Arg Arg Tyr Asp Arg Arg Arg Asn Arg Ile Arg
65                  70                  75                  80

Tyr Leu Gln His Ile Phe Ala Glu Glu Met Asn Arg Ala Asp Glu Asn
                85                  90                  95

Phe Phe His Arg Leu Lys Glu Ser Phe Phe Val Glu Glu Asp Lys Thr
            100                 105                 110

Tyr Ser Lys Tyr Pro Ile Phe Gly Thr Leu Glu Glu Glu Lys Asn Tyr
        115                 120                 125

His Lys Asn Tyr Pro Thr Ile Tyr His Leu Arg Lys Thr Leu Ala Asp
    130                 135                 140

Thr Pro Asp Lys Met Asp Ile Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asp Ile
                165                 170                 175

Glu Asn Ile Gly Ile Gln Asp Ser Phe Lys Ser Phe Ile Glu Glu Tyr
            180                 185                 190

Asn Thr Gln Phe Gly Thr Lys Leu Asp Ser Thr Thr Lys Val Glu Ala
        195                 200                 205

Ile Phe Thr Glu Asn Ser Ser Lys Ala Lys Arg Val Glu Thr Ile Leu
    210                 215                 220

Gly Leu Phe Pro Asp Glu Thr Ala Ala Gly Asn Leu Asp Lys Phe Leu
225                 230                 235                 240

Lys Leu Met Leu Gly Asn Gln Ala Asp Phe Lys Lys Val Phe Asp Leu
                245                 250                 255

Glu Glu Lys Ile Thr Leu Gln Phe Ser Lys Asp Ser Tyr Glu Glu Asp
            260                 265                 270
```

```
Leu Glu Leu Leu Leu Ser Lys Ile Asp Glu Glu Tyr Ala Ala Leu Phe
        275                 280                 285

Asp Leu Ala Lys Lys Val Tyr Asp Ala Val Leu Leu Ser Asn Ile Leu
    290                 295                 300

Thr Val Lys Glu Lys Asn Thr Lys Ala Pro Leu Ser Ala Ser Met Ile
305                 310                 315                 320

Lys Arg Tyr Glu Glu His Lys Asp Asp Leu Lys Ala Phe Lys Arg Phe
                325                 330                 335

Phe Arg Glu Arg Leu Pro Glu Lys Tyr Glu Thr Met Phe Lys Asp Leu
            340                 345                 350

Thr Lys Pro Ser Tyr Ala Ala Tyr Val Ser Gly Ala Val Thr Glu Asp
        355                 360                 365

Asp Phe Tyr Lys Phe Ser Lys Gly Leu Leu Ile Asp Val Glu Gly Ala
    370                 375                 380

Glu Tyr Phe Leu Glu Lys Ile Glu Arg Glu Asp Phe Leu Arg Lys Gln
385                 390                 395                 400

Arg Thr Phe Asp Asn Gly Ala Ile Pro Asn Gln Val His Val Lys Glu
                405                 410                 415

Leu Gln Ala Ile Ile Leu Asn Gln Ser Lys Tyr Tyr Pro Phe Leu Ala
            420                 425                 430

Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr
        435                 440                 445

Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Ser Phe Ala Trp Leu Gln
    450                 455                 460

Arg Lys Ser Asp Glu Ala Ile Arg Pro Trp Asn Phe Glu Gln Val Val
465                 470                 475                 480
```

```
Asp Met Glu Thr Ser Ala Ser Arg Phe Ile Glu Arg Met Thr Leu His
                485                 490                 495

Asp Leu Tyr Leu Pro Asp Glu Lys Val Leu Pro Arg His Ser Leu Ile
            500                 505                 510

Tyr Glu Lys Tyr Thr Val Phe Asn Glu Leu Thr Lys Val Arg Phe Thr
        515                 520                 525

Pro Glu Gly Gly Lys Glu Val Tyr Phe Ser Lys Thr Asp Lys Glu Asn
    530                 535                 540

Ile Phe Asp Ser Leu Phe Lys Arg Tyr Arg Lys Val Thr Lys Arg Lys
545                 550                 555                 560

Leu Lys Asp Phe Ile Glu Lys Glu Leu Gly Tyr Gly Tyr Ile Asp Ile
                565                 570                 575

Asp Asn Ile Lys Gly Val Glu Glu Gln Phe Asn Ala Ser Tyr Thr Thr
            580                 585                 590

Tyr Gln Asp Leu Leu Lys Ile Ile Gly Asp Lys Glu Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Lys Asp Leu Leu Glu Glu Ile Ile Tyr Ile Leu Thr Val
    610                 615                 620

Phe Glu Asp Arg Lys Met Ile Glu Lys Arg Leu Ser Glu Leu Asn Ile
625                 630                 635                 640

Pro Phe Glu Asn Lys Ile Ile Lys Lys Leu Ala Arg Lys Lys Tyr Thr
                645                 650                 655

Gly Trp Gly Asn Leu Ser Arg Lys Leu Ile Asp Gly Ile Arg Asn Arg
            660                 665                 670

Glu Thr Asn Arg Thr Ile Leu Gly His Leu Ile Asp Asp Gly Phe Ser
        675                 680                 685
```

```
Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Asp Gly Leu Asp Phe Lys
    690                 695                 700

Glu Ile Ile Arg Lys Ala Gln Thr Ile Glu Asn Ile Asp Thr Asn Gln
705                 710                 715                 720

Ala Leu Val Ser Ser Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Leu Asn Ile Val Asp Glu Ile Ile Ala Ile Met Gly Tyr
            740                 745                 750

Ala Pro Thr Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Arg Asp Asn Ser Ala Gln Arg Leu Lys Lys Ile Glu Asp
    770                 775                 780

Gly Ile Lys Leu Gly Ser Asp Leu Leu Lys Gln Asn Pro Ile Gln Asp
785                 790                 795                 800

Asn Lys Asp Leu Gln Lys Glu Lys Leu Phe Leu Tyr Tyr Met Gln Asn
                805                 810                 815

Gly Ile Asp Leu Tyr Thr Gly Gln Pro Leu Asn Cys Asp Pro Asp Ser
            820                 825                 830

Leu Ala Phe Tyr Asp Val Asp His Ile Val Pro Arg Ser Tyr Ile Lys
        835                 840                 845

Asn Asp Ser Phe Asp Asn Lys Val Leu Thr Thr Ser Lys Gly Asn Arg
    850                 855                 860

Lys Lys Leu Asp Asp Val Pro Ala Lys Glu Val Val Glu Lys Met Glu
865                 870                 875                 880

Asn Thr Trp Arg Arg Leu His Ala Ala Gly Leu Ile Ser Asp Ile Lys
                885                 890                 895
```

```
Leu Ser Tyr Leu Met Lys Gly Glu Leu Thr Glu Glu Asp Lys Ala Gly
            900                 905                 910

Phe Ile Arg Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Arg Leu Leu Asp Glu Lys Leu Asn Arg Lys Lys Asn Glu Asn Gly
    930                 935                 940

Glu Lys Leu Arg Thr Thr Lys Ile Ile Thr Leu Lys Ser Val Phe Ala
945                 950                 955                 960

Ser Arg Phe Arg Ala Asn Phe Asp Leu Tyr Lys Leu Arg Glu Leu Asn
                965                 970                 975

His Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala Gln
            980                 985                 990

Ala Leu Leu Lys Val Tyr Pro Lys  Phe Glu Arg Glu Leu  Val Tyr Gly
        995                 1000                1005

Ser Tyr  Val Lys Glu Ser Ile  Phe Ser Arg Lys Ala  Thr Glu Arg
    1010                1015                1020

Met Arg  Met Tyr Asn Asn Ile  Leu Lys Phe Ile Ser  Lys Asp Lys
    1025                1030                1035

Lys Asp  Gln Glu Thr Gly Glu  Ile Val Trp Asp Lys  Lys Glu Ile
    1040                1045                1050

Glu Asn  Ile Val Lys Lys Val  Ile Tyr Ser Ser Pro  Val Asn Ile
    1055                1060                1065

Val Lys  Lys Arg Glu Glu Gln  Ser Gly Ala Leu Phe  Lys Gln Ser
    1070                1075                1080

Asn Met  Ala Val Gly Tyr Asn  Asn Lys Leu Ile Pro  Arg Lys Lys
    1085                1090                1095
```

```
Asp Trp  Ser Val Asp Lys Tyr  Gly Gly Phe Ile Glu  Pro Ala Glu
    1100                1105                1110

Ser Tyr  Ser Leu Ala Ile Phe  Tyr Thr Asp Ile Asn  Gly Lys Lys
    1115                1120                1125

Pro Lys  Lys Lys Ser Thr Ile  Ile Ala Ile Ser Arg  Met Glu Lys
    1130                1135                1140

Lys Asp  Tyr Glu Lys Glu Pro  Glu Arg Phe Leu Ala  Gln Lys Gly
    1145                1150                1155

Phe Glu  Arg Val Glu Lys Thr  Ile Lys Leu Pro Lys  Tyr Ser Leu
    1160                1165                1170

Phe Glu  Met Glu Lys Gly Arg  Arg Arg Leu Leu Ala  Ser Ser Gly
    1175                1180                1185

Glu Leu  Gln Lys Gly Asn Gln  Val Leu Leu Pro Glu  His Leu Ile
    1190                1195                1200

Arg Leu  Leu Ser Tyr Ala Lys  Lys Val Asp Val Leu  Val Lys Ser
    1205                1210                1215

Lys Asp  Asp Asp Tyr Asp Leu  Glu Glu His Arg Ala  Glu Phe Ala
    1220                1225                1230

Glu Leu  Leu Asp Cys Ile Lys  Lys Phe Asn Asp Met  Tyr Ile Leu
    1235                1240                1245

Ala Ser  Ser Asn Met Ser Lys  Ile Glu Glu Ile Tyr  Gln Lys Asn
    1250                1255                1260

Ile Asp  Ala Pro Ile Glu Glu  Val Ala Arg Ser Phe  Val Leu Leu
    1265                1270                1275

Asn Phe  Thr Met Met Gly Ala  Ala Thr Asp Phe Lys  Phe Phe Gly
    1280                1285                1290
```

```
Gln Ile  Ile Pro Arg Lys Arg  Tyr Pro Ser Thr Thr  Glu Cys Leu
    1295                1300                1305


Lys Ser  Thr Leu Ile His Gln  Ser Val Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320


Arg Ile  Asp Leu Ser Lys Leu  Gly Glu Asn
    1325                1330
```

<210> 137
<211> 1361
<212> PRT
<213> Streptococcus mitis

<400> 137

```
Asn Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Thr Glu Glu Met Ser Lys Val Asp Ile Ser
                85                  90                  95


Phe Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Glu Glu Glu Lys Glu Tyr
        115                 120                 125
```

```
His Lys Asn Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Lys Glu Lys Ala Asp Phe Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ser Phe Asp Ile
                165                 170                 175

Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Gly Ser Ser Leu Asn Gly Gln Asn Ala Gln Val
        195                 200                 205

Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Asn Leu Leu Val Gln Ile Gly Asp Asp Phe Ala Asp
        275                 280                 285

Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Asp Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Ala Leu Lys
                325                 330                 335
```

```
Gln Phe Ile Lys Thr Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe Ser
            340                 345                 350

Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Leu Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Asn Ala Ile Ile Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Gln Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp
    450                 455                 460

Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Ile Val Asp Lys Ala Arg Ser Ala Glu Asp Phe Ile Asn Lys Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln
    530                 535                 540
```

```
Lys Gln Gln Ile Val Thr Gln Leu Phe Lys Glu Lys Arg Lys Val Thr
545                 550                 555                 560


Glu Lys Asp Ile Ile Gln Tyr Leu His Asn Val Asp Ser Tyr Asp Gly
                565                 570                 575


Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser Thr
            580                 585                 590


Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp Asp
        595                 600                 605


Ser Lys Asn Glu Ala Ile Leu Glu Asn Ile Val His Thr Leu Thr Ile
    610                 615                 620


Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala His Tyr Ala Ser
625                 630                 635                 640


Ile Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr
                645                 650                 655


Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Tyr Asp Lys
            660                 665                 670


Gln Ser Lys Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Glu Ile
        675                 680                 685


Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys
    690                 695                 700


Glu Ile Ile Gln Lys Ala Gln Val Val Gly Lys Thr Asn Asp Val Lys
705                 710                 715                 720


Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735


Leu Gln Ser Ile Lys Leu Val Asp Glu Leu Val Lys Val Met Gly His
            740                 745                 750
```

```
Ala Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765


Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp
    770                 775                 780


Ala Leu Lys Asn Leu Ala His Asn Ile Leu Lys Glu His Pro Thr Asp
785                 790                 795                 800


Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn
                805                 810                 815


Gly Lys Asp Met Tyr Thr Gly Lys Ser Leu Asp Ile Asn Gln Leu Ser
            820                 825                 830


Ser Cys Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp
        835                 840                 845


Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys Asp Asn Arg Gly Lys
    850                 855                 860


Ser Asp Asn Val Pro Ser Leu Glu Ile Val Gln Lys Arg Lys Ala Phe
865                 870                 875                 880


Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu Arg Lys Phe Asn
                885                 890                 895


Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp Glu Arg Asp Lys Val
            900                 905                 910


Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925


Val Ala Gln Ile Leu Asp Ala Arg Phe Asn Thr Glu Val Thr Glu Lys
    930                 935                 940


Asp Lys Lys Asp Arg Ser Val Lys Ile Ile Thr Leu Lys Ser Asn Leu
945                 950                 955                 960
```

```
Val Ser Asn Phe Arg Lys Glu Phe Arg Leu Tyr Lys Val Arg Glu Ile
                965                 970                 975


Asn Asp Tyr His His Ala His Asp Pro Tyr Leu Asn Ala Val Val Ala
            980                 985                 990


Lys Ala Ile Leu Lys Lys Tyr Pro  Lys Leu Glu Pro Glu  Phe Val Tyr
        995                 1000                1005


Gly Asp  Tyr Gln Lys Tyr Asp  Leu Thr Lys Asp Pro  Lys Glu Val
    1010                1015                1020


Glu Lys  Ala Thr Glu Lys Tyr  Phe Phe Tyr Ser Asn  Leu Leu Asn
    1025                1030                1035


Phe Phe  Lys Glu Glu Val His  Tyr Ala Asp Gly Thr  Ile Val Lys
    1040                1045                1050


Arg Glu  Asn Ile Glu Tyr Ser  Lys Asp Thr Gly Glu  Ile Ala Trp
    1055                1060                1065


Asn Lys  Glu Lys Asp Phe Ala  Thr Ile Lys Lys Val  Leu Ser Leu
    1070                1075                1080


Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu Glu Gln  Thr Gly Gly
    1085                1090                1095


Leu Phe  Asp Asn Asn Ile Val  Ser Lys Lys Lys Val  Val Asp Ala
    1100                1105                1110


Ser Lys  Leu Thr Pro Ile Lys  Ser Gly Leu Ser Pro  Glu Lys Tyr
    1115                1120                1125


Gly Gly  Tyr Ala Arg Pro Thr  Ile Ala Tyr Ser Val  Leu Val Ile
    1130                1135                1140


Ala Asp  Ile Glu Lys Gly Lys  Ala Lys Lys Leu Lys  Arg Ile Lys
    1145                1150                1155
```

```
Glu Met  Val Gly Ile Thr Val  Gln Asp Lys Lys Lys  Phe Glu Ala
    1160                1165                1170


Asn Pro  Ile Ala Tyr Leu Glu  Glu Cys Gly Tyr Lys  Asn Ile Asn
    1175                1180                1185


Pro Asn  Leu Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Phe
    1190                1195                1200


Asn Asn  Gly Gln Arg Arg Leu  Leu Ala Ser Ser Ile  Glu Leu Gln
    1205                1210                1215


Lys Gly  Asn Glu Leu Ile Val  Pro Tyr His Phe Thr  Ala Leu Leu
    1220                1225                1230


Tyr His  Ala Gln Arg Ile Asn  Lys Ile Ser Glu Pro  Ile His Lys
    1235                1240                1245


Gln Tyr  Val Glu Thr His Gln  Ser Glu Phe Lys Glu  Leu Leu Thr
    1250                1255                1260


Ala Ile  Ile Ser Leu Ser Lys  Lys Tyr Ile Gln Lys  Pro Asn Val
    1265                1270                1275


Glu Ser  Leu Leu Gln Gln Ala  Phe Asp Gln Ser Asp  Lys Asp Ile
    1280                1285                1290


Tyr Gln  Leu Ser Glu Ser Phe  Ile Ser Leu Leu Lys  Leu Ile Ser
    1295                1300                1305


Phe Gly  Ala Pro Gly Thr Phe  Lys Phe Leu Gly Val  Glu Ile Ser
    1310                1315                1320


Gln Ser  Asn Val Arg Tyr Gln  Ser Val Ser Ser Cys  Phe Asn Ala
    1325                1330                1335


Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile
    1340                1345                1350
```

Asp Leu Ser Lys Leu Gly Glu Asp
    1355   1360

<210> 138
<211> 1359
<212> PRT
<213> Streptococcus mitis

<400> 138

Lys Lys Gly Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val Gly
1   5   10   15

Phe Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met Lys
            20   25   30

Val Leu Gly Asn Thr Asp Lys Arg Phe Ile Lys Lys Asn Leu Ile Gly
        35   40   45

Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Ala Arg Arg Leu Lys
    50   55   60

Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg Tyr
65   70   75   80

Leu Gln Glu Ile Phe Ser Glu Glu Met Ser Lys Val Asp Ser Ser Phe
                85   90   95

Phe His Arg Leu Asp Asp Ser Phe Leu Ile Pro Glu Asp Lys Arg Glu
            100   105   110

Ser Lys Tyr Pro Ile Phe Ala Thr Leu Thr Glu Glu Lys Glu Tyr His
        115   120   125

Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp Ser
    130   135   140

Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met
145   150   155   160

Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ala Phe Asp Ile Lys

165 170 175

Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile Tyr Asp
180 185 190

Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln Val Glu
195 200 205

Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu Arg Val
210 215 220

Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu Phe
225 230 235 240

Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe Asp
245 250 255

Leu Glu Asp Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp Glu
260 265 270

Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Thr Asp Leu
275 280 285

Phe Val Ser Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly Ile
290 295 300

Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser Met
305 310 315 320

Ile Glu Arg Tyr Glu Asn His Gln Asn Asp Leu Ala Ala Leu Lys Gln
325 330 335

Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe Ser Asp
340 345 350

Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr Gln
355 360 365

Glu Thr Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe Glu Gly

```
    370                 375                 380

Thr Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gln
                405                 410                 415

Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu Tyr Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp Leu
    450                 455                 460

Thr Arg Asn Ser Asp Glu Ala Ile Arg Pro Trp Asn Phe Glu Glu Ile
465                 470                 475                 480

Val Asp Lys Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met Thr Asn
                485                 490                 495

Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys Phe
        515                 520                 525

Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln Lys
    530                 535                 540

Lys Gln Ile Val Asn Gln Leu Phe Lys Glu Asn Arg Lys Val Thr Glu
545                 550                 555                 560

Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly Tyr Asp Gly Ile
                565                 570                 575

Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser Thr Tyr
```

580 585 590

His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp Asp Ala
595 600 605

Lys Asn Glu Ala Ile Leu Glu Asn Ile Val His Thr Leu Thr Ile Phe
610 615 620

Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp Ser Leu
625 630 635 640

Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr Gly
645 650 655

Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Cys Asp Lys Gln
660 665 670

Thr Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Lys Ile Asn
675 680 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys Glu
690 695 700

Ile Ile Gln Lys Ala Gln Val Ile Gly Lys Thr Asp Asp Val Lys Gln
705 710 715 720

Val Val Gln Glu Leu Ser Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
725 730 735

Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His Ala
740 745 750

Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Ala
755 760 765

Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp Ser
770 775 780

Leu Lys Ile Leu Ala Ser Asn Ile Leu Lys Glu Asn Pro Thr Asp Asn

785 790 795 800

Asn Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn Gly
805 810 815

Lys Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asn Gln Leu Ser Ser
820 825 830

Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser
835 840 845

Leu Asp Asn Arg Val Leu Thr Ser Ser Lys Asp Asn Arg Gly Lys Ser
850 855 860

Asp Asn Val Pro Ser Ile Glu Val Val Gln Lys Arg Lys Ala Phe Trp
865 870 875 880

Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu Arg Lys Phe Asn Asn
885 890 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp Glu Arg Asp Lys Val Gly
900 905 910

Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
915 920 925

Ala Gln Ile Leu Asp Ala Arg Tyr Asn Thr Glu Val Asn Glu Lys Asp
930 935 940

Lys Lys Asn Arg Thr Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val
945 950 955 960

Ser Asn Phe Arg Lys Glu Phe Arg Leu Tyr Lys Val Arg Glu Ile Asn
965 970 975

Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala Lys
980 985 990

Ala Ile Leu Lys Lys Tyr Pro Lys Leu Glu Pro Glu Phe Val Tyr Gly

995 1000 1005

Glu Tyr Gln Lys Tyr Asp Leu Ser Lys Asp Pro Lys Glu Val Glu
1010 1015 1020

Lys Ala Thr Glu Lys Tyr Phe Phe Tyr Ser Asn Leu Leu Asn Phe
1025 1030 1035

Phe Lys Glu Glu Val His Tyr Ala Asp Gly Thr Ile Val Lys Arg
1040 1045 1050

Glu Asn Ile Glu Tyr Ser Lys Asp Thr Gly Glu Ile Ala Trp Asn
1055 1060 1065

Lys Glu Lys Asp Phe Ala Ile Ile Lys Lys Val Leu Ser Leu Pro
1070 1075 1080

Gln Val Asn Ile Val Lys Lys Arg Glu Val Gln Thr Gly Gly Phe
1085 1090 1095

Ser Lys Glu Ser Ile Leu Pro Lys Gly Asn Ser Asp Lys Leu Ile
1100 1105 1110

Pro Arg Lys Thr Lys Asp Ile Leu Leu Asp Thr Thr Lys Tyr Gly
1115 1120 1125

Gly Phe Asp Ser Pro Val Ile Ala Tyr Ser Ile Leu Leu Ile Ala
1130 1135 1140

Asp Ile Glu Lys Gly Lys Ala Lys Lys Leu Lys Thr Val Lys Thr
1145 1150 1155

Leu Val Gly Ile Thr Ile Met Glu Lys Ala Ala Phe Glu Glu Asn
1160 1165 1170

Pro Ile Thr Phe Leu Glu Asn Lys Gly Tyr His Asn Val Arg Lys
1175 1180 1185

Glu Asn Ile Leu Cys Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu

```
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Lys Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Ile Val Leu Pro  Val Tyr Leu Thr Thr  Leu Leu Tyr
    1220                1225                1230

His Ser  Lys Asn Val His Lys  Leu Asp Glu Pro Gly  His Leu Glu
    1235                1240                1245

Tyr Ile  Gln Lys His Arg Asn  Glu Phe Lys Asp Leu  Leu Asn Leu
    1250                1255                1260

Val Ser  Glu Phe Ser Gln Lys  Tyr Val Leu Ala Asp  Ala Asn Leu
    1265                1270                1275

Glu Lys  Ile Lys Ser Leu Tyr  Ala Asp Asn Glu Gln  Ala Asp Ile
    1280                1285                1290

Glu Ile  Leu Ala Asn Ser Phe  Ile Asn Leu Leu Thr  Phe Thr Ala
    1295                1300                1305

Leu Gly  Ala Pro Ala Ala Phe  Lys Phe Phe Gly Lys  Asp Ile Asp
    1310                1315                1320

Arg Lys  Arg Tyr Thr Thr Val  Ser Glu Ile Leu Asn  Ala Thr Leu
    1325                1330                1335

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Trp  Ile Asp Leu
    1340                1345                1350

Ser Lys  Leu Gly Glu Asp
    1355
```

<210> 139
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 139

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205
```

```
Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620
```

```
Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830
```

```
Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035
```

```
Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230
```

```
Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Asn  Lys Leu Gly Gly Asp
    1340                1345


<210>  140
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  140

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255
```

```
Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460
```

```
Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Ile Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670
```

```
Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880
```

```
Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895


Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910


Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080
```

```
Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275
```

```
Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Asn  Lys Leu Gly Gly Asp
    1340                1345


<210>  141
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  141

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110

Phe Asp Ser Tyr Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125

His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220

Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Arg Asn
225                 230                 235                 240

Leu Val Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300
```

```
Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320


Met Ile Lys Arg Tyr Ala Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335


Glu Phe Ile Lys Ala Asn Lys Pro Glu Leu Tyr His Asp Ile Phe Lys
            340                 345                 350


Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365


Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Ala
    370                 375                 380


Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400


Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415


Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
            420                 425                 430


Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445


Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460


Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480


Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495


Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510
```

```
Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720
```

```
Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Gly Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925
```

```
Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125
```

```
Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320
```

Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp
    1325   1330   1335

Leu Ser Lys Leu Gly Gly Asp
    1340   1345

<210> 142
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 142

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20   25   30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100   105   110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115   120   125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130   135   140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His

```
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
```

```
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
```

565 570 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
580 585 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
595 600 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu

```
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
```

```
           980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
```

```
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Asn  Lys Leu Gly Gly Asp
    1340                1345


<210>  143
<211>  1345
<212>  PRT
<213>  Streptococcus mutans
```

<400> 143

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205
```

```
Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620
```

```
Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Gln Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830
```

```
Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035
```

```
Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230
```

```
Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  144
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  144

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255
```

```
Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460
```

```
Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670
```

```
Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880
```

```
Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895


Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910


Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080
```

```
Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275
```

```
Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  145
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  145

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300
```

```
Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320


Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335


Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350


Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365


Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380


Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400


Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415


Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430


Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445


Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460


Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480


Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495


Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510
```

```
Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720
```

```
Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925
```

```
Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Glu  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125
```

```
Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320
```

Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp
    1325   1330   1335

Leu Ser Lys Leu Gly Gly Asp
    1340   1345

<210> 146
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 146

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20   25   30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100   105   110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115   120   125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130   135   140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His

```
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
```

```
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
```

565 570 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
580 585 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
595 600 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu

```
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
```

980 985 990

Ile Gly Lys Ala Leu Leu Gly Val Tyr Pro Gln Leu Glu Pro Glu Phe
995 1000 1005

Val Tyr Gly Asp Tyr Pro His Phe His Gly His Lys Glu Asn Lys
1010 1015 1020

Ala Thr Ala Lys Lys Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe
1025 1030 1035

Lys Lys Asp Asp Val Arg Thr Asp Lys Asn Gly Glu Ile Ile Trp
1040 1045 1050

Lys Lys Asp Glu His Ile Ser Asn Ile Lys Lys Val Leu Ser Tyr
1055 1060 1065

Pro Gln Val Asn Ile Val Lys Lys Val Glu Glu Gln Thr Gly Gly
1070 1075 1080

Phe Ser Lys Glu Ser Ile Leu Pro Lys Gly Asn Ser Asp Lys Leu
1085 1090 1095

Ile Pro Arg Lys Thr Lys Lys Phe Tyr Trp Asp Thr Lys Lys Tyr
1100 1105 1110

Gly Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Ile Leu Val Ile
1115 1120 1125

Ala Asp Ile Glu Lys Gly Lys Ser Lys Lys Leu Lys Thr Val Lys
1130 1135 1140

Ala Leu Val Gly Val Thr Ile Met Glu Lys Met Thr Phe Glu Arg
1145 1150 1155

Asp Pro Val Ala Phe Leu Glu Arg Lys Gly Tyr Arg Asn Val Gln
1160 1165 1170

Glu Glu Asn Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Lys Leu

```
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345

<210>  147
<211>  1345
<212>  PRT
<213>  Streptococcus mutans
```

<400> 147

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205
```

```
Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Thr Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620
```

```
Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Leu Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830
```

```
Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Glu  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035
```

```
Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230
```

```
Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ser Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  148
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  148

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255
```

```
Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460
```

```
Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670
```

```
Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880
```

```
Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895


Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910


Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Arg Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080
```

```
Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275
```

```
Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  149
<211>  1336
<212>  PRT
<213>  Streptococcus mutans

<400>  149

Met Lys Lys Ser Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110

Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125

His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220

Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300
```

```
Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320


Met Ile Lys Arg Tyr Ala Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335


Glu Phe Ile Lys Ala Asn Lys Pro Glu Leu Tyr His Asp Ile Phe Lys
            340                 345                 350


Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365


Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Ala
    370                 375                 380


Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400


Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415


Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
            420                 425                 430


Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445


Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala Trp
    450                 455                 460


Ala Glu Tyr His Ser Asp Glu Ala Val Met Pro Trp Asn Phe Asp Gln
465                 470                 475                 480


Val Ile Asp Lys Glu Ser Ser Ala Gln Ala Phe Ile Glu His Met Thr
                485                 490                 495


Asn Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510
```

```
Pro Leu Tyr Glu Lys Tyr Thr Val Tyr Asn Glu Leu Thr Lys Ile Lys
        515                 520                 525


Tyr Val Thr Glu Ile Gly Glu Ala Lys Phe Phe Asp Ala Asn Leu Lys
    530                 535                 540


Gln Glu Ile Phe Asp Gly Leu Phe Lys His Glu Arg Lys Val Thr Lys
545                 550                 555                 560


Lys Lys Leu Arg Thr Phe Leu Asp Lys Asn Phe Asp Glu Phe Arg Ile
                565                 570                 575


Val Asp Ile Gln Gly Leu Asp Lys Glu Thr Glu Thr Phe Asn Ala Ser
            580                 585                 590


Tyr Ala Thr Tyr Gln Asp Leu Leu Lys Val Ile Lys Asp Lys Val Phe
        595                 600                 605


Met Asp Asn Pro Glu Asn Ala Glu Ile Leu Glu Asn Ile Val Leu Thr
    610                 615                 620


Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Lys
625                 630                 635                 640


Tyr Ala Asp Val Phe Asp Lys Lys Val Ile Asp Gln Leu Ala Arg Arg
                645                 650                 655


His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Asn Gly Ile
            660                 665                 670


Arg Asp Lys Gln Ser Cys Lys Thr Ile Met Asp Tyr Leu Ile Asp Asp
        675                 680                 685


Ala Gln Ser Asn Arg Asn Leu Met Gln Leu Ile Thr Asp Asp Asn Leu
    690                 695                 700


Thr Phe Lys Asp Asp Ile Val Lys Ala Gln Tyr Val Asp Asn Ser Asp
705                 710                 715                 720
```

```
Asp Leu His Gln Val Val Gln Ser Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Lys Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Ala Lys Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Arg
    770                 775                 780

Leu Lys Glu Ala Ile Lys Asp Leu Asn His Lys Ile Leu Lys Glu His
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Asn Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ser Leu Asp Ile Asn
            820                 825                 830

Arg Leu Ser Asp Tyr Asp Ile Asp His Val Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Ala Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Asn Arg Met
865                 870                 875                 880

Arg Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu Ile Ser Gln Arg
                885                 890                 895

Lys Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Pro Asp Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925
```

```
Val Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu Phe Asp Asp Asn
    930                 935                 940

Asn Lys Arg Ile Arg Arg Val Lys Ile Val Thr Leu Lys Ser Asn Leu
945                 950                 955                 960

Val Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Val
            980                 985                 990

Lys Ala Leu Leu Val Lys Tyr Pro  Lys Leu Glu Pro Glu  Phe Val Tyr
        995                 1000                1005

Gly Glu  Tyr Pro Lys Tyr Asn  Ser Tyr Arg Glu Arg  Lys Ala Thr
    1010                1015                1020

Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met Asn Met  Phe Lys Ser
    1025                1030                1035

Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val Glu Arg  Pro Met Ile
    1040                1045                1050

Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala Trp Asp  Lys Thr Lys
    1055                1060                1065

His Ile  Thr Thr Val Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1070                1075                1080

Ile Val  Lys Lys Val Glu Glu  Gln Thr Gly Gly Leu  Phe Asp Pro
    1085                1090                1095

Lys Ser  Pro Leu Glu Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn
    1100                1105                1110

Pro Glu  Lys Tyr Gly Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro
    1115                1120                1125
```

```
Ile Leu  Leu Ile Val Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val
    1130                1135                1140


Met Asp  Lys Lys Arg Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys
    1145                1150                1155


Asp Lys  Gly Tyr Gln Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu
    1160                1165                1170


Pro Lys  Tyr Thr Leu Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu
    1175                1180                1185


Trp Ala  Ser Ser Lys Glu Val  His Lys Gly Asn Gln  Leu Val Val
    1190                1195                1200


Ser Lys  Lys Ser Gln Asp Leu  Leu Tyr His Ala His  His Leu Asp
    1205                1210                1215


Asn Asp  Tyr Ser Asn Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe
    1220                1225                1230


Asp Ile  Leu Phe Asn Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys
    1235                1240                1245


Leu Gly  Lys Glu His Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys
    1250                1255                1260


Glu Arg  Asp Ser Ala Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile
    1265                1270                1275


Lys Leu  Leu Gly Phe Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser
    1280                1285                1290


Phe Leu  Gly Ile Lys Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys
    1295                1300                1305


Asp Tyr  Leu Glu Ala Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1310                1315                1320
```

Tyr Glu Thr Arg Ile Asp Leu Asn Lys Leu Gly Gly Asp
1325 1330 1335

<210> 150
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 150

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
100 105 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
115 120 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
130 135 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr

165 170 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
180 185 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
195 200 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
210 215 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225 230 235 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
245 250 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
260 265 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
275 280 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
290 295 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305 310 315 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
325 330 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
340 345 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
355 360 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu

```
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
```

580 585 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
595 600 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
770 775 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro

785 790 795 800

Val Glu His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
835 840 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
850 855 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865 870 875 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
885 890 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
900 905 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
915 920 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
930 935 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945 950 955 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
965 970 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
980 985 990

Ile Gly Lys Ala Leu Leu Gly Val Tyr Pro Gln Leu Glu Pro Glu Phe

995 1000 1005

Val Tyr Gly Asp Tyr Pro His Phe His Gly His Lys Glu Asn Lys
1010 1015 1020

Ala Thr Ala Lys Lys Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe
1025 1030 1035

Lys Lys Asp Asp Val Arg Thr Asp Lys Asn Gly Glu Ile Ile Trp
1040 1045 1050

Lys Lys Asp Glu His Ile Ser Asn Ile Lys Lys Val Leu Ser Tyr
1055 1060 1065

Pro Gln Val Asn Ile Val Lys Lys Val Glu Glu Gln Thr Gly Gly
1070 1075 1080

Phe Ser Lys Glu Ser Ile Leu Pro Lys Gly Asn Ser Asp Lys Leu
1085 1090 1095

Ile Pro Arg Lys Thr Lys Lys Phe Tyr Trp Asp Thr Lys Lys Tyr
1100 1105 1110

Gly Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Ile Leu Val Ile
1115 1120 1125

Ala Asp Ile Glu Lys Gly Lys Ser Lys Lys Leu Lys Thr Val Lys
1130 1135 1140

Ala Leu Val Gly Val Thr Ile Met Glu Lys Met Thr Phe Glu Arg
1145 1150 1155

Asp Pro Val Ala Phe Leu Glu Arg Lys Gly Tyr Arg Asn Val Gln
1160 1165 1170

Glu Glu Asn Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Lys Leu
1175 1180 1185

Glu Asn Gly Arg Lys Arg Leu Leu Ala Ser Ala Arg Glu Leu Gln

1190 1195 1200

Lys Gly Asn Glu Ile Val Leu Pro Asn His Leu Gly Thr Leu Leu
1205 1210 1215

Tyr His Ala Lys Asn Ile His Lys Val Asp Glu Pro Lys His Leu
1220 1225 1230

Asp Tyr Val Asp Lys His Lys Asp Glu Phe Lys Glu Leu Leu Asp
1235 1240 1245

Val Val Ser Asn Phe Ser Lys Lys Tyr Thr Leu Ala Glu Gly Asn
1250 1255 1260

Leu Glu Lys Ile Lys Glu Leu Tyr Ala Gln Asn Asn Gly Glu Asp
1265 1270 1275

Leu Lys Glu Leu Ala Ser Ser Phe Ile Asn Leu Leu Thr Phe Thr
1280 1285 1290

Ala Ile Gly Ala Pro Ala Thr Phe Lys Phe Phe Asp Lys Asn Ile
1295 1300 1305

Asp Arg Lys Arg Tyr Thr Ser Thr Thr Glu Ile Leu Asn Ala Thr
1310 1315 1320

Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp
1325 1330 1335

Leu Ser Lys Leu Gly Gly Asp
1340 1345

<210> 151
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 151

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

```
Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Phe Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220
```

```
Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ser Glu Phe Tyr Pro Phe
            420                 425                 430
```

```
Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Glu Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640
```

```
Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845
```

```
Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Glu  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050
```

```
Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245
```

```
Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                 1255                 1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                 1270                 1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                 1285                 1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                 1300                 1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                 1315                 1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                 1345


<210>  152
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  152

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110

Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125

His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220

Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270
```

```
Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480
```

```
Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685
```

```
Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895
```

```
Phe Asp Asn Leu Thr Lys Gly Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1085                1090                1095
```

```
Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290
```

```
Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                 1300                 1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                 1315                 1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                 1345


<210>  153
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  153

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110
```

```
Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320
```

```
Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525
```

```
Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735
```

```
Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940
```

```
Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140
```

```
Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335
```

Leu Ser Lys Leu Gly Gly Asp
    1340   1345

<210> 154
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 154

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20   25   30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100   105   110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115   120   125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130   135   140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145   150   155   160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr

```
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
```

```
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
```

580 585 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
595 600 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
770 775 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro

785 790 795 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
835 840 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
850 855 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865 870 875 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
885 890 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
900 905 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
915 920 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
930 935 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945 950 955 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
965 970 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
980 985 990

Ile Gly Lys Ala Leu Leu Gly Val Tyr Pro Gln Leu Glu Pro Glu Phe

995 1000 1005

Val Tyr Gly Asp Tyr Pro His Phe His Gly His Lys Glu Asn Lys
1010 1015 1020

Ala Thr Ala Lys Lys Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe
1025 1030 1035

Lys Lys Asp Asp Val Arg Thr Asp Lys Asn Gly Glu Ile Ile Trp
1040 1045 1050

Lys Lys Asp Glu His Ile Ser Asn Ile Lys Lys Val Leu Ser Tyr
1055 1060 1065

Pro Gln Val Asn Ile Val Lys Lys Val Glu Glu Gln Thr Gly Gly
1070 1075 1080

Phe Ser Lys Glu Ser Ile Leu Pro Lys Gly Asn Ser Asp Lys Leu
1085 1090 1095

Ile Pro Arg Lys Thr Lys Lys Phe Tyr Trp Asp Thr Lys Lys Tyr
1100 1105 1110

Gly Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Ile Leu Val Ile
1115 1120 1125

Ala Asp Ile Glu Lys Gly Lys Ser Lys Lys Leu Lys Thr Val Lys
1130 1135 1140

Ala Leu Val Gly Val Thr Ile Met Glu Lys Met Thr Phe Glu Arg
1145 1150 1155

Asp Pro Val Ala Phe Leu Glu Arg Lys Gly Tyr Arg Asn Val Gln
1160 1165 1170

Glu Glu Asn Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Lys Leu
1175 1180 1185

Glu Asn Gly Arg Lys Arg Leu Leu Ala Ser Ala Arg Glu Leu Gln

```
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ser Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  155
<211>  1336
<212>  PRT
<213>  Streptococcus mutans

<400>  155

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15
```

```
Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110

Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125

His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220
```

```
Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Ala Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335

Glu Phe Ile Lys Ala Asn Lys Pro Glu Leu Tyr His Asp Ile Phe Lys
            340                 345                 350

Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Thr
    370                 375                 380

Gly Ser Asp Tyr Phe Leu Asp Gln Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
            420                 425                 430
```

```
Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr His Ser Asp Glu Ala Val Thr Pro Trp Asn Phe Asp Gln
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Gln Ala Phe Ile Glu His Met Thr
                485                 490                 495

Asn Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Pro Leu Tyr Glu Lys Tyr Thr Val Tyr Asn Glu Leu Thr Lys Ile Lys
        515                 520                 525

Tyr Val Thr Glu Ile Gly Glu Ala Lys Phe Phe Asp Ala Asn Leu Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Leu Phe Lys His Glu Arg Lys Val Thr Lys
545                 550                 555                 560

Lys Lys Leu Arg Thr Phe Leu Asp Lys Asn Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Ile Gln Gly Leu Asp Lys Glu Thr Glu Thr Phe Asn Ala Ser
            580                 585                 590

Tyr Ala Thr Tyr Gln Asp Leu Leu Lys Val Ile Lys Asp Lys Val Phe
        595                 600                 605

Met Asp Asn Pro Glu Asn Ala Glu Ile Leu Glu Asn Ile Val Leu Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Lys
625                 630                 635                 640
```

```
Tyr Ala Asp Val Phe Asp Lys Lys Val Ile Asp Gln Leu Ala Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Asn Gly Ile
            660                 665                 670

Arg Asp Lys Gln Ser Cys Lys Thr Ile Met Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Ala Gln Ser Asn Arg Asn Leu Met Gln Leu Ile Thr Asp Asp Asn Leu
    690                 695                 700

Thr Phe Lys Asp Asp Ile Val Lys Ala Gln Tyr Val Asp Asn Ser Asp
705                 710                 715                 720

Asp Leu His Gln Val Val Gln Ser Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Lys Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Thr Thr Ala Lys Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Arg
    770                 775                 780

Leu Lys Glu Ala Ile Lys Asp Leu Asn His Lys Ile Leu Lys Glu His
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Asn Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ser Leu Asp Ile Asn
            820                 825                 830

Arg Leu Ser Asp Tyr Asp Ile Asp His Val Ile Pro Gln Ala Phe Ile
        835                 840                 845
```

```
Lys Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Ala Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Asn Arg Met
865                 870                 875                 880

Arg Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu Ile Ser Gln Arg
                885                 890                 895

Lys Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Leu Asp Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu Phe Asp Asp Asn
    930                 935                 940

Asn Lys Arg Ile Arg Arg Val Lys Ile Val Thr Leu Lys Ser Asn Leu
945                 950                 955                 960

Val Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Val
            980                 985                 990

Lys Ala Leu Leu Val Lys Tyr Pro  Lys Leu Glu Pro Glu  Phe Val Tyr
        995                 1000                1005

Gly Glu  Tyr Pro Lys Tyr Asn  Ser Tyr Arg Glu Arg  Lys Ala Thr
    1010                1015                1020

Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met Asn Met  Phe Lys Ser
    1025                1030                1035

Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val Glu Arg  Pro Met Ile
    1040                1045                1050
```

```
Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala Trp Asp  Lys Thr Lys
    1055                1060                1065

His Ile  Thr Thr Val Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1070                1075                1080

Ile Val  Lys Lys Val Glu Glu  Gln Thr Gly Gly Leu  Phe Asp Pro
    1085                1090                1095

Lys Ser  Pro Leu Glu Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn
    1100                1105                1110

Pro Glu  Lys Tyr Gly Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro
    1115                1120                1125

Ile Leu  Leu Ile Val Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val
    1130                1135                1140

Met Asp  Lys Lys Arg Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys
    1145                1150                1155

Asp Lys  Gly Tyr Gln Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu
    1160                1165                1170

Pro Lys  Tyr Thr Leu Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu
    1175                1180                1185

Trp Ala  Ser Ser Lys Glu Val  His Lys Gly Asn Gln  Leu Val Val
    1190                1195                1200

Ser Lys  Lys Ser Gln Asp Leu  Leu Tyr His Ala His  His Leu Asp
    1205                1210                1215

Asn Asp  Tyr Ser Asn Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe
    1220                1225                1230

Asp Ile  Leu Phe Asn Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys
    1235                1240                1245
```

```
Leu Gly  Lys Glu His Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys
    1250                 1255                 1260


Glu Arg  Asp Phe Ala Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile
    1265                 1270                 1275


Lys Leu  Leu Gly Phe Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser
    1280                 1285                 1290


Phe Leu  Gly Ile Lys Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys
    1295                 1300                 1305


Asp Tyr  Leu Glu Ala Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1310                 1315                 1320


Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu Gly Gly  Asp
    1325                 1330                 1335


<210>  156
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  156

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285
```

```
Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495
```

```
Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700
```

```
Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910
```

```
Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Ile  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110
```

```
Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305
```

```
Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 157
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 157

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125
```

```
His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335
```

```
Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540
```

```
Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560


Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575


Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590


Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605


Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620


Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640


Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655


Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670


Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685


Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700


Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720


Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735


Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750
```

```
Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960
```

```
Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
           980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155
```

```
Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 158
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 158

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Ser Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175


Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
```

```
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
```

385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
420 425 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
450 455 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465 470 475 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
485 490 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
500 505 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
515 520 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
530 535 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545 550 555 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
565 570 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
580 585 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu

595 600 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
770 775 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785 790 795 800

Val Glu His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu

805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
835 840 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
850 855 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865 870 875 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
885 890 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
900 905 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
915 920 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
930 935 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945 950 955 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
965 970 975

Glu Ile Asn Asp Tyr His His Thr His Asp Ala Tyr Leu Asn Ala Val
980 985 990

Ile Gly Lys Ala Leu Leu Gly Val Tyr Pro Gln Leu Glu Pro Glu Phe
995 1000 1005

Val Tyr Gly Asp Tyr Pro His Phe His Gly His Lys Glu Asn Lys

1010 1015 1020

Ala Thr Ala Lys Lys Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe
1025 1030 1035

Lys Lys Asp Asp Val Arg Thr Asp Lys Asn Gly Glu Ile Ile Trp
1040 1045 1050

Lys Lys Asp Glu His Ile Ser Asn Ile Lys Lys Val Leu Ser Tyr
1055 1060 1065

Pro Gln Val Asn Ile Val Lys Lys Val Glu Glu Gln Thr Gly Gly
1070 1075 1080

Phe Ser Lys Glu Ser Ile Leu Pro Lys Gly Asn Ser Asp Lys Leu
1085 1090 1095

Ile Pro Arg Lys Thr Lys Lys Phe Tyr Trp Asp Thr Lys Lys Tyr
1100 1105 1110

Gly Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Ile Leu Val Ile
1115 1120 1125

Ala Asp Ile Glu Lys Gly Lys Ser Lys Lys Leu Lys Thr Val Lys
1130 1135 1140

Ala Leu Val Gly Val Thr Ile Met Glu Lys Met Thr Phe Glu Arg
1145 1150 1155

Asp Pro Val Ala Phe Leu Glu Arg Lys Gly Tyr Arg Asn Val Gln
1160 1165 1170

Glu Glu Asn Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Lys Leu
1175 1180 1185

Glu Asn Gly Arg Lys Arg Leu Leu Ala Ser Ala Arg Glu Leu Gln
1190 1195 1200

Lys Gly Asn Glu Ile Val Leu Pro Asn His Leu Gly Thr Leu Leu

1205 1210 1215

Tyr His Ala Lys Asn Ile His Lys Val Asp Glu Pro Lys His Leu
1220 1225 1230

Asp Tyr Val Asp Lys His Lys Asp Glu Phe Lys Glu Leu Leu Asp
1235 1240 1245

Val Val Ser Asn Phe Ser Lys Lys Tyr Thr Leu Ala Glu Gly Asn
1250 1255 1260

Leu Glu Lys Ile Lys Glu Leu Tyr Ala Gln Asn Asn Gly Glu Asp
1265 1270 1275

Leu Lys Glu Leu Ala Ser Ser Phe Ile Asn Leu Leu Thr Phe Thr
1280 1285 1290

Ala Ile Gly Ala Pro Ala Thr Phe Lys Phe Phe Asp Lys Asn Ile
1295 1300 1305

Asp Arg Lys Arg Tyr Thr Ser Thr Thr Glu Ile Leu Asn Ala Thr
1310 1315 1320

Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp
1325 1330 1335

Leu Ser Lys Leu Gly Gly Asp
1340 1345

<210> 159
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 159

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655
```

```
Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860
```

```
Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065
```

```
Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Tyr Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260
```

```
Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  160
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  160

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Thr Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Cys Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285
```

```
Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Ser Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495
```

```
Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700
```

```
Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910
```

```
Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110
```

```
Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305
```

```
Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 161
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 161

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125
```

```
His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335
```

```
Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540
```

```
Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560


Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575


Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590


Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605


Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620


Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640


Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655


Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670


Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685


Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700


Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720


Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Leu Ala Ile Lys Lys
                725                 730                 735


Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750
```

```
Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Gly Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960
```

```
Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Phe  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110


Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155
```

```
Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 162
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 162

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asn Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
```

```
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
```

385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
420 425 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
450 455 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465 470 475 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
485 490 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
500 505 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
515 520 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
530 535 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545 550 555 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
565 570 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
580 585 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu

595 600 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
770 775 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785 790 795 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu

805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
835 840 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
850 855 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865 870 875 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
885 890 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
900 905 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
915 920 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
930 935 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945 950 955 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
965 970 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
980 985 990

Ile Gly Lys Ala Leu Leu Gly Val Tyr Pro Gln Leu Glu Pro Glu Phe
995 1000 1005

Val Tyr Gly Asp Tyr Pro His Phe His Gly His Lys Glu Asn Lys

1010 1015 1020

Ala Thr Ala Lys Lys Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe
1025 1030 1035

Lys Lys Asp Asp Val Arg Thr Asp Lys Asn Gly Glu Ile Ile Trp
1040 1045 1050

Lys Lys Asp Glu Tyr Ile Ser Asn Ile Lys Lys Val Leu Ser Tyr
1055 1060 1065

Pro Gln Val Asn Ile Val Lys Lys Val Glu Glu Gln Thr Gly Gly
1070 1075 1080

Phe Ser Lys Glu Ser Ile Leu Pro Lys Gly Asn Ser Asp Lys Leu
1085 1090 1095

Ile Pro Arg Lys Thr Lys Lys Phe Tyr Trp Asp Thr Lys Lys Tyr
1100 1105 1110

Gly Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Ile Leu Val Ile
1115 1120 1125

Ala Asp Ile Glu Lys Gly Lys Ser Lys Lys Leu Lys Thr Val Lys
1130 1135 1140

Ala Leu Val Gly Val Thr Ile Met Glu Lys Met Thr Phe Glu Arg
1145 1150 1155

Asp Pro Ile Ala Phe Leu Glu Arg Lys Gly Tyr Arg Asn Val Gln
1160 1165 1170

Glu Glu Asn Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Lys Leu
1175 1180 1185

Glu Asn Gly Arg Lys Arg Leu Leu Ala Ser Ala Arg Glu Leu Gln
1190 1195 1200

Lys Gly Asn Glu Ile Val Leu Pro Asn His Leu Gly Thr Leu Leu

1205 1210 1215

Tyr His Ala Lys Asn Ile His Lys Val Asp Glu Pro Lys His Leu
1220 1225 1230

Asp Tyr Val Asp Lys His Lys Asp Glu Phe Lys Glu Leu Leu Asp
1235 1240 1245

Val Val Ser Asn Phe Ser Lys Lys Tyr Thr Leu Ala Glu Gly Asn
1250 1255 1260

Leu Glu Lys Ile Lys Glu Leu Tyr Ala Gln Asn Asn Gly Glu Asp
1265 1270 1275

Leu Lys Glu Leu Ala Ser Ser Phe Ile Asn Leu Leu Thr Phe Thr
1280 1285 1290

Ala Ile Gly Ala Pro Ala Ala Phe Lys Phe Phe Asp Lys Asn Ile
1295 1300 1305

Asp Arg Lys Arg Tyr Thr Ser Thr Thr Glu Ile Leu Asn Ala Thr
1310 1315 1320

Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp
1325 1330 1335

Leu Ser Lys Leu Gly Gly Asp
1340 1345

<210> 163
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 163

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Gly Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655
```

```
Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860
```

```
Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065
```

```
Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260
```

```
Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 164
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 164

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Met Gln Val Asp Glu Ser
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Glu Glu Asp Lys Arg
            100                 105                 110

Gly Ser Arg Tyr Pro Ile Phe Gly Thr Leu Lys Glu Glu Lys Lys Tyr
        115                 120                 125

His Lys Glu Phe Lys Thr Ile Tyr His Leu Arg Glu Lys Leu Ala Asn
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ser Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Lys Ala
                165                 170                 175

Glu Asn Thr Asn Val Gln Ala Leu Phe Lys Asp Phe Val Glu Val Tyr
            180                 185                 190

Asp Lys Thr Val Glu Glu Ser His Leu Ser Glu Met Thr Val Asp Ala
        195                 200                 205

Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Leu Val Glu Cys Tyr Pro Thr Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Gly Leu Leu Gly Glu Ile Gly Asp Glu Tyr Ala Asp
        275                 280                 285
```

```
Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Ala Val Asp Asp Asn Thr Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Val Lys Arg Tyr Lys Glu His Lys Glu Glu Leu Ala Ala Phe Lys
                325                 330                 335

Arg Phe Ile Lys Glu Lys Leu Pro Lys Lys Tyr Glu Glu Ile Phe Lys
            340                 345                 350

Asp Asp Thr Lys Asn Gly Tyr Ala Gly Tyr Val Gly Ala Asp Ala Thr
        355                 360                 365

Glu Glu Glu Phe Tyr Lys Tyr Val Lys Gly Ile Leu Asn Lys Val Glu
    370                 375                 380

Gly Ala Asp Val Trp Leu Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Val Arg Lys Gly Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465                 470                 475                 480

Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495
```

```
Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Leu Asn Tyr Leu Asn Lys Glu Phe Glu Glu Phe Arg Ile
                565                 570                 575

Val Asn Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ser Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asn Lys Ser Phe Leu
        595                 600                 605

Asp Asn Lys Glu Asn Glu Gln Ile Ile Glu Asp Ile Ile Gln Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr
625                 630                 635                 640

Ser Asp Ile Phe Thr Lys Ala Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asp Lys Gln Ser Asn Lys Thr Ile Leu Gly Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Tyr Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700
```

```
Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Met Asp Gly
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly His Asn Pro Ala Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Ala Lys Gly Arg Arg Ser Ser Gln Lys Arg Tyr Lys Arg Leu
    770                 775                 780

Glu Glu Ala Ile Lys Asp Leu Asn His Lys Ile Leu Lys Glu His Pro
785                 790                 795                 800

Thr Asp Asn Gln Ala Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Glu Asp Pro Leu Asp Ile Asn Arg
            820                 825                 830

Leu Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Arg Ser Asp Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Glu Glu Val Val His Lys Met Lys
865                 870                 875                 880

Pro Phe Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910
```

```
Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Gly Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110
```

```
Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Glu  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305
```

```
Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Asn  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 165
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 165

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Asp Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125
```

```
His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335
```

```
Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540
```

```
Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560


Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575


Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590


Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605


Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620


Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640


Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655


Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670


Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685


Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700


Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720


Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735


Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750
```

```
Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Lys Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960
```

```
Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
           980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155
```

```
Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 166
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 166

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175


Arg Asn Asn Asp Val Gln Lys Leu Phe Gln Glu Phe Leu Ala Val Tyr
```

```
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Leu Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
```

385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
420 425 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
450 455 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465 470 475 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
485 490 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
500 505 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
515 520 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
530 535 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545 550 555 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
565 570 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
580 585 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu

595 600 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Leu Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
770 775 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785 790 795 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu

805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
835 840 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
850 855 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865 870 875 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
885 890 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
900 905 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
915 920 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
930 935 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945 950 955 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
965 970 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
980 985 990

Ile Gly Lys Ala Leu Leu Gly Val Tyr Pro Gln Leu Glu Pro Glu Phe
995 1000 1005

Val Tyr Gly Asp Tyr Pro His Phe His Gly His Lys Glu Asn Lys

1010 1015 1020

Ala Thr Ala Lys Lys Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe
1025 1030 1035

Lys Lys Asp Asp Val Arg Thr Asp Lys Asn Gly Glu Ile Ile Trp
1040 1045 1050

Lys Lys Asp Glu Tyr Ile Ser Asn Ile Lys Lys Val Leu Ser Tyr
1055 1060 1065

Pro Gln Val Asn Ile Val Lys Lys Val Glu Glu Gln Thr Gly Gly
1070 1075 1080

Phe Ser Lys Glu Ser Ile Leu Pro Lys Gly Asn Ser Asp Lys Leu
1085 1090 1095

Ile Pro Arg Lys Thr Lys Lys Phe Tyr Trp Asp Thr Lys Lys Tyr
1100 1105 1110

Gly Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Ile Leu Val Ile
1115 1120 1125

Ala Asp Ile Glu Lys Gly Lys Ser Lys Lys Leu Lys Thr Val Lys
1130 1135 1140

Ala Leu Val Gly Val Thr Ile Met Glu Lys Met Thr Phe Glu Arg
1145 1150 1155

Asp Pro Ile Ala Phe Leu Glu Arg Lys Gly Tyr Arg Asn Val Gln
1160 1165 1170

Glu Glu Asn Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Lys Leu
1175 1180 1185

Glu Asn Gly Arg Lys Arg Leu Leu Ala Ser Ala Arg Glu Leu Gln
1190 1195 1200

Lys Gly Asn Glu Ile Val Leu Pro Asn His Leu Gly Thr Leu Leu

1205 1210 1215

Tyr His Ala Lys Asn Ile His Lys Val Asp Glu Pro Lys His Leu
1220 1225 1230

Asp Tyr Val Asp Lys His Lys Asp Glu Phe Lys Glu Leu Leu Asp
1235 1240 1245

Val Val Ser Asn Phe Ser Lys Lys Tyr Thr Leu Ala Glu Gly Asn
1250 1255 1260

Leu Glu Lys Ile Lys Glu Leu Tyr Ala Gln Asn Asn Gly Glu Asp
1265 1270 1275

Leu Lys Glu Leu Ala Ser Ser Phe Ile Asn Leu Leu Thr Phe Thr
1280 1285 1290

Ala Ile Gly Ala Pro Ala Thr Phe Lys Phe Phe Asp Lys Asn Ile
1295 1300 1305

Asp Arg Lys Arg Tyr Thr Ser Thr Thr Glu Ile Leu Asn Ala Thr
1310 1315 1320

Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp
1325 1330 1335

Leu Ser Lys Leu Gly Gly Asp
1340 1345

<210> 167
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 167

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655
```

```
Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Leu Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860
```

```
Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Gly Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys His Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065
```

```
Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Phe  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260
```

```
Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 168
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 168

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285
```

```
Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495
```

```
Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Leu Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700
```

```
Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Gln Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910
```

```
Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110
```

```
Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asp His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305
```

```
Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 169
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 169

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125
```

```
His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335
```

```
Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540
```

```
Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560


Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575


Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590


Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605


Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620


Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640


Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655


Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670


Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685


Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700


Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720


Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735


Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750
```

```
Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Lys His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960
```

```
Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
           980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155
```

```
Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 170
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 170

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Asp Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175


Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
```

```
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
```

385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
420 425 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
450 455 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465 470 475 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
485 490 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
500 505 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
515 520 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
530 535 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545 550 555 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
565 570 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
580 585 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu

595 600 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
770 775 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785 790 795 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu

805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
835 840 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
850 855 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865 870 875 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
885 890 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
900 905 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
915 920 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Tyr Thr Glu Thr Asp
930 935 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945 950 955 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
965 970 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
980 985 990

Ile Gly Lys Ala Leu Leu Gly Val Tyr Pro Gln Leu Glu Pro Glu Phe
995 1000 1005

Val Tyr Gly Asp Tyr Pro His Phe His Gly His Lys Glu Asn Lys

1010 1015 1020

Ala Thr Ala Lys Lys Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe
1025 1030 1035

Lys Lys Asp Asp Val Arg Thr Asp Lys Asn Gly Glu Ile Ile Trp
1040 1045 1050

Lys Lys Asp Glu His Ile Ser Asn Ile Lys Lys Val Leu Ser Tyr
1055 1060 1065

Pro Gln Val Asn Ile Val Lys Lys Val Glu Glu Gln Thr Gly Gly
1070 1075 1080

Phe Ser Lys Glu Ser Ile Leu Pro Lys Gly Asn Ser Asp Lys Leu
1085 1090 1095

Ile Pro Arg Lys Thr Lys Lys Phe Tyr Trp Asp Thr Lys Lys Tyr
1100 1105 1110

Gly Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Ile Leu Val Ile
1115 1120 1125

Ala Asp Ile Glu Lys Gly Lys Ser Lys Lys Leu Lys Thr Val Lys
1130 1135 1140

Ala Leu Val Gly Val Thr Ile Met Glu Lys Met Thr Phe Glu Arg
1145 1150 1155

Asp Pro Val Ala Phe Leu Glu Arg Lys Gly Tyr Arg Asn Val Gln
1160 1165 1170

Glu Glu Asn Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Lys Leu
1175 1180 1185

Glu Asn Gly Arg Lys Arg Leu Leu Ala Ser Ala Arg Glu Leu Gln
1190 1195 1200

Lys Gly Asn Glu Ile Val Leu Pro Asn His Leu Gly Thr Leu Leu

1205 1210 1215

Tyr His Ala Lys Asn Ile His Lys Val Asp Glu Pro Lys His Leu
1220 1225 1230

Asp Tyr Val Asp Lys His Lys Asp Glu Phe Lys Glu Leu Leu Asp
1235 1240 1245

Val Val Ser Asn Phe Ser Lys Lys Tyr Thr Leu Ala Glu Gly Asn
1250 1255 1260

Leu Glu Lys Ile Lys Glu Leu Tyr Ala Gln Asn Asn Gly Glu Asp
1265 1270 1275

Leu Lys Glu Leu Ala Ser Ser Phe Ile Asn Leu Leu Thr Phe Thr
1280 1285 1290

Ala Ile Gly Ala Pro Ala Thr Phe Lys Phe Phe Asp Lys Asn Ile
1295 1300 1305

Asp Arg Lys Arg Tyr Thr Ser Thr Thr Glu Ile Leu Asn Ala Thr
1310 1315 1320

Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp
1325 1330 1335

Leu Ser Lys Leu Gly Gly Asp
1340 1345

<210> 171
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 171

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655
```

```
Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860
```

```
Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065
```

```
Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260
```

```
Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 172
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 172

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Ile Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285
```

```
Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Gln Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495
```

```
Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700
```

```
Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910
```

```
Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110
```

```
Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305
```

```
Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Asn  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 173
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 173

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125
```

```
His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Lys Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Leu Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335
```

```
Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Val Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540
```

```
Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560


Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575


Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590


Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605


Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620


Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640


Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655


Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670


Asn Lys Glu Ser Arg Lys Thr Leu Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685


Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700


Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720


Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735


Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750
```

```
Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960
```

```
Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
           980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155
```

```
Asp Pro  Ile Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290

Ala Ile  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305

Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320

Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335

Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 174
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 174

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Cys His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125


His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175


Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
```

```
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Asn Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
```

385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
420 425 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
450 455 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465 470 475 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
485 490 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
500 505 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
515 520 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
530 535 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545 550 555 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
565 570 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
580 585 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu

595 600 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Leu Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
770 775 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785 790 795 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu

805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
835 840 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
850 855 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865 870 875 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
885 890 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
900 905 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
915 920 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
930 935 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945 950 955 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
965 970 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
980 985 990

Ile Gly Lys Ala Leu Leu Gly Val Tyr Pro Gln Leu Glu Pro Glu Phe
995 1000 1005

Val Tyr Gly Asp Tyr Pro His Phe His Gly His Glu Glu Asn Lys

1010 1015 1020

Ala Thr Ala Lys Lys Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe
1025 1030 1035

Lys Lys Asp Asp Val Arg Thr Asp Lys Asn Gly Glu Ile Ile Trp
1040 1045 1050

Lys Lys Asp Glu His Ile Ser Asn Ile Lys Lys Val Leu Ser Tyr
1055 1060 1065

Pro Gln Val Asn Ile Val Lys Lys Val Glu Glu Gln Thr Gly Gly
1070 1075 1080

Phe Ser Lys Glu Ser Ile Leu Pro Lys Gly Asn Ser Asp Lys Leu
1085 1090 1095

Ile Pro Arg Lys Thr Lys Lys Phe Tyr Trp Asp Thr Lys Lys Tyr
1100 1105 1110

Gly Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Ile Leu Val Ile
1115 1120 1125

Ala Asp Ile Glu Lys Gly Lys Ser Lys Lys Leu Lys Thr Val Lys
1130 1135 1140

Ala Leu Val Gly Val Thr Ile Met Glu Lys Met Thr Phe Glu Arg
1145 1150 1155

Asp Pro Val Ala Phe Leu Glu Arg Lys Gly Tyr Arg Asn Val Gln
1160 1165 1170

Glu Glu Asn Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Lys Leu
1175 1180 1185

Glu Asn Gly Arg Lys Arg Leu Leu Ala Ser Ala Arg Glu Leu Gln
1190 1195 1200

Lys Gly Asn Glu Ile Val Leu Pro Asn His Leu Gly Thr Leu Leu

1205 1210 1215

Tyr His Ala Lys Asn Ile His Lys Val Asp Glu Pro Lys His Leu
1220 1225 1230

Asp Tyr Val Asp Lys His Lys Asp Glu Phe Lys Glu Leu Leu Asp
1235 1240 1245

Val Val Ser Asn Phe Ser Lys Lys Tyr Thr Leu Ala Glu Gly Asn
1250 1255 1260

Leu Glu Lys Ile Lys Glu Leu Tyr Ala Gln Asn Asn Gly Glu Asp
1265 1270 1275

Leu Lys Glu Leu Ser Ser Ser Phe Ile Asn Leu Leu Thr Phe Thr
1280 1285 1290

Ala Ile Gly Ala Pro Ala Ala Phe Lys Phe Phe Asp Lys Asn Ile
1295 1300 1305

Asp Arg Lys Arg Tyr Thr Ser Thr Thr Glu Ile Leu Asn Ala Thr
1310 1315 1320

Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp
1325 1330 1335

Leu Ser Lys Leu Gly Gly Asp
1340 1345

<210> 175
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 175

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

```
Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240
```

```
Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Val Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655
```

```
Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860
```

```
Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065
```

```
Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260
```

```
Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Asn  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 176
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 176

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80
```

```
Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Ile Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285
```

```
Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495
```

```
Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Lys Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Leu Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700
```

```
Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Leu Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Asn Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Gly Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910
```

```
Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940


Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020


Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050


Lys Lys  Asp Glu Tyr Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065


Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080


Phe Phe  Lys Glu Ser Ile Leu  Pro Lys Gly Asp Ser  Asp Lys Leu
    1085                1090                1095


Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110
```

```
Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125


Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305
```

```
Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 177
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 177

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Glu Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125
```

```
His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Gly Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
                325                 330                 335
```

```
Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540
```

```
Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560


Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575


Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590


Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605


Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620


Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640


Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655


Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670


Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685


Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700


Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720


Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735


Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750
```

```
Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960
```

```
Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
               965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
           980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Ser Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155
```

```
Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Asn  Lys Leu Gly Gly Asp
    1340                1345
```

<210> 178
<211> 1336
<212> PRT
<213> Streptococcus mutans

<400> 178

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110

Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125

His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175

Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
```

```
            180                 185                 190

Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205

Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220

Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240

Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Lys Arg Tyr Ala Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335

Glu Phe Ile Lys Ala Asn Lys Pro Glu Leu Tyr His Asp Ile Phe Lys
            340                 345                 350

Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Thr
    370                 375                 380

Gly Ser Asp Tyr Phe Leu Asp Gln Ile Glu Arg Glu Asp Phe Leu Arg
```

385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
420 425 430

Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala Trp
450 455 460

Ala Glu Tyr His Ser Asp Glu Ala Val Thr Pro Trp Asn Phe Asp Gln
465 470 475 480

Val Ile Asp Lys Glu Ser Ser Ala Gln Ala Phe Ile Glu His Met Thr
485 490 495

Asn Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
500 505 510

Pro Leu Tyr Glu Lys Tyr Thr Val Tyr Asn Glu Leu Thr Lys Ile Lys
515 520 525

Tyr Val Thr Glu Ile Gly Glu Ala Lys Phe Phe Asp Ala Asn Leu Lys
530 535 540

Gln Glu Ile Phe Asp Gly Leu Phe Lys His Glu Arg Lys Val Thr Lys
545 550 555 560

Lys Lys Leu Arg Thr Phe Leu Asp Lys Asn Phe Asp Glu Phe Arg Ile
565 570 575

Val Asp Ile Gln Gly Leu Asp Lys Glu Thr Glu Thr Phe Asn Ala Ser
580 585 590

Tyr Ala Thr Tyr Gln Asp Leu Leu Lys Val Ile Lys Asp Lys Val Phe

595 600 605

Met Asp Asn Pro Glu Asn Ala Glu Ile Leu Glu Asn Ile Val Leu Thr
610 615 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Lys
625 630 635 640

Tyr Ala Asp Val Phe Asp Lys Lys Val Ile Asp Gln Leu Ala Arg Arg
645 650 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Asn Gly Ile
660 665 670

Arg Asp Lys Gln Ser Cys Lys Thr Ile Met Asp Tyr Leu Ile Asp Asp
675 680 685

Ala Gln Ser Asn Arg Asn Leu Met Gln Leu Ile Thr Asp Asp Asn Leu
690 695 700

Thr Phe Lys Asp Asp Ile Val Lys Ala Gln Tyr Val Asp Asn Ser Asp
705 710 715 720

Asp Leu His Gln Val Val Gln Ser Leu Ala Gly Ser Pro Ala Ile Lys
725 730 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
740 745 750

Met Gly Lys Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Ala Lys Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Arg
770 775 780

Leu Lys Glu Ala Ile Lys Asp Leu Asn His Lys Ile Leu Lys Glu His
785 790 795 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Asn Arg Leu Phe Leu Tyr Tyr

```
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ser Leu Asp Ile Asn
            820                 825                 830

Arg Leu Ser Asp Tyr Asp Ile Asp His Val Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Ala Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Asn Arg Met
865                 870                 875                 880

Arg Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu Ile Ser Gln Arg
                885                 890                 895

Lys Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Leu Asp Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu Phe Asp Asp Asn
    930                 935                 940

Asn Lys Arg Ile Arg Arg Val Lys Ile Val Thr Leu Lys Ser Asn Leu
945                 950                 955                 960

Val Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Val
            980                 985                 990

Lys Ala Leu Leu Val Lys Tyr Pro  Lys Leu Glu Pro Glu  Phe Val Tyr
        995                 1000                1005

Gly Glu  Tyr Leu Lys Tyr Asn  Ser Tyr Arg Glu Arg  Lys Ala Thr
```

1010 1015 1020

Gln Lys Met Phe Phe Tyr Ser Asn Ile Met Asn Met Phe Lys Ser
1025 1030 1035

Lys Val Lys Leu Ala Asp Asp Gln Ile Val Glu Arg Pro Met Ile
1040 1045 1050

Glu Val Asn Asp Glu Thr Gly Glu Ile Ala Trp Asp Lys Thr Lys
1055 1060 1065

His Ile Thr Thr Val Lys Lys Val Leu Ser Tyr Pro Gln Val Asn
1070 1075 1080

Ile Val Lys Lys Val Glu Glu Gln Thr Gly Gly Leu Phe Asp Pro
1085 1090 1095

Lys Ser Pro Leu Glu Lys Leu Val Pro Leu Lys Lys Ala Leu Asn
1100 1105 1110

Pro Glu Lys Tyr Gly Gly Tyr Gln Lys Pro Thr Thr Ala Tyr Pro
1115 1120 1125

Ile Leu Leu Ile Val Asp Thr Lys Gln Leu Ile Pro Ile Ser Val
1130 1135 1140

Met Asp Lys Lys Arg Phe Glu Gln Asn Pro Val Lys Phe Leu Lys
1145 1150 1155

Asp Lys Gly Tyr Gln Gln Ile Glu Lys Asn Asn Phe Val Lys Leu
1160 1165 1170

Pro Lys Tyr Thr Leu Val Asp Ile Gly Asn Gly Ile Lys Arg Leu
1175 1180 1185

Trp Ala Ser Ser Lys Glu Val His Lys Gly Asn Gln Leu Val Val
1190 1195 1200

Ser Lys Lys Ser Gln Asp Leu Leu Tyr His Ala His His Leu Asp

```
    1205                1210                1215

Asn Asp  Tyr Ser Asn Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe
    1220                1225                1230

Asp Ile  Leu Phe Asn Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys
    1235                1240                1245

Leu Gly  Lys Glu His Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys
    1250                1255                1260

Glu Arg  Asp Phe Ala Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile
    1265                1270                1275

Lys Leu  Leu Gly Phe Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser
    1280                1285                1290

Phe Leu  Gly Ile Lys Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys
    1295                1300                1305

Asp Tyr  Leu Glu Ala Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1310                1315                1320

Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu Gly Gly  Asp
    1325                1330                1335
```

<210> 179
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 179

```
Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255
```

```
Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Val Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460
```

```
Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Ala Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670
```

```
Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu His Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asn Val Val Arg Lys Met Lys
865                 870                 875                 880
```

```
Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe His Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080
```

```
Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275
```

```
Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  180
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  180

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Thr Arg Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95
```

```
Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300
```

```
Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Ser Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510
```

```
Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720
```

```
Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925
```

```
Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095

Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125
```

```
Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140


Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155


Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170


Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185


Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200


Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215


Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230


Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245


Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260


Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275


Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290


Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Asn Ala Thr
    1310                1315                1320
```

```
Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                 1330                 1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                 1345


<210>  181
<211>  1336
<212>  PRT
<213>  Streptococcus mutans

<400>  181

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Asn Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Asp Glu Ser Phe Leu Thr Asp Asp Asp Lys Asn
            100                 105                 110


Phe Asp Ser His Pro Ile Phe Gly Asn Lys Ala Glu Glu Asp Ala Tyr
        115                 120                 125


His Gln Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140
```

```
Ser Thr Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Ala
                165                 170                 175


Glu Asn Thr Asp Val Gln Lys Leu Phe Ala Asp Phe Val Gly Val Tyr
            180                 185                 190


Asp Arg Thr Phe Asp Asp Ser His Leu Ser Glu Ile Thr Val Asp Ala
        195                 200                 205


Ser Ser Ile Leu Thr Glu Lys Ile Ser Lys Ser Arg Arg Leu Glu Lys
    210                 215                 220


Leu Ile Asn Asn Tyr Pro Lys Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240


Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255


Lys Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270


Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285


Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300


Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320


Met Ile Lys Arg Tyr Ala Glu His His Glu Asp Leu Glu Lys Leu Lys
                325                 330                 335


Glu Phe Ile Lys Ala Asn Lys Pro Glu Leu Tyr His Asp Ile Phe Lys
            340                 345                 350
```

```
Asp Glu Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Asn Thr Leu Ser Lys Ile Ala
    370                 375                 380

Gly Ser Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Gly Asp Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Asn Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr His Ser Asp Glu Ala Val Thr Pro Trp Asn Phe Asp Gln
465                 470                 475                 480

Val Ile Asp Lys Glu Ser Ser Ala Gln Ala Phe Ile Glu His Met Thr
                485                 490                 495

Asn Asn Asp Leu Tyr Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Pro Leu Tyr Glu Lys Tyr Thr Val Tyr Asn Glu Leu Thr Lys Ile Lys
        515                 520                 525

Tyr Val Thr Glu Ile Gly Glu Ala Lys Phe Phe Asp Ala Asn Leu Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Leu Phe Lys His Glu Arg Lys Val Thr Lys
545                 550                 555                 560
```

```
Lys Lys Leu Arg Thr Phe Leu Asp Lys Asn Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Ile Gln Gly Leu Asp Lys Glu Thr Glu Thr Phe Asn Ala Ser
            580                 585                 590

Tyr Ala Thr Tyr Gln Asp Leu Leu Lys Val Ile Lys Asp Lys Val Phe
        595                 600                 605

Met Asp Asn Pro Glu Asn Ala Glu Ile Leu Glu Asn Ile Val Leu Thr
    610                 615                 620

Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Lys
625                 630                 635                 640

Tyr Ala Asp Val Phe Asp Lys Lys Val Ile Asp Gln Leu Ala Arg Arg
                645                 650                 655

His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Asn Gly Ile
            660                 665                 670

Arg Asp Lys Gln Ser Cys Lys Thr Ile Met Asp Tyr Leu Ile Asp Asp
        675                 680                 685

Ala Gln Ser Asn Arg Asn Leu Met Gln Leu Ile Thr Asp Asp Asn Leu
    690                 695                 700

Thr Phe Lys Asp Asp Ile Val Lys Ala Gln Tyr Val Asp Asn Ser Asp
705                 710                 715                 720

Asp Leu His Gln Val Val Gln Ser Leu Ala Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val
            740                 745                 750

Met Gly Lys Glu Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu Asn
        755                 760                 765
```

```
Gln Thr Thr Ala Lys Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Arg
    770                 775                 780

Leu Lys Glu Ala Ile Lys Asp Leu Asn His Lys Ile Leu Lys Glu His
785                 790                 795                 800

Pro Thr Asp Asn Gln Ala Leu Gln Asn Asn Arg Leu Phe Leu Tyr Tyr
                805                 810                 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Ser Leu Asp Ile Asn
            820                 825                 830

Arg Leu Ser Asp Tyr Asp Ile Asp His Val Ile Pro Gln Ala Phe Ile
        835                 840                 845

Lys Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Ala Asn
    850                 855                 860

Arg Gly Lys Ser Asp Asp Val Pro Ser Glu Asp Val Val Asn Arg Met
865                 870                 875                 880

Arg Pro Phe Trp Asn Lys Leu Leu Ser Ser Gly Leu Ile Ser Gln Arg
                885                 890                 895

Lys Tyr Asn Asn Leu Thr Lys Lys Glu Leu Thr Leu Asp Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Arg Met Leu Asp Glu Arg Phe Asn Lys Glu Phe Asp Asp Asn
    930                 935                 940

Asn Lys Arg Ile Arg Arg Val Lys Ile Val Thr Leu Lys Ser Asn Leu
945                 950                 955                 960

Val Ser Ser Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile
                965                 970                 975
```

```
Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Val
            980                 985                 990


Lys Ala Leu Leu Val Lys Tyr Pro  Lys Leu Glu Pro Glu  Phe Val Tyr
        995                 1000                1005


Gly Glu  Tyr Pro Lys Tyr Asn  Ser Tyr Arg Glu Arg  Lys Ala Thr
    1010                1015                1020


Gln Lys  Met Phe Phe Tyr Ser  Asn Ile Met Asn Met  Phe Lys Ser
    1025                1030                1035


Lys Val  Lys Leu Ala Asp Asp  Gln Ile Val Glu Arg  Pro Met Ile
    1040                1045                1050


Glu Val  Asn Asp Glu Thr Gly  Glu Ile Ala Trp Asp  Lys Thr Lys
    1055                1060                1065


His Ile  Thr Thr Val Lys Lys  Val Leu Ser Tyr Pro  Gln Val Asn
    1070                1075                1080


Ile Val  Lys Lys Val Glu Glu  Gln Thr Gly Gly Leu  Phe Asp Pro
    1085                1090                1095


Lys Ser  Pro Leu Glu Lys Leu  Val Pro Leu Lys Lys  Ala Leu Asn
    1100                1105                1110


Pro Glu  Lys Tyr Gly Gly Tyr  Gln Lys Pro Thr Thr  Ala Tyr Pro
    1115                1120                1125


Ile Leu  Leu Ile Val Asp Thr  Lys Gln Leu Ile Pro  Ile Ser Val
    1130                1135                1140


Met Asp  Lys Lys Arg Phe Glu  Gln Asn Pro Val Lys  Phe Leu Lys
    1145                1150                1155


Asp Lys  Gly Tyr Gln Gln Ile  Glu Lys Asn Asn Phe  Val Lys Leu
    1160                1165                1170
```

```
Pro Lys  Tyr Thr Leu Val Asp  Ile Gly Asn Gly Ile  Lys Arg Leu
    1175                1180                1185


Trp Ala  Ser Ser Lys Glu Val  His Lys Gly Asn Gln  Leu Val Val
    1190                1195                1200


Ser Lys  Lys Ser Gln Asp Leu  Leu Tyr His Ala His  His Leu Asp
    1205                1210                1215


Asn Asp  Tyr Ser Asn Glu Tyr  Val Lys Asn His Tyr  Gln Gln Phe
    1220                1225                1230


Asp Ile  Leu Phe Asn Glu Ile  Thr Ser Phe Ser Lys  Lys Cys Lys
    1235                1240                1245


Leu Gly  Lys Glu His Ile Gln  Lys Ile Glu Glu Ala  Tyr Ser Lys
    1250                1255                1260


Glu Arg  Asp Ser Ala Ser Ile  Glu Glu Leu Ala Asp  Gly Phe Ile
    1265                1270                1275


Lys Leu  Leu Gly Phe Thr Gln  Leu Gly Ala Thr Ser  Pro Phe Ser
    1280                1285                1290


Phe Leu  Gly Ile Lys Leu Asn  Gln Lys Gln Tyr Thr  Gly Lys Lys
    1295                1300                1305


Asp Tyr  Leu Glu Ala Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1310                1315                1320


Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu Gly Gly  Asp
    1325                1330                1335


<210>  182
<211>  1345
<212>  PRT
<213>  Streptococcus mutans

<400>  182

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
```

```
1               5                   10                  15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Ala Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

Tyr Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Val Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
```

210 215 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225 230 235 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
245 250 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
260 265 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
275 280 285

Leu Phe Thr Leu Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
290 295 300

Ile Leu Thr Ala Asp Asp Ser Ser Thr Lys Ala Pro Leu Ser Ala Ser
305 310 315 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Ala Gln Leu Lys
325 330 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
340 345 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
355 360 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
370 375 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe

420 425 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Asp Phe Ala Trp
450 455 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465 470 475 480

Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
485 490 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
500 505 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
515 520 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
530 535 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545 550 555 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
565 570 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
580 585 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
595 600 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
610 615 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr

625 630 635 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
660 665 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705 710 715 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
740 745 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
770 775 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785 790 795 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
805 810 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
820 825 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys

835 840 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
850 855 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865 870 875 880

Pro Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
885 890 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
900 905 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
915 920 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
930 935 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945 950 955 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
965 970 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
980 985 990

Ile Gly Lys Ala Leu Leu Gly Val Tyr Pro Gln Leu Glu Pro Glu Phe
995 1000 1005

Val Tyr Gly Asp Tyr Pro His Phe His Gly His Glu Glu Asn Lys
1010 1015 1020

Ala Thr Ala Lys Lys Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe
1025 1030 1035

Lys Lys Asp Asp Val Arg Thr Asp Lys Asn Gly Glu Ile Ile Trp

1040 1045 1050

Lys Lys Asp Glu His Ile Ser Asn Ile Lys Lys Val Leu Ser Tyr
1055 1060 1065

Pro Gln Val Asn Ile Val Lys Lys Val Glu Glu Gln Thr Gly Gly
1070 1075 1080

Phe Ser Lys Glu Ser Ile Leu Pro Lys Gly Asn Ser Asp Lys Leu
1085 1090 1095

Ile Pro Arg Lys Thr Lys Lys Phe Tyr Trp Asp Thr Lys Lys Tyr
1100 1105 1110

Gly Gly Phe Asp Ser Pro Ile Val Ala Tyr Ser Ile Leu Val Ile
1115 1120 1125

Ala Asp Ile Glu Lys Gly Lys Ser Lys Lys Leu Lys Thr Val Lys
1130 1135 1140

Ala Leu Val Gly Val Thr Ile Met Glu Lys Met Thr Phe Glu Arg
1145 1150 1155

Asp Pro Val Ala Phe Leu Glu Arg Lys Gly Tyr Arg Asn Val Gln
1160 1165 1170

Glu Glu Asn Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Lys Leu
1175 1180 1185

Glu Asn Gly Arg Lys Arg Leu Leu Ala Ser Ala Arg Glu Leu Gln
1190 1195 1200

Lys Gly Asn Glu Ile Val Leu Pro Asn His Leu Gly Thr Leu Leu
1205 1210 1215

Tyr His Ala Lys Asn Ile His Lys Val Asp Glu Pro Lys His Leu
1220 1225 1230

Asp Tyr Val Asp Lys His Lys Asp Glu Phe Lys Glu Leu Leu Asp

1235 1240 1245

Val Val Ser Asn Phe Ser Lys Lys Tyr Thr Leu Ala Glu Gly Asn
1250 1255 1260

Leu Glu Lys Ile Lys Glu Leu Tyr Ala Gln Asn Asn Gly Glu Asp
1265 1270 1275

Leu Lys Glu Leu Ala Ser Ser Phe Ile Asn Leu Leu Thr Phe Thr
1280 1285 1290

Ala Ile Gly Ala Pro Ala Thr Phe Lys Phe Phe Asp Lys Asn Ile
1295 1300 1305

Asp Arg Lys Arg Tyr Thr Ser Thr Thr Glu Ile Leu Asn Ala Thr
1310 1315 1320

Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp
1325 1330 1335

Leu Ser Lys Leu Gly Gly Asp
1340 1345

<210> 183
<211> 1345
<212> PRT
<213> Streptococcus mutans

<400> 183

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
20 25 30

Lys Val Leu Gly Asn Thr Asp Lys Ser His Ile Lys Lys Asn Leu Leu
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Asn Thr Ala Glu Asp Arg Arg Leu
50 55 60

```
Lys Arg Thr Thr Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Met Gly Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Asp Ser Phe Leu Val Thr Glu Asp Lys Arg
            100                 105                 110

Gly Glu Arg His Pro Ile Phe Gly Asn Leu Glu Glu Glu Val Lys Tyr
        115                 120                 125

His Glu Asn Phe Pro Thr Ile Tyr His Leu Arg Gln Tyr Leu Ala Asp
    130                 135                 140

Asn Pro Glu Lys Thr Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Phe Asp Thr
                165                 170                 175

Arg Asn Asn Asp Val Gln Arg Leu Phe Gln Glu Phe Leu Ala Val Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Asn Ser Ser Leu Gln Glu Gln Asn Val Gln Val
        195                 200                 205

Glu Glu Ile Leu Thr Asp Lys Ile Ser Lys Ser Ala Lys Lys Asp Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asn Glu Lys Ser Asn Gly Arg Phe Ala Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Glu Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270
```

```
Glu Glu Leu Glu Val Leu Leu Ala Gln Ile Gly Asp Asn Tyr Ala Glu
        275                 280                 285

Leu Phe Leu Ser Ala Lys Lys Leu Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Val Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Gln Arg Tyr Asn Glu His Gln Met Asp Leu Thr Gln Leu Lys
                325                 330                 335

Gln Phe Ile Arg Gln Lys Leu Ser Asp Lys Tyr Asn Glu Val Phe Ser
            340                 345                 350

Asp Val Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Leu Lys Gly Leu Leu Asn Lys Ile Glu
    370                 375                 380

Gly Ser Gly Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Arg Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Gln Asp Arg Ile Glu Lys Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Ser Gly Lys Ser Asp Phe Ala Trp
    450                 455                 460

Leu Ser Arg Lys Ser Ala Asp Lys Ile Thr Pro Trp Asn Phe Asp Glu
465                 470                 475                 480
```

```
Ile Val Asp Lys Glu Ser Ser Ala Glu Ala Phe Ile Asn Arg Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Asn Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Lys Thr Glu Gln Gly Lys Thr Ala Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Asp Lys Leu Met Asp Phe Leu Glu Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ala Ser
            580                 585                 590

Tyr Gly Thr Tyr His Asp Leu Cys Lys Ile Leu Asp Lys Asp Phe Leu
        595                 600                 605

Asp Asn Ser Lys Asn Glu Lys Ile Leu Glu Asp Ile Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Asn Tyr
625                 630                 635                 640

Ser Asp Leu Leu Thr Lys Glu Gln Val Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Glu Leu Ile His Gly Ile Arg
            660                 665                 670

Asn Lys Glu Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685
```

```
Asn Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asn
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Ile Met
            740                 745                 750

Gly His Gln Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Gly Leu
    770                 775                 780

Thr Asp Ser Ile Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro
785                 790                 795                 800

Val Glu Asn Ser Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Glu Glu Leu Asp Ile Asp Tyr
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Lys Asp Val Val Arg Lys Met Lys
865                 870                 875                 880

Ser Tyr Trp Ser Lys Leu Leu Ser Ala Lys Leu Ile Thr Gln Arg Lys
                885                 890                 895
```

```
Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Asp Asp
            900                 905                 910

Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Thr Glu Thr Asp
    930                 935                 940

Glu Asn Asn Lys Lys Ile Arg Gln Val Lys Ile Val Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Ile Gly Lys Ala Leu Leu Gly Val  Tyr Pro Gln Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Pro His  Phe His Gly His Lys  Glu Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Lys  Asp Asp Val Arg Thr  Asp Lys Asn Gly Glu  Ile Ile Trp
    1040                1045                1050

Lys Lys  Asp Glu His Ile Ser  Asn Ile Lys Lys Val  Leu Ser Tyr
    1055                1060                1065

Pro Gln  Val Asn Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1070                1075                1080

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1085                1090                1095
```

```
Ile Pro  Arg Lys Thr Lys Lys  Phe Tyr Trp Asp Thr  Lys Lys Tyr
    1100                1105                1110

Gly Gly  Phe Asp Ser Pro Ile  Val Ala Tyr Ser Ile  Leu Val Ile
    1115                1120                1125

Ala Asp  Ile Glu Lys Gly Lys  Ser Lys Lys Leu Lys  Thr Val Lys
    1130                1135                1140

Ala Leu  Val Gly Val Thr Ile  Met Glu Lys Met Thr  Phe Glu Arg
    1145                1150                1155

Asp Pro  Val Ala Phe Leu Glu  Arg Lys Gly Tyr Arg  Asn Val Gln
    1160                1165                1170

Glu Glu  Asn Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Lys Leu
    1175                1180                1185

Glu Asn  Gly Arg Lys Arg Leu  Leu Ala Ser Ala Arg  Glu Leu Gln
    1190                1195                1200

Lys Gly  Asn Glu Ile Val Leu  Pro Asn His Leu Gly  Thr Leu Leu
    1205                1210                1215

Tyr His  Ala Lys Asn Ile His  Lys Val Asp Glu Pro  Lys His Leu
    1220                1225                1230

Asp Tyr  Val Asp Lys His Lys  Asp Glu Phe Lys Glu  Leu Leu Asp
    1235                1240                1245

Val Val  Ser Asn Phe Ser Lys  Lys Tyr Thr Leu Ala  Glu Gly Asn
    1250                1255                1260

Leu Glu  Lys Ile Lys Glu Leu  Tyr Ala Gln Asn Asn  Gly Glu Asp
    1265                1270                1275

Leu Lys  Glu Leu Ala Ser Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1280                1285                1290
```

```
Ala Ile  Gly Ala Pro Ala Thr  Phe Lys Phe Phe Asp  Lys Asn Ile
    1295                1300                1305


Asp Arg  Lys Arg Tyr Thr Ser  Thr Thr Glu Ile Leu  Lys Ala Thr
    1310                1315                1320


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1325                1330                1335


Leu Ser  Lys Leu Gly Gly Asp
    1340                1345


<210>  184
<211>  1338
<212>  PRT
<213>  Streptococcus mutans

<400>  184

Met Asp Leu Ile Gly Thr Asn Ser Val Gly Trp Ala Val Val Thr Asp
1               5                   10                  15


Asp Tyr Lys Val Pro Ala Lys Lys Met Lys Val Leu Gly Asn Thr Asp
            20                  25                  30


Lys Ser His Ile Lys Lys Asn Leu Leu Gly Ala Leu Leu Phe Asp Ser
        35                  40                  45


Gly Asn Thr Ala Ala Asp Arg Arg Leu Lys Arg Thr Ala Arg Arg Arg
    50                  55                  60


Tyr Thr Arg Arg Arg Asn Arg Ile Leu Tyr Leu Gln Glu Ile Phe Ala
65                  70                  75                  80


Glu Glu Met Ser Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Asp
                85                  90                  95


Ser Phe Leu Val Thr Glu Asp Lys Arg Gly Glu Arg His Pro Ile Phe
            100                 105                 110
```

```
Gly Asn Leu Glu Glu Glu Val Lys Tyr His Glu Asn Phe Pro Thr Ile
        115                 120                 125


Tyr His Leu Arg Gln Tyr Leu Ala Asp Asn Pro Glu Lys Val Asp Leu
    130                 135                 140


Arg Leu Val Tyr Leu Ala Leu Ala His Ile Ile Lys Phe Arg Gly His
145                 150                 155                 160


Phe Leu Ile Glu Gly Lys Phe Asp Thr Arg Asn Asn Asp Val Gln Arg
                165                 170                 175


Leu Phe Gln Glu Phe Leu Ala Val Tyr Asp Asn Thr Phe Glu Asn Ser
            180                 185                 190


Ser Leu Gln Glu Gln Asn Val Gln Val Glu Glu Ile Leu Thr Asp Lys
        195                 200                 205


Ile Ser Lys Ser Ala Lys Lys Asp Arg Val Leu Lys Leu Phe Pro Asn
    210                 215                 220


Glu Lys Ser Asn Gly Arg Phe Ala Glu Phe Leu Lys Leu Ile Val Gly
225                 230                 235                 240


Asn Gln Ala Asp Phe Lys Lys His Phe Glu Leu Glu Glu Lys Ala Pro
                245                 250                 255


Leu Gln Phe Ser Lys Asp Thr Tyr Glu Glu Glu Leu Glu Val Leu Leu
            260                 265                 270


Ala Gln Ile Gly Asp Asn Tyr Ala Glu Leu Phe Leu Ser Ala Lys Lys
        275                 280                 285


Leu Tyr Asp Ser Ile Leu Leu Ser Gly Ile Leu Thr Val Thr Asp Val
    290                 295                 300


Ser Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Gln Arg Tyr Asn Glu
305                 310                 315                 320
```

```
His Gln Met Asp Leu Ala Gln Leu Lys Gln Phe Ile Arg Gln Lys Leu
                325                 330                 335

Ser Asp Lys Tyr Asn Glu Val Phe Ser Asp Val Ser Lys Asp Gly Tyr
            340                 345                 350

Ala Gly Tyr Ile Asp Gly Lys Thr Asn Gln Glu Ala Phe Tyr Lys Tyr
        355                 360                 365

Leu Lys Gly Leu Leu Asn Lys Ile Glu Gly Ser Gly Tyr Phe Leu Asp
    370                 375                 380

Lys Ile Glu Arg Glu Asp Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn
385                 390                 395                 400

Gly Ser Ile Pro His Gln Ile His Leu Gln Glu Met Arg Ala Ile Ile
                405                 410                 415

Arg Arg Gln Ala Glu Phe Tyr Pro Phe Leu Ala Asp Asn Gln Asp Arg
            420                 425                 430

Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu
        435                 440                 445

Ala Arg Gly Lys Ser Asp Phe Ala Trp Leu Ser Arg Lys Ser Ala Asp
    450                 455                 460

Lys Ile Thr Pro Trp Asn Phe Asp Glu Ile Val Asp Lys Glu Ser Ser
465                 470                 475                 480

Ala Glu Ala Phe Ile Asn Arg Met Thr Asn Tyr Asp Leu Tyr Leu Pro
                485                 490                 495

Asn Gln Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Thr
            500                 505                 510

Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Lys Thr Glu Gln Gly Lys
        515                 520                 525
```

```
Thr Ala Phe Phe Asp Ala Asn Met Lys Gln Glu Ile Phe Asp Gly Val
    530                 535                 540

Phe Lys Val Tyr Arg Lys Val Thr Lys Asp Lys Leu Met Asp Phe Leu
545                 550                 555                 560

Glu Lys Glu Phe Asp Glu Phe Arg Ile Val Asp Leu Thr Gly Leu Asp
                565                 570                 575

Lys Glu Asn Lys Ala Phe Asn Ala Ser Tyr Gly Thr Tyr His Asp Leu
            580                 585                 590

Arg Lys Ile Leu Asp Lys Asp Phe Leu Asp Asn Ser Lys Asn Glu Lys
        595                 600                 605

Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu
    610                 615                 620

Met Ile Arg Lys Arg Leu Glu Asn Tyr Ser Asp Leu Leu Thr Lys Glu
625                 630                 635                 640

Gln Val Lys Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg Leu
                645                 650                 655

Ser Ala Glu Leu Ile His Gly Ile Arg Asn Lys Glu Ser Arg Lys Thr
            660                 665                 670

Ile Leu Asp Tyr Leu Ile Asp Asp Gly Asn Ser Asn Arg Asn Phe Met
        675                 680                 685

Gln Leu Ile Asn Asp Asp Ala Leu Ser Phe Lys Glu Glu Ile Ala Lys
    690                 695                 700

Ala Gln Val Ile Gly Glu Thr Asp Asn Leu Asn Gln Val Val Ser Asp
705                 710                 715                 720

Ile Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys
                725                 730                 735
```

```
Ile Val Asp Glu Leu Val Lys Ile Met Gly His Gln Pro Glu Asn Ile
            740                 745                 750

Val Val Glu Met Ala Arg Glu Asn Gln Phe Thr Asn Gln Gly Arg Arg
        755                 760                 765

Asn Ser Gln Gln Arg Leu Lys Gly Leu Thr Asp Ser Ile Lys Glu Phe
    770                 775                 780

Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu His Ser Gln Leu Gln
785                 790                 795                 800

Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr
                805                 810                 815

Thr Gly Glu Glu Leu Asp Ile Asp Tyr Leu Ser Gln Tyr Asp Ile Asp
            820                 825                 830

His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asn Ser Ile Asp Asn Arg
        835                 840                 845

Val Leu Thr Ser Ser Lys Glu Asn Arg Gly Lys Ser Asp Asp Val Pro
    850                 855                 860

Ser Lys Asn Val Val Arg Lys Met Lys Ser Tyr Trp Ser Lys Leu Leu
865                 870                 875                 880

Ser Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp Asn Leu Thr Lys Ala
                885                 890                 895

Glu Arg Gly Gly Leu Thr Asp Asp Asp Lys Ala Gly Phe Ile Lys Arg
            900                 905                 910

Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Arg Ile Leu
        915                 920                 925

Asp Glu Arg Phe His Thr Glu Thr Asp Glu Asn Asn Lys Lys Ile Arg
    930                 935                 940
```

```
Gln Val Lys Ile Val Thr Leu Lys Ser Asn Leu Val Ser Asn Phe Arg
945                 950                 955                 960


Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr His His
                965                 970                 975


Ala His Asp Ala Tyr Leu Asn Ala Val Ile Gly Lys Ala Leu Leu Gly
            980                 985                 990


Val Tyr Pro Gln Leu Glu Pro Glu  Phe Val Tyr Gly Asp  Tyr Pro His
        995                 1000                1005


Phe His  Gly His Lys Glu Asn  Lys Ala Thr Ala Lys  Lys Phe Phe
    1010                1015                1020


Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Lys Asp Asp  Val Arg Thr
    1025                1030                1035


Asp Lys  Asn Gly Glu Ile Ile  Trp Lys Lys Asp Glu  His Ile Ser
    1040                1045                1050


Asn Ile  Lys Lys Val Leu Ser  Tyr Pro Gln Val Asn  Ile Val Lys
    1055                1060                1065


Lys Val  Glu Glu Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1070                1075                1080


Pro Lys  Gly Asn Ser Asp Lys  Leu Ile Pro Arg Lys  Thr Lys Lys
    1085                1090                1095


Phe Tyr  Trp Asp Thr Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Ile
    1100                1105                1110


Val Ala  Tyr Ser Ile Leu Val  Ile Ala Asp Ile Glu  Lys Gly Lys
    1115                1120                1125


Ser Lys  Lys Leu Lys Thr Val  Lys Ala Leu Val Gly  Val Thr Ile
    1130                1135                1140
```

```
Met Glu  Lys Met Thr Phe Glu  Arg Asp Pro Val Ala  Phe Leu Glu
    1145                1150                1155

Arg Lys  Gly Tyr Arg Asn Val  Gln Glu Glu Asn Ile  Ile Lys Leu
    1160                1165                1170

Pro Lys  Tyr Ser Leu Phe Lys  Leu Glu Asn Gly Arg  Lys Arg Leu
    1175                1180                1185

Leu Ala  Ser Ala Arg Glu Leu  Gln Lys Gly Asn Glu  Ile Val Leu
    1190                1195                1200

Pro Asn  His Leu Gly Thr Leu  Leu Tyr His Ala Lys  Asn Ile His
    1205                1210                1215

Lys Val  Asp Glu Pro Lys His  Leu Asp Tyr Val Asp  Lys His Lys
    1220                1225                1230

Asp Glu  Phe Lys Glu Leu Leu  Asp Val Val Ser Asn  Phe Ser Lys
    1235                1240                1245

Lys Tyr  Thr Leu Ala Glu Gly  Asn Leu Glu Lys Ile  Lys Glu Leu
    1250                1255                1260

Tyr Ala  Gln Asn Asn Gly Glu  Asp Leu Lys Glu Leu  Ala Ser Ser
    1265                1270                1275

Phe Ile  Asn Leu Leu Thr Phe  Thr Ala Ile Gly Ala  Pro Ala Thr
    1280                1285                1290

Phe Lys  Phe Phe Asp Lys Asn  Ile Asp Arg Lys Arg  Tyr Thr Ser
    1295                1300                1305

Thr Thr  Glu Ile Leu Asn Ala  Thr Leu Ile His Gln  Ser Ile Thr
    1310                1315                1320

Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser Lys Leu  Gly Gly Asp
    1325                1330                1335
```

<210> 185
<211> 1362
<212> PRT
<213> Streptococcus oralis

<400> 185

```
Glu Asn Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Arg Phe Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Ala Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Ser Ser
                85                  90                  95


Phe Phe His Arg Leu Asp Asp Ser Phe Leu Ile Pro Glu Asp Lys Lys
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Ile Glu Glu Lys Glu Tyr
        115                 120                 125


His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
    130                 135                 140


Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Asp Thr Phe Asp Ile
                165                 170                 175
```

```
Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile Tyr
            180                 185                 190

Asn Asn Thr Phe Glu Gly Asn Ser Leu Ser Gly Gln Asn Val Gln Val
        195                 200                 205

Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Arg Asp Thr Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala Asp
        275                 280                 285

Leu Phe Val Ala Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Thr Leu Lys
                325                 330                 335

Gln Phe Ile Lys Thr Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe Ser
            340                 345                 350

Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr
        355                 360                 365

Gln Glu Ser Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe Glu
    370                 375                 380
```

```
Gly Ala Asp Tyr Phe Leu Glu Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400


Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415


Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430


Leu Lys Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445


Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp
    450                 455                 460


Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu Glu
465                 470                 475                 480


Ile Val Asp Lys Ala Ser Ser Ala Glu Ser Phe Ile Asn Lys Met Thr
                485                 490                 495


Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510


Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525


Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Arg Gln
    530                 535                 540


Lys Lys Asp Ile Phe Tyr Thr Leu Phe Lys Ala Glu Asp Lys Arg Lys
545                 550                 555                 560


Val Thr Glu Lys Asp Ile Ile Gln Tyr Leu His Thr Val Asp Gly Tyr
                565                 570                 575


Asp Gly Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu
            580                 585                 590
```

```
Ser Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met
        595                 600                 605


Asp Asp Pro Asn Asn Glu Glu Ile Leu Glu Asn Ile Val His Thr Leu
    610                 615                 620


Thr Ile Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr
625                 630                 635                 640


Asp Ser Leu Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His
                645                 650                 655


Tyr Thr Gly Trp Gly Lys Leu Ser Ser Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670


Asp Lys Gln Thr Gly Lys Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly
        675                 680                 685


Tyr Asn Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Glu Leu Ser
    690                 695                 700


Phe Lys Glu Ile Ile Lys Lys Ala Gln Val Val Gly Lys Thr Asp Asp
705                 710                 715                 720


Val Lys Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735


Gly Ile Leu Gln Ser Ile Lys Leu Val Asp Glu Leu Val Lys Val Met
            740                 745                 750


Gly His Glu Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765


Thr Thr Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile
    770                 775                 780


Glu Asp Ser Leu Lys Ile Leu Ala Ser Lys Ile Leu Lys Glu His Pro
785                 790                 795                 800
```

```
Thr Asp Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Lys Pro Leu Asp Ile Asn Gln
            820                 825                 830

Leu Ser Ser Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser Leu Lys Asp Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Leu Glu Val Val Glu Lys Met Lys
865                 870                 875                 880

Thr Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Tyr Arg Lys
                885                 890                 895

Phe Asn Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp Glu Arg Asp
            900                 905                 910

Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ala Arg Tyr Asn Thr Glu Val Asn
    930                 935                 940

Glu Lys Asp Lys Lys Asn Arg Thr Val Lys Ile Ile Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Arg Leu Tyr Lys Ile Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Ala Lys Ala Ile Leu Lys Lys  Tyr Pro Lys Leu Glu  Pro Glu Phe
        995                 1000                1005
```

```
Val Tyr  Gly Asp Tyr Gln Lys  Tyr Asp Leu Ser Lys  Asp Pro Lys
    1010                1015                1020

Glu Ile  Glu Lys Ala Thr Glu  Lys Tyr Phe Phe Tyr  Ser Asn Leu
    1025                1030                1035

Leu Asn  Phe Phe Lys Glu Glu  Val His Tyr Ala Asp  Gly Thr Ile
    1040                1045                1050

Val Lys  Arg Glu Asn Ile Glu  Tyr Ser Lys Asp Thr  Gly Glu Ile
    1055                1060                1065

Ala Trp  Asn Lys Glu Lys Asp  Phe Ala Thr Ile Lys  Lys Val Leu
    1070                1075                1080

Ser Leu  Pro Gln Val Asn Ile  Val Lys Lys Arg Glu  Val Gln Thr
    1085                1090                1095

Gly Gly  Phe Ser Lys Glu Ser  Ile Leu Pro Lys Gly  Asn Ser Asp
    1100                1105                1110

Lys Leu  Ile Pro Arg Lys Thr  Lys Asp Ile Leu Trp  Asp Thr Thr
    1115                1120                1125

Lys Tyr  Gly Gly Phe Asp Ser  Pro Val Ile Ala Tyr  Ser Ile Leu
    1130                1135                1140

Leu Ile  Ala Asp Ile Glu Lys  Gly Lys Ala Lys Arg  Leu Lys Thr
    1145                1150                1155

Val Lys  Thr Leu Val Gly Ile  Thr Ile Met Glu Lys  Ala Thr Phe
    1160                1165                1170

Glu Lys  Ser Pro Ile Ala Phe  Leu Glu Asn Lys Gly  Tyr His Asn
    1175                1180                1185

Val Arg  Lys Glu Asn Ile Leu  Cys Leu Pro Lys Tyr  Ser Leu Phe
    1190                1195                1200
```

```
Glu Leu  Lys Asn Gly Arg Arg  Arg Met Leu Ala Ser  Ala Lys Glu
    1205                 1210                 1215


Leu Gln  Lys Gly Asn Glu Ile  Val Leu Pro Val His  Leu Thr Thr
    1220                 1225                 1230


Leu Leu  Tyr His Ala Lys Asn  Ile His Arg Leu Asp  Glu Pro Glu
    1235                 1240                 1245


His Leu  Glu Tyr Ile Gln Lys  His Arg Asn Glu Phe  Lys Gly Leu
    1250                 1255                 1260


Leu Asn  Leu Val Ser Glu Phe  Ser Gln Lys Tyr Val  Leu Ala Asp
    1265                 1270                 1275


Ala Asn  Leu Glu Lys Ile Lys  Asn Leu Tyr Ala Asp  Asn Glu Gln
    1280                 1285                 1290


Ala Asp  Ile Glu Ile Leu Ala  Asn Ser Phe Ile Asn  Leu Leu Thr
    1295                 1300                 1305


Phe Thr  Ala Leu Gly Ala Pro  Ala Ala Phe Lys Phe  Phe Gly Lys
    1310                 1315                 1320


Asp Val  Asp Arg Lys Arg Tyr  Thr Thr Val Ser Glu  Ile Leu Asn
    1325                 1330                 1335


Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg
    1340                 1345                 1350


Ile Asp  Leu Ser Lys Leu Gly  Glu Asp
    1355                 1360


<210>  186
<211>  1360
<212>  PRT
<213>  Streptococcus oralis

<400>  186

Glu Asn Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
```

```
1               5                   10                  15

Gly Trp Ser Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys Arg Phe Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Ala Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Ser Ser
                85                  90                  95

Phe Phe His Arg Leu Asp Asp Ser Phe Leu Ile Pro Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Ala Glu Glu Lys Glu Tyr
        115                 120                 125

His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
    130                 135                 140

Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Asp Thr Phe Asp Ile
                165                 170                 175

Lys Asn Asn Asp Ile Gln Lys Ile Phe Ser Glu Phe Ile Ser Ile Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln Val
        195                 200                 205

Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu Arg
```

210 215 220

Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu
225 230 235 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
245 250 255

Asp Leu Gly Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp
260 265 270

Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala Asp
275 280 285

Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
290 295 300

Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser
305 310 315 320

Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Val Leu Lys
325 330 335

Gln Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe Ser
340 345 350

Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr
355 360 365

Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe Glu
370 375 380

Gly Thr Asp Tyr Phe Leu Glu Lys Ile Glu Arg Glu Asp Phe Leu Arg
385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe

420 425 430

Leu Lys Asp Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp
450 455 460

Leu Thr Arg Asn Ser Asp Glu Ala Ile Arg Pro Trp Asn Phe Glu Glu
465 470 475 480

Ile Val Asp Lys Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met Thr
485 490 495

Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
500 505 510

Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
515 520 525

Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln
530 535 540

Lys Lys Gln Ile Val Thr Gln Leu Phe Lys Glu Lys Arg Lys Val Thr
545 550 555 560

Glu Lys Asp Ile Ile Gln Phe Leu His Asn Val Asp Gly Tyr Asp Gly
565 570 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser Thr
580 585 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp Asp
595 600 605

Ser Lys Asn Glu Glu Ile Leu Glu Asn Ile Val His Thr Leu Thr Ile
610 615 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp Ser

625 630 635 640

Leu Phe Asp Glu Lys Val Ile Lys Ala Leu Ile Arg Arg His Tyr Thr
645 650 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asp Gly Ile Cys Asp Lys
660 665 670

Gln Thr Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Lys Asn
675 680 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys
690 695 700

Glu Ile Thr Gln Lys Ala Gln Val Val Gly Lys Thr Asp Asp Val Lys
705 710 715 720

Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile
725 730 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His
740 745 750

Thr Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
755 760 765

Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp
770 775 780

Ala Leu Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu His Pro Thr Asn
785 790 795 800

Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn
805 810 815

Gly Arg Asp Met Tyr Thr Gly Lys Pro Leu Asp Ile Asn Gln Leu Ser
820 825 830

Ser Tyr Asp Ile Asp His Ile Val Pro Gln Ala Phe Ile Lys Asp Asp

```
        835                 840                 845

Ser Leu Asp Asn Arg Val Leu Thr Ser Leu Lys Asp Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Ile Glu Val Val Gln Lys Arg Lys Ala Phe
865                 870                 875                 880

Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu Arg Lys Phe Asn
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp Glu Arg Asp Lys Val
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ala Arg Phe Asn Lys Glu Val Asn Glu Lys
    930                 935                 940

Asp Lys Lys Asn Arg Thr Val Lys Ile Ile Thr Leu Lys Ser Asn Leu
945                 950                 955                 960

Val Ser Asn Phe Arg Lys Glu Phe Arg Leu Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala
            980                 985                 990

Lys Ala Ile Leu Lys Lys Tyr Pro  Lys Leu Glu Pro Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Gln Lys Tyr Asp  Leu Ser Arg Asn Pro  Lys Glu Val
    1010                1015                1020

Glu Lys  Ala Thr Glu Lys Tyr  Phe Phe Tyr Ser Asn  Leu Leu Asn
    1025                1030                1035

Phe Phe  Lys Glu Glu Val His  Tyr Ala Asp Gly Thr  Ile Val Lys
```

1040 1045 1050

Arg Glu Asn Ile Glu Tyr Ser Lys Asp Thr Gly Glu Ile Ala Trp
1055 1060 1065

Asn Lys Glu Lys Asp Phe Ala Thr Ile Lys Lys Val Leu Ser Tyr
1070 1075 1080

Pro Gln Val Asn Ile Val Lys Lys Arg Glu Val Gln Thr Gly Gly
1085 1090 1095

Phe Ser Lys Glu Ser Ile Leu Pro Lys Gly Asn Ser Asp Lys Leu
1100 1105 1110

Ile Pro Arg Lys Thr Lys Asp Ile Leu Trp Glu Thr Thr Lys Tyr
1115 1120 1125

Gly Gly Phe Asp Ser Pro Val Ile Ala Tyr Ser Ile Leu Leu Ile
1130 1135 1140

Ala Asp Ile Glu Lys Gly Lys Ala Lys Lys Leu Lys Thr Val Lys
1145 1150 1155

Thr Leu Val Gly Ile Thr Ile Met Glu Lys Ala Ala Phe Glu Glu
1160 1165 1170

Asn Pro Ile Thr Phe Leu Glu Asn Lys Gly Tyr His Asn Val Arg
1175 1180 1185

Lys Glu Asn Ile Leu Cys Leu Pro Lys Tyr Ser Leu Phe Glu Leu
1190 1195 1200

Glu Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Lys Glu Leu Gln
1205 1210 1215

Lys Gly Asn Glu Ile Val Leu Pro Val Tyr Leu Thr Thr Leu Leu
1220 1225 1230

Tyr His Ser Lys Asn Val His Lys Leu Asp Glu Pro Glu His Leu

1235 1240 1245

Glu Tyr Ile Gln Lys His Arg Asn Glu Phe Lys Asp Leu Leu Asn
1250 1255 1260

Leu Val Ser Glu Phe Ser Gln Lys Tyr Val Leu Ala Asp Ala Asn
1265 1270 1275

Leu Glu Lys Ile Gln Asn Leu Tyr Ala Asp Asn Glu Gln Ala Asp
1280 1285 1290

Ile Glu Ile Leu Ala Asn Ser Phe Ile Asn Leu Leu Thr Phe Thr
1295 1300 1305

Ala Leu Gly Ala Pro Ala Ala Phe Lys Phe Phe Gly Lys Asp Ile
1310 1315 1320

Asp Arg Lys Arg Tyr Thr Thr Val Ser Glu Ile Leu Asn Ala Thr
1325 1330 1335

Leu Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp
1340 1345 1350

Leu Ser Lys Leu Gly Glu Asp
1355 1360

<210> 187
<211> 1358
<212> PRT
<213> Streptococcus parasanguinis

<400> 187

Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val Gly
1 5 10 15

Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met Lys
20 25 30

Val Leu Gly Asn Thr Asn Lys Glu Ser Ile Lys Lys Asn Leu Ile Gly
35 40 45

```
Ala Leu Leu Phe Asp Ala Gly Asn Thr Ala Ala Asp Arg Arg Leu Lys
    50                  55                  60

Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu Tyr
65                  70                  75                  80

Leu Gln Glu Ile Phe Ala Ala Glu Met Asn Lys Val Asp Glu Ser Phe
                85                  90                  95

Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys Arg Gly
            100                 105                 110

Ser Lys Tyr Pro Ile Phe Gly Thr Leu Glu Glu Glu Lys Glu Tyr His
        115                 120                 125

Lys Gln Phe Pro Thr Ile Tyr Tyr Leu Arg Lys Ile Leu Ala Asp Ser
    130                 135                 140

Lys Glu Lys Val Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Ile
145                 150                 155                 160

Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Asp Ser Phe Asp Ile Lys
                165                 170                 175

Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Thr Ile Leu Tyr Asp
            180                 185                 190

Asn Thr Phe Glu Glu Ser Ser Leu Ser Lys Gly Asn Ala Gln Val Glu
        195                 200                 205

Glu Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Asp Arg Val
    210                 215                 220

Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu Phe
225                 230                 235                 240

Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe Asp
                245                 250                 255
```

```
Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Glu Glu
            260                 265                 270

Asp Leu Glu Ser Leu Leu Gly Gln Ile Gly Asp Val Tyr Ala Asp Leu
        275                 280                 285

Phe Val Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ala Gly Ile
    290                 295                 300

Leu Ser Val Lys Asp Pro Gly Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Glu Arg Tyr Asp Asn His Gln Asn Asp Leu Ser Ala Leu Lys Gln
                325                 330                 335

Phe Val Arg Arg Asn Leu Pro Glu Lys Tyr Ala Glu Val Phe Ser Asp
            340                 345                 350

Asp Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr Gln
        355                 360                 365

Glu Gly Phe Tyr Lys Tyr Ile Lys Asn Leu Ile Ser Lys Ile Glu Gly
    370                 375                 380

Ala Glu Tyr Phe Leu Glu Lys Ile Glu Arg Glu Asp Phe Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gln
                405                 410                 415

Glu Met Asn Ala Ile Leu Arg His Gln Gly Glu Tyr Tyr Pro Phe Leu
            420                 425                 430

Lys Glu Asn Lys Asp Lys Ile Glu Gln Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Asp Phe Ala Trp Leu
    450                 455                 460
```

```
Ser Arg Asn Ser Asp Glu Ala Ile Arg Pro Trp Asn Phe Glu Glu Met
465                 470                 475                 480

Val Asp Lys Ser Ser Ser Ala Glu Asp Phe Ile His Arg Met Thr Asn
                485                 490                 495

Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Ile Ala Glu Gly Met Lys Asp Tyr Gln Phe Leu Asp Ser Gly Gln Lys
    530                 535                 540

Lys Gln Ile Val Asn Gln Leu Phe Lys Glu Lys Arg Lys Val Thr Glu
545                 550                 555                 560

Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly Tyr Asp Gly Ile
                565                 570                 575

Glu Leu Lys Gly Ile Glu Lys His Phe Asn Ser Ser Leu Ser Thr Tyr
            580                 585                 590

His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp Asp Pro
        595                 600                 605

Lys Asn Glu Glu Ile Phe Glu Asn Ile Val His Thr Leu Thr Ile Phe
    610                 615                 620

Glu Asp Arg Val Met Ile Lys Gln Arg Leu Asn Gln Tyr Asp Ser Ile
625                 630                 635                 640

Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Lys Lys
            660                 665                 670
```

```
Thr Ser Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Tyr Ser Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys Glu
    690                 695                 700

Thr Ile Gln Lys Ala Gln Val Val Gly Glu Thr Asn Asp Val Lys Gln
705                 710                 715                 720

Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His Ala
            740                 745                 750

Pro Glu Ser Val Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Asn
        755                 760                 765

Lys Gly Lys Ser Lys Ser Gln Gln Arg Leu Lys Thr Leu Ser Asp Ala
    770                 775                 780

Ile Ser Glu Leu Gly Asn Ile Leu Lys Glu His Pro Thr Asp Asn Ile
785                 790                 795                 800

Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asn Gln Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser Leu
        835                 840                 845

Asp Asn Arg Val Leu Thr Ser Ser Lys Asp Asn Arg Gly Lys Ser Asp
    850                 855                 860

Asn Val Pro Ser Leu Glu Ile Val Glu Lys Met Lys Gly Phe Trp Gln
865                 870                 875                 880
```

```
Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu Arg Lys Phe Asn Asn Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Asp Glu Arg Asp Lys Val Gly Phe
            900                 905                 910

Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala
        915                 920                 925

Gln Ile Leu Asp Asp Arg Phe Asn Ala Glu Val Asn Glu Lys Asn Gln
    930                 935                 940

Lys Leu Arg Ser Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val Ser
945                 950                 955                 960

Asn Phe Arg Lys Glu Phe Gly Leu Tyr Lys Val Arg Glu Ile Asn Asp
                965                 970                 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala Lys Ala
            980                 985                 990

Ile Leu Lys Lys Tyr Pro Lys Leu  Glu Pro Glu Phe Val  Tyr Gly Asp
        995                 1000                1005

Tyr Gln  Lys Tyr Asp Leu Thr  Lys Asp Pro Lys Glu  Ile Glu Lys
    1010                1015                1020

Ala Thr  Glu Lys Tyr Phe Phe  Tyr Ser Asn Leu Leu  Asn Phe Phe
    1025                1030                1035

Lys Asp  Lys Val Tyr Tyr Ala  Asp Gly Thr Ile Ile  Gln Arg Gly
    1040                1045                1050

Asn Val  Glu Tyr Ser Lys Asp  Thr Gly Glu Ile Ala  Trp Asn Lys
    1055                1060                1065

Lys Arg  Asp Phe Ala Ile Val  Arg Lys Val Leu Ser  Tyr Pro Gln
    1070                1075                1080
```

```
Val Asn  Ile Val Lys Lys Thr  Glu Glu Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Gly Asn Ser Asp Lys  Leu Ile Pro
    1100                1105                1110

Arg Lys  Thr Lys Asn Val Gln  Leu Asp Thr Thr Lys  Tyr Gly Gly
    1115                1120                1125

Phe Asp  Ser Pro Val Ile Ala  Tyr Ser Ile Leu Leu  Val Ala Asp
    1130                1135                1140

Val Glu  Lys Gly Lys Ser Lys  Lys Leu Lys Thr Val  Lys Ser Leu
    1145                1150                1155

Ile Gly  Ile Thr Ile Met Glu  Lys Val Lys Phe Glu  Ala Asn Pro
    1160                1165                1170

Val Ala  Phe Leu Glu Gly Lys  Gly Tyr Gln Asn Val  Val Glu Glu
    1175                1180                1185

Asn Ile  Ile Arg Leu Pro Lys  Tyr Ser Leu Phe Glu  Leu Glu Asn
    1190                1195                1200

Gly Arg  Arg Arg Met Leu Ala  Ser Ala Lys Glu Leu  Gln Lys Gly
    1205                1210                1215

Asn Glu  Met Val Leu Pro Ser  Tyr Leu Ile Ala Leu  Leu Tyr His
    1220                1225                1230

Ala Lys  Arg Ile Gln Lys Lys  Asp Glu Pro Glu His  Leu Glu Tyr
    1235                1240                1245

Ile Lys  Gln His His Ser Glu  Phe Asn Asp Leu Leu  Asn Phe Val
    1250                1255                1260

Ser Glu  Phe Ser Gln Lys Tyr  Val Leu Ala Glu Ser  Asn Leu Glu
    1265                1270                1275
```

```
Lys Ile  Lys Asn Leu Tyr Ile  Asp Asn Glu Gln Thr  Asn Met Glu
    1280                1285                1290


Glu Ile  Ala Asn Ser Phe Ile  Asn Leu Leu Thr Phe  Thr Ala Phe
    1295                1300                1305


Gly Ala  Pro Ala Val Phe Lys  Phe Phe Gly Lys Asp  Ile Glu Arg
    1310                1315                1320


Lys Arg  Tyr Ser Thr Val Thr  Glu Ile Leu Lys Ala  Thr Leu Ile
    1325                1330                1335


His Gln  Ser Leu Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser
    1340                1345                1350


Lys Leu  Gly Glu Glu
    1355
```

<210> 188
<211> 1327
<212> PRT
<213> Streptococcus parauberis

<400> 188

```
Met Lys Val Leu Gly Asn Thr Asp Arg Gln Thr Val Lys Lys Asn Met
1               5                   10                  15


Ile Gly Thr Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Arg Arg
            20                  25                  30


Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Ile Asn Arg Ile
        35                  40                  45


Lys Tyr Leu Gln Ser Ile Phe Asp Asp Glu Met Ser Lys Ile Asp Ser
    50                  55                  60


Ala Phe Phe Gln Arg Ile Lys Asp Ser Phe Leu Val Pro Asp Asp Lys
65                  70                  75                  80
```

```
Asn Asp Asp Arg His Pro Ile Phe Gly Asn Ile Lys Asp Glu Val Asp
                85                  90                  95

Tyr His Lys Asn Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala
            100                 105                 110

Asp Ser Asp Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala
        115                 120                 125

His Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asp
    130                 135                 140

Ser Gln Asn Thr Asp Val Asn Ala Leu Phe Leu Lys Leu Val Asp Thr
145                 150                 155                 160

Tyr Asn Leu Met Phe Glu Asp Asp Ile Asp Thr Gln Thr Ile Asp Ala
                165                 170                 175

Thr Val Ile Leu Thr Glu Lys Met Ser Lys Ser Arg Arg Leu Glu Asn
            180                 185                 190

Leu Ile Ala Lys Ile Pro Asn Gln Lys Lys Asn Thr Leu Phe Gly Asn
        195                 200                 205

Leu Ile Ser Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ala Asn Phe
    210                 215                 220

Glu Leu Ser Glu Asp Ala Lys Leu Gln Ile Ser Lys Glu Ser Phe Glu
225                 230                 235                 240

Glu Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp
                245                 250                 255

Leu Phe Ile Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp
            260                 265                 270

Ile Leu Thr Val Lys Gly Val Asn Thr Lys Ala Pro Leu Ser Ala Ser
        275                 280                 285
```

```
Met Val Gln Arg Phe Asn Glu His Gln Asp Asp Leu Lys Leu Leu Lys
    290                 295                 300

Lys Leu Val Lys Val Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Asp
305                 310                 315                 320

Ile Lys Asp Lys Asn Gly Tyr Ala Gly Tyr Ile Asn Gly Lys Thr Ser
                325                 330                 335

Gln Glu Asp Phe Tyr Lys Tyr Ile Lys Pro Ile Leu Ser Lys Leu Lys
            340                 345                 350

Gly Ala Glu Ser Leu Ile Ser Lys Leu Glu Arg Glu Asp Phe Leu Arg
        355                 360                 365

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
    370                 375                 380

Asn Glu Leu Lys Ser Ile Ile Arg Arg Gln Glu Lys Tyr Tyr Pro Phe
385                 390                 395                 400

Leu Lys Asp Lys Gln Val Arg Ile Glu Lys Ile Phe Thr Phe Arg Ile
                405                 410                 415

Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly Asn Ser Ser Phe Ala Trp
            420                 425                 430

Val Lys Arg Arg Ser Asn Glu Ser Ile Thr Pro Trp Asn Phe Glu Glu
        435                 440                 445

Val Val Glu Gln Glu Ala Ser Ala Lys Val Phe Ile Glu Arg Met Thr
    450                 455                 460

Asn Phe Asp Thr Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
465                 470                 475                 480

Leu Leu Tyr Glu Met Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
                485                 490                 495
```

```
Tyr Gln Ala Glu Gly Met Arg Lys Pro Glu Phe Leu Ser Ser Glu Glu
            500                 505                 510

Lys Ile Glu Ile Val Ser Asn Leu Phe Lys Thr Glu Arg Lys Val Thr
        515                 520                 525

Val Lys Gln Leu Lys Glu Asn Tyr Phe Asn Lys Ile Arg Cys Leu Asp
    530                 535                 540

Ser Ile Thr Ile Ser Gly Val Glu Asp Lys Phe Asn Ala Ser Leu Gly
545                 550                 555                 560

Thr Tyr His Asp Leu Leu Asn Ile Ile Lys Asn Gln Lys Ile Leu Asp
                565                 570                 575

Asp Glu Gln Asn Gln Asp Ser Leu Glu Asp Ile Val Leu Thr Leu Thr
            580                 585                 590

Leu Phe Glu Asp Glu Lys Met Ile Ala Lys Arg Leu Ser Lys Tyr Glu
        595                 600                 605

Ser Ile Phe Asp Pro Ser Ile Leu Lys Lys Leu Lys Lys Arg His Tyr
    610                 615                 620

Thr Gly Trp Gly Arg Leu Ser Gln Lys Leu Ile Asn Gly Ile Arg Asp
625                 630                 635                 640

Lys Gln Thr Gly Lys Thr Ile Leu Asp Phe Leu Ile Asp Gly Gln Ala
                645                 650                 655

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Pro Ser Leu Asp Phe Ala
            660                 665                 670

Ser Ile Ile Lys Glu Ala Gln Glu Lys Thr Ile Lys Ser Glu Lys Leu
        675                 680                 685

Glu Glu Thr Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly
    690                 695                 700
```

```
Ile Leu Gln Ser Val Lys Ile Val Asp Glu Val Val Lys Val Met Gly
705                 710                 715                 720


Tyr Glu Pro Ser Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Ser
                725                 730                 735


Thr Gln Arg Gly Ile Asn Asn Ser Arg Glu Arg Leu Arg Lys Leu Glu
            740                 745                 750


Glu Val His Lys Asn Ile Gly Ser Lys Ile Leu Lys Glu His Glu Ile
        755                 760                 765


Ser Asn Ala Gln Leu Gln Ser Asp Arg Val Tyr Leu Tyr Leu Leu Gln
    770                 775                 780


Asp Gly Lys Asp Met Tyr Thr Gly Lys Asp Leu Asp Phe Asp Arg Leu
785                 790                 795                 800


Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Lys Asp
                805                 810                 815


Asn Ser Ile Asp Asn Ile Val Leu Thr Ser Gln Glu Ser Asn Arg Gly
            820                 825                 830


Lys Ser Asp Asn Val Pro Tyr Ile Ala Ile Val Asn Lys Met Lys Ser
        835                 840                 845


Tyr Trp Gln His Gln Leu Lys Ser Gly Ala Ile Ser Gln Arg Lys Phe
    850                 855                 860


Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Tyr Asp Lys
865                 870                 875                 880


Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
                885                 890                 895


His Val Ala Gln Ile Leu Asn Asn Arg Phe Asn Asn Asn Val Asp Asp
            900                 905                 910
```

```
Ser Ser Lys Asn Lys Arg Pro Val Lys Ile Ile Thr Leu Lys Ser Lys
        915                 920                 925


Met Val Ser Asp Phe Arg Lys Glu Phe Gly Phe Tyr Lys Ile Arg Glu
    930                 935                 940


Val Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
945                 950                 955                 960


Gly Thr Ala Leu Leu Lys Lys Tyr Pro Lys Leu Glu Ala Glu Phe Val
                965                 970                 975


Tyr Gly Asp Tyr Lys His Tyr Asp Leu Ser Asp Thr Ser Leu Gly Lys
            980                 985                 990


Ala Thr Ala Lys Met Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
        995                 1000                1005


Lys Glu  Val Arg Leu Ala Asp  Gly Thr Val Ile Thr  Arg Pro Gln
    1010                1015                1020


Ile Glu  Thr Asn Thr Glu Thr  Gly Glu Ile Val Trp  Asp Lys Val
    1025                1030                1035


Lys Asp  Ile Lys Thr Ile Arg  Lys Val Leu Ser Ile  Pro Gln Ile
    1040                1045                1050


Asn Val  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1055                1060                1065


Glu Ser  Ile Leu Ser Lys Arg  Asp Ser Asp Lys Leu  Ile Pro Arg
    1070                1075                1080


Lys Asn  Asn Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Gly Ser Pro
    1085                1090                1095


Ile Ile  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Thr Lys Gly
    1100                1105                1110
```

```
Lys Ser  Gln Lys Thr Lys Ser  Val Lys Glu Leu Val  Gly Ile Thr
    1115                1120                1125

Ile Met  Glu Gln Asn Glu Phe  Glu Lys Asp Arg Ile  Thr Phe Leu
    1130                1135                1140

Glu Lys  Lys Gly Tyr Gln Asp  Ile Gln Glu Ser Leu  Ile Ile Lys
    1145                1150                1155

Leu Pro  Lys Phe Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1160                1165                1170

Leu Leu  Ala Ser Glu Leu Gln  Lys Gly Asn Glu Leu  Ser Leu Pro
    1175                1180                1185

Asn Lys  Tyr Ile Gln Phe Leu  Tyr Leu Ala Ser Arg  Tyr Thr Ser
    1190                1195                1200

Phe Ser  Gly Lys Glu Glu Asp  Arg Glu Lys His Arg  His Phe Val
    1205                1210                1215

Glu Ser  His Leu His Tyr Phe  Asp Glu Ile Lys Asp  Ile Ile Ala
    1220                1225                1230

Asp Phe  Ser Arg Arg Tyr Ile  Leu Ala Asp Ala Asn  Leu Glu Lys
    1235                1240                1245

Ile Leu  Thr Leu Tyr Asn Glu  Lys Asn Gln Phe Ser  Ile Glu Glu
    1250                1255                1260

Gln Ala  Thr Asn Met Leu Asn  Leu Phe Thr Phe Thr  Gly Leu Gly
    1265                1270                1275

Ala Pro  Ala Thr Leu Lys Phe  Phe Asn Val Asp Ile  Asp Arg Lys
    1280                1285                1290

Arg Tyr  Thr Ser Ser Thr Glu  Ile Leu Asn Ser Thr  Leu Ile Arg
    1295                1300                1305
```

```
Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Lys
    1310                1315                1320


Ile Gly  Gly Asp
    1325


<210>  189
<211>  1355
<212>  PRT
<213>  Streptococcus phocae

<400>  189

Lys Lys Ser Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val Gly
1               5                   10                  15


Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met Lys
            20                  25                  30


Val Leu Gly Asn Thr Ser Arg Gln Ser Ile Lys Lys Asn Met Ile Gly
        35                  40                  45


Ala Leu Leu Phe Asp Glu Gly Gly Pro Ala Ala Ser Thr Arg Val Lys
    50                  55                  60


Arg Thr Thr Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Cys Tyr
65                  70                  75                  80


Leu Arg Asp Ile Phe Glu Ser Glu Met His Thr Ile Asp Lys His Phe
                85                  90                  95


Phe Leu Arg Leu Glu Asp Ser Phe Leu His Lys Ser Asp Lys Arg Tyr
            100                 105                 110


Glu Ala His Pro Ile Phe Gly Thr Leu Gln Glu Glu Lys Ala Tyr His
        115                 120                 125


Asp Asn Tyr Pro Thr Ile Tyr His Leu Arg Lys Ala Leu Ala Asp Asn
    130                 135                 140
```

```
Thr Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Ile
145                 150                 155                 160


Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Ala Leu Ser Ala Asn
                165                 170                 175


Asn Thr Asp Val Gln Gln Leu Val His Ala Leu Val Asp Ala Tyr Asn
            180                 185                 190


Ile Met Phe Glu Glu Asp Leu Asp Ile Glu Ala Ile Asp Val Lys Ala
        195                 200                 205


Ile Leu Thr Glu Lys Ile Ser Lys Thr Arg Arg Leu Glu Asn Leu Ile
    210                 215                 220


Ser Asn Ile Pro Gly Gln Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile
225                 230                 235                 240


Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser His Phe Asn Leu
                245                 250                 255


Pro Glu Asp Ala Lys Leu Gln Leu Ala Lys Asp Thr Tyr Asp Glu Glu
            260                 265                 270


Leu Asn Asn Leu Leu Thr Gln Ile Gly Asp Glu Tyr Ala Asp Leu Phe
        275                 280                 285


Leu Ser Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu
    290                 295                 300


Thr Val Asn Gly Asp Gly Thr Gln Ala Pro Leu Ser Ala Ser Leu Ile
305                 310                 315                 320


Lys Arg Tyr Glu Glu His Arg Gln Asp Leu Ala Leu Leu Lys Gln Met
                325                 330                 335


Phe Lys Glu Gln Leu Pro Asp Leu Tyr Arg Asp Val Phe Thr Asp Glu
            340                 345                 350
```

```
Asn Lys Asp Gly Tyr Ala Gly Tyr Ile Ser Gly Lys Thr Ser Gln Glu
        355                 360                 365

Ala Phe Tyr Lys Tyr Ile Lys Pro Ile Leu Glu Thr Leu Asp Gly Ala
    370                 375                 380

Glu Asp Phe Leu Thr Lys Ile Asn Arg Glu Asp Phe Leu Arg Lys Gln
385                 390                 395                 400

Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu
                405                 410                 415

Leu Gln Ala Ile Leu Glu Arg Gln Gln Ala Tyr Tyr Pro Phe Leu Lys
            420                 425                 430

Asp Asn Gln Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr
        435                 440                 445

Tyr Ile Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Leu Thr
    450                 455                 460

Arg Thr Ser Asp Gln Lys Ile Thr Pro Trp Asn Phe Asp Glu Met Val
465                 470                 475                 480

Asp Gln Glu Ala Ser Ala Gln Ala Phe Ile Glu Arg Met Thr Asn Phe
                485                 490                 495

Asp Glu Tyr Leu Pro Gln Glu Lys Val Leu Pro Lys His Ser Leu Thr
            500                 505                 510

Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val
        515                 520                 525

Thr Glu Gly Met Thr Lys Pro Glu Phe Leu Ser Ala Gly Gln Lys Glu
    530                 535                 540

Gln Ile Val Glu Leu Leu Phe Lys Lys Tyr Arg Lys Val Thr Val Lys
545                 550                 555                 560
```

```
Gln Leu Lys Glu Asp Phe Phe Ser Lys Ile Glu Cys Phe Asp Thr Val
                565                 570                 575

Asp Ile Ser Gly Val Glu Asp Lys Phe Asn Ala Ser Leu Gly Thr Tyr
            580                 585                 590

His Asp Leu Leu Lys Ile Ile Lys Asp Lys Ala Phe Leu Asp Asn Ser
        595                 600                 605

Glu Asn Glu Asn Ile Ile Glu Asp Ile Ile Leu Thr Leu Thr Leu Phe
    610                 615                 620

Glu Asp Lys Glu Met Ile Ala Asn Arg Leu Ala Val Tyr Glu Asp Leu
625                 630                 635                 640

Phe Asp Gln Asn Val Leu Lys Gln Leu Lys Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Arg Leu Ser Lys Gln Leu Ile Asn Gly Met Arg Asp Lys His
            660                 665                 670

Thr Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ile Asn Arg
        675                 680                 685

Asn Phe Met Gln Leu Ile Asn Asp Asp Asn Leu Ser Phe Lys Glu Glu
    690                 695                 700

Ile Lys Lys Ala Gln Glu Gly Gly Leu Lys Asp Ser Ile Asn Asp Gln
705                 710                 715                 720

Ile Arg Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735

Thr Ile Asn Ile Val Asp Glu Ile Val Lys Ile Met Gly Lys Ala Pro
            740                 745                 750

Gln His Ile Val Val Glu Met Ala Arg Asp Val Gln Lys Thr Asp Ile
        755                 760                 765
```

```
Gly Val Lys Gln Ser Arg Glu Arg Met Lys Arg Val Gln Glu Val Leu
    770                 775                 780

Lys Lys Leu Gly Ser Gln Leu Leu Lys Glu His Pro Val Glu Asn Phe
785                 790                 795                 800

Gln Leu Gln Asn Glu Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Glu Glu Leu Ser Ile Ser Asn Leu Ser His Tyr
            820                 825                 830

Asp Ile Asp His Ile Ile Pro Arg Ser Phe Ile Lys Asp Asp Ser Ile
        835                 840                 845

Asp Asn Lys Val Leu Thr Arg Ser Glu His Asn Arg Gly Lys Thr Asp
    850                 855                 860

Asn Val Pro Ser Ile Glu Val Val Lys Arg Met Lys Pro Tyr Trp Gln
865                 870                 875                 880

Lys Leu Leu Asp Thr Lys Val Ile Ser Gln Arg Lys Phe Asp Asn Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Gln Glu Ser Asp Lys Ala Asn Phe
            900                 905                 910

Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala
        915                 920                 925

Gln Ile Leu Asp Ser Arg Phe Asn Thr Glu Arg Asp Glu Lys Asp Arg
    930                 935                 940

Pro Ile Arg Arg Val Lys Val Ile Thr Leu Lys Ser Lys Phe Val Ser
945                 950                 955                 960

Asp Phe Arg Gln Asp Phe Gly Phe Tyr Lys Leu Arg Glu Ile Asn Asp
                965                 970                 975
```

```
Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly Thr Ala
            980                 985                 990


Leu Leu Lys Met Tyr Pro Lys Leu  Ala Ser Glu Phe Val  Tyr Gly Asp
        995                 1000                1005


Tyr Gln  Lys Tyr Asp Leu Ser  Gly Lys Ala Ser Gly  His Ala Thr
    1010                1015                1020


Ala Lys  Tyr Phe Phe Tyr Ser  Asn Leu Met Asn Phe  Phe Lys Ser
    1025                1030                1035


Glu Val  Lys Leu Ala Asn Gly  Asn Ile Ile Lys Arg  Ser Pro Ile
    1040                1045                1050


Glu Val  Asn Glu Glu Thr Gly  Glu Ile Val Trp Asp  Lys Thr Lys
    1055                1060                1065


Asp Phe  Gly Thr Val Arg Lys  Val Leu Ser Ala Pro  Gln Val Asn
    1070                1075                1080


Ile Val  Lys Lys Thr Glu Ile  Gln Thr Gly Gly Phe  Ser Asn Glu
    1085                1090                1095


Thr Ile  Leu Ser Lys Gly Lys  Ser Ser Lys Leu Ile  Pro Arg Lys
    1100                1105                1110


Asn Lys  Trp Arg Asp Thr Thr  Lys Tyr Gly Gly Phe  Asn Thr Pro
    1115                1120                1125


Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1130                1135                1140


Lys Ala  Lys Lys Leu Lys Pro  Val Lys Glu Leu Val  Gly Ile Thr
    1145                1150                1155


Ile Met  Glu Arg Thr Lys Phe  Glu Ala Asn Pro Ile  Ala Phe Leu
    1160                1165                1170
```

```
Glu Ser  Lys Gly Tyr His Asp  Ile Gln Glu His Leu  Met Ile Thr
    1175                1180                1185

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Arg Arg
    1190                1195                1200

Leu Leu  Ala Ser Glu Leu Gln  Lys Gly Asn Glu Met  Val Leu Pro
    1205                1210                1215

Gln His  Leu Val Thr Phe Leu  Tyr Arg Val Ser Lys  Arg Asp Lys
    1220                1225                1230

Gly Thr  Gln Ser Glu Asn Met  Glu Tyr Ile Ser Asn  His Lys Glu
    1235                1240                1245

Lys Phe  Ile Glu Ile Phe His  Tyr Ile Ile Arg Tyr  Ala Glu Lys
    1250                1255                1260

Asn Val  Ile Lys Pro Lys Val  Ile Glu Arg Leu Asn  Asp Thr Phe
    1265                1270                1275

Asn Gln  Lys Phe Asn Asp Ser  Asp Leu Thr Glu Leu  Ser Ile Ser
    1280                1285                1290

Phe Leu  Asn Leu Phe Lys Phe  Thr Ser Phe Gly Ala  Pro Glu Lys
    1295                1300                1305

Phe Thr  Phe Leu Asn Ser Glu  Ile Lys Gln Asp Asp  Val Arg Tyr
    1310                1315                1320

Arg Ser  Thr Lys Glu Cys Leu  Asn Ser Thr Leu Ile  His Gln Ser
    1325                1330                1335

Val Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Phe Gly
    1340                1345                1350

Gly Asp
    1355
```

<210> 190
<211> 1361
<212> PRT
<213> Streptococcus pseudopneumoniae

<400> 190

Ser Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
20 25 30

Lys Val Leu Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Glu Glu Ile Ser Lys Val Asp Asn Ser
85 90 95

Phe Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys Arg
100 105 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Thr Glu Glu Lys Glu Tyr
115 120 125

Tyr Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
130 135 140

Ser Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Thr Leu Ala His
145 150 155 160

Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ser Phe Asp Ile
165 170 175

Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile Tyr

```
            180                 185                 190

Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln Val
        195                 200                 205

Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Thr Lys Arg Glu Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asp Gln Lys Ser Thr Gly Leu Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala Asp
        275                 280                 285

Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Ala Leu Lys
                325                 330                 335

Gln Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe Ser
            340                 345                 350

Asp Gln Ser Lys Glu Gly Tyr Ala Gly Tyr Ile Asp Ser Lys Thr Thr
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Ile Asp
    370                 375                 380

Gly Ala Asp Tyr Leu Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
```

385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
420 425 430

Leu Lys Glu Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp
450 455 460

Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu Glu
465 470 475 480

Ile Val Asp Lys Ala Ser Ser Ala Glu Ala Phe Ile Asn Lys Met Thr
485 490 495

Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
500 505 510

Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
515 520 525

Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln
530 535 540

Lys Lys Lys Ile Ile Asn Gln Leu Phe Lys Glu Lys Arg Lys Val Thr
545 550 555 560

Glu Lys Asp Leu Ile His Tyr Leu His Asn Val Asp Gly Tyr Asp Gly
565 570 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser Thr
580 585 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Arg Phe Met Asp Glu

595 600 605

Pro Lys Asn Gln Glu Ile Leu Glu Asn Ile Val His Thr Leu Thr Ile
610 615 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Ala Ser
625 630 635 640

Ile Phe Asp Glu Lys Val Ile Lys Thr Leu Thr Arg Arg His Tyr Thr
645 650 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Cys Ile Arg Asp Arg
660 665 670

Lys Thr Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Tyr Asn
675 680 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys
690 695 700

Glu Ile Ile Gln Glu Ser Gln Val Val Gly Lys Pro Asp Asp Val Lys
705 710 715 720

Gln Ile Val Gln Glu Leu Pro Gly Ser Ser Ala Ile Lys Lys Gly Ile
725 730 735

Leu Gln Ser Ile Lys Leu Val Asp Glu Leu Val Lys Val Met Gly His
740 745 750

Asp Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
755 760 765

Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp
770 775 780

Ser Leu Lys Ile Leu Ala Ser Asn Ile Leu Lys Glu His Pro Thr Asp
785 790 795 800

Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn

```
                805                 810                 815

Gly Lys Asp Met Tyr Thr Gly Asn Pro Leu Asp Ile Asn His Leu Ser
            820                 825                 830

Ser Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp
        835                 840                 845

Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys Asp Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Leu Glu Val Val Gln Lys Arg Lys Ala Phe
865                 870                 875                 880

Trp Gln Gln Leu Leu Glu Ser Lys Leu Ile Ser Glu Arg Lys Phe Asn
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asn Glu Arg Asp Lys Val
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Phe Asn Thr Lys Val Asn Glu Lys
    930                 935                 940

Asn Gln Lys Ile Arg Thr Val Lys Ile Ile Thr Leu Lys Ser Asn Leu
945                 950                 955                 960

Val Ser Asn Phe Arg Lys Glu Phe Arg Leu Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala
            980                 985                 990

Lys Ala Ile Leu Lys Lys Tyr Pro  Lys Leu Glu Pro Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Gln Lys Tyr Asp  Leu Ser Arg Asp Pro  Lys Glu Ile
```

1010 1015 1020

Glu Lys Ala Thr Glu Lys Tyr Phe Phe Tyr Ser Asn Leu Leu Asn
1025 1030 1035

Phe Phe Lys Glu Glu Val His Tyr Ala Asp Gly Thr Ile Val Lys
1040 1045 1050

Arg Glu Asn Ile Glu Tyr Ser Lys Asp Thr Gly Glu Ile Ala Trp
1055 1060 1065

Asn Lys Glu Ile Asp Phe Ala Thr Ile Arg Lys Ile Leu Ser Leu
1070 1075 1080

Ser Gln Val Asn Ile Val Lys Lys Thr Glu Glu Gln Thr Gly Gly
1085 1090 1095

Leu Phe Asp Asn Asn Ile Val Ser Lys Lys Lys Val Val Asp Ala
1100 1105 1110

Ser Lys Leu Ile Pro Ile Lys Ser Gly Leu Ser Pro Glu Lys Tyr
1115 1120 1125

Gly Gly Tyr Ala Arg Pro Thr Ile Ala Tyr Ser Val Leu Val Ile
1130 1135 1140

Ala Asp Ile Glu Lys Gly Lys Ala Lys Lys Leu Lys Arg Ile Lys
1145 1150 1155

Glu Met Val Gly Ile Thr Ile Gln Asp Lys Lys Lys Phe Glu Ala
1160 1165 1170

Asn Pro Thr Ala Tyr Leu Glu Glu Tyr Gly Tyr Lys Asn Ile Asn
1175 1180 1185

Pro Asn Leu Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Lys Phe
1190 1195 1200

Asn Asp Gly Gln Arg Arg Leu Leu Ala Ser Ser Ile Glu Leu Gln

```
    1205                1210                1215

Lys Gly  Asn Glu Leu Ile Leu  Pro Tyr His Phe Thr  Thr Leu Leu
    1220                1225                1230

Tyr His  Ala Gln Arg Ile Asn  Lys Ile Ser Glu Pro  Ile His Lys
    1235                1240                1245

Gln Tyr  Val Glu Thr His Gln  Ser Glu Phe Glu Glu  Leu Leu Thr
    1250                1255                1260

Thr Ile  Ile Ser Leu Ser Lys  Lys Tyr Ile Gln Lys  Pro Ile Val
    1265                1270                1275

Glu Ser  Leu Leu Gln Gln Ala  Phe Glu Gln Ala Asp  Lys Asp Ile
    1280                1285                1290

Tyr Gln  Leu Ser Glu Ser Phe  Ile Ser Leu Leu Lys  Leu Thr Ser
    1295                1300                1305

Phe Gly  Ala Pro Gly Ala Phe  Arg Phe Leu Gly Val  Glu Ile Ser
    1310                1315                1320

Gln Ser  Asn Val Arg Tyr Gln  Ser Val Ser Ser Cys  Phe Asn Ala
    1325                1330                1335

Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile
    1340                1345                1350

Asp Leu  Ser Lys Leu Gly Glu  Asp
    1355                1360


<210>  191
<211>  1361
<212>  PRT
<213>  Streptococcus pseudopneumoniae

<400>  191

Ser Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15
```

```
Gly Trp Val Ile Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Asn Lys Val Asp Ser Ser
                85                  90                  95

Phe Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Ala Glu Glu Lys Glu Tyr
        115                 120                 125

His Lys Asn Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
    130                 135                 140

Ser Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ala Phe Asp Ile
                165                 170                 175

Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Asn Ile Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Glu Gln Val
        195                 200                 205

Glu Ala Ile Phe Ser Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu Arg
    210                 215                 220
```

```
Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Gly Phe Ala Asp
        275                 280                 285

Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Glu Arg Tyr Gln Asn His Gln Asn Asp Leu Ala Ser Leu Lys
                325                 330                 335

Gln Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe Ser
            340                 345                 350

Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Val Asp Gly Lys Thr Thr
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Glu Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430
```

```
Leu Lys Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp
    450                 455                 460

Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Ile Val Asp Lys Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln
    530                 535                 540

Lys Lys Gln Ile Val Asn Gln Leu Phe Lys Glu Lys Arg Lys Val Thr
545                 550                 555                 560

Glu Lys Asp Ile Ile Gln Tyr Leu His Asn Val Asp Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp Asp
        595                 600                 605

Ser Lys Asn Glu Glu Ile Leu Glu Asn Ile Val His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp Ser
625                 630                 635                 640
```

```
Ile Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Thr Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Tyr Ser
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys
    690                 695                 700

Glu Ile Ile Gln Lys Ala Gln Val Phe Gly Lys Thr Asn Asp Val Lys
705                 710                 715                 720

Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Ile Lys Ile Val Glu Glu Leu Val Lys Val Met Gly His
            740                 745                 750

Glu Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Thr Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asn
    770                 775                 780

Ser Leu Lys Ile Leu Ala Ser Lys Ile Leu Lys Glu His Pro Thr Asp
785                 790                 795                 800

Asn Asn Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Lys Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asn Gln Leu Ser
            820                 825                 830

Ser Cys Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp
        835                 840                 845
```

```
Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys Glu Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Cys Leu Glu Val Val Asp Lys Met Lys Val Phe
865                 870                 875                 880

Trp Gln Gln Leu Leu Asp Phe Lys Leu Ile Ser Tyr Arg Lys Phe Asn
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp Glu Arg Asp Lys Val
            900                 905                 910

Gly Phe Ile Arg Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Phe Asn Thr Glu Val Thr Glu Lys
    930                 935                 940

Asp Lys Lys Asn Arg Asn Val Lys Ile Ile Thr Leu Lys Ser Asn Leu
945                 950                 955                 960

Val Ser Asn Phe Arg Lys Glu Phe Gly Leu Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala
            980                 985                 990

Lys Ala Ile Leu Lys Lys Tyr Pro  Lys Leu Glu Pro Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Gln Lys Tyr Asp  Leu Ser Lys Asp Pro  Lys Asp Ile
    1010                1015                1020

Glu Lys  Ala Thr Glu Lys Tyr  Phe Phe Tyr Ser Asn  Leu Leu Asn
    1025                1030                1035

Phe Phe  Lys Glu Glu Val His  Tyr Ala Asp Gly Thr  Ile Val Lys
    1040                1045                1050
```

```
Arg Glu  Asn Ile Glu Tyr Ser  Lys Asp Thr Gly Glu  Ile Ala Trp
    1055                1060                1065

Asn Lys  Glu Lys Asp Phe Ala  Thr Ile Lys Lys Ile  Leu Ser Leu
    1070                1075                1080

Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu Glu Gln  Thr Gly Gly
    1085                1090                1095

Leu Phe  Asp Asn Asn Ile Val  Ser Lys Lys Lys Val  Val Asp Ala
    1100                1105                1110

Ser Lys  Leu Ile Pro Ile Lys  Ser Gly Leu Ser Pro  Glu Lys Tyr
    1115                1120                1125

Gly Gly  Tyr Ala Arg Pro Thr  Ile Ala Tyr Ser Val  Leu Val Ile
    1130                1135                1140

Ala Asp  Ile Glu Lys Gly Lys  Thr Lys Lys Leu Lys  Arg Ile Lys
    1145                1150                1155

Glu Met  Ile Gly Ile Thr Val  Gln Asp Lys Lys Ile  Phe Glu Ser
    1160                1165                1170

Asn Pro  Ile Ala Tyr Leu Glu  Glu Cys Gly Tyr Lys  Asn Ile Asn
    1175                1180                1185

Pro Asn  Leu Ile Ile Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Phe
    1190                1195                1200

Asn Gly  Gly Gln Arg Arg Leu  Leu Ala Ser Ser Ile  Glu Leu Gln
    1205                1210                1215

Lys Gly  Asn Glu Leu Ile Leu  Pro Tyr His Phe Thr  Ala Leu Leu
    1220                1225                1230

Tyr His  Thr Gln Arg Ile Asn  Lys Ile Ser Glu Pro  Ile His Lys
    1235                1240                1245
```

```
Gln Tyr  Val Glu Ala His Gln  Asn Glu Phe Lys Glu  Leu Leu Thr
    1250                1255                1260


Thr Ile  Ile Ser Leu Ser Lys  Lys Tyr Ile Gln Lys  Pro Asn Val
    1265                1270                1275


Glu Ser  Leu Leu Gln Gln Ala  Phe Glu Gln Ala Asp  Lys Asp Ile
    1280                1285                1290


Tyr Gln  Leu Ser Glu Ser Phe  Ile Ser Leu Leu Lys  Leu Thr Ser
    1295                1300                1305


Phe Gly  Ala Pro Gly Ala Phe  Lys Phe Leu Gly Val  Glu Ile Ser
    1310                1315                1320


Gln Ser  Ser Val Arg Tyr Lys  Pro Asn Ser Gln Phe  Leu Asp Ala
    1325                1330                1335


Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Ile
    1340                1345                1350


Asp Leu  Ser Lys Leu Gly Glu  Asp
    1355                1360


<210>  192
<211>  1363
<212>  PRT
<213>  Streptococcus pseudopneumoniae

<400>  192

Ser Asn Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Thr Val Leu Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu Ile
        35                  40                  45
```

```
Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Gly Glu Met Ser Lys Val Asp Ser Ser
                85                  90                  95

Phe Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys Arg
            100                 105                 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Val Glu Glu Lys Glu Tyr
        115                 120                 125

His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
    130                 135                 140

Ser Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Val Leu Ala His
145                 150                 155                 160

Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ala Phe Asp Ile
                165                 170                 175

Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln Val
        195                 200                 205

Glu Thr Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255
```

```
Asp Leu Gly Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala Asp
        275                 280                 285

Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Thr Thr Leu Lys
                325                 330                 335

Gln Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe Ser
            340                 345                 350

Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe Glu
    370                 375                 380

Gly Thr Asp Tyr Phe Leu Glu Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp
    450                 455                 460
```

```
Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Ile Val Asp Lys Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln
    530                 535                 540

Lys Lys Gln Ile Val Asn Gln Leu Phe Lys Glu Lys Arg Lys Val Thr
545                 550                 555                 560

Glu Lys Asp Ile Ile His Tyr Leu His Thr Val Asp Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp Asp
        595                 600                 605

Ser Lys Asn Glu Ala Ile Leu Glu Asn Ile Val His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp Ser
625                 630                 635                 640

Leu Phe Asp Lys Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Cys Asp Lys
            660                 665                 670
```

```
Gln Thr Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Glu Ile
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys
    690                 695                 700

Lys Ile Ile Gln Lys Ser Gln Val Val Gly Glu Thr Asp Asp Val Lys
705                 710                 715                 720

Gln Val Val Arg Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Asp His
            740                 745                 750

Ala Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp
    770                 775                 780

Ser Leu Lys Ile Leu Ala Ser Asn Ile Leu Lys Glu Asn Pro Thr Asp
785                 790                 795                 800

Asn Asn Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Lys Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asn Gln Leu Ser
            820                 825                 830

Ser Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp
        835                 840                 845

Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys Asp Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Leu Glu Val Val Gln Lys Arg Lys Ala Phe
865                 870                 875                 880
```

```
Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu Arg Lys Phe Asn
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Glu Arg Asp Gly Leu Asn Glu Leu Asp
            900                 905                 910

Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Gln Ile Leu Asp Ala Arg Phe Asn Lys Glu Val Thr
    930                 935                 940

Glu Lys Asp Lys Lys Asn Arg Asn Val Lys Ile Ile Thr Leu Lys Ser
945                 950                 955                 960

Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Arg Leu Tyr Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990

Val Ala Lys Ala Ile Leu Lys Lys  Tyr Pro Lys Leu Glu  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Asp Tyr Gln Lys  Asn Asp Leu Ser Lys  Asp Pro Lys
    1010                1015                1020

Asp Ile  Glu Lys Ala Thr Glu  Lys Tyr Phe Phe Tyr  Ser Asn Leu
    1025                1030                1035

Leu Asn  Phe Phe Lys Glu Glu  Val His Tyr Ala Asp  Gly Thr Ile
    1040                1045                1050

Val Lys  Arg Glu Asn Ile Glu  Tyr Ser Lys Asp Thr  Gly Glu Ile
    1055                1060                1065

Ala Trp  Asn Lys Glu Lys Asp  Phe Ala Thr Ile Lys  Lys Val Leu
    1070                1075                1080
```

```
Ser Tyr  Pro Gln Val Asn Ile  Val Lys Lys Thr Glu  Glu Gln Thr
    1085                1090                1095

Gly Gly  Leu Phe Asp Asn Asn  Ile Val Ser Lys Glu  Lys Val Val
    1100                1105                1110

Asp Ala  Ser Lys Leu Ile Pro  Ile Lys Ser Gly Leu  Ser Pro Glu
    1115                1120                1125

Lys Tyr  Gly Gly Tyr Ala Arg  Pro Thr Ile Ala Tyr  Ser Val Leu
    1130                1135                1140

Val Ile  Ala Asp Ile Glu Lys  Gly Lys Thr Lys Lys  Leu Lys Arg
    1145                1150                1155

Ile Lys  Glu Met Val Gly Ile  Thr Ile Gln Asp Lys  Lys Lys Phe
    1160                1165                1170

Glu Ala  Asn Pro Ile Ala Tyr  Leu Glu Glu Cys Gly  Tyr Lys Asn
    1175                1180                1185

Ile Asn  Pro Asn Leu Ile Ile  Lys Leu Pro Lys Tyr  Ser Leu Phe
    1190                1195                1200

Glu Phe  Asn Gly Gly Gln Arg  Arg Leu Leu Ala Ser  Ser Ile Glu
    1205                1210                1215

Leu Gln  Lys Gly Asn Glu Leu  Ile Leu Pro Tyr His  Phe Thr Ala
    1220                1225                1230

Leu Leu  Tyr His Ala Gln Arg  Ile Asn Lys Phe Ser  Glu Pro Ile
    1235                1240                1245

His Lys  Gln Tyr Val Glu Ala  His Gln Asn Glu Phe  Lys Glu Leu
    1250                1255                1260

Leu Thr  Ile Ile Ile Ser Leu  Ser Lys Lys Tyr Ile  Gln Lys Pro
    1265                1270                1275
```

```
Asn Val  Glu Ser Leu Leu His  Gln Ala Phe Glu Gln  Ala Asp Asn
    1280                 1285                 1290


Asp Ile  Tyr Gln Leu Ser Glu  Ser Phe Ile Ser Leu  Leu Lys Leu
    1295                 1300                 1305


Thr Ser  Phe Gly Ala Pro Gly  Ala Phe Lys Phe Leu  Gly Ala Glu
    1310                 1315                 1320


Ile Ser  Gln Ser Ser Val Arg  Tyr Lys Pro Asn Ser  Gln Phe Leu
    1325                 1330                 1335


Asp Thr  Thr Leu Ile His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr
    1340                 1345                 1350


Arg Ile  Asp Leu Ser Lys Leu  Gly Glu Asp
    1355                 1360


<210>  193
<211>  1360
<212>  PRT
<213>  Streptococcus pseudoporcinus

<400>  193

Tyr Ser Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val Gly Trp
1               5                   10                  15


Ala Val Ile Asn Glu Asp Tyr Lys Val Pro Ala Lys Lys Met Thr Val
            20                  25                  30


Phe Gly Asn Thr Asp Arg Lys Thr Ile Lys Lys Asn Leu Leu Gly Thr
        35                  40                  45


Val Leu Phe Asp Ser Gly Glu Thr Ala Gln Ala Arg Arg Leu Lys Arg
    50                  55                  60


Thr Asn Arg Arg Arg Tyr Thr Arg Arg Arg Tyr Arg Leu Cys Gln Leu
65                  70                  75                  80
```

```
Gln Asn Ile Phe Ala Thr Glu Met Val Lys Val Asp Asp Thr Phe Phe
                85                  90                  95

Gln Arg Leu Ser Glu Ser Phe Phe Tyr Tyr Gln Asp Lys Ala Phe Asp
            100                 105                 110

Lys His Pro Ile Phe Gly Asn Ser Lys Glu Glu Arg Ala Tyr His Lys
        115                 120                 125

Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Asp Leu Ala Asp Arg Asp
    130                 135                 140

Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ser His Ile Ile
145                 150                 155                 160

Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Leu Asn Ser Glu Asn
                165                 170                 175

Thr Asp Val Gln Lys Leu Phe Ile Ala Leu Val Thr Val Tyr Asn Leu
            180                 185                 190

Leu Phe Glu Glu Glu Ile Ala Gly Glu Thr Cys Asp Ala Lys Ala Leu
        195                 200                 205

Leu Thr Ala Lys Thr Ser Lys Ser Lys Arg Leu Glu Ser Leu Ile Ser
    210                 215                 220

Glu Phe Pro Gly Gln Lys Lys Asn Gly Leu Phe Gly Asn Leu Leu Ala
225                 230                 235                 240

Leu Ala Leu Gly Leu Arg Pro Asn Phe Lys Ser Asn Phe Gly Leu Ser
                245                 250                 255

Glu Asp Ala Lys Leu Gln Ile Thr Lys Asp Thr Tyr Glu Glu Glu Leu
            260                 265                 270

Asp Asn Leu Leu Ala Glu Ile Gly Asp His Tyr Ala Asp Leu Phe Leu
        275                 280                 285
```

```
Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Thr
    290                 295                 300

Leu Ser Asp Glu Asn Thr Arg Ala Pro Leu Ser Ala Ser Met Ile Lys
305                 310                 315                 320

Arg Tyr Glu Glu His Gln Glu Asp Leu Ala Leu Leu Lys Lys Leu Val
                325                 330                 335

Lys Glu Gln Met Pro Glu Lys Tyr Trp Glu Ile Phe Ser Asn Ala Lys
            340                 345                 350

Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Val Ser Gln Glu Asp
        355                 360                 365

Phe Tyr Arg Tyr Ile Lys Pro Ile Leu Ser Arg Leu Lys Gly Gly Asp
    370                 375                 380

Glu Phe Leu Ala Lys Ile Asp Arg Asp Asp Phe Leu Arg Lys Gln Arg
385                 390                 395                 400

Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Lys Glu Leu
                405                 410                 415

His Ala Ile Leu Arg Arg Gln Glu Lys Tyr Tyr Pro Phe Leu Ala Glu
            420                 425                 430

Gln Lys Glu Lys Ile Glu Gln Leu Leu Cys Phe Arg Ile Pro Tyr Tyr
        435                 440                 445

Val Gly Pro Leu Ala Lys Gly Gly Asn Ser Ser Phe Ala Trp Leu Lys
    450                 455                 460

Arg Arg Ser Asp Glu Pro Ile Thr Pro Trp Asn Phe Lys Asp Val Val
465                 470                 475                 480

Asp Glu Glu Ala Ser Ala Gln Ala Phe Ile Glu Gly Met Thr Asn Tyr
                485                 490                 495
```

```
Asp Thr Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser Pro Leu
            500                 505                 510

Tyr Glu Met Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Ile
        515                 520                 525

Ala Glu Asn Met Thr Lys Pro Leu Tyr Leu Ser Ala Glu Gln Lys Glu
    530                 535                 540

Ala Ile Ile Asp His Leu Phe Lys Gln Thr Arg Lys Val Thr Val Lys
545                 550                 555                 560

Asp Leu Lys Glu Lys Tyr Phe Ser Gln Ile Glu Gly Leu Glu Asn Val
                565                 570                 575

Asp Val Thr Gly Val Glu Gly Ala Phe Asn Ala Ser Leu Gly Thr Tyr
            580                 585                 590

Asn Asp Leu Leu Lys Ile Ile Lys Asp Lys Ala Phe Leu Asp Asp Glu
        595                 600                 605

Ala Asn Ala Glu Ile Leu Glu Glu Ile Val Leu Ile Leu Thr Leu Phe
    610                 615                 620

Gln Asp Glu Lys Leu Ile Glu Lys Arg Leu Ala Lys Tyr Ala Asn Leu
625                 630                 635                 640

Phe Glu Lys Ser Val Leu Lys Lys Leu Arg Lys Arg His Tyr Arg Gly
                645                 650                 655

Trp Gly Arg Leu Ser Arg Gln Leu Ile Asp Gly Met Lys Asp Lys Ala
            660                 665                 670

Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Asp Phe Ala Asn Arg
        675                 680                 685

Asn Phe Ile Gln Leu Ile Asn Asp Ser Ser Leu Asp Phe Glu Lys Leu
    690                 695                 700
```

```
Ile Asp Asp Ala Gln Lys Lys Ala Ile Lys Arg Glu Ser Leu Thr Glu
705                 710                 715                 720


Ala Val Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735


Gln Ser Leu Lys Val Val Asp Glu Ile Val Lys Val Met Gly His Asn
            740                 745                 750


Pro Asp Asn Ile Val Ile Glu Met Ser Arg Glu Asn Gln Thr Thr Ala
        755                 760                 765


Gln Gly Leu Lys Asn Ala Arg Gln Arg Leu Lys Lys Ile Lys Glu Val
    770                 775                 780


His Lys Lys Thr Gly Ser Arg Ile Leu Glu Asp Asn Ser Glu Arg Ile
785                 790                 795                 800


Thr Asn Leu Thr Leu Gln Asp Asn Arg Leu Tyr Leu Tyr Leu Leu Gln
                805                 810                 815


Asp Gly Lys Asp Met Tyr Thr Gly Gln Asp Leu Asp Ile Asn Asn Leu
            820                 825                 830


Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Lys Asp
        835                 840                 845


Asn Ser Ile Asp Asn Leu Val Leu Thr Thr Gln Lys Ala Asn Arg Gly
    850                 855                 860


Lys Ser Asp Asn Val Pro Ser Ile Glu Val Val Arg Asp Met Lys Asp
865                 870                 875                 880


Arg Val Trp Arg Arg Gln Leu Ala Asn Gly Ala Ile Ser Arg Gln Lys
                885                 890                 895


Phe Asp His Leu Thr Lys Ala Glu Arg Gly Gly Leu Ala Asp Ser Asp
            900                 905                 910
```

```
Lys Ala Arg Phe Leu Arg Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925


Lys His Val Ala Gln Leu Leu Asp Ser Arg Phe Asn Ser Lys Ser Asn
    930                 935                 940


Gln Asn Lys Lys Leu Ala Arg Asn Val Lys Ile Ile Thr Leu Lys Ser
945                 950                 955                 960


Lys Ile Val Ser Asp Phe Arg Lys Asp Phe Gly Leu Tyr Lys Leu Arg
                965                 970                 975


Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Val Gly Thr Ala Leu Leu Lys Lys  Tyr Pro Lys Leu Glu  Ala Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Lys His  Phe Asp Leu Ser Asp  Pro Ser Leu
    1010                1015                1020


Gly Lys  Ala Thr Ala Lys Val  Phe Phe Tyr Ser Asn  Ile Met Asn
    1025                1030                1035


Phe Phe  Lys Glu Glu Leu Ser  Leu Ala Asp Gly Thr  Leu Met Lys
    1040                1045                1050


Arg Pro  Val Ile Glu Thr Asn  Thr Glu Thr Gly Glu  Val Val Trp
    1055                1060                1065


Asp Lys  Val Lys Asp Phe Lys  Thr Ile Arg Lys Val  Leu Ser Tyr
    1070                1075                1080


Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu Ile Gln  Ser Gly Ala
    1085                1090                1095


Phe Ser  Lys Glu Ser Val Leu  Ser Lys Gly Asn Ser  Asp Lys Leu
    1100                1105                1110
```

```
Ile Glu  Arg Lys Lys Gly Trp  Asp Pro Lys Lys Tyr  Gly Gly Phe
    1115                1120                1125

Asp Ser  Pro Asn Thr Ala Tyr  Ser Ile Phe Val Val  Ala Lys Val
    1130                1135                1140

Ala Lys  Arg Lys Ala Gln Lys  Leu Lys Thr Val Lys  Glu Ile Val
    1145                1150                1155

Gly Ile  Thr Ile Met Glu Gln  Ala Glu Tyr Glu Lys  Asp Asn Ile
    1160                1165                1170

Ala Phe  Leu Glu Lys Lys Gly  Tyr Gln Asp Ile Gln  Glu Lys Leu
    1175                1180                1185

Leu Ile  Lys Leu Pro Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly
    1190                1195                1200

Arg Arg  Arg Leu Leu Ala Ser  Glu Phe Gln Lys Gly  Asn Glu Leu
    1205                1210                1215

Ala Leu  Ser Gly Lys Tyr Met  Lys Phe Leu Tyr Leu  Ala Ser Arg
    1220                1225                1230

Tyr Asp  Lys Leu Ser Ser Lys  Ile Glu Ser Glu Gln  Gln Lys Lys
    1235                1240                1245

Leu Phe  Val Glu Gln His Leu  His Tyr Phe Asp Glu  Ile Leu Asp
    1250                1255                1260

Ile Val  Val Lys His Ala Thr  Cys Tyr Ile Lys Ala  Glu Asn Asn
    1265                1270                1275

Leu Lys  Lys Ile Ile Ser Leu  Tyr Lys Lys Lys Glu  Ala Tyr Ser
    1280                1285                1290

Ile Asn  Glu Gln Ala Leu Asn  Met Leu Asn Leu Phe  Ile Phe Thr
    1295                1300                1305
```

```
Ser Leu  Gly Ala Pro Ser Thr  Phe Val Phe Phe Asp  Glu Thr Ile
    1310                1315                1320


Asp Arg  Lys Arg Tyr Thr Thr  Ser Ser Asp Val Leu  Asn Gly Ile
    1325                1330                1335


Leu Ile  Gln Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1340                1345                1350


Leu Ser  Arg Phe Gly Gly Asp
    1355                1360
```

<210> 194
<211> 1316
<212> PRT
<213> Streptococcus pseudoporcinus

<400> 194

```
Met Leu Gly Thr Val Leu Phe Asp Ser Gly Glu Thr Ala Gln Ala Arg
1               5                   10                  15


Arg Leu Lys Arg Thr Asn Arg Arg Arg Tyr Thr Arg Arg Arg Tyr Arg
            20                  25                  30


Leu Cys Gln Leu Gln Asn Ile Phe Ala Thr Glu Met Val Lys Val Asp
        35                  40                  45


Asp Thr Phe Phe Gln Arg Leu Ser Glu Ser Phe Phe Tyr Tyr Gln Asp
    50                  55                  60


Lys Ala Phe Asp Lys His Pro Ile Phe Gly Asn Ser Lys Glu Glu Arg
65                  70                  75                  80


Ala Tyr His Lys Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Asp Leu
                85                  90                  95


Ala Asp Arg Asp Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu
            100                 105                 110


Ser His Ile Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Lys Leu
```

```
        115                 120                 125

Asn Ser Glu Asn Thr Asp Val Gln Lys Leu Phe Ile Ala Leu Val Thr
    130                 135                 140

Val Tyr Asn Leu Leu Phe Glu Glu Glu Ile Ala Gly Glu Thr Cys Asp
145                 150                 155                 160

Ala Lys Ala Leu Leu Thr Ala Lys Thr Ser Lys Ser Lys Arg Leu Glu
                165                 170                 175

Ser Leu Ile Ser Glu Phe Pro Gly Gln Lys Lys Asn Gly Leu Phe Gly
            180                 185                 190

Asn Leu Leu Ala Leu Ala Leu Gly Leu Arg Pro Asn Phe Lys Ser Asn
        195                 200                 205

Phe Gly Leu Ser Glu Asp Ala Lys Leu Gln Ile Thr Lys Asp Thr Tyr
    210                 215                 220

Glu Glu Glu Leu Asp Asn Leu Leu Ala Glu Ile Gly Asp His Tyr Ala
225                 230                 235                 240

Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser
                245                 250                 255

Asp Ile Leu Thr Leu Ser Asp Glu Asn Thr Arg Ala Pro Leu Ser Ala
            260                 265                 270

Ser Met Ile Lys Arg Tyr Glu Glu His Gln Glu Asp Leu Ala Leu Leu
        275                 280                 285

Lys Lys Leu Val Lys Glu Gln Met Pro Glu Lys Tyr Trp Glu Ile Phe
    290                 295                 300

Ser Asn Ala Lys Lys Asn Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Val
305                 310                 315                 320

Ser Gln Glu Asp Phe Tyr Arg Tyr Ile Lys Pro Ile Leu Ser Arg Leu
```

325 330 335

Lys Gly Gly Asp Glu Phe Leu Ala Lys Ile Asp Arg Asp Asp Phe Leu
340 345 350

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His
355 360 365

Leu Lys Glu Leu His Ala Ile Leu Arg Arg Gln Glu Lys Tyr Tyr Pro
370 375 380

Phe Leu Ala Glu Gln Lys Glu Lys Ile Glu Gln Leu Leu Cys Phe Arg
385 390 395 400

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Lys Gly Gly Asn Ser Ser Phe
405 410 415

Ala Trp Leu Lys Arg Arg Ser Asp Glu Pro Ile Thr Pro Trp Asn Phe
420 425 430

Lys Asp Val Val Asp Glu Glu Ala Ser Ala Gln Ala Phe Ile Glu Gly
435 440 445

Met Thr Asn Tyr Asp Thr Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys
450 455 460

His Ser Pro Leu Tyr Glu Met Phe Thr Val Tyr Asn Glu Leu Thr Lys
465 470 475 480

Val Lys Tyr Ile Ala Glu Asn Met Thr Lys Pro Leu Tyr Leu Ser Ala
485 490 495

Glu Gln Lys Glu Ala Ile Ile Asp His Leu Phe Lys Gln Thr Arg Lys
500 505 510

Val Thr Val Lys Asp Leu Lys Glu Lys Tyr Phe Ser Gln Ile Glu Gly
515 520 525

Leu Glu Asn Val Asp Val Thr Gly Val Glu Gly Ala Phe Asn Ala Ser

530 535 540

Leu Gly Thr Tyr Asn Asp Leu Leu Lys Ile Ile Lys Asp Lys Ala Phe
545 550 555 560

Leu Asp Asp Glu Ala Asn Ala Glu Ile Leu Glu Glu Ile Val Leu Ile
565 570 575

Leu Thr Leu Phe Gln Asp Glu Lys Leu Ile Glu Lys Arg Leu Ala Lys
580 585 590

Tyr Ala Asn Leu Phe Glu Lys Ser Val Leu Lys Lys Leu Arg Lys Arg
595 600 605

His Tyr Arg Gly Trp Gly Arg Leu Ser Arg Gln Leu Ile Asp Gly Met
610 615 620

Lys Asp Lys Ala Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Asp
625 630 635 640

Phe Ala Asn Arg Asn Phe Ile Gln Leu Ile Asn Asp Ser Ser Leu Asp
645 650 655

Phe Glu Lys Leu Ile Asp Asp Ala Gln Lys Lys Ala Ile Lys Arg Glu
660 665 670

Ser Leu Thr Glu Ala Val Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys
675 680 685

Lys Gly Ile Leu Gln Ser Leu Lys Val Val Asp Glu Ile Val Lys Val
690 695 700

Met Gly His Asn Pro Asp Asn Ile Val Ile Glu Met Ser Arg Glu Asn
705 710 715 720

Gln Thr Thr Ala Gln Gly Leu Lys Asn Ala Arg Gln Arg Leu Lys Lys
725 730 735

Ile Lys Glu Val His Lys Lys Thr Gly Ser Arg Ile Leu Glu Asp Asn

740 745 750

Ser Glu Arg Ile Thr Asn Leu Thr Leu Gln Asp Asn Arg Leu Tyr Leu
755 760 765

Tyr Leu Leu Gln Asp Gly Lys Asp Met Tyr Thr Gly Gln Asp Leu Asp
770 775 780

Ile Asn Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
785 790 795 800

Phe Ile Lys Asp Asn Ser Ile Asp Asn Leu Val Leu Thr Thr Gln Lys
805 810 815

Ala Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Ile Glu Val Val Arg
820 825 830

Asp Met Lys Asp Arg Val Trp Arg Arg Gln Leu Ala Asn Gly Ala Ile
835 840 845

Ser Arg Gln Lys Phe Asp His Leu Thr Lys Ala Glu Arg Gly Gly Leu
850 855 860

Ala Asp Ser Asp Lys Ala Arg Phe Leu Arg Arg Gln Leu Val Glu Thr
865 870 875 880

Arg Gln Ile Thr Lys His Val Ala Gln Leu Leu Asp Ser Arg Phe Asn
885 890 895

Ser Lys Ser Asn Gln Asn Lys Lys Leu Ala Arg Asn Val Lys Ile Ile
900 905 910

Thr Leu Lys Ser Lys Ile Val Ser Asp Phe Arg Lys Asp Phe Gly Leu
915 920 925

Tyr Lys Leu Arg Glu Val Asn Asn Tyr His His Ala His Asp Ala Tyr
930 935 940

Leu Asn Ala Val Val Gly Thr Ala Leu Leu Lys Lys Tyr Pro Lys Leu

945 950 955 960

Glu Ala Glu Phe Val Tyr Gly Asp Tyr Lys His Phe Asp Leu Ser Asp
965 970 975

Pro Ser Leu Gly Lys Ala Thr Ala Lys Val Phe Phe Tyr Ser Asn Ile
980 985 990

Met Asn Phe Phe Lys Glu Glu Leu Ser Leu Ala Asp Gly Thr Leu Met
995 1000 1005

Lys Arg Pro Val Ile Glu Thr Asn Thr Glu Thr Gly Glu Val Val
1010 1015 1020

Trp Asp Lys Val Lys Asp Phe Lys Thr Ile Arg Lys Val Leu Ser
1025 1030 1035

Tyr Pro Gln Val Asn Ile Val Lys Lys Thr Glu Ile Gln Ser Gly
1040 1045 1050

Ala Phe Ser Lys Glu Ser Val Leu Ser Lys Gly Asn Ser Asp Lys
1055 1060 1065

Leu Ile Glu Arg Lys Lys Gly Trp Asp Pro Lys Lys Tyr Gly Gly
1070 1075 1080

Phe Asp Ser Pro Asn Thr Ala Tyr Ser Ile Phe Val Val Ala Lys
1085 1090 1095

Val Ala Lys Arg Lys Ala Gln Lys Leu Lys Thr Val Lys Glu Ile
1100 1105 1110

Val Gly Ile Thr Ile Met Glu Gln Ala Glu Tyr Glu Lys Asp Asn
1115 1120 1125

Ile Ala Phe Leu Glu Lys Lys Gly Tyr Gln Asp Ile Gln Glu Lys
1130 1135 1140

Leu Leu Ile Lys Leu Pro Lys Tyr Ser Leu Phe Glu Leu Glu Asn

1145 1150 1155

Gly Arg Arg Arg Leu Leu Ala Ser Glu Phe Gln Lys Gly Asn Glu
1160 1165 1170

Leu Ala Leu Ser Gly Lys Tyr Met Lys Phe Leu Tyr Leu Ala Ser
1175 1180 1185

Arg Tyr Asp Lys Leu Ser Ser Lys Ile Glu Ser Glu Gln Gln Lys
1190 1195 1200

Lys Leu Phe Val Glu Gln His Leu His Tyr Phe Asp Glu Ile Leu
1205 1210 1215

Asp Ile Val Val Lys His Ala Thr Cys Tyr Ile Lys Ala Glu Asn
1220 1225 1230

Asn Leu Lys Lys Ile Ile Ser Leu Tyr Lys Lys Lys Glu Ala Tyr
1235 1240 1245

Ser Ile Asn Glu Gln Ala Leu Asn Met Leu Asn Leu Phe Ile Phe
1250 1255 1260

Thr Ser Leu Gly Ala Pro Ser Thr Phe Val Phe Phe Asp Glu Thr
1265 1270 1275

Ile Asp Arg Lys Arg Tyr Thr Thr Ser Ser Asp Val Leu Asn Gly
1280 1285 1290

Ile Leu Ile Gln Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile
1295 1300 1305

Asp Leu Ser Arg Phe Gly Gly Asp
1310 1315

<210> 195
<211> 1359
<212> PRT
<213> Streptococcus sanguinis

<400> 195

```
Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val Gly
1               5                  10                  15

Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met Arg
            20                  25                  30

Val Phe Gly Asp Thr Asp Arg Ser His Ile Lys Lys Asn Leu Leu Gly
        35                  40                  45

Thr Leu Leu Phe Asp Asp Gly Asn Thr Ala Glu Ser Arg Arg Leu Lys
    50                  55                  60

Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu Tyr
65                  70                  75                  80

Leu Gln Glu Ile Phe Thr Glu Ser Met Asn Glu Ile Asp Glu Ser Phe
                85                  90                  95

Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys Arg Gly
            100                 105                 110

Ser Lys Tyr Pro Ile Phe Ala Thr Leu Gln Glu Glu Lys Glu Tyr His
        115                 120                 125

Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp Ser
    130                 135                 140

Lys Glu Lys Ser Asp Val Arg Leu Ile Tyr Leu Ala Leu Ala His Met
145                 150                 155                 160

Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Thr Phe Asp Ile Lys
                165                 170                 175

Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Asn Ile Tyr Asp
            180                 185                 190

Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln Val Glu
        195                 200                 205
```

```
Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu Arg Val
    210                 215                 220

Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu Phe
225                 230                 235                 240

Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe Asp
                245                 250                 255

Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp Glu
            260                 265                 270

Glu Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala Asp Leu
        275                 280                 285

Phe Leu Ile Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly Ile
    290                 295                 300

Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Ala Leu Lys Gln
                325                 330                 335

Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Val Glu Val Phe Ser Asp
            340                 345                 350

Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr Gln
        355                 360                 365

Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe Glu Gly
    370                 375                 380

Ala Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gln
                405                 410                 415
```

```
Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe Leu
            420                 425                 430

Lys Glu Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Asp Asn Arg Asp Phe Ser Trp Leu
    450                 455                 460

Thr Arg Asn Ser Asp Glu Pro Ile Arg Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Ala Arg Ser Ala Glu Asp Phe Ile His Arg Met Thr Asn
                485                 490                 495

Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys Phe
        515                 520                 525

Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln Lys
    530                 535                 540

Lys Gln Ile Val Asn Gln Leu Phe Lys Glu Lys Arg Lys Val Thr Glu
545                 550                 555                 560

Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly Tyr Asp Gly Ile
                565                 570                 575

Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Asn Leu Ser Thr Tyr
            580                 585                 590

His Asp Leu Leu Lys Ile Thr Lys Asp Lys Glu Phe Met Asp Asp Pro
        595                 600                 605

Lys Asn Glu Glu Ile Leu Glu Asn Ile Val His Thr Leu Thr Ile Phe
    610                 615                 620
```

```
Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp Thr Leu
625                 630                 635                 640

Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Lys Gln
            660                 665                 670

Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Lys Ile Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys Glu
    690                 695                 700

Ile Ile Gln Lys Ala Gln Val Val Gly Lys Thr Asp Asp Val Lys Gln
705                 710                 715                 720

Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly Tyr Ala
            740                 745                 750

Leu Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Ala
        755                 760                 765

Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp Ala
    770                 775                 780

Leu Lys Asn Leu Ala Pro Asn Ile Leu Lys Glu Asn Pro Thr Asp Asn
785                 790                 795                 800

Ile Gln Leu Lys Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Lys Asp Met Tyr Thr Gly Lys Pro Leu Asp Ile Asn Gln Leu Ser Ser
            820                 825                 830
```

```
Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser
        835                 840                 845

Ile Asp Asn Arg Val Leu Thr Ser Ser Lys Asp Asn Arg Gly Lys Ser
    850                 855                 860

Asp Asn Val Pro Ser Leu Glu Val Val Gln Lys Arg Lys Ala Phe Trp
865                 870                 875                 880

Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu Arg Lys Phe Asn Asn
                885                 890                 895

Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp Glu Arg Asp Lys Val Gly
            900                 905                 910

Phe Ile Arg Arg Gln Leu Val Glu Thr Gln Gln Ile Thr Lys Asn Val
        915                 920                 925

Ala Gln Ile Leu Asp Ala Arg Phe Asn Thr Glu Val Lys Glu Lys Asn
    930                 935                 940

Gln Lys Ile Arg Thr Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val
945                 950                 955                 960

Ser Asn Phe Arg Lys Glu Phe Gly Leu Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala Lys
            980                 985                 990

Ala Ile Leu Lys Lys Tyr Pro Lys  Leu Glu Pro Glu Phe  Val Tyr Gly
        995                 1000                1005

Asp Tyr  Gln Lys Tyr Asp Leu  Phe Lys Pro Ser Lys  Glu Ile Glu
    1010                1015                1020

Lys Ala  Thr Glu Lys Tyr Phe  Phe Tyr Ser Asn Leu  Leu Asn Phe
    1025                1030                1035
```

```
Phe Lys  Glu Glu Val Leu Tyr  Ala Asp Gly Thr Ile  Arg Lys Arg
    1040                1045                1050

Glu Asn  Ile Glu Tyr Ser Lys  Asp Thr Gly Glu Ile  Ala Trp Asp
    1055                1060                1065

Lys Glu  Lys Asp Phe Ala Thr  Ile Lys Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Arg Glu Val Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Pro  Lys Gly Asn Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Lys Asp Ile  Leu Trp Asp Thr Thr  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Val Ile  Ala Tyr Ser Ile Leu  Leu Ile Ala
    1130                1135                1140

Asp Ile  Glu Lys Gly Lys Ala  Lys Lys Leu Lys Thr  Val Lys Thr
    1145                1150                1155

Leu Val  Gly Ile Thr Ile Met  Glu Lys Ala Ala Phe  Glu Glu Asn
    1160                1165                1170

Pro Ile  Thr Phe Leu Glu Asn  Lys Gly Tyr His Asn  Val Arg Lys
    1175                1180                1185

Glu Asn  Ile Leu Cys Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Lys Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Ile Val Leu Pro  Val Cys Leu Thr Thr  Leu Leu Tyr
    1220                1225                1230
```

```
His Ser  Lys Asn Leu His Lys  Leu Asp Glu Pro Glu  His Leu Glu
    1235                 1240                 1245


Tyr Ile  Gln Lys His Arg Asn  Glu Phe Lys Asp Leu  Leu Asn Leu
    1250                 1255                 1260


Val Ser  Glu Phe Ser Gln Lys  Tyr Ile Leu Ala Glu  Ala Asn Leu
    1265                 1270                 1275


Glu Lys  Ile Lys Asp Leu Tyr  Ala Asp Asn Glu Gln  Ala Asp Ile
    1280                 1285                 1290


Glu Ile  Leu Ala Asn Ser Phe  Ile Asn Leu Leu Thr  Phe Thr Ala
    1295                 1300                 1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Phe Phe Gly Lys  Asp Val Asp
    1310                 1315                 1320


Arg Lys  Arg Tyr Thr Thr Val  Ser Glu Ile Leu Asn  Ala Thr Leu
    1325                 1330                 1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                 1345                 1350


Ser Lys  Leu Gly Glu Glu
    1355


<210>  196
<211>  1362
<212>  PRT
<213>  Streptococcus sanguinis

<400>  196

Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val Gly
1               5                  10                  15


Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met Lys
            20                  25                  30
```

```
Val Leu Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu Ile Gly
        35                  40                  45

Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Asp Arg Arg Leu Lys
    50                  55                  60

Arg Thr Ser Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg Tyr
65                  70                  75                  80

Leu Gln Glu Ile Phe Ser Glu Glu Ile Ser Lys Leu Asp Ser Ser Phe
                85                  90                  95

Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys Arg Gly
            100                 105                 110

Ser Lys Tyr Pro Ile Phe Ala Thr Leu Glu Glu Glu Lys Glu Tyr His
        115                 120                 125

Lys Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp Ser
    130                 135                 140

Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met
145                 150                 155                 160

Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ser Phe Asp Ile Lys
                165                 170                 175

Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile Tyr Asp
            180                 185                 190

Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln Val Glu
        195                 200                 205

Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Thr Lys Arg Glu Arg Val
    210                 215                 220

Leu Lys Leu Phe Ser Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu Phe
225                 230                 235                 240
```

```
Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe Asp
               245                 250                 255

Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp Glu
            260                 265                 270

Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Gly Phe Ala Asp Leu
        275                 280                 285

Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly Ile
    290                 295                 300

Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Glu Arg Tyr Glu Asn His Gln Glu Asp Leu Ala Ala Leu Lys Gln
               325                 330                 335

Phe Ile Lys Asn Asn Leu Ser Glu Lys Tyr Ala Glu Val Phe Ser Asp
            340                 345                 350

Gln Ser Lys Asp Gly Tyr Ala Gly Phe Ile Asp Gly Lys Thr Thr Gln
        355                 360                 365

Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Leu Glu Gly
    370                 375                 380

Ala Asp Tyr Phe Leu Asn Lys Ile Glu Arg Glu Asp Phe Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gln
               405                 410                 415

Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Leu Phe Leu
            420                 425                 430

Lys Glu Asn Arg Glu Lys Ile Glu Lys Ile Leu Ala Phe Arg Ile Pro
        435                 440                 445
```

```
Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp Leu
    450                 455                 460

Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met Thr Asn
                485                 490                 495

Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys Phe
        515                 520                 525

Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln Lys
    530                 535                 540

Lys Gln Ile Val Asn Gln Leu Phe Lys Asp Lys Arg Lys Val Thr Glu
545                 550                 555                 560

Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly Tyr Asp Gly Ile
                565                 570                 575

Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser Thr Tyr
            580                 585                 590

His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp Asn Pro
        595                 600                 605

Lys Asn Gly Glu Ile Leu Glu Asn Ile Ile His Thr Leu Thr Ile Phe
    610                 615                 620

Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp Thr Leu
625                 630                 635                 640

Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr Gly
                645                 650                 655
```

```
Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg Asp Lys Gln
            660                 665                 670

Thr Gly Lys Thr Ile Leu Glu Tyr Leu Ile Asp Asp Gly Asp Cys Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys Glu
    690                 695                 700

Ile Ile Gln Lys Ala Gln Val Val Gly Lys Thr Asp Asp Val Lys Gln
705                 710                 715                 720

Val Val Gln Glu Ile Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His Asn
            740                 745                 750

Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr Ala
        755                 760                 765

Lys Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp Ala
    770                 775                 780

Leu Lys Asn Leu Ala Pro Asn Ile Leu Lys Glu Asn Pro Thr Asp Asn
785                 790                 795                 800

Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Lys Asp Met Tyr Thr Gly Lys Ala Ile Asp Ile Asn Gln Leu Ser Asn
            820                 825                 830

Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser
        835                 840                 845

Leu Asp Asn Arg Val Leu Thr Ser Ser Lys Asp Asn Arg Gly Lys Ser
    850                 855                 860
```

```
Asp Asn Val Pro Ser Ile Glu Val Val Gln Lys Arg Lys Ala Phe Trp
865                 870                 875                 880


Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu Arg Lys Phe Asn Asn
                885                 890                 895


Leu Thr Lys Ala Lys Arg Gly Gly Leu Asp Glu Arg Asp Lys Val Gly
            900                 905                 910


Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925


Ala Gln Leu Leu Asp Thr Arg Phe Asn Thr Glu Val Asn Glu Glu Asn
    930                 935                 940


Gln Lys Ile Arg Thr Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val
945                 950                 955                 960


Ser Asn Phe Arg Lys Glu Phe Gly Leu Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975


Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala Lys
            980                 985                 990


Ala Ile Leu Lys Lys Tyr Pro Lys  Leu Glu Pro Glu Phe  Val Tyr Gly
        995                 1000                1005


Asp Tyr  Gln Lys Tyr Asp Leu  Ser Lys Ala Ser Asn  Thr Ile Asp
    1010                1015                1020


Lys Ala  Thr Glu Lys Tyr Phe  Phe Tyr Ser Asn Leu  Leu Asn Phe
    1025                1030                1035


Phe Lys  Glu Lys Val Arg Tyr  Ala Asp Gly Thr Ile  Lys Lys Arg
    1040                1045                1050


Glu Asn  Ile Glu Tyr Ser Asn  Asp Thr Gly Glu Ile  Ala Trp Asn
    1055                1060                1065
```

```
Lys Glu  Lys Asp Phe Ala Thr  Ile Lys Lys Val Leu  Ser Leu Pro
    1070                1075                1080

Gln Val  Asn Ile Val Lys Lys  Thr Glu Glu Gln Thr  Gly Gly Leu
    1085                1090                1095

Phe Asp  Asn Asn Ile Val Ser  Lys Lys Lys Val Val  Asp Ala Ser
    1100                1105                1110

Lys Leu  Ile Pro Ile Lys Ser  Ser Leu Ser Pro Glu  Lys Tyr Gly
    1115                1120                1125

Gly Tyr  Ala Arg Pro Thr Ile  Ala Tyr Ser Val Leu  Val Ile Ala
    1130                1135                1140

Asp Ile  Glu Lys Gly Lys Gly  Lys Ala Lys Lys Leu  Lys Arg Ile
    1145                1150                1155

Lys Glu  Ile Val Gly Ile Thr  Ile Gln Asp Lys Lys  Lys Phe Glu
    1160                1165                1170

Ser Asn  Pro Val Thr Tyr Leu  Glu Glu Cys Gly Tyr  Lys Asn Ile
    1175                1180                1185

Asn Ser  Asn Leu Ile Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu
    1190                1195                1200

Phe Asn  Asp Gly Gln Arg Arg  Leu Leu Ala Ser Ser  Ile Glu Leu
    1205                1210                1215

Gln Lys  Gly Asn Glu Leu Ile  Leu Pro Tyr His Leu  Thr Ala Leu
    1220                1225                1230

Leu Tyr  His Ala Gln Arg Ile  Asn Lys Ile Ser Glu  Pro Ile His
    1235                1240                1245

Lys Gln  Tyr Val Glu Ala His  Gln Asn Glu Phe Lys  Glu Leu Leu
    1250                1255                1260
```

```
Thr Thr  Ile Ile Ser Leu Ser  Lys Lys Tyr Ile Gln  Lys Pro Asn
    1265                1270                1275


Val Glu  Leu Leu Leu Gln Gln  Ala Phe Asp Gln Ala  Asp Lys Asp
    1280                1285                1290


Ile Tyr  Gln Leu Ser Glu Ser  Phe Ile Ser Leu Leu  Lys Leu Thr
    1295                1300                1305


Ser Phe  Gly Ala Pro Gly Ala  Phe Lys Phe Leu Gly  Val Glu Ile
    1310                1315                1320


Ser Gln  Ser Ser Val Arg Tyr  Lys Pro Asn Ser Gln  Phe Leu Asp
    1325                1330                1335


Thr Thr  Leu Ile His Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg
    1340                1345                1350


Ile Asp  Leu Ser Lys Leu Gly  Glu Asp
    1355                1360


<210>  197
<211>  1360
<212>  PRT
<213>  Streptococcus sp. F0441

<400>  197

Glu Asn Lys Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Ala Arg Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Glu Glu Ile Gly Lys Val Asp Ser Ser
                85                  90                  95


Phe Phe His Arg Leu Asp Asp Ser Phe Leu Ile Pro Glu Asp Lys Arg
            100                 105                 110


Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Ala Glu Glu Lys Lys Tyr
        115                 120                 125


His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
    130                 135                 140


Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ala Phe Asp Ile
                165                 170                 175


Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Ser Ile Tyr
            180                 185                 190


Asn Asn Thr Phe Glu Gly Asn Ser Leu Ser Gly Gln Asn Val Gln Val
        195                 200                 205


Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Ala Lys Arg Glu Arg
    210                 215                 220


Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu
225                 230                 235                 240


Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255


Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Arg Asp Thr Tyr Asp
            260                 265                 270
```

```
Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala Asp
        275                 280                 285

Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asn Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Ser Leu Lys
                325                 330                 335

Gln Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Asp Glu Val Phe Ser
            340                 345                 350

Asp Gln Ser Glu Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr
        355                 360                 365

Gln Glu Thr Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp
    450                 455                 460

Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu Glu
465                 470                 475                 480
```

```
Ile Val Asp Lys Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln
    530                 535                 540

Lys Lys Gln Ile Val Thr Gln Leu Phe Lys Glu Lys Arg Lys Val Thr
545                 550                 555                 560

Glu Lys Asp Ile Ile Gln Phe Leu His Asn Val Asp Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Ala Phe Met Asp Asp
        595                 600                 605

Ala Lys Asn Glu Ala Ile Leu Glu Asn Ile Val His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp Ser
625                 630                 635                 640

Leu Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Ser Asp Lys
            660                 665                 670

Gln Thr Gly Asn Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Glu Ile
        675                 680                 685
```

```
Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys
    690                 695                 700

Glu Ile Ile Gln Lys Ala Gln Val Val Gly Lys Thr Asn Asp Val Lys
705                 710                 715                 720

Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met Gly His
            740                 745                 750

Ala Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp
    770                 775                 780

Ser Leu Lys Ile Leu Ala Ser Lys Ile Leu Lys Glu His Pro Thr Asp
785                 790                 795                 800

Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Lys Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asn Gln Leu Ser
            820                 825                 830

Ser Cys Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp
        835                 840                 845

Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys Asp Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Leu Glu Val Val Asp Lys Met Lys Val Phe
865                 870                 875                 880

Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Tyr Arg Lys Phe Asn
                885                 890                 895
```

```
Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asn Glu Leu Asp Lys Val
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ala Arg Phe Asn Lys Glu Val Thr Glu Lys
    930                 935                 940

Asp Lys Lys Asn Arg Thr Val Lys Ile Ile Thr Leu Lys Ser Asn Leu
945                 950                 955                 960

Val Ser Asn Phe Arg Lys Glu Phe Glu Leu Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala
            980                 985                 990

Lys Ala Ile Leu Lys Lys Tyr Pro  Lys Leu Glu Pro Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Gln Lys Tyr Asp  Leu Ser Lys Asp Pro  Lys Glu Ile
    1010                1015                1020

Glu Lys  Ala Thr Glu Lys Tyr  Phe Phe Tyr Ser Asn  Leu Leu Asn
    1025                1030                1035

Phe Phe  Lys Glu Glu Val His  Tyr Ala Asp Gly Thr  Ile Val Lys
    1040                1045                1050

Arg Glu  Asn Ile Glu Tyr Ser  Lys Asp Thr Gly Glu  Ile Ala Trp
    1055                1060                1065

Asn Lys  Glu Lys Asp Phe Ala  Thr Ile Lys Lys Val  Leu Ser Leu
    1070                1075                1080

Pro Gln  Val Asn Ile Val Lys  Lys Arg Glu Val Gln  Thr Gly Gly
    1085                1090                1095
```

```
Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1100                1105                1110

Ile Pro  Arg Lys Thr Lys Asp  Ile Leu Trp Asp Thr  Thr Lys Tyr
    1115                1120                1125

Gly Gly  Phe Asp Ser Pro Val  Ile Ala Tyr Ser Ile  Leu Leu Ile
    1130                1135                1140

Ala Asp  Ile Glu Lys Gly Lys  Ala Lys Lys Leu Lys  Thr Val Lys
    1145                1150                1155

Thr Leu  Val Gly Ile Thr Ile  Met Glu Lys Asp Ala  Phe Glu Lys
    1160                1165                1170

Asn Pro  Ile Ala Phe Leu Glu  Asn Lys Gly Tyr His  Asn Val Cys
    1175                1180                1185

Lys Glu  Asn Ile Leu Cys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu
    1190                1195                1200

Glu Asn  Gly Arg Arg Arg Leu  Leu Ala Ser Ala Lys  Glu Leu Gln
    1205                1210                1215

Lys Cys  Asn Glu Ile Val Leu  Pro Val Tyr Leu Thr  Thr Leu Leu
    1220                1225                1230

Tyr His  Ser Lys Asn Val His  Lys Leu Asp Glu Pro  Gly His Leu
    1235                1240                1245

Glu Tyr  Ile Gln Lys His Arg  Asn Glu Phe Lys Asp  Leu Leu Asn
    1250                1255                1260

Leu Val  Ser Glu Phe Ser Gln  Lys Tyr Val Leu Ala  Asp Ala Asn
    1265                1270                1275

Leu Glu  Lys Ile Lys Asn Leu  Tyr Ala Asp Asn Glu  Gln Ala Asp
    1280                1285                1290
```

```
Ile Glu  Ile Leu Ala Asn Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1295                1300                1305


Ala Leu  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Gly  Lys Asp Val
    1310                1315                1320


Asp Arg  Lys Arg Tyr Thr Thr  Val Ser Glu Ile Leu  Asn Ala Thr
    1325                1330                1335


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1340                1345                1350


Leu Ser  Lys Leu Gly Glu Asp
    1355                1360


<210>  198
<211>  1360
<212>  PRT
<213>  Streptococcus sp. FF10

<400>  198

Met Lys Lys Pro Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Glu Tyr Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Met
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Asp Ile Phe Ser Pro Glu Leu Asn Gln Val Asp Glu Ser
                85                  90                  95


Phe Leu His Arg Leu Asp Asp Ser Phe Leu Val Ala Glu Asp Lys Arg
```

```
            100                 105                 110

Gly Glu Arg His Val Ile Phe Gly Asn Ile Ala Asp Glu Val Lys Tyr
        115                 120                 125

His Lys Glu Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Ile Asp Glu Pro Ile Asp Ile
                165                 170                 175

Arg Asn Met Asn Ser Gln Asn Leu Phe Lys Glu Phe Leu Leu Ala Phe
            180                 185                 190

Asp Gly Ile Gln Val Asp Cys Tyr Leu Ala Ser Lys His Thr Asp Ile
        195                 200                 205

Ser Gly Ile Ile Thr Ala Lys Ile Ser Lys Ser Arg Lys Val Glu Ala
    210                 215                 220

Val Leu Glu Gln Phe Pro Asp Gln Lys Lys Asn Ser Phe Phe Gly Asn
225                 230                 235                 240

Met Val Ser Leu Val Phe Gly Leu Met Pro Asn Phe Lys Ser Asn Phe
                245                 250                 255

Glu Leu Asp Glu Asp Ala Lys Leu Gln Phe Ser Arg Asp Ser Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Asn Leu Leu Gly Ile Ile Gly Asp Glu Tyr Ala Asp
        275                 280                 285

Val Phe Val Ala Ala Lys Lys Val Tyr Asp Ser Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Thr Asn Asn His Ser Thr Lys Ala Pro Leu Ser Ala Ser
```

```
305                 310                 315                 320

Met Ile Asp Arg Tyr Asp Glu His Asn Ser Asp Lys Lys Leu Leu Arg
                325                 330                 335

Asp Phe Ile Arg Thr Asn Ile Gly Lys Glu Val Phe Lys Glu Val Phe
            340                 345                 350

Tyr Asp Thr Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr
        355                 360                 365

Asn Gln Glu Asp Phe Tyr Lys Tyr Leu Lys Asn Leu Leu Gln Lys Val
    370                 375                 380

Asp Gly Gly Asp Tyr Phe Ile Glu Lys Ile Glu Arg Glu Asp Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Val His
                405                 410                 415

Leu Asp Glu Met Lys Ala Ile Leu Arg Arg Gln Gly Glu Phe Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Ala Glu Lys Ile Gln Gln Ile Leu Thr Phe Lys
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala
    450                 455                 460

Trp Ala Ser Tyr Asn Ser Asn Glu Lys Met Thr Pro Trp Asn Phe Asp
465                 470                 475                 480

Asn Val Ile Asp Lys Thr Ser Ser Ala Gln Ala Phe Ile Glu Arg Met
                485                 490                 495

Thr Asn Asn Asp Leu Tyr Leu Pro Asp Gln Lys Val Leu Pro Lys His
            500                 505                 510

Ser Leu Leu Tyr Gln Lys Phe Ala Val Tyr Asn Glu Leu Thr Lys Ile
```

515 520 525

Lys Tyr Val Thr Glu Thr Gly Glu Ala Arg Leu Phe Asp Val Phe Leu
530 535 540

Lys Lys Glu Ile Phe Asp Gly Leu Phe Lys Lys Glu Arg Lys Val Thr
545 550 555 560

Lys Lys Lys Ile Leu Asn Phe Leu Asp Lys Asn Phe Asp Glu Phe Arg
565 570 575

Ile Thr Asp Ile Gln Gly Leu Asp Asn Glu Thr Gly Asn Phe Asn Ala
580 585 590

Ser Tyr Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Gly Asp Lys Glu
595 600 605

Phe Met Asp Ser Ser Asp Asn Val Asp Val Leu Glu Asp Ile Val Leu
610 615 620

Ser Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Leu
625 630 635 640

Lys Tyr Glu Asp Ile Phe Ser Lys Lys Val Ile Ala Asn Leu Thr Arg
645 650 655

Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly
660 665 670

Ile Lys Asp Lys His Ser Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp
675 680 685

Asp Gly His Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Asn
690 695 700

Leu Ser Phe Lys Asp Glu Ile Ala Asn Ser Gln Val Ile Gly Asp Gly
705 710 715 720

Asp Asp Leu His Gln Val Val Gln Glu Leu Ala Gly Ser Pro Ala Ile

725 730 735

Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys
740 745 750

Val Met Gly Tyr Asn Pro Glu Gln Ile Val Val Glu Met Ala Arg Glu
755 760 765

Asn Gln Thr Thr Ala Arg Gly Arg Asn Asn Ser Gln Gln Arg Leu Gly
770 775 780

Ser Leu Thr Lys Ala Ile Gln Asp Phe Gly Ser Asp Ile Leu Lys Arg
785 790 795 800

Tyr Pro Val Glu Asn Asn Gln Leu Gln Asn Asp Gln Leu Tyr Leu Tyr
805 810 815

Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Thr Leu Asp Ile
820 825 830

His Asn Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe
835 840 845

Ile Lys Asp Asn Ser Leu Asp Asn Arg Val Leu Thr Asn Ser Lys Ser
850 855 860

Asn Arg Gly Lys Ser Asp Asn Val Pro Ser Asn Glu Val Val Lys Arg
865 870 875 880

Met Lys Gly Phe Trp Leu Lys Gln Leu Asp Ala Lys Leu Ile Ser Gln
885 890 895

Arg Lys Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Ala
900 905 910

Glu Asp Lys Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln
915 920 925

Ile Thr Lys His Val Ala Arg Ile Leu Asp Glu Arg Phe Asn Arg Asp

```
    930                 935                 940

Phe Asp Lys Asn Asp Lys Arg Ile Arg Asn Val Lys Ile Val Thr Leu
945                 950                 955                 960

Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Phe Tyr Lys
                965                 970                 975

Val Arg Glu Ile Asn Asn Phe His His Ala His Asp Ala Tyr Leu Asn
            980                 985                 990

Ala Val Val Ala Lys Ala Leu Leu  Ile Arg Tyr Pro Lys  Leu Glu Pro
        995                 1000                1005

Glu Phe  Val Tyr Gly Glu Tyr  Pro Lys Tyr Asn Ser  Tyr Arg Glu
    1010                1015                1020

Arg Lys  Ala Thr Glu Lys Met  Phe Phe Tyr Ser Asn  Ile Met Asn
    1025                1030                1035

Met Phe  Lys Thr Thr Ile Lys  Leu Ala Asp Gly Arg  Val Val Glu
    1040                1045                1050

Lys Pro  Val Ile Glu Ala Asn  Glu Glu Thr Gly Glu  Ile Ala Trp
    1055                1060                1065

Asp Lys  Thr Lys His Phe Ala  Asn Val Lys Lys Val  Leu Ser Tyr
    1070                1075                1080

Pro Gln  Val Ser Ile Val Lys  Lys Val Glu Glu Gln  Thr Gly Gly
    1085                1090                1095

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Gly Ser  Asp Lys Leu
    1100                1105                1110

Ile Ala  Arg Lys Thr Lys Asn  Asn Tyr Leu Ser Thr  Gln Lys Tyr
    1115                1120                1125

Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr Ser Ile  Met Phe Val
```

1130 1135 1140

Ala Asp Ile Glu Lys Gly Lys Ser Lys Arg Leu Lys Thr Val Lys
1145 1150 1155

Glu Met Ile Gly Ile Thr Ile Met Glu Arg Ser Arg Phe Glu Ser
1160 1165 1170

Asn Ser Val Thr Phe Leu Glu Glu Lys Gly Tyr Arg Asn Ile Arg
1175 1180 1185

Glu Asn Thr Ile Ile Lys Phe Pro Lys Tyr Ser Leu Phe Glu Leu
1190 1195 1200

Glu Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Ile Glu Leu Gln
1205 1210 1215

Lys Gly Asn Glu Met Phe Leu Pro Gln Gln Phe Val Asn Leu Leu
1220 1225 1230

Tyr His Ala Gln His Ala Asn Lys Glu Asp Ser Val Ile Tyr Leu
1235 1240 1245

Glu Lys His Arg His Glu Leu Ser Glu Leu Phe His His Ile Ile
1250 1255 1260

Gly Val Ser Glu Lys Thr Ile Leu Lys Pro Lys Val Glu Met Thr
1265 1270 1275

Leu Asn Glu Ala Phe Glu Lys His Phe Glu Phe Asp Glu Val Ser
1280 1285 1290

Glu Leu Ala Gln Ser Phe Ile Ser Leu Leu Lys Phe Thr Ala Phe
1295 1300 1305

Gly Ala Pro Gly Gly Phe Lys Phe Leu Asp Ala Asp Ile Lys Gln
1310 1315 1320

Ser Asn Leu Arg Tyr Gln Thr Val Thr Glu Val Leu Ser Ser Thr

1325 1330 1335

Leu Ile His Gln Ser Val Thr Gly Leu Tyr Glu Thr Arg Ile Asp
1340 1345 1350

Leu Ser Lys Leu Gly Gly Glu
1355 1360

<210> 199
<211> 1364
<212> PRT
<213> Streptococcus sp. M334

<400> 199

Ser Asn Lys Ser Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
20 25 30

Lys Val Leu Gly Asn Thr Asp Lys His Phe Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Gln Glu Ile Ser Lys Val Asp Ser Ser
85 90 95

Phe Phe His Arg Leu Asp Asp Phe Phe Leu Val Pro Glu Asp Lys Arg
100 105 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Val Glu Glu Lys Glu Tyr
115 120 125

His Lys Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
130 135 140

```
Ser Lys Glu Lys Thr Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ser Phe Asp Ile
                165                 170                 175

Lys Asn Asn Asp Ile Gln Lys Ile Phe Ser Glu Phe Ile Ser Ile Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Gly Lys Ser Leu Ser Gly Gln Asn Ala Gln Val
        195                 200                 205

Glu Ala Ile Phe Thr Asp Lys Ile Ser Lys Ser Thr Lys Arg Glu Arg
    210                 215                 220

Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Asp Leu Glu Glu Lys Ala Pro Leu Gln Phe Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala Asp
        275                 280                 285

Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Lys Asp Leu Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Glu Arg Tyr Glu Asn His Gln Lys Asp Leu Ala Ala Leu Lys
                325                 330                 335

Gln Phe Ile Gln Asn Asn Leu Gln Glu Lys Tyr Asp Glu Val Phe Ser
            340                 345                 350
```

```
Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Lys
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Asn Ala Ile Ile Arg Arg Gln Gly Glu His Tyr Pro Phe
            420                 425                 430

Leu Gln Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Gly Asp Phe Ala Trp
    450                 455                 460

Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Ile Val Asp Gln Ala Ser Ser Ala Glu Asp Phe Ile Asn Lys Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Phe Ile Ala Glu Gly Leu Thr Arg Tyr Gln Phe Leu Asp Lys Lys Gln
    530                 535                 540

Lys Lys Asp Ile Phe Asp Thr Phe Phe Lys Ala Glu Asn Lys Arg Lys
545                 550                 555                 560
```

```
Val Thr Glu Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly Tyr
                565                 570                 575

Asp Gly Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu
            580                 585                 590

Ser Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Ala Phe Met
        595                 600                 605

Asp Asp Ser Lys Asn Glu Glu Ile Leu Glu Asn Ile Ile His Thr Leu
    610                 615                 620

Thr Ile Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr
625                 630                 635                 640

Asp Ser Leu Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asp Lys Lys Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Glu Ile Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Gly Leu Ser
    690                 695                 700

Phe Lys Glu Ile Ile Gln Lys Ala Gln Val Phe Gly Lys Thr Asn Asp
705                 710                 715                 720

Val Lys Gln Val Val Gln Glu Leu Pro Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly His Ala Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765
```

```
Thr Thr Ala Arg Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile
    770                 775                 780

Glu Asp Ser Leu Lys Asn Leu Ala Ser Asn Ile Leu Lys Glu Asn Pro
785                 790                 795                 800

Thr Asp Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Gly Lys Pro Leu Glu Ile Asn Gln
            820                 825                 830

Leu Ser Asn Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asp Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys Asp Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Leu Glu Val Val Glu Lys Met Lys
865                 870                 875                 880

Ala Phe Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu Arg Lys
                885                 890                 895

Phe Asn Asn Leu Thr Lys Ala Glu Arg Glu Arg Gly Gly Leu Asn Glu
            900                 905                 910

Leu Asp Lys Val Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln
        915                 920                 925

Ile Thr Lys His Val Ala Gln Phe Leu Asp Ala Arg Phe Asn Lys Glu
    930                 935                 940

Val Thr Glu Lys Asp Lys Lys Asn Arg Asn Val Lys Ile Ile Thr Leu
945                 950                 955                 960

Lys Ser Asn Leu Val Ser Asn Phe Arg Lys Glu Phe Gly Leu Tyr Lys
                965                 970                 975
```

```
Val Arg Glu Ile Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn
            980                 985                 990

Ala Val Leu Ala Lys Ala Ile Leu  Lys Lys Tyr Pro Lys  Leu Glu Pro
        995                 1000                1005

Glu Phe  Val Tyr Gly Asp Tyr  Gln Lys Tyr Asp Leu  Ser Arg Glu
    1010                1015                1020

Pro Lys  Glu Val Glu Lys Ala  Thr Gln Lys Tyr Phe  Phe Tyr Ser
    1025                1030                1035

Asn Leu  Leu Asn Phe Phe Lys  Glu Glu Val His Tyr  Ala Asp Gly
    1040                1045                1050

Thr Ile  Val Lys Arg Glu Asn  Ile Glu Tyr Ser Lys  Asp Thr Gly
    1055                1060                1065

Glu Ile  Ala Trp Asn Lys Glu  Lys Asp Phe Ala Thr  Val Lys Lys
    1070                1075                1080

Val Leu  Ser Leu Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Val
    1085                1090                1095

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Pro  Lys Gly Asn
    1100                1105                1110

Ser Asp  Lys Leu Ile Pro Arg  Lys Thr Lys Glu Ile  Leu Trp Asp
    1115                1120                1125

Thr Thr  Lys Tyr Gly Gly Phe  Asp Ser Pro Val Ile  Ala Tyr Ser
    1130                1135                1140

Ile Leu  Leu Ile Ala Asp Ile  Glu Lys Gly Lys Ala  Lys Lys Leu
    1145                1150                1155

Lys Thr  Val Lys Thr Leu Val  Gly Ile Thr Ile Met  Glu Lys Ala
    1160                1165                1170
```

```
Thr Phe  Glu Lys Asn Pro Ile  Thr Phe Leu Glu Asn  Lys Gly Tyr
    1175                1180                1185

His Asn  Val Arg Lys Glu Asn  Ile Leu Cys Leu Pro  Lys Tyr Ser
    1190                1195                1200

Leu Phe  Glu Leu Glu Ser Gly  Arg Arg Arg Met Leu  Ala Ser Ala
    1205                1210                1215

Lys Glu  Leu Gln Lys Gly Asn  Glu Ile Val Leu Pro  Val Tyr Leu
    1220                1225                1230

Thr Thr  Leu Leu Tyr His Ser  Lys Asn Val His Lys  Leu Asp Glu
    1235                1240                1245

Pro Glu  His Leu Glu Tyr Ile  Gln Lys His Arg Tyr  Glu Phe Lys
    1250                1255                1260

Asp Leu  Leu Asn Leu Val Ser  Glu Phe Ser Gln Lys  Tyr Val Leu
    1265                1270                1275

Ala Asp  Ala Asn Leu Glu Lys  Ile Lys Asn Leu Tyr  Ala Asp Asn
    1280                1285                1290

Glu Gln  Ala Asp Ile Glu Ile  Leu Ala Asn Ser Phe  Ile Asn Leu
    1295                1300                1305

Leu Thr  Phe Thr Ala Leu Gly  Ala Pro Ala Ala Phe  Lys Phe Leu
    1310                1315                1320

Gly Lys  Asp Val Asp Arg Lys  Arg Tyr Thr Thr Val  Ser Glu Ile
    1325                1330                1335

Leu Asn  Ala Thr Leu Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu
    1340                1345                1350

Thr Arg  Ile Asp Leu Ser Lys  Leu Gly Glu Asp
    1355                1360
```

<210> 200
<211> 1360
<212> PRT
<213> Streptococcus sp. taxon 056

<400> 200

Asn Asn Asn Asn Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
20 25 30

Arg Val Leu Gly Asn Thr Asp Lys Arg Phe Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Glu Gly Thr Thr Ala Glu Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Ser Lys Val Asp Ser Ser
85 90 95

Phe Phe His Arg Leu Asp Asp Ser Phe Leu Val Pro Glu Asp Lys Ser
100 105 110

Gly Ser Lys Tyr Pro Ile Phe Ala Thr Leu Ala Glu Glu Lys Glu Tyr
115 120 125

His Lys Lys Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
130 135 140

Ser Lys Glu Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145 150 155 160

Ile Thr Lys Tyr Arg Gly His Phe Leu Tyr Glu Glu Ala Phe Asp Ile
165 170 175

```
Lys Asn Asn Asp Ile Gln Lys Ile Phe Asn Glu Phe Ile Asn Ile Tyr
            180                 185                 190

Asp Asn Thr Phe Glu Gly Ser Ser Leu Ser Gly Gln Asn Ala Gln Val
        195                 200                 205

Glu Ala Ile Phe Thr Gly Lys Ile Ser Lys Ser Val Lys Arg Glu His
    210                 215                 220

Val Leu Lys Leu Phe Pro Asp Glu Lys Ser Thr Gly Leu Phe Ser Glu
225                 230                 235                 240

Phe Leu Lys Leu Ile Val Gly Asn Gln Ala Asp Phe Lys Lys His Phe
                245                 250                 255

Asp Leu Glu Glu Lys Ala Ser Leu Gln Phe Ser Lys Asp Thr Tyr Asp
            260                 265                 270

Glu Asp Leu Glu Asn Leu Leu Gly Gln Ile Gly Asp Asp Phe Ala Asp
        275                 280                 285

Leu Phe Leu Val Ala Lys Lys Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300

Ile Leu Thr Val Thr Asp Pro Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320

Met Ile Glu Arg Tyr Glu Asn His Gln Glu Asp Leu Ala Ala Leu Lys
                325                 330                 335

Gln Phe Ile Lys Asn Asn Leu Pro Glu Lys Tyr Ala Glu Val Phe Ser
            340                 345                 350

Asp Gln Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Ile Lys Asn Leu Leu Ser Lys Phe Glu
    370                 375                 380
```

```
Gly Ala Asp Tyr Phe Leu Asp Lys Ile Glu Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met Asn Ala Ile Leu Arg Arg Gln Gly Glu His Tyr Pro Leu
            420                 425                 430

Leu Lys Glu Asn Lys Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Arg Asp Phe Ala Trp
    450                 455                 460

Leu Thr Arg Asn Ser Asp Gln Ala Ile Arg Pro Trp Asn Phe Glu Glu
465                 470                 475                 480

Ile Val Asp Lys Ala Ser Ser Ala Glu Ser Phe Ile Asn Lys Met Thr
                485                 490                 495

Asn Tyr Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Phe Ile Ala Glu Gly Leu Arg Asp Tyr Gln Phe Phe Asp Ser Gly Gln
    530                 535                 540

Lys Lys Gln Ile Val Asn Gln Leu Phe Lys Glu Lys Arg Lys Val Thr
545                 550                 555                 560

Glu Lys Asp Ile Ile His Tyr Leu His Asn Val Asp Gly Tyr Asp Gly
                565                 570                 575

Ile Glu Leu Lys Gly Ile Glu Lys Gln Phe Asn Ala Ser Leu Ser Thr
            580                 585                 590
```

```
Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Glu Phe Met Asp Asn
        595                 600                 605

His Lys Asn Gln Glu Ile Leu Glu Asn Ile Val His Thr Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Gln Arg Leu Ala Gln Tyr Asp Ser
625                 630                 635                 640

Ile Phe Asp Glu Lys Val Ile Lys Ala Leu Thr Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Lys Leu Ser Ala Lys Leu Ile Asn Gly Ile Cys Asp Lys
            660                 665                 670

Lys Thr Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Tyr Asn
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Gly Leu Ser Phe Lys
    690                 695                 700

Glu Ile Ile Gln Lys Ala Gln Val Val Gly Lys Thr Asp Asp Leu Thr
705                 710                 715                 720

Gln Val Val Arg Glu Leu Ser Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Ser Ile Lys Ile Val Asp Glu Leu Val Lys Ile Met Gly Tyr
            740                 745                 750

Ala Pro Glu Ser Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Lys Gly Lys Lys Asn Ser Gln Gln Arg Tyr Lys Arg Ile Glu Asp
    770                 775                 780

Ala Leu Lys Asn Leu Ala Pro Thr Ile Ser Lys Glu Asn Pro Thr Asp
785                 790                 795                 800
```

```
Asn Ile Gln Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Lys Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asn Gln Leu Ser
            820                 825                 830

Ser Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp
        835                 840                 845

Ser Leu Asp Asn Arg Val Leu Thr Ser Ser Lys Asp Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Leu Glu Val Val Lys Lys Arg Lys Ala Phe
865                 870                 875                 880

Trp Gln Gln Leu Leu Asp Ser Lys Leu Ile Ser Glu Arg Lys Phe Asn
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Asp Glu Arg Asp Lys Val
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Arg Ile Leu Asp Ala Arg Phe Asn Thr Glu Val Ser Glu Lys
    930                 935                 940

Asn Gln Lys Ile Arg Ser Val Lys Ile Ile Thr Leu Lys Ser Asn Leu
945                 950                 955                 960

Val Ser Asn Phe Arg Lys Glu Phe Lys Leu Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala
            980                 985                 990

Lys Ala Ile Leu Lys Lys Tyr Pro  Lys Leu Glu Pro Glu  Phe Val Tyr
        995                 1000                1005
```

```
Gly Asp  Tyr Gln Lys Tyr Asp  Leu Ser Lys Asp Pro  Lys Glu Val
    1010                1015                1020

Glu Lys  Ala Thr Glu Lys Tyr  Phe Phe Tyr Ser Asn  Leu Leu Asn
    1025                1030                1035

Phe Phe  Lys Glu Glu Val His  Tyr Ala Asp Gly Thr  Ile Val Lys
    1040                1045                1050

Arg Glu  Asn Ile Glu Tyr Ser  Lys Asp Thr Gly Glu  Ile Ala Trp
    1055                1060                1065

Asn Lys  Glu Lys Asp Phe Val  Thr Ile Lys Lys Val  Leu Ser Tyr
    1070                1075                1080

Pro Gln  Val Asn Ile Val Lys  Lys Arg Glu Val Gln  Thr Gly Gly
    1085                1090                1095

Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Gly Asn Ser  Asp Lys Leu
    1100                1105                1110

Ile Pro  Arg Lys Thr Lys Asp  Ile Leu Trp Asp Thr  Thr Lys Tyr
    1115                1120                1125

Gly Gly  Phe Asp Ser Pro Val  Ile Ala Tyr Ser Ile  Leu Leu Ile
    1130                1135                1140

Ala Asp  Ile Glu Lys Gly Lys  Ala Lys Lys Leu Lys  Thr Val Lys
    1145                1150                1155

Thr Leu  Val Gly Ile Thr Ile  Met Glu Lys Ala Ala  Phe Glu Lys
    1160                1165                1170

Asn Pro  Ile Thr Phe Leu Glu  Asn Lys Gly Tyr His  Asn Val Arg
    1175                1180                1185

Lys Glu  Asn Ile Leu Cys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu
    1190                1195                1200
```

```
Glu Asn  Gly Arg Arg Arg Leu  Leu Ala Ser Ala Lys  Glu Leu Gln
    1205                 1210                 1215


Lys Gly  Asn Glu Ile Val Leu  Pro Val Tyr Leu Thr  Thr Leu Leu
    1220                 1225                 1230


Tyr His  Ser Lys Asn Val His  Lys Leu Asp Glu Pro  Glu His Leu
    1235                 1240                 1245


Glu Tyr  Ile Gln Lys His Arg  Tyr Glu Phe Lys Asp  Leu Leu Asn
    1250                 1255                 1260


Leu Val  Ser Glu Phe Ser Gln  Lys Tyr Val Leu Ala  Glu Ala Asn
    1265                 1270                 1275


Leu Glu  Lys Ile Lys Ser Leu  Tyr Val Asp Asn Glu  Gln Ala Asp
    1280                 1285                 1290


Ile Glu  Ile Leu Ala Asn Ser  Phe Ile Asn Leu Leu  Thr Phe Thr
    1295                 1300                 1305


Ala Leu  Gly Ala Pro Ala Ala  Phe Lys Phe Phe Gly  Lys Asp Val
    1310                 1315                 1320


Asp Arg  Lys Arg Tyr Thr Thr  Val Ser Glu Ile Leu  Asn Ala Thr
    1325                 1330                 1335


Leu Ile  His Gln Ser Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp
    1340                 1345                 1350


Leu Ser  Lys Leu Gly Glu Asp
    1355                 1360


<210>  201
<211>  1359
<212>  PRT
<213>  Streptococcus suis

<400>  201
```

```
Met Lys Lys Lys Tyr Ala Ile Gly Ile Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30

Lys Val Phe Gly Asn Thr Glu Lys Arg Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45

Gly Thr Leu Leu Phe Asp Glu Gly Asn Thr Ala Glu Asn Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Ile Asn Lys Ile Asp Asp Ser
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Ile Val Glu Asp Lys Gln
            100                 105                 110

Gly Ser Lys His Pro Ile Phe Gly Thr Leu Gln Glu Glu Lys Lys Tyr
        115                 120                 125

His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
    130                 135                 140

Ser Ser Gln Lys Ala Asp Ile Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Asp Leu Lys Ser
                165                 170                 175

Glu Asn Lys Asp Val Gln His Leu Phe Asn Asp Phe Val Glu Met Phe
            180                 185                 190

Asp Lys Thr Val Glu Gly Ser Tyr Leu Ser Glu Asn Leu Pro Asn Val
        195                 200                 205
```

```
Ala Asp Val Leu Val Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Ile Leu His Tyr Phe Pro Asn Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Phe Leu Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Glu Leu Ala Glu Asp Ala Lys Ile Gln Phe Ser Lys Glu Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Ile Ala Thr Lys Ser Leu Tyr Asp Gly Ile Leu Leu Ala Gly
    290                 295                 300

Ile Leu Ser Thr Thr Asp Ser Thr Thr Lys Ala Pro Leu Ser Ser Ser
305                 310                 315                 320

Met Val Asn Arg Tyr Glu Glu His Lys Lys Asp Leu Ala Leu Leu Lys
                325                 330                 335

Asn Phe Ile His Gln Asn Leu Ser Asp Ser Tyr Lys Glu Val Phe Asn
            340                 345                 350

Asp Lys Leu Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr Thr
        355                 360                 365

Gln Glu Asn Phe Tyr Arg Phe Ile Lys Lys Ala Ile Glu Lys Ile Glu
    370                 375                 380

Gly Ser Asp Tyr Phe Ile Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415
```

```
Gln Glu Met His Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Val Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Glu Phe Ala Trp
    450                 455                 460

Leu Asn Arg Lys Ser Asp Glu Lys Ile Arg Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Met Val Asp Lys Glu Thr Ser Ala Glu Asn Phe Ile Thr Arg Met Thr
                485                 490                 495

Asn Tyr Asp Gln Tyr Leu Pro Asp Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Phe Ile Ala Glu Gly Met Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln
    530                 535                 540

Lys Lys Asp Ile Val Lys Thr Leu Phe Lys Thr Lys Arg Lys Val Thr
545                 550                 555                 560

Ala Lys Asp Ile Lys Ala Tyr Leu Glu Asn Ser Asn Gly Tyr Ala Gly
                565                 570                 575

Val Glu Leu Lys Gly Leu Glu Glu Gln Phe Asn Ala Ser Leu Pro Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Leu Arg Asp Lys Ala Phe Ile Asp Ala
        595                 600                 605

Glu Glu Asn Gln Glu Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620
```

```
Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Lys Tyr Lys Asp
625                 630                 635                 640


Ile Leu Thr Glu Glu Gln Arg Lys Lys Leu Glu Arg Arg His Tyr Thr
                645                 650                 655


Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Leu Asp Lys
            660                 665                 670


Val Thr Arg Lys Thr Ile Leu Gly Tyr Leu Ile Asp Asp Gly Thr Ser
        675                 680                 685


Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Thr Leu Ser Phe Val
    690                 695                 700


Asp Glu Ile Arg Leu Ala Gln Gly Ser Gly Glu Ala Glu Asp Tyr Arg
705                 710                 715                 720


Ala Glu Val Gln Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735


Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Ile Glu Val Met Gly Tyr
            740                 745                 750


Asp Pro Glu His Ile Val Val Glu Met Ala Arg Glu Asn Gln Phe Thr
        755                 760                 765


Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Lys Ile Glu Asn
    770                 775                 780


Ala Ile Lys Asn Leu Asn Ser Lys Ile Leu Lys Glu Tyr Pro Thr Asn
785                 790                 795                 800


Asn Gln Ala Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn
                805                 810                 815


Gly Lys Asp Met Tyr Thr Asp Glu Glu Leu Asp Ile Asp Gln Leu Ser
            820                 825                 830
```

```
Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp
        835                 840                 845


Ser Leu Asp Asn Lys Val Leu Thr Lys Ser Ala Lys Asn Arg Gly Lys
    850                 855                 860


Ser Asp Asp Val Pro Ser Leu Glu Ile Val His Lys Lys Lys Asn Phe
865                 870                 875                 880


Trp Lys Gln Leu Leu Asp Ser Gln Leu Ile Ser Gln Arg Lys Phe Asp
                885                 890                 895


Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asn Glu Asp Lys Ala
            900                 905                 910


Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925


Val Ala Arg Ile Leu Asp Thr Arg Phe Asn Thr Lys Leu Asp Glu Ala
    930                 935                 940


Gly Asn Arg Ile Arg Asp Pro Lys Val Asn Ile Ile Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Gln Phe Arg Lys Asp Tyr Gln Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Val Ala Thr Ala Leu Leu Lys Lys  Tyr Pro Gln Leu Ala  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro Lys  Tyr Asn Ser Tyr Lys  Ser Arg Lys
    1010                1015                1020


Ala Thr  Glu Lys Val Leu Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035
```

```
Arg Arg  Val Leu Val Tyr Ser  Lys Thr Gly Glu Val  Arg Ile Arg
    1040                1045                1050

Pro Val  Ile Glu Val Asn Lys  Glu Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065

Lys Lys  Ser Asp Phe Arg Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080

Gln Val  Asn Val Val Lys Lys  Val Glu Met Gln Thr  Gly Gly Phe
    1085                1090                1095

Ser Lys  Glu Ser Ile Leu Gln  His Gly Asp Ser Asp  Lys Leu Ile
    1100                1105                1110

Pro Arg  Lys Thr Glu Lys Phe  Tyr Leu Asp Thr Lys  Lys Tyr Gly
    1115                1120                1125

Gly Phe  Asp Ser Pro Thr Ile  Ala Tyr Ser Val Leu  Leu Ile Ala
    1130                1135                1140

Asp Ile  Glu Lys Gly Lys Ala  Lys Lys Leu Lys Arg  Val Lys Glu
    1145                1150                1155

Leu Ile  Gly Ile Thr Ile Met  Glu Arg Met Ala Phe  Glu Lys Asn
    1160                1165                1170

Pro Ile  Glu Phe Leu Glu His  Lys Gly Tyr Lys Asn  Ile Leu Glu
    1175                1180                1185

Lys Asn  Ile Ile Lys Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Lys Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Met Ile Leu Pro  Pro His Leu Val Thr  Leu Leu Tyr
    1220                1225                1230
```

```
His Ser  Ser Asn Ile His Lys  Ile Thr Glu Pro Ile  His Leu Asn
    1235                1240                1245


Tyr Val  Asn Lys Asn Lys His  Glu Phe Lys Glu Leu  Leu Arg His
    1250                1255                1260


Ile Ser  Asp Phe Ser Thr Arg  Tyr Ile Leu Ala Gln  Asp Arg Leu
    1265                1270                1275


Ser Lys  Ile Glu Glu Leu Tyr  Asp Lys Asn Asp Gly  Asp Asp Ile
    1280                1285                1290


Ser Asp  Leu Thr Ser Ser Phe  Val Asn Leu Leu Thr  Phe Thr Ala
    1295                1300                1305


Ile Gly  Ala Pro Ala Ala Phe  Lys Phe Leu Gly Ser  Val Ile Asp
    1310                1315                1320


Arg Lys  Arg Tyr Thr Ser Ile  Ala Glu Ile Leu Glu  Ala Thr Leu
    1325                1330                1335


Ile His  Gln Ser Val Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Lys  Leu Gly Gly Asp
    1355


<210>  202
<211>  1361
<212>  PRT
<213>  Streptococcus suis

<400>  202

Met Lys Lys Lys Tyr Ala Ile Gly Ile Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Phe Gly Asn Thr Glu Lys Arg Tyr Ile Lys Lys Asn Leu Leu
```

```
        35                  40                  45

Gly Thr Leu Leu Phe Asp Glu Gly Asn Thr Ala Glu Asn Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Glu Glu Ile Asn Lys Ile Asp Asp Ser
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Ile Val Glu Asp Lys Gln
            100                 105                 110

Gly Ser Lys His Pro Ile Phe Gly Thr Leu Gln Glu Glu Lys Glu Tyr
        115                 120                 125

His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
    130                 135                 140

Ser Ser Gln Lys Ala Asp Ile Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Asp Leu Lys Ser
                165                 170                 175

Glu Asn Lys Asp Val Gln His Leu Phe Asn Asp Phe Val Glu Met Phe
            180                 185                 190

Asp Lys Thr Val Glu Gly Ser Tyr Leu Ser Glu Asn Leu Pro Asn Val
        195                 200                 205

Ala Asp Val Leu Val Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Ile Leu His Tyr Phe Pro Asn Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Phe Leu Thr Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
```

245 250 255

Glu Leu Ala Glu Asp Ala Lys Ile Gln Phe Ser Lys Glu Thr Tyr Glu
260 265 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
275 280 285

Leu Phe Ile Ala Thr Lys Ser Leu Tyr Asp Gly Ile Leu Leu Ala Gly
290 295 300

Ile Leu Ser Thr Thr Asp Ser Thr Thr Lys Ala Pro Leu Ser Ser Ser
305 310 315 320

Met Val Asn Arg Tyr Glu Glu His Gln Lys Asp Leu Ala Leu Leu Lys
325 330 335

Asn Phe Ile His Gln Asn Leu Ser Asp Ser Tyr Lys Glu Val Phe Asn
340 345 350

Asp Lys Leu Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr Thr
355 360 365

Gln Glu Asn Phe Tyr Arg Phe Ile Lys Lys Ala Ile Glu Lys Ile Glu
370 375 380

Gly Ser Asn Tyr Phe Ile Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
405 410 415

Gln Glu Met His Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
420 425 430

Leu Val Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
435 440 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Glu Phe Ala Trp

```
    450                 455                 460

Leu Asn Arg Lys Ser Asp Glu Lys Ile Arg Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Met Val Asp Lys Glu Thr Ser Ala Glu Asn Phe Ile Thr Arg Met Thr
                485                 490                 495

Asn Tyr Asp Gln Tyr Leu Pro Asp Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Tyr Val Thr Glu Gln Gly Lys Ser Phe Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Glu Lys Leu Met Asp Phe Leu Gly Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Leu Gly Leu Asp Lys Asp Asn Lys Ser Phe Asn Ala Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Val Ser Lys Asp Leu Leu
        595                 600                 605

Asp Asn Pro Glu Asn Glu Asp Ile Leu Glu Asn Val Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Lys Tyr
625                 630                 635                 640

Lys Asp Val Leu Thr Glu Glu Gln Arg Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg
```

660 665 670

Asp Lys Val Thr Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
675 680 685

Thr Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Thr Leu Ser
690 695 700

Phe Val Asp Glu Ile Arg Leu Ala Gln Gly Ser Gly Glu Ala Glu Asp
705 710 715 720

Tyr Arg Ala Glu Val Gln Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Ile Glu Val Met
740 745 750

Gly Tyr Asp Pro Glu His Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Lys Ile
770 775 780

Glu Asn Ala Ile Lys Asn Leu Asn Ser Lys Ile Leu Lys Glu Tyr Pro
785 790 795 800

Thr Asn Asn Gln Ala Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
805 810 815

Gln Asn Gly Lys Asp Met Tyr Thr Asp Glu Glu Leu Asp Ile Asp Gln
820 825 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
835 840 845

Asp Asp Ser Leu Asp Asn Lys Val Leu Thr Lys Ser Ala Lys Asn Arg
850 855 860

Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val His Lys Lys Lys

865 870 875 880

Asn Phe Trp Lys Gln Leu Leu Asp Ser Gln Leu Ile Ser Gln Arg Lys
885 890 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asn Glu Asp
900 905 910

Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
915 920 925

Lys His Val Ala Arg Ile Leu Asp Thr Arg Phe Asn Thr Lys Leu Asp
930 935 940

Glu Ala Gly Asn Arg Ile Arg Asp Pro Lys Val Asn Ile Ile Thr Leu
945 950 955 960

Lys Ser Asn Leu Val Ser Gln Phe Arg Lys Asp Tyr Gln Leu Tyr Lys
965 970 975

Val Arg Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn
980 985 990

Ala Val Val Ala Thr Ala Leu Leu Lys Lys Tyr Pro Gln Leu Ala Pro
995 1000 1005

Glu Phe Val Tyr Gly Asp Tyr Pro Lys Tyr Asn Ser Tyr Lys Ser
1010 1015 1020

Arg Lys Ala Thr Glu Lys Val Leu Phe Tyr Ser Asn Ile Met Asn
1025 1030 1035

Phe Phe Arg Arg Val Leu Val Tyr Ser Lys Thr Gly Glu Val Arg
1040 1045 1050

Ile Arg Pro Val Ile Glu Val Asn Lys Glu Thr Gly Glu Ile Val
1055 1060 1065

Trp Asp Lys Lys Ser Asp Phe Arg Thr Val Arg Lys Val Leu Ser

1070 1075 1080

Tyr Pro Gln Val Asn Val Val Lys Lys Val Glu Met Gln Thr Gly
1085 1090 1095

Gly Phe Ser Lys Glu Ser Ile Leu Gln His Gly Asp Ser Asp Lys
1100 1105 1110

Leu Ile Pro Arg Lys Thr Glu Lys Phe Tyr Leu Asp Thr Lys Lys
1115 1120 1125

Tyr Gly Gly Phe Asp Ser Pro Thr Ile Ala Tyr Ser Val Leu Leu
1130 1135 1140

Ile Ala Asp Ile Glu Lys Gly Lys Ala Lys Lys Leu Lys Arg Val
1145 1150 1155

Lys Glu Leu Ile Gly Ile Thr Ile Met Glu Arg Met Ala Phe Glu
1160 1165 1170

Lys Asn Pro Ile Glu Phe Leu Glu His Lys Gly Tyr Lys Asn Ile
1175 1180 1185

Leu Glu Lys Asn Ile Ile Lys Leu Pro Lys Tyr Ser Leu Phe Glu
1190 1195 1200

Leu Glu Asn Gly Arg Arg Arg Leu Leu Ala Ser Ala Lys Glu Leu
1205 1210 1215

Gln Lys Gly Asn Glu Met Ile Leu Pro Pro His Leu Val Thr Leu
1220 1225 1230

Leu Tyr His Ser Ser Asn Ile His Lys Ile Thr Glu Pro Ile His
1235 1240 1245

Leu Asn Tyr Val Asn Lys Asn Lys His Glu Phe Lys Glu Leu Leu
1250 1255 1260

Arg His Ile Ser Asp Phe Ser Thr Arg Tyr Ile Leu Ala Gln Asp

1265 1270 1275

Arg Leu Ser Lys Ile Glu Glu Leu Tyr Asp Lys Asn Asp Gly Asp
1280 1285 1290

Asp Ile Ser Asp Leu Thr Ser Ser Phe Val Asn Leu Leu Thr Phe
1295 1300 1305

Thr Ala Ile Gly Ala Pro Ala Ala Phe Lys Phe Leu Gly Ser Val
1310 1315 1320

Ile Asp Arg Lys Arg Tyr Thr Ser Ile Ala Glu Ile Leu Glu Ala
1325 1330 1335

Thr Leu Ile His Gln Ser Val Thr Gly Leu Tyr Glu Thr Arg Ile
1340 1345 1350

Asp Leu Ser Lys Leu Gly Gly Asp
1355 1360

<210> 203
<211> 1361
<212> PRT
<213> Streptococcus suis

<400> 203

Met Lys Lys Lys Tyr Ala Ile Gly Ile Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
20 25 30

Lys Val Phe Gly Asn Thr Glu Lys Arg Tyr Ile Lys Lys Asn Leu Leu
35 40 45

Gly Thr Leu Leu Phe Asp Glu Gly Asn Thr Ala Glu Asn Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65 70 75 80

```
Tyr Leu Gln Glu Ile Phe Ala Glu Glu Ile Asn Lys Ile Asp Asp Ser
                85                  90                  95

Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Ile Val Glu Asp Lys Gln
            100                 105                 110

Gly Ser Lys His Pro Ile Phe Gly Thr Leu Gln Glu Glu Lys Glu Tyr
        115                 120                 125

His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
    130                 135                 140

Ser Ser Gln Lys Ala Asp Ile Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Asp Leu Lys Ser
                165                 170                 175

Glu Asn Lys Asp Val Gln His Leu Phe Asn Asp Phe Val Glu Met Phe
            180                 185                 190

Asp Lys Thr Val Glu Gly Ser Tyr Leu Ser Glu Asn Leu Pro Asn Val
        195                 200                 205

Ala Asp Val Leu Val Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Ile Leu His Tyr Phe Pro Asn Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Phe Leu Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Glu Leu Ala Glu Asp Ala Lys Ile Gln Phe Ser Lys Glu Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285
```

```
Leu Phe Ile Ala Thr Lys Ser Leu Tyr Asp Gly Ile Leu Leu Ala Gly
    290                 295                 300

Ile Leu Ser Thr Thr Asp Ser Thr Thr Lys Ala Pro Leu Ser Ser Ser
305                 310                 315                 320

Met Val Asn Arg Tyr Glu Glu His Gln Lys Asp Leu Ala Leu Leu Lys
                325                 330                 335

Asn Phe Ile His Gln Asn Leu Ser Asp Ser Tyr Lys Glu Val Phe Asn
            340                 345                 350

Asp Lys Leu Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr Thr
        355                 360                 365

Gln Glu Asn Phe Tyr Arg Phe Ile Lys Lys Ala Ile Glu Lys Ile Glu
    370                 375                 380

Gly Ser Asn Tyr Phe Ile Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Val Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Glu Phe Ala Trp
    450                 455                 460

Leu Asn Arg Lys Ser Asp Glu Lys Ile Arg Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Met Val Asp Lys Glu Thr Ser Ala Glu Asn Phe Ile Thr Arg Met Thr
                485                 490                 495
```

```
Asn Tyr Asp Gln Tyr Leu Pro Asp Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Tyr Val Thr Glu Gln Gly Lys Ser Phe Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp Gly Val Phe Lys Val Tyr Arg Lys Val Thr Lys
545                 550                 555                 560

Glu Lys Leu Met Asp Phe Leu Gly Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Leu Gly Leu Asp Lys Asp Asn Lys Ser Phe Asn Ala Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Lys Lys Ile Val Ser Lys Asp Leu Leu
        595                 600                 605

Asp Asn Pro Glu Asn Glu Asp Ile Leu Glu Asn Val Val Leu Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Lys Tyr
625                 630                 635                 640

Lys Asp Val Leu Thr Glu Glu Gln Arg Lys Lys Leu Glu Arg Arg His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asp Lys Val Thr Arg Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Thr Ser Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Thr Leu Ser
    690                 695                 700
```

```
Phe Val Asp Glu Ile Arg Leu Ala Gln Gly Ser Gly Glu Ala Glu Asp
705                 710                 715                 720

Tyr Arg Ala Glu Val Gln Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Ile Glu Val Met
            740                 745                 750

Gly Tyr Asp Pro Glu His Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Phe Thr Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Lys Ile
    770                 775                 780

Glu Asn Ala Ile Lys Asn Leu Asn Ser Lys Ile Leu Lys Glu Tyr Pro
785                 790                 795                 800

Thr Asn Asn Gln Ala Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Lys Asp Met Tyr Thr Asp Glu Glu Leu Asp Ile Asp Gln
            820                 825                 830

Leu Ser Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys
        835                 840                 845

Asp Asp Ser Leu Asp Asn Lys Val Leu Thr Lys Ser Ala Lys Asn Arg
    850                 855                 860

Gly Lys Ser Asp Asp Val Pro Ser Leu Glu Ile Val His Lys Lys Lys
865                 870                 875                 880

Asn Phe Trp Lys Gln Leu Leu Asp Ser Gln Leu Ile Ser Gln Arg Lys
                885                 890                 895

Phe Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asn Glu Asp
            900                 905                 910
```

```
Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Thr Arg Phe Asn Thr Lys Leu Asp
    930                 935                 940

Glu Ala Gly Asn Arg Ile Arg Asp Pro Lys Val Asn Ile Ile Thr Leu
945                 950                 955                 960

Lys Ser Asn Leu Val Ser Gln Phe Arg Lys Asp Tyr Gln Leu Tyr Lys
                965                 970                 975

Val Arg Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn
            980                 985                 990

Ala Val Val Ala Thr Ala Leu Leu  Lys Lys Tyr Pro Gln  Leu Ala Pro
        995                 1000                1005

Glu Phe  Val Tyr Gly Asp Tyr  Pro Lys Tyr Asn Ser  Tyr Lys Ser
    1010                1015                1020

Arg Lys  Ala Thr Glu Lys Val  Leu Phe Tyr Ser Asn  Ile Met Asn
    1025                1030                1035

Phe Phe  Arg Arg Val Leu Val  Tyr Ser Lys Thr Gly  Glu Val Arg
    1040                1045                1050

Ile Arg  Pro Val Ile Glu Val  Asn Lys Glu Thr Gly  Glu Ile Val
    1055                1060                1065

Trp Asp  Lys Lys Ser Asp Phe  Arg Thr Val Arg Lys  Val Leu Ser
    1070                1075                1080

Tyr Pro  Gln Val Asn Val Val  Lys Lys Val Glu Met  Gln Thr Gly
    1085                1090                1095

Gly Phe  Ser Lys Glu Ser Ile  Leu Gln His Gly Asp  Ser Asp Lys
    1100                1105                1110
```

```
Leu Ile  Pro Arg Lys Thr Glu  Lys Phe Tyr Leu Asp  Thr Lys Lys
    1115                1120                1125

Tyr Gly  Gly Phe Asp Ser Pro  Thr Ile Ala Tyr Ser  Val Leu Leu
    1130                1135                1140

Ile Ala  Asp Ile Glu Lys Gly  Lys Ala Lys Lys Leu  Lys Arg Val
    1145                1150                1155

Lys Glu  Leu Ile Gly Ile Thr  Ile Met Glu Arg Met  Ala Phe Glu
    1160                1165                1170

Lys Asn  Pro Ile Glu Phe Leu  Glu His Lys Gly Tyr  Lys Asn Ile
    1175                1180                1185

Leu Glu  Lys Asn Ile Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu
    1190                1195                1200

Leu Glu  Asn Gly Arg Arg Arg  Leu Leu Ala Ser Ala  Lys Glu Leu
    1205                1210                1215

Gln Lys  Gly Asn Glu Met Ile  Leu Pro Pro His Leu  Val Thr Leu
    1220                1225                1230

Leu Tyr  His Ser Ser Asn Ile  His Lys Ile Thr Glu  Pro Ile His
    1235                1240                1245

Leu Asn  Tyr Val Asn Lys Asn  Lys His Glu Phe Lys  Glu Leu Leu
    1250                1255                1260

Arg His  Ile Ser Asp Phe Ser  Thr Arg Tyr Ile Leu  Ala Gln Asp
    1265                1270                1275

Arg Leu  Ser Lys Ile Glu Glu  Leu Tyr Asp Lys Asn  Asp Gly Asp
    1280                1285                1290

Asp Ile  Ser Asp Leu Thr Ser  Ser Phe Val Asn Leu  Leu Thr Phe
    1295                1300                1305
```

```
Thr Ala  Ile Gly Ala Pro Ala  Ala Phe Lys Phe Leu  Gly Ser Val
    1310                1315                1320


Ile Asp  Arg Lys Arg Tyr Thr  Ser Ile Ala Glu Ile  Leu Glu Ala
    1325                1330                1335


Thr Leu  Ile His Gln Ser Val  Thr Gly Leu Tyr Glu  Thr Arg Ile
    1340                1345                1350


Asp Leu  Ser Lys Leu Gly Gly  Asp
    1355                1360


<210>  204
<211>  1359
<212>  PRT
<213>  Streptococcus suis

<400>  204

Met Lys Lys Lys Tyr Ala Ile Gly Ile Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Val Val Thr Asp Asp Tyr Lys Val Pro Ser Lys Lys Met
            20                  25                  30


Lys Val Phe Gly Asn Thr Glu Lys Arg Tyr Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Thr Leu Leu Phe Asp Glu Gly Asn Thr Ala Glu Asn Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Ile Leu
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Ile Asn Lys Ile Asp Asp Ser
                85                  90                  95


Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Ile Val Glu Asp Lys Gln
            100                 105                 110
```

```
Gly Ser Lys His Pro Ile Phe Gly Thr Leu Gln Glu Glu Lys Lys Tyr
        115                 120                 125

His Lys Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Gln Leu Ala Asp
    130                 135                 140

Ser Ser Gln Lys Ala Asp Ile Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Asp Leu Lys Ser
                165                 170                 175

Glu Asn Lys Asp Val Gln His Leu Phe Asn Asp Phe Val Glu Met Phe
            180                 185                 190

Asp Lys Thr Val Glu Gly Ser Tyr Leu Ser Glu Asn Leu Pro Asn Val
        195                 200                 205

Ala Asp Val Leu Val Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220

Ile Leu His Tyr Phe Pro Asn Glu Lys Lys Asn Gly Leu Phe Gly Asn
225                 230                 235                 240

Phe Leu Ala Leu Ala Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255

Glu Leu Ala Glu Asp Ala Lys Ile Gln Phe Ser Lys Glu Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Gly Lys Ile Gly Asp Asp Tyr Ala Asp
        275                 280                 285

Leu Phe Ile Ala Thr Lys Ser Leu Tyr Asp Gly Ile Leu Leu Ala Gly
    290                 295                 300

Ile Leu Ser Thr Thr Asp Ser Thr Thr Lys Ala Pro Leu Ser Ser Ser
305                 310                 315                 320
```

```
Met Val Asn Arg Tyr Glu Glu His Lys Lys Asp Leu Ala Leu Leu Lys
                325                 330                 335

Asn Phe Ile His Gln Asn Leu Ser Asp Ser Tyr Lys Glu Val Phe Asn
            340                 345                 350

Asp Lys Leu Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Lys Thr Thr
        355                 360                 365

Gln Glu Asn Phe Tyr Arg Phe Ile Lys Lys Ala Ile Glu Lys Ile Glu
    370                 375                 380

Gly Ser Asp Tyr Phe Ile Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Ile Arg Arg Gln Ala Glu Phe Tyr Pro Phe
            420                 425                 430

Leu Val Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Lys Ser Glu Phe Ala Trp
    450                 455                 460

Leu Asn Arg Lys Ser Asp Glu Lys Ile Arg Pro Trp Asn Phe Asp Glu
465                 470                 475                 480

Met Val Asp Lys Glu Thr Ser Ala Glu Asn Phe Ile Thr Arg Met Thr
                485                 490                 495

Asn Tyr Asp Gln Tyr Leu Pro Asp Gln Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Lys Phe Ala Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525
```

```
Phe Ile Ala Glu Gly Met Arg Asp Tyr Gln Phe Leu Asp Ser Gly Gln
    530                 535                 540

Lys Lys Asp Ile Val Lys Thr Leu Phe Lys Thr Lys Arg Lys Val Thr
545                 550                 555                 560

Ala Lys Asp Ile Lys Ala Tyr Leu Glu Asn Ser Asn Gly Tyr Ala Gly
                565                 570                 575

Val Glu Leu Lys Gly Leu Glu Glu Gln Phe Asn Ala Ser Leu Pro Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Leu Arg Asp Lys Ala Phe Ile Asp Ala
        595                 600                 605

Glu Glu Asn Gln Glu Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Arg Lys Arg Leu Glu Lys Tyr Lys Asp
625                 630                 635                 640

Ile Leu Thr Glu Glu Gln Arg Lys Lys Leu Glu Arg Arg His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Ala Lys Leu Ile Asn Gly Ile Leu Asp Lys
            660                 665                 670

Val Thr Arg Lys Thr Ile Leu Gly Tyr Leu Ile Asp Asp Gly Thr Ser
        675                 680                 685

Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Thr Leu Ser Phe Val
    690                 695                 700

Asp Glu Ile Arg Leu Ala Gln Gly Ser Gly Glu Ala Glu Asp Tyr Arg
705                 710                 715                 720

Ala Glu Val Gln Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735
```

```
Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Ile Glu Val Met Gly Tyr
            740                 745                 750

Asp Pro Glu His Ile Val Val Glu Met Ala Arg Glu Asn Gln Phe Thr
        755                 760                 765

Asn Gln Gly Arg Arg Asn Ser Gln Gln Arg Tyr Lys Lys Ile Glu Asn
    770                 775                 780

Ala Ile Lys Asn Leu Asn Ser Lys Ile Leu Lys Glu Tyr Pro Thr Asn
785                 790                 795                 800

Asn Gln Ala Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Lys Asp Met Tyr Thr Asp Glu Glu Leu Asp Ile Asp Gln Leu Ser
            820                 825                 830

Gln Tyr Asp Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp
        835                 840                 845

Ser Leu Asp Asn Lys Val Leu Thr Lys Ser Ala Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asp Val Pro Ser Leu Glu Ile Val His Lys Lys Lys Asn Phe
865                 870                 875                 880

Trp Lys Gln Leu Leu Asp Ser Gln Leu Ile Ser Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Thr Asn Glu Asp Lys Ala
            900                 905                 910

Arg Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Arg Ile Leu Asp Thr Arg Phe Asn Thr Lys Leu Asp Glu Ala
    930                 935                 940
```

```
Gly Asn Arg Ile Arg Asp Pro Lys Val Asn Ile Ile Thr Leu Lys Ser
945                 950                 955                 960


Asn Leu Val Ser Gln Phe Arg Lys Asp Tyr Gln Leu Tyr Lys Val Arg
                965                 970                 975


Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val
            980                 985                 990


Val Ala Thr Ala Leu Leu Lys Lys  Tyr Pro Gln Leu Ala  Pro Glu Phe
        995                 1000                1005


Val Tyr  Gly Asp Tyr Pro Lys  Tyr Asn Ser Tyr Lys  Ser Arg Lys
    1010                1015                1020


Ala Thr  Glu Lys Val Leu Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Arg Arg  Val Leu Val Tyr Ser  Lys Thr Gly Glu Val  Arg Ile Arg
    1040                1045                1050


Pro Val  Ile Glu Val Asn Lys  Glu Thr Gly Glu Ile  Val Trp Asp
    1055                1060                1065


Lys Lys  Ser Asp Phe Lys Thr  Val Arg Lys Val Leu  Ser Tyr Pro
    1070                1075                1080


Gln Val  Asn Val Val Lys Lys  Val Glu Met Gln Thr  Gly Gly Phe
    1085                1090                1095


Ser Lys  Glu Ser Ile Leu Gln  His Gly Asp Ser Asp  Lys Leu Ile
    1100                1105                1110


Pro Arg  Lys Thr Glu Lys Phe  Tyr Leu Asp Thr Lys  Lys Tyr Gly
    1115                1120                1125


Gly Phe  Asp Ser Pro Thr Ile  Ala Tyr Ser Val Leu  Leu Ile Ala
    1130                1135                1140
```

```
Asp Ile  Glu Lys Gly Lys Ala  Lys Lys Leu Lys Arg  Val Lys Glu
    1145                1150                1155

Leu Ile  Gly Ile Thr Ile Met  Glu Arg Met Ala Phe  Glu Lys Asn
    1160                1165                1170

Pro Ile  Glu Phe Leu Glu His  Lys Gly Tyr Lys Asn  Ile Leu Glu
    1175                1180                1185

Lys Asn  Ile Ile Lys Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1190                1195                1200

Asn Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Lys Glu  Leu Gln Lys
    1205                1210                1215

Gly Asn  Glu Met Ile Leu Pro  Pro His Leu Val Thr  Leu Leu Tyr
    1220                1225                1230

His Ser  Ser Asn Ile His Lys  Ile Thr Glu Pro Ile  His Leu Asn
    1235                1240                1245

Tyr Val  Asn Lys Asn Lys His  Glu Phe Lys Glu Leu  Leu Arg His
    1250                1255                1260

Ile Ser  Asp Phe Ser Thr Arg  Tyr Ile Leu Ala Gln  Asp Arg Leu
    1265                1270                1275

Ser Lys  Ile Glu Glu Leu Tyr  Asp Lys Asn Asp Gly  Asp Asp Ile
    1280                1285                1290

Ser Asp  Leu Thr Ser Ser Phe  Val Asn Leu Leu Thr  Phe Thr Ala
    1295                1300                1305

Ile Gly  Ala Pro Ala Ala Phe  Lys Phe Leu Gly Ser  Val Ile Asp
    1310                1315                1320

Arg Lys  Arg Tyr Thr Ser Ile  Ala Glu Ile Leu Glu  Ala Thr Leu
    1325                1330                1335
```

```
Ile His  Gln Ser Val Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Lys  Leu Gly Gly Asp
    1355


<210>  205
<211>  1351
<212>  PRT
<213>  Streptococcus suis

<400>  205

Met Asp Gln Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Lys Val Pro Ala Lys Lys Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Lys Gln Ser Ile Lys Lys Asn Leu Leu
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Glu Glu Met Asn Lys Val Asp Glu Asn
                85                  90                  95


Phe Phe Gln Arg Leu Asp Asp Ser Phe Leu Val Asp Glu Asp Lys Arg
            100                 105                 110


Gly Glu Arg His Pro Ile Phe Gly Asn Ile Ala Ala Glu Val Lys Tyr
        115                 120                 125


His Asp Asp Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140
```

```
Ile Ser Gln Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Gln Leu Lys Ala
                165                 170                 175


Glu Asn Thr Asn Val Gln Ala Leu Phe Lys Asp Phe Val Glu Val Tyr
            180                 185                 190


Asp Lys Thr Val Glu Glu Ser His Leu Ser Glu Met Thr Val Asp Ala
        195                 200                 205


Leu Ser Ile Leu Thr Glu Lys Val Ser Lys Ser Arg Arg Leu Glu Asn
    210                 215                 220


Leu Ile Ala His Tyr Pro Ala Glu Lys Lys Asn Thr Leu Phe Gly Asn
225                 230                 235                 240


Leu Ile Ala Leu Ser Leu Gly Leu Gln Pro Asn Phe Lys Thr Asn Phe
                245                 250                 255


Gln Leu Ser Glu Asp Ala Lys Leu Gln Phe Ser Lys Asp Thr Tyr Glu
            260                 265                 270


Glu Asp Leu Glu Gly Leu Leu Gly Glu Ile Gly Asp Glu Tyr Ala Asp
        275                 280                 285


Leu Phe Ala Ser Ala Lys Asn Leu Tyr Asp Ala Ile Leu Leu Ser Gly
    290                 295                 300


Ile Leu Thr Val Asp Asp Asn Ser Thr Lys Ala Pro Leu Ser Ala Ser
305                 310                 315                 320


Met Val Lys Arg Tyr Glu Glu His Gln Lys Asp Leu Lys Lys Leu Lys
                325                 330                 335


Asp Phe Ile Lys Val Asn Ala Pro Asp Gln Tyr Asn Ala Ile Phe Lys
            340                 345                 350
```

```
Asp Lys Asn Lys Lys Gly Tyr Ala Gly Tyr Ile Glu Asn Gly Val Lys
        355                 360                 365

Gln Asp Glu Phe Tyr Lys Tyr Leu Lys Gly Ile Leu Leu Gln Ile Asn
    370                 375                 380

Gly Ser Gly Asp Phe Leu Asp Lys Ile Asp Arg Glu Asp Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu
                405                 410                 415

Gln Glu Met His Ala Ile Leu Arg Arg Gln Glu Glu His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Gln Asp Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Arg Lys Gly Ser Arg Phe Ala Trp
    450                 455                 460

Ala Glu Tyr Lys Ala Asp Glu Lys Ile Thr Pro Trp Asn Phe Asp Asp
465                 470                 475                 480

Ile Leu Asp Lys Glu Lys Ser Ala Glu Lys Phe Ile Thr Arg Met Thr
                485                 490                 495

Leu Asn Asp Leu Tyr Leu Pro Glu Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Leu Leu Tyr Glu Thr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys
        515                 520                 525

Tyr Val Asn Glu Gln Gly Glu Ala Lys Phe Phe Asp Ala Asn Met Lys
    530                 535                 540

Gln Glu Ile Phe Asp His Val Phe Lys Glu Asn Arg Lys Val Thr Lys
545                 550                 555                 560
```

```
Asp Lys Leu Leu Asn Tyr Leu Gly Lys Glu Phe Asp Glu Phe Arg Ile
                565                 570                 575

Val Asp Leu Thr Gly Leu Asp Lys Glu Asn Lys Val Phe Asn Ser Ser
            580                 585                 590

Leu Gly Thr Tyr His Asp Leu Arg Lys Ile Leu Asp Lys Ser Phe Leu
        595                 600                 605

Asp Asn Lys Glu Asn Glu Gln Ile Ile Glu Asp Ile Ile Gln Thr Leu
    610                 615                 620

Thr Leu Phe Glu Asp Arg Glu Met Ile Arg Gln Arg Leu Gln Lys Tyr
625                 630                 635                 640

Ser Asp Ile Phe Thr Lys Ala Gln Leu Lys Lys Leu Glu Arg Cys His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Tyr Lys Leu Ile Asn Gly Ile Arg
            660                 665                 670

Asn Lys Glu Asn Lys Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Tyr Ala Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ala Leu Ser
    690                 695                 700

Phe Lys Glu Glu Ile Ala Lys Ala Gln Val Ile Gly Glu Thr Asp Asp
705                 710                 715                 720

Leu Asn Gln Val Val Ser Asp Ile Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Lys Val Met
            740                 745                 750

Gly Tyr Asn Pro Ala Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765
```

```
Thr Thr Asp Lys Gly Arg Arg Asn Ser Gln Gln Arg Leu Lys Leu Leu
    770                 775                 780

Gln Asp Ser Leu Lys Pro Val Asn Ile Lys Asn Val Glu Asn Gln Gln
785                 790                 795                 800

Leu Gln Asn Asp Arg Leu Phe Leu Tyr Tyr Ile Gln Asn Gly Lys Asp
                805                 810                 815

Met Tyr Thr Gly Glu Thr Leu Asp Ile Asn Asn Leu Ser Gln Tyr Asp
            820                 825                 830

Ile Asp His Ile Ile Pro Gln Ala Phe Ile Lys Asp Asp Ser Phe Asp
        835                 840                 845

Asn Arg Val Leu Thr Ser Ser Ser Glu Asn Arg Gly Lys Ser Asp Asn
    850                 855                 860

Val Pro Ser Ile Glu Val Val Arg Ala Arg Lys Ala Asp Trp Met Arg
865                 870                 875                 880

Leu Arg Lys Ala Gly Leu Ile Ser Gln Arg Lys Phe Asp Asn Leu Thr
                885                 890                 895

Lys Ala Glu Arg Gly Gly Leu Thr Glu Asn Asp Lys Ala Gly Phe Ile
            900                 905                 910

Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln
        915                 920                 925

Val Leu Asp Ala Arg Phe Asn Ala Lys His Asp Glu Asn Lys Lys Val
    930                 935                 940

Ile Arg Asp Val Lys Ile Ile Thr Leu Lys Ser Asn Leu Val Ser Gln
945                 950                 955                 960

Phe Arg Lys Asp Phe Lys Phe Tyr Lys Val Arg Glu Ile Asn Asp Tyr
                965                 970                 975
```

```
His His Ala His Asp Ala Tyr Leu Asn Ala Val Ile Gly Thr Ala Leu
            980                 985                 990


Leu Lys Lys Tyr Pro Lys Leu Ala  Ser Glu Phe Val Tyr  Gly Glu Phe
        995                 1000                1005


Lys Lys  Tyr Asp Val Ser Asp  Lys Glu Ile Gly Lys  Ala Thr Ala
    1010                1015                1020


Lys Tyr  Phe Phe Tyr Ser Asn  Leu Met Asn Phe Phe  Lys Lys Glu
    1025                1030                1035


Val Lys  Phe Ala Asp Gly Thr  Val Val Glu Arg Pro  Asp Ile Glu
    1040                1045                1050


Thr Ser  Glu Asp Gly Glu Ile  Ala Trp Asn Lys Gln  Thr Asp Phe
    1055                1060                1065


Lys Ile  Val Arg Lys Val Leu  Ser Tyr Pro Gln Val  Asn Ile Val
    1070                1075                1080


Lys Lys  Thr Glu Val Gln Thr  His Gly Leu Asp Arg  Pro Ser Pro
    1085                1090                1095


Lys Pro  Lys Pro Asp Ser Ser  Glu Asn Leu Val Gly  Val Lys Arg
    1100                1105                1110


Asn Leu  Asp Pro Lys Lys Tyr  Gly Gly Tyr Ala Gly  Ile Ser Asn
    1115                1120                1125


Ser Tyr  Ala Val Leu Val Lys  Ala Ile Ile Glu Lys  Gly Val Lys
    1130                1135                1140


Lys Lys  Glu Thr Met Val Leu  Glu Phe Gln Gly Ile  Ser Ile Leu
    1145                1150                1155


Asp Arg  Ile Thr Phe Glu Lys  Asp Lys Arg Ala Phe  Leu Leu Gly
    1160                1165                1170
```

```
Lys Gly  Tyr Lys Asp Ile Lys  Lys Ile Ile Glu Leu  Pro Lys Tyr
    1175                1180                1185


Ser Leu  Phe Glu Leu Lys Asp  Gly Ser Arg Arg Met  Leu Ala Ser
    1190                1195                1200


Arg Gly  Glu Ile His Lys Gly  Asn Glu Leu Phe Val  Pro Gln Lys
    1205                1210                1215


Phe Thr  Thr Leu Leu Tyr His  Ala Lys Arg Ile Asn  Asn Pro Ile
    1220                1225                1230


Asn Lys  Asp His Ile Glu Tyr  Val Lys Lys His Arg  Asp Asp Phe
    1235                1240                1245


Lys Glu  Leu Leu Asn Tyr Val  Leu Glu Phe Asn Glu  Lys Tyr Val
    1250                1255                1260


Gly Ala  Thr Lys Asn Gly Glu  Arg Leu Lys Glu Ala  Val Ala Asp
    1265                1270                1275


Phe Asp  Ser Lys Ser Asn Glu  Glu Ile Cys Thr Ser  Phe Leu Gly
    1280                1285                1290


Leu Phe  Glu Leu Thr Ser Leu  Gly Ser Ala Ser Asp  Phe Glu Phe
    1295                1300                1305


Leu Gly  Val Lys Ile Pro Arg  Tyr Arg Asp Tyr Thr  Pro Ser Ser
    1310                1315                1320


Leu Leu  Lys Asp Ser Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1325                1330                1335


Tyr Glu  Thr Arg Ile Asp Leu  Ser Lys Leu Gly Glu  Asp
    1340                1345                1350
```

<210> 206
<211> 1256
<212> PRT
<213> Brochothrix thermosphacta

<400> 206

```
Met Trp Gly Val Ser Leu Phe Glu Ala Gly Lys Thr Ala Ala Glu Arg
1               5                  10                  15

Arg Gly Tyr Arg Ser Thr Arg Arg Arg Leu Asn His Arg Lys Phe Arg
            20                  25                  30

Leu Arg Leu Leu Glu Asp Met Phe Glu Lys Glu Ile Leu Ser Lys Asp
        35                  40                  45

Pro Ser Phe Phe Ile Arg Leu Lys Glu Ala Phe Leu Ser Pro Lys Asp
    50                  55                  60

Glu Gln Lys Gln Phe Leu Phe Asn Asp Lys Asp Tyr Thr Asp Ala Asp
65                  70                  75                  80

Tyr Tyr Glu Gln Tyr Lys Thr Ile Tyr His Leu Arg Tyr Asp Leu Ile
                85                  90                  95

Ser Gln His Arg Gln Phe Asp Ile Arg Glu Val Tyr Leu Ala Ile His
            100                 105                 110

His Leu Ile Lys Tyr Arg Gly His Phe Ile Tyr Glu Asp Gln Thr Phe
        115                 120                 125

Thr Thr Asp Gly Asn Gln Leu Gln His His Ile Lys Ala Ile Ile Thr
    130                 135                 140

Met Ile Asn Ser Thr Leu Asn Arg Ile Ile Pro Glu Thr Ile Asp Ile
145                 150                 155                 160

Asn Val Phe Glu Lys Ile Leu Leu Asp Arg Met Met Asn Arg Ser Ser
                165                 170                 175

Lys Val Lys Phe Leu Ile Glu Leu Thr Gly Lys Gln Asp Lys Pro Leu
            180                 185                 190

Leu Lys Glu Leu Phe Asn Leu Ile Val Gly Leu Lys Ala Lys Pro Ala
```

195 200 205

Ser Ile Phe Glu Gln Glu Asn Leu Ala Thr Ile Val Glu Thr Met Asn
210 215 220

Met Ser Thr Glu Gln Val Gln Leu Asp Leu Leu Thr Leu Ala Asp Val
225 230 235 240

Leu Ala Asp Glu Glu Tyr Asp Leu Leu Leu Thr Ala Gln Lys Ile Tyr
245 250 255

Ser Ala Ile Ile Leu Asp Glu Ser Met Asp Gly Tyr Glu Tyr Phe Ala
260 265 270

Glu Ala Lys Lys Glu Ser Tyr Arg Lys His Gln Glu Glu Leu Val Leu
275 280 285

Val Lys Lys Met Leu Lys Ser Asn Ala Ile Thr Asn Asp Glu Arg Ala
290 295 300

Lys Phe Glu Tyr Phe Tyr Thr Asp Tyr Ile Gly Tyr Glu Glu Ser Lys
305 310 315 320

Ser Lys Glu Glu Arg Leu Phe Lys His Ile Glu Leu Leu Leu Ala Lys
325 330 335

Glu Asn Val Leu Thr Thr Val Glu His Ala Leu Leu Glu Lys Asn Ile
340 345 350

Thr Phe Ala Ser Leu Leu Pro Leu Gln Arg Ser Ser Arg Asn Ala Val
355 360 365

Ile Pro Tyr Gln Val His Glu Lys Glu Leu Val Ala Ile Leu Glu Asn
370 375 380

Gln Ala Thr Tyr Tyr Pro Phe Leu Leu Glu Gln Lys Asp Asn Ile His
385 390 395 400

Lys Leu Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Asp

405 410 415

Gln Lys Asp Ser Glu Phe Ala Trp Met Val Arg Lys Gln Ala Gly Lys
420 425 430

Ile Thr Pro Phe Asn Phe Glu Glu Met Val Asp Ile Asp Ala Ser Ser
435 440 445

Glu Ala Phe Ile Lys Arg Met Thr Asn Lys Cys Thr Tyr Leu Ile His
450 455 460

Glu Asp Val Ile Pro Lys His Ser Phe Ser Tyr Ala Lys Phe Glu Val
465 470 475 480

Leu Asn Glu Leu Asn Lys Ile Arg Leu Asp Gly Lys Pro Ile Asp Ile
485 490 495

Pro Leu Lys Lys Arg Ile Phe Glu Gly Leu Phe Leu Glu Lys Thr Lys
500 505 510

Val Thr Gln Thr Ser Leu Lys Lys Trp Leu Ala Glu His Glu His Met
515 520 525

Thr Val Ser Val Val Gln Gly Thr Gln Lys Glu Thr Glu Phe Ala Thr
530 535 540

Ser Leu Gln Ala Phe His Arg Phe Val Lys Ile Phe Asp Arg Glu Thr
545 550 555 560

Val Ser Asn Pro Ala Asn Glu Glu Met Phe Glu Lys Ile Ile Tyr Trp
565 570 575

Ser Thr Val Phe Glu Asp Lys Lys Ile Met Arg Arg Lys Leu Ser Glu
580 585 590

Tyr Pro Gln Leu Thr Glu Gln Gln Gln Val Gln Leu Ala Gln Val Arg
595 600 605

Phe Arg Gly Trp Gly Arg Leu Ser Gln Arg Leu Ile Asn Arg Ile Lys

610 615 620

Thr Pro Glu Asp His Lys Leu Ser Ile Asn Glu Ile Leu Gln Thr Asn
625 630 635 640

Glu Asn Phe Met Gln Ile Ile Arg Asn Lys Asp Tyr Leu Phe Lys Lys
645 650 655

Ile Ile Glu Glu Gln Phe Glu Asn Glu Thr Ala Leu Leu Asn Lys Gln
660 665 670

Arg Ile Asp Glu Leu Ala Ala Ser Pro Ala Asn Lys Lys Gly Ile Trp
675 680 685

Gln Ala Ile Lys Ile Val Lys Glu Leu Glu Lys Val Leu Gln Gln Pro
690 695 700

Ala Glu Asn Ile Phe Ile Glu Phe Ala Arg Ser Asp Glu Glu Ser Lys
705 710 715 720

Arg Ser Thr Pro Arg Asp Lys Phe Ile Glu Lys Ala Tyr Ala Glu Thr
725 730 735

Asp Thr Glu His Leu Lys Glu Leu Lys Gln Arg Ser Lys Gln Leu Ser
740 745 750

Ser Gln Arg Leu Phe Leu Tyr Phe Ile Gln Asn Gly Lys Cys Met Tyr
755 760 765

Ser Gly Glu His Leu Asp Ile Glu Arg Leu Asp Ser Tyr Glu Val Asp
770 775 780

His Ile Leu Pro Gln Ser Tyr Ile Lys Asp Asn Ser Ile Glu Asn Leu
785 790 795 800

Ala Leu Val Lys Lys Val Glu Asn Gln Arg Lys Lys Asp Ser Leu Leu
805 810 815

Leu Asn Ser Ser Ile Ile Asn Gln Asn Tyr Ser Arg Trp Glu Gln Leu

820 825 830

Lys Asn Ala Gly Leu Ile Gly Glu Lys Lys Phe Arg Asn Leu Thr Arg
835 840 845

Thr Lys Ile Thr Asp Arg Asp Lys Glu Gly Phe Ile Ala Arg Gln Leu
850 855 860

Val Glu Thr Arg Gln Ile Thr Lys His Val Thr Gln Leu Leu Gln Gln
865 870 875 880

Glu Tyr Lys Asp Thr Thr Lys Val Phe Ala Ile Lys Ala Thr Leu Val
885 890 895

Ser Gly Leu Arg Arg Lys Phe Glu Phe Ile Lys Asn Arg Asn Val Asn
900 905 910

Asp Tyr His His Ala Gln Asp Ala Phe Leu Val Ala Phe Leu Gly Thr
915 920 925

Asn Ile Thr Ser Asn Tyr Pro Lys Ile Glu Met Glu Tyr Leu Phe Lys
930 935 940

Gly Tyr Gln His Tyr Leu Asn Glu Val Gly Lys Ala Ala Lys Pro Lys
945 950 955 960

Phe Thr Phe Ile Val Glu Asn Leu Ser Lys Gln Gln Asn Ser Thr Thr
965 970 975

Gly Glu Val Lys Trp Asn Pro Glu Val Asp Ile Ala Lys Leu Lys Arg
980 985 990

Ile Leu Asn Phe Lys Gln Cys Asn Ile Val Arg Lys Val Glu Glu Gln
995 1000 1005

Ser Gly Ala Leu Phe Lys Glu Thr Ile Tyr Pro Val Glu Glu Ser
1010 1015 1020

Ser Ser Lys Thr Ile Pro Leu Lys Lys His Leu Asp Thr Ala Ile

1025 1030 1035

Tyr Gly Gly Tyr Thr Ala Val Asn Tyr Ala Ser Tyr Ala Leu Ile
1040 1045 1050

Gln Phe Lys Lys Gly Arg Lys Leu Lys Arg Glu Ile Ile Gly Ile
1055 1060 1065

Pro Leu Ala Val Gln Thr Arg Ile Asp Asn Ser Glu Thr Ser Leu
1070 1075 1080

Gln Ala Tyr Ile Ala Glu Gln Ile Lys Ser Glu Val Glu Ile Leu
1085 1090 1095

Asn Gly Arg Ile Leu Lys Tyr Gln Leu Ile Ser Asn Asn Gly Asn
1100 1105 1110

Arg Leu Tyr Ile Ala Gly Ser Glu Arg His Asn Ala Arg Gln Leu
1115 1120 1125

Ile Val Ser Asp Glu Ala Ala Lys Val Ile Trp Leu Ile Ser Thr
1130 1135 1140

Lys Gln Ala Asp Glu Ala Met Phe Leu Lys Tyr Tyr Arg Leu Glu
1145 1150 1155

His Leu Glu Ala Val Phe Glu Glu Leu Ile Arg Lys Gln Ala Ala
1160 1165 1170

Asp Tyr Gln Ile Phe Glu Lys Leu Ile Lys Lys Ile Glu Val Asn
1175 1180 1185

Phe Tyr Ser Cys Thr Tyr Asn Glu Lys Val Lys Val Ile Glu Leu
1190 1195 1200

Leu Lys Ile Thr Gln Ala Asn Ala Thr Asn Gly Asp Leu Lys Leu
1205 1210 1215

Leu Lys Met Ser Asn Arg Glu Gly Arg Leu Gly Ser Val Ser Val

1220 1225 1230

Ala Leu Asp Phe Lys Ile Ile Asn Gln Ser Val Thr Gly Leu Tyr
1235 1240 1245

Gln Ser Ile Glu Asp Tyr Asn Asn
1250 1255

<210> 207
<211> 1290
<212> PRT
<213> Catenibacterium mitsuokai

<400> 207

Ile Val Asp Tyr Cys Ile Gly Leu Asp Leu Gly Thr Gly Ser Val Gly
1 5 10 15

Trp Ala Val Val Asp Met Asn His Arg Leu Met Lys Arg Asn Gly Lys
20 25 30

His Leu Trp Gly Ser Arg Leu Phe Ser Asn Ala Glu Thr Ala Ala Asn
35 40 45

Arg Arg Ala Ser Arg Ser Ile Arg Arg Arg Tyr Asn Lys Arg Arg Glu
50 55 60

Arg Ile Arg Leu Leu Arg Ala Ile Leu Gln Asp Met Val Leu Glu Lys
65 70 75 80

Asp Pro Thr Phe Phe Ile Arg Leu Glu His Thr Ser Phe Leu Asp Glu
85 90 95

Glu Asp Lys Ala Lys Tyr Leu Gly Asp Asn Tyr Asn Leu Phe Ile Asp
100 105 110

Glu Asp Phe Asn Asp Tyr Thr Tyr Tyr His Lys Tyr Pro Thr Ile Tyr
115 120 125

His Leu Arg Lys Ala Leu Cys Glu Ser Thr Glu Lys Ala Asp Pro Arg
130 135 140

```
Leu Ile Tyr Leu Ala Leu His His Ile Val Lys Tyr Arg Gly Asn Phe
145                 150                 155                 160

Leu Tyr Glu Gly Gln Lys Phe Asn Met Asp Ala Ser Asn Ile Glu Asp
                165                 170                 175

Lys Leu Ser Asp Ile Phe Thr Gln Phe Thr Ser Phe Asn Asn Ile Pro
            180                 185                 190

Tyr Glu Asp Asp Lys Lys Asn Leu Glu Ile Leu Glu Ile Leu Lys Lys
        195                 200                 205

Pro Leu Ser Lys Lys Ala Lys Val Asp Glu Val Met Thr Leu Ile Ala
    210                 215                 220

Pro Glu Lys Asp Tyr Lys Ser Ala Phe Lys Glu Leu Val Thr Gly Ile
225                 230                 235                 240

Ala Gly Asn Lys Met Asn Val Thr Lys Met Ile Leu Cys Glu Pro Ile
                245                 250                 255

Lys Gln Gly Asp Ser Glu Ile Lys Leu Lys Phe Ser Asp Ser Asn Tyr
            260                 265                 270

Asp Asp Gln Phe Ser Glu Val Glu Lys Asp Leu Gly Glu Tyr Val Glu
        275                 280                 285

Phe Val Asp Ala Leu His Asn Val Tyr Ser Trp Val Glu Leu Gln Thr
    290                 295                 300

Ile Met Gly Ala Thr His Thr Asp Asn Ala Ser Ile Ser Glu Ala Met
305                 310                 315                 320

Val Ser Arg Tyr Asn Lys His His Asp Asp Leu Lys Leu Leu Lys Asp
                325                 330                 335

Cys Ile Lys Asn Asn Val Pro Asn Lys Tyr Phe Asp Met Phe Arg Asn
            340                 345                 350
```

```
Asp Ser Glu Lys Ser Lys Gly Tyr Tyr Asn Tyr Ile Asn Arg Lys Ala
        355                 360                 365

Pro Val Asp Glu Phe Tyr Lys Tyr Val Lys Lys Cys Ile Glu Lys Val
    370                 375                 380

Asp Thr Pro Glu Ala Lys Gln Ile Leu Asn Asp Ile Glu Leu Glu Asn
385                 390                 395                 400

Phe Leu Leu Lys Gln Asn Ser Arg Thr Asn Gly Ser Val Pro Tyr Gln
                405                 410                 415

Met Gln Leu Asp Glu Met Ile Lys Ile Ile Asp Asn Gln Ala Glu Tyr
            420                 425                 430

Tyr Pro Ile Leu Lys Glu Lys Arg Glu Gln Leu Leu Ser Ile Leu Thr
        435                 440                 445

Phe Arg Ile Pro Tyr Tyr Phe Gly Pro Leu Glu Thr Ser Glu His Ala
    450                 455                 460

Trp Ile Lys Arg Leu Glu Gly Lys Glu Asn Gln Arg Ile Leu Pro Trp
465                 470                 475                 480

Asn Tyr Gln Asp Ile Val Asp Val Asp Ala Thr Ala Glu Gly Phe Ile
                485                 490                 495

Lys Arg Met Arg Ser Tyr Cys Thr Tyr Phe Pro Asp Glu Glu Val Leu
            500                 505                 510

Pro Lys Asn Ser Leu Ile Val Ser Lys Tyr Glu Val Tyr Asn Glu Leu
        515                 520                 525

Asn Lys Ile Arg Val Asp Asp Lys Leu Leu Glu Val Asp Val Lys Asn
    530                 535                 540

Asp Ile Tyr Asn Glu Leu Phe Met Lys Asn Lys Thr Val Thr Glu Lys
545                 550                 555                 560
```

```
Lys Leu Lys Asn Trp Leu Val Asn Asn Gln Cys Cys Ser Lys Asp Ala
                565                 570                 575

Glu Ile Lys Gly Phe Gln Lys Glu Asn Gln Phe Ser Thr Ser Leu Thr
            580                 585                 590

Pro Trp Ile Asp Phe Thr Asn Ile Phe Gly Lys Ile Asp Gln Ser Asn
        595                 600                 605

Phe Asp Leu Ile Glu Asn Ile Ile Tyr Asp Leu Thr Val Phe Glu Asp
    610                 615                 620

Lys Lys Ile Met Lys Arg Arg Leu Lys Lys Lys Tyr Ala Leu Pro Asp
625                 630                 635                 640

Asp Lys Val Lys Gln Ile Leu Lys Leu Lys Tyr Lys Asp Trp Ser Arg
                645                 650                 655

Leu Ser Lys Lys Leu Leu Asp Gly Ile Val Ala Asp Ser Val Thr Val
            660                 665                 670

Leu Asp Val Leu Glu Ser Arg Leu Asn Leu Met Glu Ile Ile Asn Asp
        675                 680                 685

Lys Asp Leu Gly Tyr Ala Gln Met Ile Glu Glu Ala Thr Ser Cys Pro
    690                 695                 700

Glu Asp Gly Lys Phe Thr Tyr Glu Glu Val Glu Arg Leu Ala Gly Ser
705                 710                 715                 720

Pro Ala Leu Lys Arg Gly Ile Trp Gln Ser Leu Gln Ile Val Glu Glu
                725                 730                 735

Ile Thr Lys Val Met Lys Cys Arg Pro Lys Tyr Ile Tyr Ile Glu Phe
            740                 745                 750

Glu Arg Ser Glu Glu Lys Glu Arg Thr Glu Ser Lys Ile Lys Lys Leu
        755                 760                 765
```

```
Glu Asn Val Tyr Lys Asp Glu Gln Thr Ser Val Leu Glu Glu Leu Lys
    770                 775                 780

Gly Phe Asp Asn Thr Lys Lys Ile Ser Ser Asp Ser Leu Phe Leu Tyr
785                 790                 795                 800

Phe Thr Gln Leu Gly Lys Cys Met Tyr Ser Gly Lys Lys Leu Asp Ile
                805                 810                 815

Asp Ser Leu Asp Lys Tyr Gln Ile Asp His Ile Val Pro Gln Ser Leu
            820                 825                 830

Val Lys Asp Asp Ser Phe Asp Asn Arg Val Leu Val Val Pro Ser Glu
        835                 840                 845

Asn Gln Arg Lys Leu Asp Asp Leu Val Val Pro Phe Asp Ile Arg Asp
    850                 855                 860

Lys Met Tyr Arg Phe Trp Lys Leu Leu Phe Asp His Glu Leu Ile Ser
865                 870                 875                 880

Pro Lys Lys Phe Tyr Ser Leu Ile Lys Thr Glu Tyr Thr Glu Arg Asp
                885                 890                 895

Glu Glu Arg Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
            900                 905                 910

Lys Asn Val Thr Gln Ile Ile Glu Asp His Tyr Ser Thr Thr Lys Val
        915                 920                 925

Ala Ala Ile Arg Ala Asn Leu Ser His Glu Phe Arg Val Lys Asn His
    930                 935                 940

Ile Tyr Lys Asn Arg Asp Ile Asn Asp Tyr His His Ala His Asp Ala
945                 950                 955                 960

Tyr Ile Val Ala Leu Ile Gly Gly Phe Met Arg Asp Arg Tyr Pro Asn
                965                 970                 975
```

```
Met His Asp Ser Lys Ala Val Tyr Ser Glu Tyr Met Lys Met Phe Arg
           980                 985                 990

Asn Lys Asn Asp Gln Lys Gly Phe  Val Ile Asn Ser Met  Asn Tyr Pro
        995                1000                1005

Tyr Glu  Val Asp Gly Lys Leu  Ile Trp Asn Pro Asp  Leu Ile Asn
    1010                1015                1020

Glu Ile  Lys Lys Cys Phe Tyr  Tyr Lys Asp Cys Tyr  Cys Thr Thr
    1025                1030                1035

Lys Leu  Asp Gln Lys Ser Gly  Gln Leu Phe Asn Thr  Val Leu Ser
    1040                1045                1050

Asn Asp  Ala His Ala Asp Lys  Gly Ala Val Val Pro  Val Asn Lys
    1055                1060                1065

Asn Arg  Ser Asp Val His Lys  Tyr Gly Gly Phe Ser  Gly Leu Gln
    1070                1075                1080

Tyr Thr  Ile Val Ala Ile Glu  Gly Gln Lys Lys Lys  Gly Lys Lys
    1085                1090                1095

Thr Glu  Leu Val Lys Lys Ile  Ser Gly Val Pro Leu  His Leu Lys
    1100                1105                1110

Ala Ala  Ser Ile Asn Glu Lys  Ile Asn Tyr Ile Glu  Glu Lys Glu
    1115                1120                1125

Gly Leu  Ser Asp Val Arg Ile  Ile Lys Asp Asn Ile  Pro Val Asn
    1130                1135                1140

Gln Met  Ile Glu Met Asp Gly  Gly Glu Tyr Leu Leu  Thr Ser Glu
    1145                1150                1155

Tyr Val  Asn Ala Arg Gln Leu  Val Leu Asn Glu Lys  Gln Cys Ala
    1160                1165                1170
```

```
Leu Ile  Ala Asp Ile Tyr Asn  Ala Ile Tyr Lys Gln  Asp Tyr Asp
    1175                1180                1185


Asn Leu  Asp Asp Ile Leu Met  Ile Gln Leu Tyr Ile  Glu Leu Thr
    1190                1195                1200


Asn Lys  Met Lys Val Leu Tyr  Pro Ala Tyr Arg Gly  Ile Ala Glu
    1205                1210                1215


Lys Phe  Glu Ser Tyr Val Val  Ile Ser Lys Glu Glu  Lys Ala Asn
    1220                1225                1230


Ile Ile  Gln Met Leu Ile Val  Met His Arg Gly Pro  Gln Asn Gly
    1235                1240                1245


Asn Ile  Val Tyr Asp Asp Phe  Lys Ile Ser Asp Arg  Ile Gly Arg
    1250                1255                1260


Leu Lys  Thr Lys Asn His Asn  Leu Asn Ile Val Phe  Ile Ser Gln
    1265                1270                1275


Ser Pro  Thr Gly Ile Tyr Thr  Lys Lys Tyr Lys Leu
    1280                1285                1290


<210>  208
<211>  1359
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  208

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240
```

```
Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445
```

```
Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655
```

```
Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860
```

```
Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880


Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895


Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910


Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925


Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940


Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960


Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975


Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990


Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005


Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020


Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050


Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065
```

```
Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260
```

Ile Ser Glu Phe Ser Lys Arg Val Ile Leu Ala Asp Ala Asn Leu
1265 1270 1275

Asp Lys Val Leu Ser Ala Tyr Asn Lys His Arg Asp Lys Pro Ile
1280 1285 1290

Arg Glu Gln Ala Glu Asn Ile Ile His Leu Phe Thr Leu Thr Asn
1295 1300 1305

Leu Gly Ala Pro Ala Ala Phe Lys Tyr Phe Asp Thr Thr Ile Asp
1310 1315 1320

Arg Lys Arg Tyr Thr Ser Thr Lys Glu Val Leu Asp Ala Thr Leu
1325 1330 1335

Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu
1340 1345 1350

Ser Gln Leu Gly Gly Asp
1355

<210> 209
<211> 1317
<212> PRT
<213> Clostridiales bacterium S5-A11

<400> 209

Met Lys Asn Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val Gly
1 5 10 15

Trp Ala Val Ile Lys Asp Asp Leu Thr Leu Val Arg Lys Lys Ile Lys
20 25 30

Ile Ser Gly Asn Thr Asp Lys Lys Glu Val Lys Lys Asn Leu Trp Gly
35 40 45

Ser Phe Leu Phe Glu Gln Gly Asp Thr Ala Gln Asp Thr Arg Val Lys
50 55 60

Arg Ile Ala Arg Arg Arg Tyr Glu Arg Arg Arg Phe Arg Ile Arg Glu

65 70 75 80

Leu Gln Lys Ile Phe Asp Lys Ser Met Gly Glu Val Asp Ser Asn Phe
85 90 95

Phe His Arg Leu Asp Glu Ser Phe Leu Val Glu Glu Asp Lys Glu Tyr
100 105 110

Ser Lys Tyr Pro Ile Phe Ser Asn Glu Lys Glu Asp Lys Asn Tyr Tyr
115 120 125

Asp Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Asp Leu Ala Asp Ser
130 135 140

Asn Gln Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met
145 150 155 160

Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Asp Leu Lys Met Asp
165 170 175

Gly Ile Ser Ile Ser Glu Ser Phe Gln Glu Phe Ile Asp Ser Tyr Asn
180 185 190

Glu Val Cys Ala Leu Glu Asp Glu Asn Asn Asp Glu Leu Leu Thr Gln
195 200 205

Ile Glu Asn Ile Phe Lys Gln Asp Ile Ser Arg Ser Lys Lys Leu Asp
210 215 220

Gln Ala Ile Ala Leu Phe Gln Gly Lys Arg Gln Ser Leu Phe Gly Ile
225 230 235 240

Phe Leu Thr Leu Ile Val Gly Asn Lys Ala Asn Phe Gln Lys Ile Phe
245 250 255

Asn Leu Glu Asp Asp Ile Lys Leu Asp Leu Lys Glu Glu Asp Tyr Asp
260 265 270

Glu Asn Leu Glu Glu Leu Leu Ser Asn Ile Asp Glu Gly Tyr Arg Asp

```
        275                 280                 285

Val Phe Leu Gln Ala Lys Asn Val Tyr Asn Ala Ile Glu Leu Ser Lys
    290                 295                 300

Ile Leu Lys Thr Asp Gly Lys Glu Thr Lys Ala Pro Leu Ser Ala Gln
305                 310                 315                 320

Met Val Glu Leu Tyr Asn Gln His Arg Glu Asp Leu Lys Lys Tyr Lys
                325                 330                 335

Asp Tyr Ile Lys Ala Tyr Leu Pro Glu Lys Tyr Gly Glu Thr Phe Lys
            340                 345                 350

Asp Ala Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Ser
        355                 360                 365

Gln Glu Asp Phe Tyr Lys Phe Val Lys Ala Gln Leu Lys Gly Glu Glu
    370                 375                 380

Asn Gly Glu Tyr Phe Leu Glu Ala Ile Glu Asn Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Ser Phe Tyr Asn Gly Val Ile Pro Tyr Gln Ile His Leu
                405                 410                 415

Gln Glu Leu Thr Ala Val Leu Asp Gln Gln Glu Lys His Tyr Ser Phe
            420                 425                 430

Leu Lys Glu Asn Arg Asp Lys Ile Ile Ser Leu Leu Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Lys Gly Glu Ser Arg Phe Ala Trp
    450                 455                 460

Leu Glu Arg Ser Asn Ser Glu Glu Lys Ile Lys Pro Trp Asn Phe Asp
465                 470                 475                 480

Lys Ile Val Asp Ile Asp Lys Ser Ala Glu Leu Phe Ile Glu Asn Leu
```

485 490 495

Thr Ser Arg Asp Thr Tyr Leu Pro Asp Glu Pro Val Leu Pro Lys Arg
500 505 510

Ser Leu Ile Tyr Gln Lys Phe Thr Ile Phe Asn Glu Leu Thr Lys Ile
515 520 525

Ser Tyr Ile Asp Glu Arg Gly Ile Leu Gln Asn Phe Ser Ser Arg Glu
530 535 540

Lys Ile Ala Ile Phe Asn Asp Leu Phe Lys Asn Lys Ser Lys Val Thr
545 550 555 560

Lys Asn Gln Leu Val Lys Tyr Ile Glu Asn Lys Glu Gln Ile Ile Ala
565 570 575

Pro Glu Ile Lys Gly Ile Glu Asp Ser Phe Asn Ser Asn Tyr Ser Thr
580 585 590

Tyr Ile Asp Leu Ser Lys Ile Pro Asp Met Lys Leu Leu Glu Lys Asp
595 600 605

Glu Asp Glu Ile Leu Glu Glu Ile Ile Lys Ile Leu Thr Ile Phe Glu
610 615 620

Asp Arg Lys Met Arg Lys Arg Gln Leu Met Lys Phe Lys Asp Lys Leu
625 630 635 640

Ser Glu Lys Ala Ile Asn Gln Leu Ser Lys Lys His Tyr Thr Gly Trp
645 650 655

Gly Gln Leu Ser Glu Lys Leu Ile Asn Gly Ile Arg Asp Glu Gln Ser
660 665 670

Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asn Gly Cys Pro Lys Asn
675 680 685

Met Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Thr Leu Ser Phe

690 695 700

Lys Glu Lys Ile Arg Lys Ala Gln Asp Ile Asn Gln Val Asn Asp Ile
705 710 715 720

Lys Glu Ile Val Lys Asp Leu Pro Gly Ser Pro Ala Ile Lys Lys Gly
725 730 735

Ile Tyr Gln Ser Ile Arg Ile Val Asp Glu Ile Ile Arg Lys Met Lys
740 745 750

Asp Arg Pro Lys Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
755 760 765

Thr Gln Glu Gly Lys Asn Lys Ser Lys Ala Arg Leu Lys Lys Ile Gln
770 775 780

Glu Gly Leu Glu Asn Leu Asp Ser His Val Glu Lys Gln Ala Leu Asp
785 790 795 800

Glu Glu Met Leu Lys Ser Pro Lys Tyr Tyr Leu Tyr Cys Leu Gln Asn
805 810 815

Gly Lys Asp Ile Tyr Thr Gly Lys Asp Leu Asp Ile Gly Gln Leu Gln
820 825 830

Thr Tyr Asp Ile Asp His Ile Ile Pro Arg Ser Phe Ile Thr Asp Asn
835 840 845

Ser Phe Asp Asn Leu Val Leu Thr Ser Ser Thr Val Asn Arg Gly Lys
850 855 860

Leu Asp Asn Val Pro Ser Pro Asp Ile Val Arg Gln Gln Lys Gly Phe
865 870 875 880

Trp Lys Gln Leu Leu Arg Ala Gly Leu Met Ser Gln Arg Lys Phe Asn
885 890 895

Asn Leu Thr Lys Gly Lys Leu Thr Asp Arg Asp Arg Gln Gln Phe Ile

900 905 910

Asn Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Asn
915 920 925

Leu Leu Ser His His Leu Asn Glu Lys Lys Glu Val Gly Glu Ile Asn
930 935 940

Ile Val Leu Leu Lys Ser Ala Leu Thr Ser Gln Phe Arg Lys Lys Phe
945 950 955 960

Asp Phe Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Ala His Asp
965 970 975

Ala Tyr Leu Asn Gly Val Ile Ala Leu Lys Leu Leu Glu Leu Tyr Pro
980 985 990

Tyr Met Ala Lys Asp Leu Ile Tyr Gly Lys Tyr Ser Tyr His Arg Lys
995 1000 1005

Gly Asp Lys Ala Thr Gln Ala Lys Tyr Lys Met Ser Asn Ile Ile
1010 1015 1020

Glu Arg Phe Ser Gln Asp Leu Leu Ala Asn Pro Asp Gly Glu Ile
1025 1030 1035

Ala Trp Glu Lys Asp Lys Asp Leu Asn Thr Ile Arg Lys Val Leu
1040 1045 1050

Ser Ser Lys Gln Ile Asn Ile Ile Lys Lys Ala Glu Glu Gly Lys
1055 1060 1065

Gly Arg Leu Phe Lys Glu Thr Ile Asn Ser Arg Pro Ser Lys Lys
1070 1075 1080

Thr Glu Lys Arg Ile Pro Ile Lys Asn Asn Leu Asp Pro Asn Ile
1085 1090 1095

Tyr Gly Gly Tyr Ile Glu Glu Lys Met Ala Tyr Tyr Ile Ala Ile

1100 1105 1110

Asn Tyr Leu Glu Asn Gly Lys Thr Lys Lys Ala Ile Val Gly Ile
1115 1120 1125

Ser Ile Lys Asp Lys Lys Asp Phe Glu Gly Gln Thr Thr Glu Tyr
1130 1135 1140

Leu Gly Lys Ile Gly Phe Asn Lys Ala Ser Ile Ile Asn Ser Phe
1145 1150 1155

Lys Asn Tyr Thr Leu Phe Glu Leu Glu Asn Gly Ser Arg Arg Met
1160 1165 1170

Ile Val Gly Lys Gly Glu Leu Gln Lys Gly Asn Gln Met Tyr Leu
1175 1180 1185

Pro Gln Asn Leu Leu Glu Phe Val Tyr His Leu Lys His Tyr Asn
1190 1195 1200

Glu Asp Glu Thr Ser His Lys Phe Ile Val Glu His Lys Ala Tyr
1205 1210 1215

Phe Asp Glu Leu Leu Asn Tyr Ile Val Glu Phe Ala Asn Lys Tyr
1220 1225 1230

Leu Glu Leu Glu Asn Ser Ile Glu Lys Ile Lys Asp Leu Tyr His
1235 1240 1245

Gly Lys Gly Pro Asp Val Glu Glu Lys Glu Leu Val Glu Ser Phe
1250 1255 1260

Ile Asn Leu Leu Ala Ile Thr Lys Cys Gly Pro Ala Ala Asp Ile
1265 1270 1275

Thr Phe Leu Gly Glu Lys Ile Ser Arg Lys Arg Tyr Arg Ser Thr
1280 1285 1290

Asn Cys Leu Trp Gly Ser Glu Val Ile Phe Gln Ser Pro Thr Gly

1295 1300 1305

Leu Tyr Glu Thr Arg Leu Arg Leu Glu
1310 1315

<210> 210
<211> 1359
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 210

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
20 25 30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
100 105 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
115 120 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
130 135 140

```
Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350
```

```
Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560
```

```
Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765
```

```
Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975
```

```
Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990


Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                1000                1005


Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020


Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050


Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065


Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080


Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095


Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110


Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125


Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140


Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155


Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170
```

```
Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350

Ser Gln  Leu Gly Gly Asp
    1355
```

<210> 211
<211> 1327
<212> PRT
<213> Dolosigranulum pigrum

<400> 211

```
Met Gln Lys Asn Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Met Lys Asp Asp Tyr Thr Leu Ile Arg Lys Arg Met
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Ile Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Glu Gly Glu Thr Ala Lys Glu Thr Arg Leu
    50                  55                  60


Lys Arg Gly Thr Arg Arg Arg Tyr Gln Arg Arg Arg Asn Arg Leu Ile
65                  70                  75                  80


Tyr Leu Gln Asp Ile Phe Gln Gln Pro Met Leu Ala Ile Asp Glu Asn
                85                  90                  95


Phe Phe His Arg Leu Asp Asp Ser Phe Phe Val Pro Asp Asp Lys Ser
            100                 105                 110


Tyr Asp Arg His Pro Ile Phe Gly Ser Leu Glu Glu Glu Val Ala Tyr
        115                 120                 125


His Asn Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
    130                 135                 140


Asn Pro Glu Lys Ala Asp Leu Arg Leu Val Tyr Thr Ala Leu Ala His
145                 150                 155                 160


Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175
```

```
Glu Asn Thr Ser Ile Ser Glu Thr Phe Glu Gln Phe Leu Asp Thr Tyr
            180                 185                 190


Ser Asp Ile Phe Lys Glu Gln Leu Val Gly Asp Ile Ser Lys Val Glu
        195                 200                 205


Glu Ile Leu Ser Ser Lys Gln Ser Arg Ser Arg Lys His Glu Gln Ile
    210                 215                 220


Met Ala Leu Phe Pro Asn Glu Asn Lys Leu Gly Asn Phe Gly Arg Phe
225                 230                 235                 240


Met Met Leu Ile Val Gly Asn Thr Ser Asn Phe Lys Pro Val Phe Asp
                245                 250                 255


Leu Asp Asp Glu Tyr Lys Leu Lys Leu Ser Asp Glu Thr Tyr Glu Glu
            260                 265                 270


Asp Leu Asp Thr Leu Leu Gly Met Thr Asp Asp Val Phe Leu Asp Val
        275                 280                 285


Phe Met Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Met Ser Ala Ile
    290                 295                 300


Ile Ser Thr Asp Thr Gly Asn Ser Lys Ala Val Leu Ser Asn Gln Met
305                 310                 315                 320


Ile Asn Phe Tyr Asp Glu His Lys Val Asp Leu Ala Gln Leu Lys Gln
                325                 330                 335


Phe Phe Lys Thr His Leu Pro Asp Lys Tyr Tyr Glu Cys Phe Ser Asp
            340                 345                 350


Pro Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Asn Gln
        355                 360                 365


Glu Asp Phe Tyr Lys Tyr Ile Glu Lys Val Met Lys Thr Ile Lys Ser
    370                 375                 380
```

```
Asp Lys Lys Asp Tyr Phe Leu Asp Lys Ile Asp Arg Glu Val Phe Leu
385                 390                 395                 400


Arg Lys Gln Arg Ser Phe Tyr Asn Ser Val Ile Pro His Gln Ile His
                405                 410                 415


Leu Gln Glu Met Gln Ala Ile Leu Asp Arg Gln Ser Gln Tyr Tyr Pro
            420                 425                 430


Phe Leu Ala Glu Asn Arg Asp Lys Ile Glu Ser Leu Val Thr Phe Arg
        435                 440                 445


Ile Pro Tyr Tyr Val Gly Pro Leu Thr Val Ser Asp Gln Ser Glu Phe
    450                 455                 460


Ala Trp Met Glu Arg Gln Ser Asp Glu Pro Ile Arg Pro Trp Asn Phe
465                 470                 475                 480


Asp Glu Ile Val Asn Lys Glu Arg Ser Ala Glu Lys Phe Ile Glu Arg
                485                 490                 495


Met Thr Asn Met Asp Thr Tyr Leu Leu Glu Glu Lys Val Leu Pro Lys
            500                 505                 510


Arg Ser Leu Leu Tyr Gln Thr Phe Glu Val Tyr Asn Glu Leu Thr Lys
        515                 520                 525


Val Arg Tyr Thr Asn Glu Gln Gly Lys Thr Glu Lys Leu Asn Arg Gln
    530                 535                 540


Gln Lys Ala Glu Ile Ile Glu Thr Leu Phe Lys Gln Lys Asn Arg Val
545                 550                 555                 560


Arg Glu Lys Asp Ile Ala Asn Tyr Leu Glu Gln Tyr Gly Tyr Val Asp
                565                 570                 575


Gly Thr Asp Ile Lys Gly Val Glu Asp Lys Phe Asn Ala Ser Leu Ser
            580                 585                 590
```

```
Thr Tyr Asn Asp Leu Ala Lys Ile Asp Gly Ala Lys Ala Tyr Leu Asp
        595                 600                 605


Asp Pro Glu Tyr Ala Asp Val Trp Glu Asp Ile Ile Lys Ile Leu Thr
    610                 615                 620


Ile Phe Glu Asp Lys Ala Met Arg Lys Lys Gln Leu Gln Thr Tyr Ser
625                 630                 635                 640


Asp Thr Leu Ser Pro Glu Ile Leu Lys Lys Leu Glu Arg Lys His Tyr
                645                 650                 655


Thr Gly Trp Gly Arg Phe Ser Lys Lys Leu Ile Asn Gly Leu Arg Asp
            660                 665                 670


Glu Gly Ser Asn Lys Thr Ile Leu Asp Tyr Leu Lys Asp Glu Gly Ser
        675                 680                 685


Ser Gly Pro Thr Asn Arg Asn Phe Met Gln Leu Ile Arg Asp Asn Thr
    690                 695                 700


Leu Ser Phe Lys Lys Lys Ile Glu Asp Ala Gln Thr Ile Glu Asp Thr
705                 710                 715                 720


Thr His Ile Tyr Asp Thr Val Ala Glu Leu Pro Gly Ser Pro Ala Ile
                725                 730                 735


Lys Lys Gly Ile Arg Gln Ala Leu Lys Ile Val Glu Glu Ile Ile Asp
            740                 745                 750


Ile Ile Gly Tyr Glu Pro Glu Asn Ile Val Val Glu Met Ala Arg Glu
        755                 760                 765


Ser Gln Thr Thr Lys Lys Gly Lys Asp Leu Ser Lys Glu Arg Leu Glu
    770                 775                 780


Lys Leu Thr Glu Ala Ile Lys Glu Phe Asp Gly Val Lys Val Lys Asp
785                 790                 795                 800
```

```
Leu Lys Asn Glu Asn Leu Arg Asn Asp Arg Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Arg Asp Met Tyr Thr Asn Glu Pro Leu Asp Ile Asn Asn
            820                 825                 830

Leu Ser Lys Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Thr Thr
        835                 840                 845

Asp Asn Ser Ile Asp Asn Lys Val Leu Val Ser Arg Thr Lys Asn Gln
    850                 855                 860

Gly Asn Lys Ser Asp Asp Val Pro Ser Ile Asn Ile Val His Lys Met
865                 870                 875                 880

Lys Pro Phe Trp Arg Gln Leu His Lys Ala Gly Leu Ile Ser Asp Arg
                885                 890                 895

Lys Phe Lys Asn Leu Thr Lys Ala Glu His Gly Gly Leu Thr Glu Ala
            900                 905                 910

Asp Arg Ala His Phe Leu Asn Arg Gln Leu Val Glu Thr Arg Gln Ile
        915                 920                 925

Thr Lys His Val Ala Asn Leu Leu Asp Ser Gln Tyr Asn Thr Ala Glu
    930                 935                 940

Glu Gln Arg Ile Asn Ile Val Leu Leu Lys Ser Ser Met Thr Ser Arg
945                 950                 955                 960

Phe Arg Lys Glu Phe Lys Leu Tyr Lys Val Arg Glu Ile Asn Asp Tyr
                965                 970                 975

His His Gly His Asp Ala Tyr Leu Asn Ala Val Val Ala Thr Thr Ile
            980                 985                 990

Met Lys Val Tyr Pro Asn Leu Lys  Pro Gln Phe Val Tyr  Gly Gln Tyr
        995                 1000                1005
```

```
Lys Lys  Thr Ser Met Phe Lys  Glu Glu Lys Ala Thr  Ala Arg Lys
    1010                1015                1020

His Phe  Tyr Ser Asn Ile Thr  Lys Phe Phe Lys Lys  Glu Lys Val
    1025                1030                1035

Val Asn  Glu Glu Thr Gly Glu  Ile Leu Trp Asp Thr  Glu Arg His
    1040                1045                1050

Leu Ser  Thr Ile Lys Arg Val  Leu Ser Trp Lys Gln  Met Asn Ile
    1055                1060                1065

Val Lys  Lys Val Glu Lys Gln  Lys Gly Gln Leu Trp  Lys Glu Thr
    1070                1075                1080

Ile Tyr  Pro Lys Gly Asp Ser  Ser Lys Leu Ile Pro  Val Lys Glu
    1085                1090                1095

Gly Met  Asp Pro Gln Lys Tyr  Gly Gly Leu Ser Gln  Val Ser Glu
    1100                1105                1110

Ala Phe  Ala Val Val Ile Thr  His Glu Lys Gly Lys  Lys Lys Gln
    1115                1120                1125

Leu Lys  Ser Asp Leu Ile Ser  Ile Pro Ile Val Asp  Gln Lys Ala
    1130                1135                1140

Tyr Glu  Gln His Pro Thr Ala  Tyr Leu Glu Glu Ala  Gly Tyr Asn
    1145                1150                1155

Asn Pro  Thr Val Leu His Glu  Leu Phe Lys Tyr Gln  Leu Phe Glu
    1160                1165                1170

Leu Glu  Asp Gly Ser Arg Arg  Met Ile Ala Ser Ala  Lys Glu Phe
    1175                1180                1185

Gln Lys  Gly Asn Gln Met Val  Leu Pro Leu Glu Leu  Val Glu Leu
    1190                1195                1200
```

```
Leu Tyr  His Ala Asn Arg Tyr  Asp Lys Val Lys Phe  Pro Asp Ser
    1205                1210                1215


Ile Glu  Tyr Val His Asp Asn  Leu Ala Lys Phe Asp  Asp Leu Leu
    1220                1225                1230


Glu Tyr  Val Ile Asp Phe Ser  Asn Lys Tyr Ile Asn  Ala Asp Lys
    1235                1240                1245


Asn Val  Gln Lys Ile Gln Lys  Ile Tyr Lys Glu His  Gly Thr Glu
    1250                1255                1260


Asp Val  Glu Leu Thr Val Glu  Ser Phe Val Asn Leu  Met Thr Phe
    1265                1270                1275


Thr Ala  Met Gly Ala Pro Ala  Thr Phe Lys Phe Tyr  Gly Glu Ser
    1280                1285                1290


Ile Thr  Arg Ser Arg Tyr Thr  Ser Ile Thr Glu Phe  Arg Gly Ser
    1295                1300                1305


Thr Leu  Ile Phe Gln Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Tyr
    1310                1315                1320


Lys Leu  Glu Asp
    1325


<210>  212
<211>  1329
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  212

Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30
```

```
Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Asp Leu Asp Glu Asn
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240
```

```
Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255

Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser
        275                 280                 285

Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser
    290                 295                 300

Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu Ser Ser
305                 310                 315                 320

Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Lys Phe
                325                 330                 335

Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe
            340                 345                 350

Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Ala His Ala Val
        355                 360                 365

Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile
    370                 375                 380

Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His
                405                 410                 415

Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Glu Lys Ile Glu Gln Leu Val Thr Phe Arg
        435                 440                 445
```

```
Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser Thr Phe
    450                 455                 460

Ala Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp Asn Leu
465                 470                 475                 480

Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg
                485                 490                 495

Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys
            500                 505                 510

His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys
        515                 520                 525

Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys
    530                 535                 540

Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val
545                 550                 555                 560

Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu
                565                 570                 575

Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe
            580                 585                 590

Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu
        595                 600                 605

Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu
    610                 615                 620

Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe
625                 630                 635                 640

Lys Gly Gln Phe Ser Ala Glu Val Leu Lys Lys Leu Glu Arg Lys His
                645                 650                 655
```

```
Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr
            660                 665                 670

Asp Lys Glu Ser Gly Lys Thr Ile Leu Gly Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His
705                 710                 715                 720

Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu
    770                 775                 780

Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys
785                 790                 795                 800

Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser
            820                 825                 830

Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
        835                 840                 845

Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr
    850                 855                 860
```

```
Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val Val Lys
865                 870                 875                 880

Asp Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser
                885                 890                 895

Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr
            900                 905                 910

Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Arg Tyr Asn Ala
    930                 935                 940

Asn Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu
945                 950                 955                 960

Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val
                965                 970                 975

Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala
            980                 985                 990

Thr Thr Leu Leu Lys Val Tyr Pro  Asn Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005

Gly Glu  Tyr Pro Lys Phe Gln  Thr Phe Lys Glu Asn  Lys Ala Thr
    1010                1015                1020

Ala Lys  Ala Ile Ile Tyr Thr  Asn Leu Leu Arg Phe  Phe Thr Glu
    1025                1030                1035

Asp Glu  Pro Arg Phe Thr Lys  Asp Gly Glu Ile Leu  Trp Ser Asn
    1040                1045                1050

Ser Tyr  Leu Lys Thr Ile Lys  Lys Glu Leu Asn Tyr  His Gln Met
    1055                1060                1065
```

```
Asn Ile  Val Lys Lys Val Glu  Val Gln Lys Gly Gly  Phe Ser Lys
    1070                1075                1080

Glu Ser  Ile Lys Pro Lys Gly  Pro Ser Asn Lys Leu  Ile Pro Val
    1085                1090                1095

Lys Asn  Gly Leu Asp Pro Gln  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1100                1105                1110

Ile Val  Ala Tyr Thr Val Leu  Phe Thr His Glu Lys  Gly Lys Lys
    1115                1120                1125

Pro Leu  Ile Lys Gln Glu Ile  Leu Gly Ile Thr Ile  Met Glu Lys
    1130                1135                1140

Thr Arg  Phe Glu Gln Asn Pro  Ile Leu Phe Leu Glu  Glu Lys Gly
    1145                1150                1155

Phe Leu  Arg Pro Arg Val Leu  Met Lys Leu Pro Lys  Tyr Thr Leu
    1160                1165                1170

Tyr Glu  Phe Pro Glu Gly Arg  Arg Arg Leu Leu Ala  Ser Ala Lys
    1175                1180                1185

Glu Ala  Gln Lys Gly Asn Gln  Met Val Leu Pro Glu  His Leu Leu
    1190                1195                1200

Thr Leu  Leu Tyr His Ala Lys  Gln Cys Leu Leu Pro  Asn Gln Ser
    1205                1210                1215

Glu Ser  Leu Ala Tyr Val Glu  Gln His Gln Pro Glu  Phe Gln Glu
    1220                1225                1230

Ile Leu  Glu Arg Val Val Asp  Phe Ala Glu Val His  Thr Leu Ala
    1235                1240                1245

Lys Ser  Lys Val Gln Gln Ile  Val Lys Leu Phe Glu  Ala Asn Gln
    1250                1255                1260
```

```
Thr Ala  Asp Val Lys Glu Ile  Ala Ala Ser Phe Ile  Gln Leu Met
    1265                1270                1275


Gln Phe  Asn Ala Met Gly Ala  Pro Ser Thr Phe Lys  Phe Phe Gln
    1280                1285                1290


Lys Asp  Ile Glu Arg Ala Arg  Tyr Thr Ser Ile Lys  Glu Ile Phe
    1295                1300                1305


Asp Ala  Thr Ile Ile Tyr Gln  Ser Thr Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320


Arg Arg  Lys Val Val Asp
    1325


<210>  213
<211>  1280
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  213

Met Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu Lys
1               5                   10                  15


Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg Tyr
            20                  25                  30


Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Asp Leu Asp Glu Asn Phe
        35                  40                  45


Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys Trp
    50                  55                  60


His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr His
65                  70                  75                  80
```

```
Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp Ser
                85                  90                  95

Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Ile
            100                 105                 110

Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr Glu
        115                 120                 125

Asn Thr Ser Val Lys Asp Gln Phe Gln Gln Phe Met Val Ile Tyr Asn
    130                 135                 140

Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu Ile
145                 150                 155                 160

Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu Lys
                165                 170                 175

Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly Gln
            180                 185                 190

Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val Phe
        195                 200                 205

Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr Glu
    210                 215                 220

Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser Asp
225                 230                 235                 240

Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser Thr
                245                 250                 255

Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu Ser Ser Ser
            260                 265                 270

Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Lys Phe Lys
        275                 280                 285
```

```
Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe Lys
    290                 295                 300

Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Ala His Ala Val Ser
305                 310                 315                 320

Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile Ala
                325                 330                 335

Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu Arg
            340                 345                 350

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His Leu
        355                 360                 365

Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro Phe
    370                 375                 380

Leu Lys Glu Asn Gln Glu Lys Ile Glu Gln Leu Val Thr Phe Arg Ile
385                 390                 395                 400

Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser Thr Phe Ala
                405                 410                 415

Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp Asn Leu Gln
            420                 425                 430

Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg Met
        435                 440                 445

Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys His
    450                 455                 460

Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys Ile
465                 470                 475                 480

Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys Glu
                485                 490                 495
```

```
Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val Lys
            500                 505                 510

Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu Ile
        515                 520                 525

Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe Ser
    530                 535                 540

Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu Asp
545                 550                 555                 560

His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu Thr
                565                 570                 575

Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe Lys
            580                 585                 590

Gly Gln Phe Ser Ala Glu Val Leu Lys Lys Leu Glu Arg Lys His Tyr
        595                 600                 605

Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr Asp
    610                 615                 620

Lys Glu Ser Gly Lys Thr Ile Leu Asp Tyr Leu Val Asp Asp Gly Val
625                 630                 635                 640

Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser Gln
                645                 650                 655

Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His Glu
            660                 665                 670

Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala Ile
        675                 680                 685

Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val Ala
    690                 695                 700
```

```
Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg Glu
705                 710                 715                 720


Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu Lys
                725                 730                 735


Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys Glu
            740                 745                 750


Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu Tyr
        755                 760                 765


Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser Leu
    770                 775                 780


His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe
785                 790                 795                 800


Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr Glu
                805                 810                 815


Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val Val Lys Asp
            820                 825                 830


Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser Gln
        835                 840                 845


Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr Leu
    850                 855                 860


Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln
865                 870                 875                 880


Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Arg Tyr Asn Ala Lys
                885                 890                 895


Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu Thr
            900                 905                 910
```

```
Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val Asn
        915                 920                 925


Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala Thr
    930                 935                 940


Thr Leu Leu Lys Val Tyr Pro Asn Leu Ala Pro Glu Phe Val Tyr Gly
945                 950                 955                 960


Glu Tyr Pro Lys Phe Gln Thr Phe Lys Glu Asn Lys Ala Thr Ala Lys
                965                 970                 975


Ala Ile Ile Tyr Thr Asn Leu Leu Arg Phe Phe Thr Glu Asp Glu Pro
            980                 985                 990


Arg Phe Thr Lys Asp Gly Glu Ile  Leu Trp Ser Asn Ser  Tyr Leu Lys
        995                 1000                1005


Thr Ile  Lys Lys Glu Leu Asn  Tyr His Gln Met Asn  Ile Val Lys
    1010                1015                1020


Lys Val  Glu Val Gln Lys Gly  Gly Phe Ser Lys Glu  Ser Ile Lys
    1025                1030                1035


Pro Lys  Gly Pro Ser Asn Lys  Leu Ile Pro Val Lys  Asn Gly Leu
    1040                1045                1050


Asp Pro  Gln Lys Tyr Gly Gly  Phe Asp Ser Pro Val  Val Ala Tyr
    1055                1060                1065


Thr Val  Leu Phe Thr His Glu  Lys Gly Lys Lys Pro  Leu Ile Lys
    1070                1075                1080


Gln Glu  Ile Leu Gly Ile Thr  Ile Met Glu Lys Thr  Arg Phe Glu
    1085                1090                1095


Gln Asn  Pro Ile Leu Phe Leu  Glu Glu Lys Gly Phe  Leu Arg Pro
    1100                1105                1110
```

```
Arg Val  Leu Met Lys Leu Pro  Lys Tyr Thr Leu Tyr  Glu Phe Pro
    1115                1120                1125


Glu Gly  Arg Arg Arg Leu Leu  Ala Ser Ala Lys Glu  Ala Gln Lys
    1130                1135                1140


Gly Asn  Gln Met Val Leu Pro  Glu His Leu Leu Thr  Leu Leu Tyr
    1145                1150                1155


His Ala  Lys Gln Cys Leu Leu  Pro Asn Gln Ser Glu  Ser Leu Ala
    1160                1165                1170


Tyr Val  Glu Gln His Gln Pro  Glu Phe Gln Glu Ile  Leu Glu Arg
    1175                1180                1185


Val Val  Asp Phe Ala Glu Val  His Thr Leu Ala Lys  Ser Lys Val
    1190                1195                1200


Gln Gln  Ile Val Lys Leu Phe  Glu Ala Asn Gln Thr  Ala Asp Val
    1205                1210                1215


Lys Glu  Ile Ala Ala Ser Phe  Ile Gln Leu Met Gln  Phe Asn Ala
    1220                1225                1230


Met Gly  Ala Pro Ser Thr Phe  Lys Phe Phe Gln Lys  Asp Ile Glu
    1235                1240                1245


Arg Ala  Arg Tyr Thr Ser Ile  Lys Glu Ile Phe Asp  Ala Thr Ile
    1250                1255                1260


Ile Tyr  Gln Ser Pro Thr Gly  Leu Tyr Glu Thr Arg  Arg Lys Val
    1265                1270                1275


Val Asp
    1280
```

<210> 214
<211> 1072
<212> PRT
<213> Enterococcus durans

<400> 214

```
Met Asp Glu Glu Ala Lys Ile Gln Leu Ser Lys Glu Ser Tyr Glu Glu
1               5                  10                  15

Glu Leu Glu Ser Leu Leu Glu Lys Ser Gly Glu Glu Phe Arg Asp Val
            20                  25                  30

Phe Leu Gln Ala Lys Lys Val Tyr Asp Ala Ile Leu Leu Ser Asp Ile
        35                  40                  45

Leu Ser Thr Lys Lys Gln Asn Ser Lys Ala Lys Leu Ser Leu Gly Met
    50                  55                  60

Ile Glu Arg Tyr Asp Ser His Lys Lys Asp Leu Glu Glu Leu Lys Gln
65                  70                  75                  80

Phe Val Lys Ala Asn Leu Pro Glu Lys Thr Ala Ile Phe Phe Lys Asp
                85                  90                  95

Ser Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr Gln
            100                 105                 110

Glu Asp Phe Tyr Lys Phe Leu Lys Lys Glu Leu Asn Gly Ile Ala Gly
        115                 120                 125

Ser Glu Arg Phe Met Glu Lys Val Asp Gln Glu Asn Phe Leu Leu Lys
    130                 135                 140

Gln Arg Thr Thr Ala Asn Gly Val Ile Pro His Gln Val His Leu Thr
145                 150                 155                 160

Glu Leu Lys Ala Ile Ile Glu Arg Gln Lys Pro Tyr Tyr Pro Ser Leu
                165                 170                 175

Glu Glu Ala Arg Asp Lys Met Ile Arg Leu Leu Thr Phe Arg Ile Pro
            180                 185                 190

Tyr Tyr Val Gly Pro Leu Ala Gln Gly Glu Glu Thr Ser Ser Phe Ala
```

195 200 205

Trp Leu Glu Arg Lys Thr Pro Glu Lys Val Thr Pro Trp Asn Ala Thr
210 215 220

Glu Val Ile Asp Tyr Ser Ala Ser Ala Met Lys Phe Ile Gln Arg Met
225 230 235 240

Ile Asn Tyr Asp Thr Tyr Leu Pro Thr Glu Lys Val Leu Pro Lys His
245 250 255

Ser Ile Leu Tyr Gln Lys Tyr Thr Ile Phe Asn Glu Leu Thr Lys Val
260 265 270

Ala Tyr Lys Asp Glu Arg Gly Ile Lys His Gln Phe Ser Ser Lys Glu
275 280 285

Lys Arg Glu Ile Phe Lys Glu Leu Phe Gln Lys Gln Arg Lys Val Thr
290 295 300

Val Lys Lys Leu Gln Gln Phe Leu Ser Ala Asn Tyr Asn Ile Glu Asp
305 310 315 320

Ala Glu Ile Leu Gly Val Asp Lys Ala Phe Asn Ser Ser Tyr Ala Thr
325 330 335

Tyr His Asp Phe Leu Asp Leu Ala Lys Pro Asn Glu Leu Leu Glu Gln
340 345 350

Pro Glu Met Asn Ala Met Phe Glu Asp Ile Val Lys Ile Leu Thr Ile
355 360 365

Phe Glu Asp Arg Glu Met Ile Arg Thr Gln Leu Lys Lys Tyr Gln Ser
370 375 380

Val Leu Gly Asp Gly Phe Phe Lys Lys Leu Val Lys Lys His Tyr Thr
385 390 395 400

Gly Trp Gly Arg Leu Ser Glu Arg Leu Ile Asn Gly Ile Arg Asp Lys

405 410 415

Lys Thr Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Phe Pro
420 425 430

Tyr Asn Arg Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu
435 440 445

Ser Phe Lys Glu Glu Leu Ala Asn Glu Leu Ala Leu Ala Gly Asn Gln
450 455 460

Ser Leu Leu Glu Val Val Glu Ala Leu Leu Gly Ser Pro Ala Ile Lys
465 470 475 480

Lys Gly Ile Trp Gln Thr Leu Lys Ile Val Glu Glu Leu Ile Glu Ile
485 490 495

Ile Gly Tyr Asn Pro Lys Asn Ile Val Val Glu Met Ala Arg Glu Asn
500 505 510

Gln Arg Thr Asn Arg Ser Lys Pro Arg Leu Lys Ala Leu Glu Glu Ala
515 520 525

Leu Lys Ser Phe Asp Ser Pro Leu Leu Lys Glu Gln Pro Val Asp Asn
530 535 540

Gln Ala Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
545 550 555 560

Lys Asp Met Tyr Thr Gly Glu Ala Leu Asp Ile Asp Arg Leu Ser Glu
565 570 575

Tyr Asp Ile Asp His Ile Ile Pro Arg Ser Phe Ile Val Asp Asn Ser
580 585 590

Ile Asp Asn Lys Val Leu Val Ser Ser Lys Glu Asn Arg Leu Lys Met
595 600 605

Asp Asp Val Pro Asp Gln Lys Val Val Ile Arg Met Arg Arg Tyr Trp

610 615 620

Glu Lys Leu Leu Arg Ala Asn Leu Ile Ser Glu Arg Lys Phe Ala Tyr
625 630 635 640

Leu Thr Lys Leu Glu Leu Thr Pro Glu Asp Lys Ala Arg Phe Ile Gln
645 650 655

Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Ala Ile
660 665 670

Leu Asp Gln Tyr Phe Asn Gln Pro Glu Glu Ser Lys Asn Lys Gly Ile
675 680 685

Arg Ile Ile Thr Leu Lys Ser Ser Leu Val Ser Gln Phe Arg Lys Thr
690 695 700

Phe Gly Ile Asn Lys Val Arg Glu Ile Asn Asn His His His Ala His
705 710 715 720

Asp Ala Tyr Leu Asn Gly Val Val Ala Ile Ala Leu Leu Lys Lys Tyr
725 730 735

Pro Lys Leu Glu Pro Glu Phe Val Tyr Gly Asn Tyr Thr Lys Phe Asn
740 745 750

Leu Ala Thr Glu Asn Lys Ala Thr Ala Lys Lys Glu Phe Tyr Ser Asn
755 760 765

Ile Leu Arg Phe Phe Glu Lys Glu Glu Tyr Ser Tyr Asp Glu Asn Gly
770 775 780

Glu Ile Phe Trp Asp Lys Ala Arg His Ile Pro Gln Ile Lys Lys Val
785 790 795 800

Ile Ser Ser His Gln Val Asn Ile Val Lys Lys Val Glu Val Gln Thr
805 810 815

Gly Gly Phe Tyr Lys Glu Thr Val Asn Pro Lys Gly Lys Pro Asp Lys

820 825 830

Leu Ile Gln Arg Lys Ala Gly Trp Asp Val Ser Lys Tyr Gly Gly Phe
835 840 845

Gly Ser Pro Val Val Ala Tyr Ala Val Ala Phe Ile Tyr Glu Lys Gly
850 855 860

Lys Ala Arg Lys Lys Ala Lys Ala Ile Glu Gly Ile Thr Ile Met Lys
865 870 875 880

Gln Ser Leu Phe Glu Gln Asp Pro Ile Gly Phe Leu Ser Asn Lys Gly
885 890 895

Tyr Ser Asn Val Thr Lys Phe Ile Lys Leu Ser Lys Tyr Thr Leu Tyr
900 905 910

Glu Leu Glu Asn Gly Arg Arg Arg Met Val Ala Ser Lys Glu Ala Gln
915 920 925

Lys Ala Asn Ser Phe Ile Leu Pro Glu Lys Leu Val Thr Leu Leu Tyr
930 935 940

His Ala Gln His Tyr Asp Glu Ile Ala His Lys Glu Ser Phe Asp Tyr
945 950 955 960

Val Asn Asp His Leu Ser Glu Phe Arg Glu Ile Leu Asp Gln Val Ile
965 970 975

Asp Phe Ser Asn Arg Tyr Thr Ile Ala Ala Lys Asn Thr Glu Lys Ile
980 985 990

Ala Glu Leu Phe Glu Gln Asn Gln Glu Ser Thr Val Gln Ser Leu Ser
995 1000 1005

Gln Ser Phe Ile Asn Leu Met Gln Leu Asn Ala Met Gly Ala Pro
1010 1015 1020

Ala Asp Phe Lys Phe Phe Asp Val Ile Ile Pro Arg Lys Arg Tyr

1025 1030 1035

Pro Ser Leu Thr Glu Ile Trp Glu Ser Thr Ile Ile Tyr Gln Ser
1040 1045 1050

Ile Thr Gly Leu Arg Glu Thr Arg Thr Arg Met Ala Thr Leu Trp
1055 1060 1065

Asp Gly Glu Gln
1070

<210> 215
<211> 1329
<212> PRT
<213> Enterococcus faecalis

<400> 215

Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
20 25 30

Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
35 40 45

Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65 70 75 80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Asp Leu Asp Glu Asn
85 90 95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
100 105 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
115 120 125

```
His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Thr Ser Val Lys Glu Gln Phe Gln Gln Phe Met Val Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240

Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255

Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser
        275                 280                 285

Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser
    290                 295                 300

Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu Ser Ser
305                 310                 315                 320

Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Lys Phe
                325                 330                 335
```

```
Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe
            340                 345                 350

Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Ala His Ala Val
        355                 360                 365

Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile
    370                 375                 380

Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His
                405                 410                 415

Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Glu Lys Ile Glu Gln Leu Val Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser Thr Phe
    450                 455                 460

Ala Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp Asn Leu
465                 470                 475                 480

Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg
                485                 490                 495

Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys
            500                 505                 510

His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys
        515                 520                 525

Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys
    530                 535                 540
```

```
Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val
545                 550                 555                 560

Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu
                565                 570                 575

Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe
            580                 585                 590

Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu
        595                 600                 605

Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu
    610                 615                 620

Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe
625                 630                 635                 640

Lys Gly Gln Phe Ser Ala Glu Val Leu Lys Lys Leu Glu Arg Lys His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr
            660                 665                 670

Asp Lys Glu Ser Gly Lys Thr Ile Leu Asp Tyr Leu Val Asp Asp Gly
        675                 680                 685

Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His
705                 710                 715                 720

Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750
```

```
Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu
    770                 775                 780

Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys
785                 790                 795                 800

Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser
            820                 825                 830

Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
        835                 840                 845

Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr
    850                 855                 860

Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Lys Val Val Lys
865                 870                 875                 880

Lys Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser
                885                 890                 895

Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr
            900                 905                 910

Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Arg Tyr Asn Ala
    930                 935                 940

Lys Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu
945                 950                 955                 960
```

```
Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val
               965                 970                 975

Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala
           980                 985                 990

Thr Thr Leu Leu Lys Val Tyr Pro  Asn Leu Ala Pro Glu  Phe Val Tyr
        995                1000                1005

Gly Glu  Tyr Pro Lys Phe Gln  Ala Phe Lys Glu Asn  Lys Ala Thr
    1010                1015                1020

Ala Lys  Thr Ile Ile Tyr Thr  Asn Leu Met Arg Phe  Phe Thr Glu
    1025                1030                1035

Asp Glu  Pro Arg Phe Thr Lys  Asp Ser Glu Ile Leu  Trp Ser Asn
    1040                1045                1050

Ser Tyr  Leu Lys Thr Ile Lys  Lys Glu Leu Asn Tyr  His Gln Met
    1055                1060                1065

Asn Ile  Val Lys Lys Val Glu  Val Gln Lys Gly Gly  Phe Ser Lys
    1070                1075                1080

Glu Ser  Ile Lys Pro Lys Gly  Pro Ser Asn Lys Leu  Ile Pro Val
    1085                1090                1095

Lys Asn  Gly Leu Asp Pro Gln  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1100                1105                1110

Val Val  Ala Tyr Thr Val Leu  Phe Thr His Glu Lys  Gly Lys Lys
    1115                1120                1125

Pro Leu  Ile Lys Gln Glu Ile  Leu Gly Ile Thr Ile  Met Glu Lys
    1130                1135                1140

Thr Arg  Phe Glu Gln Asn Pro  Ile Leu Phe Leu Glu  Glu Lys Gly
    1145                1150                1155
```

```
Phe Leu  Arg Pro Arg Val Leu  Met Lys Leu Pro Lys  Tyr Thr Leu
    1160                1165                1170

Tyr Glu  Phe Pro Glu Gly Arg  Arg Arg Leu Leu Ala  Ser Ala Lys
    1175                1180                1185

Glu Ala  Gln Lys Gly Asn Gln  Met Val Leu Pro Glu  His Leu Leu
    1190                1195                1200

Thr Leu  Leu Tyr His Ala Lys  Gln Cys Leu Leu Pro  Asn Gln Ser
    1205                1210                1215

Glu Ser  Leu Ala Tyr Val Glu  Gln His Gln Pro Glu  Phe Gln Glu
    1220                1225                1230

Ile Leu  Glu Arg Val Val Asp  Phe Ala Glu Val His  Thr Leu Ala
    1235                1240                1245

Lys Ser  Lys Val Gln Gln Ile  Val Lys Leu Phe Glu  Ala Asn Gln
    1250                1255                1260

Thr Ala  Asp Val Lys Glu Ile  Ala Ala Ser Phe Ile  Gln Leu Met
    1265                1270                1275

Gln Phe  Asn Ala Met Gly Ala  Pro Ser Thr Phe Lys  Phe Phe Gln
    1280                1285                1290

Lys Asp  Ile Glu Arg Ala Arg  Tyr Thr Ser Ile Lys  Glu Ile Phe
    1295                1300                1305

Asp Ala  Thr Ile Ile Tyr Gln  Ser Thr Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320

Arg Arg  Lys Val Val Asp
    1325
```

<210> 216
<211> 1329

<212> PRT
<213> Enterococcus faecalis

<400> 216

```
Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30

Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190
```

```
Asn Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240

Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255

Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser
        275                 280                 285

Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser
    290                 295                 300

Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu Ser Ser
305                 310                 315                 320

Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Asn Phe
                325                 330                 335

Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe
            340                 345                 350

Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Thr His Ala Val
        355                 360                 365

Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile
    370                 375                 380

Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu
385                 390                 395                 400
```

```
Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His
                405                 410                 415

Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Glu Lys Ile Glu Gln Leu Val Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Asn Thr Phe
    450                 455                 460

Ala Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp Asn Leu
465                 470                 475                 480

Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg
                485                 490                 495

Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys
            500                 505                 510

His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys
        515                 520                 525

Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys
    530                 535                 540

Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val
545                 550                 555                 560

Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu
                565                 570                 575

Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe
            580                 585                 590

Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu
        595                 600                 605
```

```
Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu
    610                 615                 620

Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe
625                 630                 635                 640

Lys Gly Gln Phe Ser Ala Glu Val Leu Lys Lys Leu Glu Arg Lys His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr
            660                 665                 670

Asp Lys Glu Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His
705                 710                 715                 720

Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu
    770                 775                 780

Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys
785                 790                 795                 800

Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu
                805                 810                 815
```

```
Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser
            820                 825                 830

Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
        835                 840                 845

Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr
    850                 855                 860

Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val Val Lys
865                 870                 875                 880

Asp Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser
                885                 890                 895

Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr
            900                 905                 910

Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Arg Tyr Asn Ala
    930                 935                 940

Lys Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu
945                 950                 955                 960

Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val
                965                 970                 975

Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala
            980                 985                 990

Thr Thr Leu Leu Lys Val Tyr Pro  Asn Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005

Gly Glu  Tyr Pro Lys Phe Gln  Thr Phe Lys Glu Asn  Lys Ala Thr
    1010                1015                1020
```

```
Ala Lys  Ala Ile Ile Tyr Thr  Asn Leu Leu Arg Phe  Phe Thr Glu
    1025                1030                1035

Asp Glu  Pro Arg Phe Thr Lys  Asp Gly Glu Ile Leu  Trp Ser Asn
    1040                1045                1050

Ser Tyr  Leu Lys Thr Ile Lys  Lys Glu Leu Asn Tyr  His Gln Met
    1055                1060                1065

Asn Ile  Val Lys Lys Val Glu  Val Gln Lys Gly Gly  Phe Ser Lys
    1070                1075                1080

Glu Ser  Ile Lys Pro Lys Gly  Pro Ser Asn Lys Leu  Ile Pro Val
    1085                1090                1095

Lys Asn  Gly Leu Asp Pro Gln  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1100                1105                1110

Ile Val  Ala Tyr Thr Val Leu  Phe Thr His Glu Lys  Gly Lys Lys
    1115                1120                1125

Pro Leu  Ile Lys Gln Glu Ile  Leu Gly Ile Thr Ile  Met Glu Lys
    1130                1135                1140

Thr Arg  Phe Glu Gln Asn Pro  Ile Leu Phe Leu Glu  Glu Lys Gly
    1145                1150                1155

Phe Leu  Arg Pro Arg Val Leu  Met Lys Leu Pro Lys  Tyr Thr Leu
    1160                1165                1170

Tyr Gln  Phe Pro Glu Gly Arg  Arg Arg Leu Leu Ala  Ser Ala Lys
    1175                1180                1185

Glu Ala  Gln Lys Gly Asn Gln  Met Val Leu Pro Glu  His Leu Leu
    1190                1195                1200

Thr Leu  Leu Tyr His Ala Lys  Gln Cys Leu Leu Pro  Asn Gln Ser
    1205                1210                1215
```

```
Glu Ser  Leu Ala Tyr Val Glu  Gln His Gln Pro Glu  Phe Gln Glu
    1220                 1225                 1230


Ile Leu  Glu Arg Val Val Asp  Phe Ala Glu Val His  Thr Leu Ala
    1235                 1240                 1245


Lys Ser  Lys Val Gln Gln Ile  Val Lys Leu Phe Glu  Ala Asn Gln
    1250                 1255                 1260


Thr Ala  Asp Val Lys Glu Ile  Ala Ala Ser Phe Ile  Gln Leu Met
    1265                 1270                 1275


Gln Phe  Asn Ala Met Gly Ala  Pro Ser Thr Phe Lys  Phe Phe Gln
    1280                 1285                 1290


Lys Asp  Ile Glu Arg Ala Arg  Tyr Thr Ser Ile Lys  Glu Ile Phe
    1295                 1300                 1305


Asp Ala  Thr Ile Ile Tyr Gln  Ser Thr Thr Gly Leu  Tyr Glu Thr
    1310                 1315                 1320


Arg Arg  Lys Val Val Asp
    1325
```

<210> 217
<211> 1329
<212> PRT
<213> Enterococcus faecalis

<400> 217

```
Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30


Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45
```

```
Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240

Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255
```

```
Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr
            260                 265                 270


Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser
        275                 280                 285


Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser
    290                 295                 300


Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu Ser Ser
305                 310                 315                 320


Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Asn Phe
                325                 330                 335


Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe
            340                 345                 350


Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Thr His Ala Val
        355                 360                 365


Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile
    370                 375                 380


Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu
385                 390                 395                 400


Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His
                405                 410                 415


Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro
            420                 425                 430


Phe Leu Lys Glu Asn Gln Glu Lys Ile Glu Gln Leu Val Thr Phe Arg
        435                 440                 445


Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser Thr Phe
    450                 455                 460
```

```
Ala Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp Asn Leu
465                 470                 475                 480


Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg
                485                 490                 495


Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys
            500                 505                 510


His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys
        515                 520                 525


Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys
    530                 535                 540


Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val
545                 550                 555                 560


Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu
                565                 570                 575


Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe
            580                 585                 590


Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu
        595                 600                 605


Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu
    610                 615                 620


Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe
625                 630                 635                 640


Lys Gly Gln Phe Ser Ala Glu Val Leu Lys Lys Leu Glu Arg Lys His
                645                 650                 655


Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr
            660                 665                 670
```

```
Asp Lys Glu Ser Gly Lys Thr Ile Leu Asp Tyr Leu Val Asp Asp Gly
        675                 680                 685

Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His
705                 710                 715                 720

Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu
    770                 775                 780

Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys
785                 790                 795                 800

Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser
            820                 825                 830

Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
        835                 840                 845

Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr
    850                 855                 860

Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val Val Lys
865                 870                 875                 880
```

```
Asp Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser
                885                 890                 895


Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr
            900                 905                 910


Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg
        915                 920                 925


Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Arg Tyr Asn Ala
    930                 935                 940


Lys Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu
945                 950                 955                 960


Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val
                965                 970                 975


Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala
            980                 985                 990


Thr Thr Leu Leu Lys Val Tyr Pro  Asn Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005


Gly Glu  Tyr Pro Lys Phe Gln  Thr Phe Lys Glu Asn  Lys Ala Thr
    1010                1015                1020


Ala Lys  Ala Ile Ile Tyr Thr  Asn Leu Leu Arg Phe  Phe Thr Glu
    1025                1030                1035


Asp Glu  Pro Arg Phe Thr Lys  Asp Gly Glu Ile Leu  Trp Ser Asn
    1040                1045                1050


Ser Tyr  Leu Lys Thr Ile Lys  Lys Glu Leu Asn Tyr  His Gln Met
    1055                1060                1065


Asn Ile  Val Lys Lys Val Glu  Val Gln Lys Gly Gly  Phe Ser Lys
    1070                1075                1080
```

```
Glu Ser  Ile Lys Pro Lys Gly  Pro Ser Asn Lys Leu  Ile Pro Val
    1085                1090                1095

Lys Asn  Gly Leu Asp Pro Gln  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1100                1105                1110

Ile Val  Ala Tyr Thr Val Leu  Phe Thr His Glu Lys  Gly Lys Lys
    1115                1120                1125

Pro Leu  Ile Lys Gln Glu Ile  Leu Gly Ile Thr Ile  Met Glu Lys
    1130                1135                1140

Thr Arg  Phe Glu Gln Asn Pro  Ile Leu Phe Leu Glu  Glu Lys Gly
    1145                1150                1155

Phe Leu  Arg Pro Arg Val Leu  Met Lys Leu Pro Lys  Tyr Thr Leu
    1160                1165                1170

Tyr Glu  Phe Pro Glu Gly Arg  Arg Arg Leu Leu Ala  Ser Ala Lys
    1175                1180                1185

Glu Ala  Gln Lys Gly Asn Gln  Met Val Leu Pro Glu  His Leu Leu
    1190                1195                1200

Thr Leu  Leu Tyr His Ala Lys  Gln Cys Leu Leu Pro  Asn Gln Ser
    1205                1210                1215

Glu Ser  Leu Ala Tyr Val Glu  Gln His Gln Pro Glu  Phe Gln Glu
    1220                1225                1230

Ile Leu  Glu Arg Val Val Asp  Phe Ala Glu Val His  Thr Leu Ala
    1235                1240                1245

Lys Ser  Lys Val Gln Gln Ile  Val Lys Leu Phe Glu  Ala Asn Gln
    1250                1255                1260

Thr Ala  Asp Val Lys Glu Ile  Ala Ala Ser Phe Ile  Gln Leu Met
    1265                1270                1275
```

```
Gln Phe  Asn Ala Met Gly Ala  Pro Ser Thr Phe Lys  Phe Phe Gln
    1280                1285                1290


Lys Asp  Ile Glu Arg Ala Arg  Tyr Thr Ser Ile Lys  Glu Ile Phe
    1295                1300                1305


Asp Ala  Thr Ile Ile Tyr Gln  Ser Thr Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320


Arg Arg  Lys Val Val Asp
    1325
```

<210> 218
<211> 1329
<212> PRT
<213> Enterococcus faecalis

<400> 218

```
Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30


Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Asp Leu Asp Glu Asn
                85                  90                  95


Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110


Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
```

```
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240

Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255

Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser
        275                 280                 285

Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser
    290                 295                 300

Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu Ser Ser
305                 310                 315                 320

Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Lys Phe
```

325 330 335

Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe
340 345 350

Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Ala His Ala Val
355 360 365

Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile
370 375 380

Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu
385 390 395 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His
405 410 415

Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro
420 425 430

Phe Leu Lys Glu Asn Gln Glu Lys Ile Glu Gln Leu Val Thr Phe Arg
435 440 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser Thr Phe
450 455 460

Ala Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp Asn Leu
465 470 475 480

Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg
485 490 495

Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys
500 505 510

His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys
515 520 525

Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys

530 535 540

Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val
545 550 555 560

Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu
565 570 575

Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe
580 585 590

Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu
595 600 605

Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu
610 615 620

Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe
625 630 635 640

Lys Gly Gln Phe Ser Ala Glu Val Leu Lys Lys Leu Glu Arg Lys His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr
660 665 670

Asp Lys Glu Ser Gly Lys Thr Ile Leu Asp Tyr Leu Val Asp Asp Gly
675 680 685

Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser
690 695 700

Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His
705 710 715 720

Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala
725 730 735

Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val

740 745 750

Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg
755 760 765

Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu
770 775 780

Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys
785 790 795 800

Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu
805 810 815

Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser
820 825 830

Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
835 840 845

Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr
850 855 860

Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val Val Lys
865 870 875 880

Asp Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser
885 890 895

Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr
900 905 910

Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg
915 920 925

Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asn Gln Arg Tyr Asn Ala
930 935 940

Asn Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu

945 950 955 960

Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val
965 970 975

Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala
980 985 990

Thr Thr Leu Leu Lys Val Tyr Pro Asn Leu Ala Pro Glu Phe Val Tyr
995 1000 1005

Gly Glu Tyr Pro Lys Phe Gln Thr Phe Lys Glu Asn Lys Ala Thr
1010 1015 1020

Ala Lys Ala Ile Ile Tyr Thr Asn Leu Leu Arg Phe Phe Thr Glu
1025 1030 1035

Asp Glu Pro Arg Phe Thr Lys Asp Gly Glu Ile Leu Trp Ser Asn
1040 1045 1050

Ser Tyr Leu Lys Thr Ile Lys Lys Glu Leu Asn Tyr His Gln Met
1055 1060 1065

Asn Ile Val Lys Lys Val Glu Val Gln Lys Gly Gly Phe Ser Lys
1070 1075 1080

Glu Ser Ile Lys Pro Lys Gly Pro Ser Asn Lys Leu Ile Pro Val
1085 1090 1095

Lys Asn Gly Leu Asp Pro Gln Lys Tyr Gly Gly Phe Asp Ser Pro
1100 1105 1110

Val Val Ala Tyr Thr Val Leu Phe Thr His Glu Lys Gly Lys Lys
1115 1120 1125

Pro Leu Ile Lys Gln Glu Ile Leu Gly Ile Thr Ile Met Glu Lys
1130 1135 1140

Thr Arg Phe Glu Gln Asn Pro Ile Leu Phe Leu Glu Glu Lys Gly

1145 1150 1155

Phe Leu Arg Pro Arg Val Leu Met Lys Leu Pro Lys Tyr Thr Leu
1160 1165 1170

Tyr Glu Phe Pro Glu Gly Arg Arg Arg Leu Leu Ala Ser Ala Lys
1175 1180 1185

Glu Ala Gln Lys Gly Asn Gln Met Val Leu Pro Glu His Leu Leu
1190 1195 1200

Thr Leu Leu Tyr His Ala Lys Gln Cys Leu Leu Pro Asn Gln Ser
1205 1210 1215

Glu Ser Leu Ala Tyr Val Glu Gln His Gln Pro Glu Phe Gln Glu
1220 1225 1230

Ile Leu Glu Arg Val Val Asp Phe Ala Glu Val His Thr Leu Ala
1235 1240 1245

Lys Ser Lys Val Gln Gln Ile Val Lys Leu Phe Glu Ala Asn Gln
1250 1255 1260

Thr Ala Asp Val Lys Glu Ile Ala Ala Ser Phe Ile Gln Leu Met
1265 1270 1275

Gln Phe Asn Ala Met Gly Ala Pro Ser Thr Phe Lys Phe Phe Gln
1280 1285 1290

Lys Asp Ile Glu Arg Ala Arg Tyr Thr Ser Ile Lys Glu Ile Phe
1295 1300 1305

Asp Ala Thr Ile Ile Tyr Gln Ser Thr Thr Gly Leu Tyr Glu Thr
1310 1315 1320

Arg Arg Lys Val Val Asp
1325

<210> 219

<211> 1331
<212> PRT
<213> Enterococcus faecalis

<400> 219

```
Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30


Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95


Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110


Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140


Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175


Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190
```

```
Asn Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240

Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255

Phe Gly Leu Glu Glu Glu Ala Lys Ile Lys Ile Thr Tyr Ala Ser Glu
            260                 265                 270

Ser Tyr Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu
        275                 280                 285

Tyr Ser Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu
    290                 295                 300

Leu Ser Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu
305                 310                 315                 320

Ser Ser Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys
                325                 330                 335

Asn Phe Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn
            340                 345                 350

Leu Phe Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Ala His
        355                 360                 365

Ala Val Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln
    370                 375                 380

Asp Ile Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn
385                 390                 395                 400
```

```
Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln
                405                 410                 415

Ile His Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr
            420                 425                 430

Tyr Pro Phe Leu Lys Glu Asn Gln Lys Lys Ile Glu Gln Leu Val Thr
        435                 440                 445

Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser
    450                 455                 460

Thr Phe Ala Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp
465                 470                 475                 480

Asn Leu Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile
                485                 490                 495

Glu Arg Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu
            500                 505                 510

Pro Lys His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu
        515                 520                 525

Thr Lys Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser
    530                 535                 540

Gly Lys Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg
545                 550                 555                 560

Lys Val Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn
                565                 570                 575

Thr Glu Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala
            580                 585                 590

Ser Phe Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala
        595                 600                 605
```

```
Glu Leu Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys
    610                 615                 620

Ile Leu Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser
625                 630                 635                 640

Thr Phe Lys Gly Gln Phe Ser Glu Glu Val Leu Lys Lys Leu Glu Arg
                645                 650                 655

Lys His Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly
            660                 665                 670

Ile Tyr Asp Lys Glu Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp
        675                 680                 685

Asp Gly Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn
    690                 695                 700

Asp Ser Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser
705                 710                 715                 720

Glu His Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser
                725                 730                 735

Pro Ala Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu
            740                 745                 750

Leu Val Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met
        755                 760                 765

Ala Arg Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln
    770                 775                 780

Arg Leu Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu
785                 790                 795                 800

Leu Lys Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu
                805                 810                 815
```

```
Phe Leu Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu
            820                 825                 830

Leu Ser Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro
        835                 840                 845

Gln Ser Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly
    850                 855                 860

Ser Thr Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val
865                 870                 875                 880

Val Lys Lys Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu
                885                 890                 895

Ile Ser Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly
            900                 905                 910

Leu Thr Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu
        915                 920                 925

Thr Arg Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Arg Tyr
    930                 935                 940

Asn Ala Lys Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala
945                 950                 955                 960

Ser Leu Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg
                965                 970                 975

Glu Val Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val
            980                 985                 990

Val Ala Thr Thr Leu Leu Lys Val  Tyr Pro Asn Leu Ala  Pro Glu Phe
        995                 1000                1005

Val Tyr  Gly Glu Tyr Pro Lys  Phe Gln Ala Phe Lys  Glu Asn Lys
    1010                1015                1020
```

```
Ala Thr  Ala Lys Ala Ile Ile  Tyr Thr Asn Leu Leu  Arg Phe Phe
    1025                1030                1035

Thr Glu  Asp Glu Pro Arg Phe  Thr Lys Asp Gly Glu  Ile Leu Trp
    1040                1045                1050

Ser Asn  Ser Tyr Leu Lys Thr  Ile Lys Lys Glu Leu  Asn Tyr His
    1055                1060                1065

Gln Met  Asn Ile Val Lys Lys  Val Glu Val Gln Lys  Gly Gly Phe
    1070                1075                1080

Ser Lys  Glu Ser Ile Lys Pro  Lys Gly Pro Ser Asn  Lys Leu Ile
    1085                1090                1095

Pro Val  Lys Asn Gly Leu Asp  Pro Gln Lys Tyr Gly  Gly Phe Asp
    1100                1105                1110

Ser Pro  Val Val Ala Tyr Thr  Val Leu Phe Thr His  Glu Lys Gly
    1115                1120                1125

Lys Lys  Pro Leu Ile Lys Gln  Glu Ile Leu Gly Ile  Thr Ile Met
    1130                1135                1140

Glu Lys  Thr Arg Phe Glu Gln  Asn Pro Ile Leu Phe  Leu Glu Glu
    1145                1150                1155

Lys Gly  Phe Leu Arg Pro Arg  Val Leu Met Lys Leu  Pro Lys Tyr
    1160                1165                1170

Thr Leu  Tyr Glu Phe Pro Glu  Gly Arg Arg Arg Leu  Leu Ala Ser
    1175                1180                1185

Ala Lys  Glu Ala Gln Lys Gly  Asn Gln Met Val Leu  Pro Glu His
    1190                1195                1200

Leu Leu  Thr Leu Leu Tyr His  Ala Lys Gln Cys Leu  Leu Pro Asn
    1205                1210                1215
```

```
Gln Ser  Glu Ser Leu Ala Tyr  Val Glu Gln His Gln  Pro Glu Phe
    1220                 1225                 1230


Gln Glu  Ile Leu Glu Arg Val  Val Asp Phe Ala Glu  Val His Thr
    1235                 1240                 1245


Leu Ala  Lys Ser Lys Val Gln  Gln Ile Val Lys Leu  Phe Glu Ala
    1250                 1255                 1260


Asn Gln  Thr Ala Asp Val Lys  Glu Ile Ala Ala Ser  Phe Ile Gln
    1265                 1270                 1275


Leu Met  Gln Phe Asn Ala Met  Gly Ala Pro Ser Thr  Phe Lys Phe
    1280                 1285                 1290


Phe Gln  Lys Asp Ile Glu Arg  Ala Arg Tyr Thr Ser  Ile Lys Glu
    1295                 1300                 1305


Ile Phe  Asp Ala Thr Ile Ile  Tyr Gln Ser Thr Thr  Gly Leu Tyr
    1310                 1315                 1320


Glu Thr  Arg Arg Lys Val Val  Asp
    1325                 1330


<210>  220
<211>  1329
<212>  PRT
<213>  Enterococcus faecalis

<400>  220

Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30


Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45
```

```
Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240

Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255
```

```
Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser
        275                 280                 285

Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser
    290                 295                 300

Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu Ser Ser
305                 310                 315                 320

Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Lys Phe
                325                 330                 335

Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe
            340                 345                 350

Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Ala His Ala Val
        355                 360                 365

Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile
    370                 375                 380

Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His
                405                 410                 415

Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Glu Lys Ile Glu Gln Leu Val Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser Thr Phe
    450                 455                 460
```

```
Ala Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp Asn Leu
465                 470                 475                 480

Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg
                485                 490                 495

Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys
            500                 505                 510

His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys
        515                 520                 525

Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys
    530                 535                 540

Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val
545                 550                 555                 560

Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu
                565                 570                 575

Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe
            580                 585                 590

Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu
        595                 600                 605

Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu
    610                 615                 620

Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe
625                 630                 635                 640

Lys Gly Gln Phe Ser Ala Glu Val Leu Lys Lys Leu Glu Arg Lys His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr
            660                 665                 670
```

```
Asp Lys Glu Ser Gly Lys Thr Ile Leu Gly Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His
705                 710                 715                 720

Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu
    770                 775                 780

Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys
785                 790                 795                 800

Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser
            820                 825                 830

Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
        835                 840                 845

Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr
    850                 855                 860

Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val Val Lys
865                 870                 875                 880
```

```
Asp Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser
               885                 890                 895


Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr
            900                 905                 910


Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg
        915                 920                 925


Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Arg Tyr Asn Ala
    930                 935                 940


Lys Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu
945                 950                 955                 960


Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val
               965                 970                 975


Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala
            980                 985                 990


Thr Thr Leu Leu Lys Val Tyr Pro  Asn Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005


Gly Glu  Tyr Pro Lys Phe Gln  Thr Phe Lys Glu Asn  Lys Ala Thr
    1010                1015                1020


Ala Lys  Ala Ile Ile Tyr Thr  Asn Leu Leu Arg Phe  Phe Thr Glu
    1025                1030                1035


Asp Glu  Pro Arg Phe Thr Lys  Asp Gly Glu Ile Leu  Trp Ser Asn
    1040                1045                1050


Ser Tyr  Leu Lys Thr Ile Lys  Lys Glu Leu Asn Tyr  His Gln Met
    1055                1060                1065


Asn Ile  Val Lys Lys Val Glu  Val Gln Lys Gly Gly  Phe Ser Lys
    1070                1075                1080
```

```
Glu Ser  Ile Lys Pro Lys Gly  Pro Ser Asn Lys Leu  Ile Pro Val
    1085                1090                1095

Lys Asn  Gly Leu Asp Pro Gln  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1100                1105                1110

Ile Val  Ala Tyr Thr Val Leu  Phe Thr His Glu Lys  Gly Lys Lys
    1115                1120                1125

Pro Leu  Ile Lys Gln Glu Ile  Leu Gly Ile Thr Ile  Met Glu Lys
    1130                1135                1140

Thr Arg  Phe Glu Gln Asn Pro  Ile Leu Phe Leu Glu  Glu Lys Gly
    1145                1150                1155

Phe Leu  Arg Pro Arg Val Leu  Met Lys Leu Pro Lys  Tyr Thr Leu
    1160                1165                1170

Tyr Glu  Phe Pro Glu Gly Arg  Arg Arg Leu Leu Ala  Ser Ala Lys
    1175                1180                1185

Glu Ala  Gln Lys Gly Asn Gln  Met Val Leu Pro Glu  His Leu Leu
    1190                1195                1200

Thr Leu  Leu Tyr His Ala Lys  Gln Cys Leu Leu Pro  Asn Gln Ser
    1205                1210                1215

Glu Ser  Leu Ala Tyr Val Glu  Gln His Gln Pro Glu  Phe Gln Glu
    1220                1225                1230

Ile Leu  Glu Arg Val Val Asp  Phe Ala Glu Val His  Thr Leu Ala
    1235                1240                1245

Lys Ser  Lys Val Gln Gln Ile  Val Lys Leu Phe Glu  Ala Asn Gln
    1250                1255                1260

Thr Ala  Asp Val Lys Glu Ile  Ala Ala Ser Phe Ile  Gln Leu Met
    1265                1270                1275
```

```
Gln Phe  Asn Ala Met Gly Ala  Pro Ser Thr Phe Lys  Phe Phe Gln
    1280                1285                1290


Lys Asp  Ile Glu Arg Ala Arg  Tyr Thr Ser Ile Lys  Glu Ile Phe
    1295                1300                1305


Asp Ala  Thr Ile Ile Tyr Gln  Ser Thr Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320


Arg Arg  Lys Val Val Asp
    1325
```

<210> 221
<211> 1329
<212> PRT
<213> Enterococcus faecalis

<400> 221

```
Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Ser Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30


Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Asp Leu Asp Glu Asn
                85                  90                  95


Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110
```

```
Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Thr Ser Val Lys Asp Gln Phe Gln Gln Phe Met Val Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240

Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255

Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser
        275                 280                 285

Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser
    290                 295                 300

Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu Ser Ser
305                 310                 315                 320
```

```
Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Asn Phe
                325                 330                 335

Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe
            340                 345                 350

Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Thr His Ala Val
        355                 360                 365

Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile
    370                 375                 380

Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His
                405                 410                 415

Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Glu Lys Ile Glu Gln Leu Val Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser Thr Phe
    450                 455                 460

Ala Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp Asn Leu
465                 470                 475                 480

Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg
                485                 490                 495

Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys
            500                 505                 510

His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys
        515                 520                 525
```

```
Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys
    530                 535                 540

Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val
545                 550                 555                 560

Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu
                565                 570                 575

Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe
            580                 585                 590

Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu
        595                 600                 605

Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu
    610                 615                 620

Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe
625                 630                 635                 640

Lys Gly Gln Phe Ser Ala Glu Val Leu Lys Lys Leu Glu Arg Lys His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr
            660                 665                 670

Asp Lys Glu Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His
705                 710                 715                 720

Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735
```

```
Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu
    770                 775                 780

Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys
785                 790                 795                 800

Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser
            820                 825                 830

Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
        835                 840                 845

Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr
    850                 855                 860

Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val Val Lys
865                 870                 875                 880

Asp Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser
                885                 890                 895

Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr
            900                 905                 910

Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Leu Tyr Asn Ala
    930                 935                 940
```

```
Lys Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu
945                 950                 955                 960


Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val
                965                 970                 975


Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala
            980                 985                 990


Thr Thr Leu Leu Lys Val Tyr Pro  Asn Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005


Gly Glu  Tyr Pro Lys Phe Gln  Thr Phe Lys Glu Asn  Lys Ala Thr
    1010                1015                1020


Ala Lys  Thr Ile Ile Tyr Thr  Asn Leu Met Arg Phe  Phe Thr Glu
    1025                1030                1035


Asp Glu  Pro Arg Phe Thr Lys  Asp Gly Glu Ile Leu  Trp Ser Asn
    1040                1045                1050


Ser Tyr  Leu Lys Thr Ile Lys  Lys Glu Leu Asn Tyr  His Gln Met
    1055                1060                1065


Asn Ile  Val Lys Lys Val Glu  Val Gln Lys Gly Gly  Phe Ser Lys
    1070                1075                1080


Glu Ser  Ile Lys Pro Lys Gly  Pro Ser Asn Lys Leu  Ile Pro Val
    1085                1090                1095


Lys Asn  Gly Leu Asp Pro Gln  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1100                1105                1110


Val Val  Ala Tyr Thr Val Leu  Phe Thr His Glu Lys  Gly Lys Lys
    1115                1120                1125


Pro Leu  Ile Lys Gln Glu Ile  Leu Gly Ile Thr Ile  Met Glu Lys
    1130                1135                1140
```

```
Thr Arg  Phe Glu Gln Asn Pro  Ile Leu Phe Leu Glu  Glu Lys Gly
    1145                1150                1155

Phe Leu  Arg Pro Arg Val Leu  Met Lys Leu Pro Lys  Tyr Thr Leu
    1160                1165                1170

Tyr Glu  Phe Pro Glu Gly Arg  Arg Arg Leu Leu Ala  Ser Ala Lys
    1175                1180                1185

Glu Ala  Gln Lys Gly Asn Gln  Met Val Leu Pro Glu  His Leu Leu
    1190                1195                1200

Thr Leu  Leu Tyr His Ala Lys  Gln Cys Leu Leu Pro  Asn Gln Ser
    1205                1210                1215

Glu Ser  Leu Ala Tyr Val Glu  Gln His Gln Pro Glu  Phe Gln Glu
    1220                1225                1230

Ile Leu  Glu Arg Val Val Asp  Phe Ala Glu Val His  Thr Leu Ala
    1235                1240                1245

Lys Ser  Lys Val Gln Gln Ile  Val Lys Leu Phe Glu  Ala Asn Gln
    1250                1255                1260

Thr Ala  Asp Val Lys Glu Ile  Ala Ala Ser Phe Ile  Gln Leu Met
    1265                1270                1275

Gln Phe  Asn Ala Met Gly Ala  Pro Ser Thr Phe Lys  Phe Phe Gln
    1280                1285                1290

Lys Asp  Ile Glu Arg Ala Arg  Tyr Thr Ser Ile Lys  Glu Ile Phe
    1295                1300                1305

Asp Ala  Thr Ile Ile Tyr Gln  Ser Thr Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320

Arg Arg  Lys Val Val Asp
    1325
```

<210> 222
<211> 1329
<212> PRT
<213> Enterococcus faecalis

<400> 222

```
Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30


Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95


Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110


Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140


Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175


Glu Asn Ile Ser Val Lys Glu Lys Phe Gln Gln Phe Met Ile Ile Tyr
```

```
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Gly Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240

Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255

Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser
        275                 280                 285

Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser
    290                 295                 300

Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser Tyr Ala Lys Leu Ser Ser
305                 310                 315                 320

Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Lys Phe
                325                 330                 335

Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe
            340                 345                 350

Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Ala His Ala Val
        355                 360                 365

Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile
    370                 375                 380

Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu
```

385 390 395 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His
405 410 415

Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro
420 425 430

Phe Leu Lys Glu Asn Gln Glu Lys Ile Glu Gln Leu Val Thr Phe Arg
435 440 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser Thr Phe
450 455 460

Ala Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp Asn Leu
465 470 475 480

Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg
485 490 495

Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys
500 505 510

His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys
515 520 525

Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys
530 535 540

Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val
545 550 555 560

Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu
565 570 575

Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe
580 585 590

Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu

595 600 605

Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu
610 615 620

Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe
625 630 635 640

Lys Gly Gln Phe Ser Ala Glu Val Leu Lys Lys Leu Glu Arg Lys His
645 650 655

Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr
660 665 670

Asp Lys Glu Ser Gly Lys Thr Ile Leu Asp Tyr Leu Val Asp Asp Gly
675 680 685

Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser
690 695 700

Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His
705 710 715 720

Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala
725 730 735

Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val
740 745 750

Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg
755 760 765

Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu
770 775 780

Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys
785 790 795 800

Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu

```
                805                 810                 815

Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser
            820                 825                 830

Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
        835                 840                 845

Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr
    850                 855                 860

Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val Val Lys
865                 870                 875                 880

Asp Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser
                885                 890                 895

Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr
            900                 905                 910

Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Arg Tyr Asn Ala
    930                 935                 940

Lys Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu
945                 950                 955                 960

Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val
                965                 970                 975

Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala
            980                 985                 990

Thr Thr Leu Leu Lys Val Tyr Pro  Asn Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005

Gly Glu  Tyr Pro Lys Phe Gln  Thr Phe Lys Glu Asn  Lys Ala Thr
```

1010 1015 1020

Ala Lys Ala Ile Ile Tyr Thr Asn Leu Leu Arg Phe Phe Thr Glu
1025 1030 1035

Asp Glu Pro Arg Phe Thr Lys Asp Gly Glu Ile Leu Trp Ser Asn
1040 1045 1050

Ser Tyr Leu Lys Thr Ile Lys Lys Glu Leu Asn Tyr His Gln Met
1055 1060 1065

Asn Ile Val Lys Lys Val Glu Val Gln Lys Gly Gly Phe Ser Lys
1070 1075 1080

Glu Ser Ile Lys Pro Lys Gly Pro Ser Asn Lys Leu Ile Pro Val
1085 1090 1095

Lys Asn Gly Leu Asp Pro Gln Lys Tyr Gly Gly Phe Asp Ser Pro
1100 1105 1110

Ile Val Ala Tyr Thr Val Leu Phe Thr His Glu Lys Gly Lys Lys
1115 1120 1125

Pro Leu Ile Lys Gln Glu Ile Leu Gly Ile Thr Ile Met Glu Lys
1130 1135 1140

Thr Arg Phe Glu Gln Asn Pro Ile Leu Phe Leu Glu Glu Lys Gly
1145 1150 1155

Phe Leu Arg Pro Arg Val Leu Met Lys Leu Pro Lys Tyr Thr Leu
1160 1165 1170

Tyr Glu Phe Pro Glu Gly Arg Arg Arg Leu Leu Ala Ser Ala Lys
1175 1180 1185

Glu Ala Gln Lys Gly Asn Gln Met Val Leu Pro Glu His Leu Leu
1190 1195 1200

Thr Leu Leu Tyr His Ala Lys Gln Cys Leu Leu Pro Asn Gln Ser

1205 1210 1215

Glu Ser Leu Ala Tyr Val Glu Gln His Gln Pro Glu Phe Gln Glu
1220 1225 1230

Ile Leu Glu Arg Val Val Asp Phe Ala Glu Val His Thr Leu Ala
1235 1240 1245

Lys Ser Lys Val Gln Gln Ile Val Lys Leu Phe Glu Ala Asn Gln
1250 1255 1260

Thr Ala Asp Val Lys Glu Ile Ala Ala Ser Phe Ile Gln Leu Met
1265 1270 1275

Gln Phe Asn Ala Met Gly Ala Pro Ser Thr Phe Lys Phe Phe Gln
1280 1285 1290

Lys Asp Ile Glu Arg Ala Arg Tyr Thr Ser Ile Lys Glu Ile Phe
1295 1300 1305

Asp Ala Thr Ile Ile Tyr Gln Ser Thr Thr Gly Leu Tyr Glu Thr
1310 1315 1320

Arg Arg Lys Val Val Asp
1325

<210> 223
<211> 1329
<212> PRT
<213> Enterococcus faecalis

<400> 223

Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
20 25 30

Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
35 40 45

```
Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95

Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110

Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Asp Gln Phe Gln Gln Phe Met Val Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240

Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255
```

```
Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser
        275                 280                 285

Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser
    290                 295                 300

Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu Ser Ser
305                 310                 315                 320

Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Asn Phe
                325                 330                 335

Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe
            340                 345                 350

Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Ala His Ala Val
        355                 360                 365

Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile
    370                 375                 380

Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His
                405                 410                 415

Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Lys Lys Ile Glu Gln Leu Val Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser Thr Phe
    450                 455                 460
```

```
Ala Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp Asn Leu
465                 470                 475                 480

Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg
                485                 490                 495

Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys
            500                 505                 510

His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys
        515                 520                 525

Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys
    530                 535                 540

Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val
545                 550                 555                 560

Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu
                565                 570                 575

Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe
            580                 585                 590

Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu
        595                 600                 605

Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu
    610                 615                 620

Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe
625                 630                 635                 640

Lys Gly Gln Phe Ser Ala Glu Val Leu Lys Lys Leu Glu Arg Lys His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr
            660                 665                 670
```

```
Asp Lys Glu Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His
705                 710                 715                 720

Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu
    770                 775                 780

Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys
785                 790                 795                 800

Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser
            820                 825                 830

Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
        835                 840                 845

Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr
    850                 855                 860

Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val Val Lys
865                 870                 875                 880
```

```
Lys Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser
               885                 890                 895

Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr
           900                 905                 910

Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg
       915                 920                 925

Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Arg Tyr Asn Ala
   930                 935                 940

Lys Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu
945                 950                 955                 960

Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val
               965                 970                 975

Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala
           980                 985                 990

Thr Thr Leu Leu Lys Val Tyr Pro  Asn Leu Ala Pro Glu  Phe Val Tyr
       995                 1000                1005

Gly Glu  Tyr Pro Lys Phe Gln  Ala Phe Lys Glu Asn  Lys Ala Met
   1010                1015                1020

Ala Lys  Ala Ile Ile Tyr Thr  Asn Leu Leu Arg Phe  Phe Thr Glu
   1025                1030                1035

Asp Glu  Pro Arg Phe Thr Lys  Asp Gly Glu Ile Leu  Trp Ser Asn
   1040                1045                1050

Ser Tyr  Leu Lys Thr Ile Lys  Lys Glu Leu Asn Tyr  His Gln Met
   1055                1060                1065

Asn Ile  Val Lys Lys Val Glu  Val Gln Lys Gly Gly  Phe Ser Lys
   1070                1075                1080
```

```
Glu Ser  Ile Lys Pro Lys Gly  Pro Ser Asn Lys Leu  Ile Pro Val
    1085                1090                1095

Lys Asn  Gly Leu Asp Pro Gln  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1100                1105                1110

Val Val  Ala Tyr Thr Val Leu  Phe Thr His Glu Lys  Gly Lys Lys
    1115                1120                1125

Pro Leu  Ile Lys Gln Glu Ile  Leu Gly Ile Thr Ile  Met Glu Lys
    1130                1135                1140

Thr Arg  Phe Glu Gln Asn Pro  Ile Leu Phe Leu Glu  Glu Lys Gly
    1145                1150                1155

Phe Leu  Arg Pro Arg Val Leu  Met Lys Leu Pro Lys  Tyr Thr Leu
    1160                1165                1170

Tyr Glu  Phe Pro Glu Gly Arg  Arg Arg Leu Leu Ala  Ser Ala Lys
    1175                1180                1185

Glu Ala  Gln Lys Gly Asn Gln  Met Val Leu Pro Glu  Arg Leu Leu
    1190                1195                1200

Thr Leu  Leu Tyr His Ala Lys  Gln Cys Leu Leu Pro  Asn Gln Ser
    1205                1210                1215

Glu Ser  Leu Ala Tyr Val Glu  Gln His Gln Pro Glu  Phe Gln Glu
    1220                1225                1230

Ile Leu  Glu Arg Val Val Asp  Phe Ala Glu Val His  Thr Leu Ala
    1235                1240                1245

Lys Ser  Lys Val Gln Gln Ile  Val Lys Leu Phe Glu  Ala Asn Gln
    1250                1255                1260

Thr Ala  Asp Val Lys Glu Ile  Ala Ala Ser Phe Ile  Gln Leu Met
    1265                1270                1275
```

```
Gln Phe  Asn Ala Met Gly Ala  Pro Ser Thr Phe Lys  Phe Phe Gln
    1280                1285                1290


Lys Asp  Ile Glu Arg Ala Arg  Tyr Thr Ser Ile Lys  Glu Ile Phe
    1295                1300                1305


Asp Ala  Thr Ile Ile Tyr Gln  Ser Thr Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320


Arg Arg  Lys Val Val Asp
    1325
```

<210> 224
<211> 1329
<212> PRT
<213> Enterococcus faecalis

<400> 224

```
Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30


Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95


Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110
```

```
Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140

Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175

Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240

Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255

Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser
        275                 280                 285

Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser
    290                 295                 300

Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu Ser Ser
305                 310                 315                 320
```

```
Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Lys Phe
                325                 330                 335

Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe
            340                 345                 350

Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Ala His Ala Val
        355                 360                 365

Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile
    370                 375                 380

Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu
385                 390                 395                 400

Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His
                405                 410                 415

Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro
            420                 425                 430

Phe Leu Lys Glu Asn Gln Glu Lys Ile Glu Gln Leu Val Thr Phe Arg
        435                 440                 445

Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser Thr Phe
    450                 455                 460

Ala Trp Leu Lys Arg Gln Asn Glu Lys Pro Ile Arg Pro Trp Asn Leu
465                 470                 475                 480

Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg
                485                 490                 495

Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys
            500                 505                 510

His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys
        515                 520                 525
```

```
Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys
    530                 535                 540

Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val
545                 550                 555                 560

Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu
                565                 570                 575

Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe
            580                 585                 590

Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu
        595                 600                 605

Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu
    610                 615                 620

Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe
625                 630                 635                 640

Lys Gly Gln Phe Ser Ala Glu Val Leu Lys Lys Leu Glu Arg Lys His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr
            660                 665                 670

Asp Lys Glu Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His
705                 710                 715                 720

Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735
```

```
Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu
    770                 775                 780

Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys
785                 790                 795                 800

Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser
            820                 825                 830

Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
        835                 840                 845

Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr
    850                 855                 860

Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val Val Lys
865                 870                 875                 880

Lys Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser
                885                 890                 895

Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr
            900                 905                 910

Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Arg Tyr Asn Ala
    930                 935                 940
```

```
Lys Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu
945                 950                 955                 960


Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val
                965                 970                 975


Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala
            980                 985                 990


Thr Thr Leu Leu Lys Val Tyr Pro  Asn Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005


Gly Glu  Tyr Pro Lys Phe Gln  Ala Phe Lys Glu Asn  Lys Ala Thr
    1010                1015                1020


Ala Lys  Ala Ile Ile Tyr Thr  Asn Leu Met Arg Phe  Phe Thr Glu
    1025                1030                1035


Val Glu  Pro Arg Phe Thr Lys  Asp Gly Glu Ile Leu  Trp Ser Asn
    1040                1045                1050


Ser Tyr  Leu Lys Thr Ile Lys  Lys Glu Leu Asn Tyr  His Gln Met
    1055                1060                1065


Asn Ile  Val Lys Lys Val Glu  Val Gln Lys Gly Gly  Phe Ser Lys
    1070                1075                1080


Glu Ser  Ile Lys Pro Lys Gly  Pro Ser Asn Lys Leu  Ile Pro Val
    1085                1090                1095


Lys Asn  Gly Leu Asp Pro Gln  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1100                1105                1110


Val Val  Ala Tyr Thr Val Leu  Phe Thr His Glu Lys  Gly Lys Lys
    1115                1120                1125


Pro Leu  Ile Lys Gln Glu Ile  Leu Gly Ile Thr Ile  Met Glu Lys
    1130                1135                1140
```

```
Thr Lys  Phe Glu Gln Asn Pro  Ile Leu Phe Leu Glu  Glu Lys Gly
    1145                1150                1155

Phe Leu  Arg Pro Arg Val Leu  Met Lys Leu Pro Lys  Tyr Thr Leu
    1160                1165                1170

Tyr Glu  Phe Pro Glu Gly Arg  Arg Arg Leu Leu Ala  Ser Ala Lys
    1175                1180                1185

Glu Ala  Gln Lys Gly Asn Gln  Met Val Leu Pro Glu  His Leu Leu
    1190                1195                1200

Thr Leu  Leu Tyr His Ala Lys  Gln Cys Leu Leu Pro  Asn Gln Ser
    1205                1210                1215

Glu Ser  Leu Ala Tyr Val Glu  Gln His Gln Pro Glu  Phe Gln Glu
    1220                1225                1230

Ile Leu  Glu Arg Val Val Asp  Phe Ala Glu Val His  Thr Leu Ala
    1235                1240                1245

Lys Ser  Lys Val Gln Gln Ile  Val Lys Leu Phe Glu  Thr Asn Gln
    1250                1255                1260

Thr Ala  Asp Val Lys Glu Ile  Ala Ala Ser Phe Ile  Gln Leu Met
    1265                1270                1275

Gln Phe  Asn Ala Met Gly Ala  Pro Ser Thr Phe Lys  Phe Phe Gln
    1280                1285                1290

Lys Asp  Ile Glu Arg Ala Arg  Tyr Thr Ser Ile Lys  Glu Ile Phe
    1295                1300                1305

Asp Ala  Thr Ile Ile Tyr Gln  Ser Thr Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320

Arg Arg  Lys Val Val Asp
    1325
```

<210> 225
<211> 1329
<212> PRT
<213> Enterococcus faecalis

<400> 225

```
Met Lys Lys Asp Tyr Val Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Met Thr Glu Asp Tyr Gln Leu Val Lys Lys Lys Met
            20                  25                  30


Pro Ile Tyr Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Glu Glu Gly His Thr Ala Glu Asp Arg Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Ile Ser Arg Arg Arg Asn Arg Leu Arg
65                  70                  75                  80


Tyr Leu Gln Ala Phe Phe Glu Glu Ala Met Thr Ala Leu Asp Glu Asn
                85                  90                  95


Phe Phe Ala Arg Leu Gln Glu Ser Phe Leu Val Pro Glu Asp Lys Lys
            100                 105                 110


Trp His Arg His Pro Ile Phe Ala Lys Leu Glu Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Thr Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Ala Asp
    130                 135                 140


Ser Ser Glu Gln Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Lys Leu Ser Thr
                165                 170                 175
```

```
Glu Asn Ile Ser Val Lys Glu Gln Phe Gln Gln Phe Met Ile Ile Tyr
            180                 185                 190

Asn Gln Thr Phe Val Asn Gly Glu Ser Pro Leu Pro Glu Ser Val Leu
        195                 200                 205

Ile Glu Glu Glu Leu Thr Glu Lys Ala Ser Arg Thr Lys Lys Ser Glu
    210                 215                 220

Lys Val Leu Gln Gln Phe Pro Gln Glu Lys Ala Asn Gly Leu Phe Gly
225                 230                 235                 240

Gln Phe Leu Lys Leu Met Val Gly Asn Lys Ala Asp Phe Lys Lys Val
                245                 250                 255

Phe Gly Leu Glu Glu Glu Ala Lys Ile Thr Tyr Ala Ser Glu Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Gly Ile Leu Ala Lys Val Gly Asp Glu Tyr Ser
        275                 280                 285

Asp Val Phe Leu Ala Ala Lys Asn Val Tyr Asp Ala Val Glu Leu Ser
    290                 295                 300

Thr Ile Leu Ala Asp Ser Asp Lys Lys Ser His Ala Lys Leu Ser Ser
305                 310                 315                 320

Ser Met Ile Val Arg Phe Thr Glu His Gln Glu Asp Leu Lys Asn Phe
                325                 330                 335

Lys Arg Phe Ile Arg Glu Asn Cys Pro Asp Glu Tyr Asp Asn Leu Phe
            340                 345                 350

Lys Asn Glu Gln Lys Asp Gly Tyr Ala Gly Tyr Ile Ala His Ala Val
        355                 360                 365

Ser Gln Leu Lys Phe Tyr Gln Tyr Val Lys Lys Ile Ile Gln Asp Ile
    370                 375                 380
```

```
Ala Gly Ala Glu Tyr Phe Leu Glu Lys Ile Ala Gln Glu Asn Phe Leu
385                 390                 395                 400


Arg Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His
                405                 410                 415


Leu Ala Glu Leu Gln Ala Ile Ile His Arg Gln Ala Ala Tyr Tyr Pro
            420                 425                 430


Phe Leu Lys Glu Asn Gln Lys Lys Ile Glu Gln Leu Val Thr Phe Arg
        435                 440                 445


Ile Pro Tyr Tyr Val Gly Pro Leu Ser Lys Gly Asp Ala Ser Thr Phe
    450                 455                 460


Ala Trp Leu Lys Arg Gln Ser Glu Glu Pro Ile Arg Pro Trp Asn Leu
465                 470                 475                 480


Gln Glu Thr Val Asp Leu Asp Gln Ser Ala Thr Ala Phe Ile Glu Arg
                485                 490                 495


Met Thr Asn Phe Asp Thr Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys
            500                 505                 510


His Ser Leu Leu Tyr Glu Lys Phe Met Val Phe Asn Glu Leu Thr Lys
        515                 520                 525


Ile Ser Tyr Thr Asp Asp Arg Gly Ile Lys Ala Asn Phe Ser Gly Lys
    530                 535                 540


Glu Lys Glu Lys Ile Phe Asp Tyr Leu Phe Lys Thr Arg Arg Lys Val
545                 550                 555                 560


Lys Lys Lys Asp Ile Ile Gln Phe Tyr Arg Asn Glu Tyr Asn Thr Glu
                565                 570                 575


Ile Val Thr Leu Ser Gly Leu Glu Glu Asp Gln Phe Asn Ala Ser Phe
            580                 585                 590
```

```
Ser Thr Tyr Gln Asp Leu Leu Lys Cys Gly Leu Thr Arg Ala Glu Leu
        595                 600                 605

Asp His Pro Asp Asn Ala Glu Lys Leu Glu Asp Ile Ile Lys Ile Leu
    610                 615                 620

Thr Ile Phe Glu Asp Arg Gln Arg Ile Arg Thr Gln Leu Ser Thr Phe
625                 630                 635                 640

Lys Gly Gln Phe Ser Glu Glu Val Leu Lys Lys Leu Glu Arg Lys His
                645                 650                 655

Tyr Thr Gly Trp Gly Arg Leu Ser Lys Lys Leu Ile Asn Gly Ile Tyr
            660                 665                 670

Asp Lys Glu Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly
        675                 680                 685

Val Ser Lys His Tyr Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Ser
    690                 695                 700

Gln Leu Ser Phe Lys Asn Ala Ile Gln Lys Ala Gln Ser Ser Glu His
705                 710                 715                 720

Glu Glu Thr Leu Ser Glu Thr Val Asn Glu Leu Ala Gly Ser Pro Ala
                725                 730                 735

Ile Lys Lys Gly Ile Tyr Gln Ser Leu Lys Ile Val Asp Glu Leu Val
            740                 745                 750

Ala Ile Met Gly Tyr Ala Pro Lys Arg Ile Val Val Glu Met Ala Arg
        755                 760                 765

Glu Asn Gln Thr Thr Ser Thr Gly Lys Arg Arg Ser Ile Gln Arg Leu
    770                 775                 780

Lys Ile Val Glu Lys Ala Met Ala Glu Ile Gly Ser Asn Leu Leu Lys
785                 790                 795                 800
```

```
Glu Gln Pro Thr Thr Asn Glu Gln Leu Arg Asp Thr Arg Leu Phe Leu
                805                 810                 815

Tyr Tyr Met Gln Asn Gly Lys Asp Met Tyr Thr Gly Asp Glu Leu Ser
            820                 825                 830

Leu His Arg Leu Ser His Tyr Asp Ile Asp His Ile Ile Pro Gln Ser
        835                 840                 845

Phe Met Lys Asp Asp Ser Leu Asp Asn Leu Val Leu Val Gly Ser Thr
    850                 855                 860

Glu Asn Arg Gly Lys Ser Asp Asp Val Pro Ser Lys Glu Val Val Lys
865                 870                 875                 880

Lys Met Lys Ala Tyr Trp Glu Lys Leu Tyr Ala Ala Gly Leu Ile Ser
                885                 890                 895

Gln Arg Lys Phe Gln Arg Leu Thr Lys Gly Glu Gln Gly Gly Leu Thr
            900                 905                 910

Leu Glu Asp Lys Ala His Phe Ile Gln Arg Gln Leu Val Glu Thr Arg
        915                 920                 925

Gln Ile Thr Lys Asn Val Ala Gly Ile Leu Asp Gln Arg Tyr Asn Ala
    930                 935                 940

Lys Ser Lys Glu Lys Lys Val Gln Ile Ile Thr Leu Lys Ala Ser Leu
945                 950                 955                 960

Thr Ser Gln Phe Arg Ser Ile Phe Gly Leu Tyr Lys Val Arg Glu Val
                965                 970                 975

Asn Asp Tyr His His Gly Gln Asp Ala Tyr Leu Asn Cys Val Val Ala
            980                 985                 990

Thr Thr Leu Leu Lys Val Tyr Pro  Asn Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005
```

```
Gly Glu  Tyr Pro Lys Phe Gln  Ala Phe Lys Glu Asn  Lys Ala Thr
    1010                1015                1020

Ala Lys  Ala Ile Ile Tyr Thr  Asn Leu Leu Arg Phe  Phe Thr Glu
    1025                1030                1035

Asp Glu  Pro Arg Phe Thr Lys  Asp Gly Glu Ile Leu  Trp Ser Asn
    1040                1045                1050

Ser Tyr  Leu Lys Thr Ile Lys  Lys Glu Leu Asn Tyr  His Gln Met
    1055                1060                1065

Asn Ile  Val Lys Lys Val Glu  Val Gln Lys Gly Gly  Phe Ser Lys
    1070                1075                1080

Glu Ser  Ile Lys Pro Lys Gly  Pro Ser Asn Lys Leu  Ile Pro Val
    1085                1090                1095

Lys Asn  Gly Leu Asp Pro Gln  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1100                1105                1110

Val Val  Ala Tyr Thr Val Leu  Phe Thr His Glu Lys  Gly Lys Lys
    1115                1120                1125

Pro Leu  Ile Lys Gln Glu Ile  Leu Gly Ile Thr Ile  Met Glu Lys
    1130                1135                1140

Thr Arg  Phe Glu Gln Asn Pro  Ile Leu Phe Leu Glu  Glu Lys Gly
    1145                1150                1155

Phe Leu  Arg Pro Arg Val Leu  Met Lys Leu Pro Lys  Tyr Thr Leu
    1160                1165                1170

Tyr Glu  Phe Pro Glu Gly Arg  Arg Arg Leu Leu Ala  Ser Ala Lys
    1175                1180                1185

Glu Ala  Gln Lys Gly Asn Gln  Met Val Leu Pro Glu  His Leu Leu
    1190                1195                1200
```

```
Thr Leu  Leu Tyr His Ala Lys  Gln Cys Leu Leu Pro  Asn Gln Ser
    1205                1210                1215


Glu Ser  Leu Ala Tyr Val Glu  Gln His Gln Pro Glu  Phe Gln Glu
    1220                1225                1230


Ile Leu  Glu Arg Val Val Asp  Phe Ala Glu Val His  Thr Leu Ala
    1235                1240                1245


Lys Ser  Lys Val Gln Gln Ile  Val Lys Leu Phe Glu  Ala Asn Gln
    1250                1255                1260


Thr Ala  Asp Val Lys Glu Ile  Ala Ala Ser Phe Ile  Gln Leu Met
    1265                1270                1275


Gln Phe  Asn Ala Met Gly Ala  Pro Ser Thr Phe Lys  Phe Phe Gln
    1280                1285                1290


Lys Asp  Ile Glu Arg Ala Arg  Tyr Thr Ser Ile Lys  Glu Ile Phe
    1295                1300                1305


Asp Ala  Thr Ile Ile Tyr Gln  Ser Thr Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320


Arg Arg  Lys Val Val Asp
    1325


<210>  226
<211>  1328
<212>  PRT
<213>  Enterococcus faecium

<400>  226

Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
```

```
        35                  40                  45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65                  70                  75                  80

Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
                85                  90                  95

Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
            100                 105                 110

Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
        115                 120                 125

His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
    130                 135                 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Asp Lys Leu Asp Glu Ala Val Asp Cys
        195                 200                 205

Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr Lys Lys Ala Glu Thr
    210                 215                 220

Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn Gly Tyr Leu Ser Gln
225                 230                 235                 240

Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn Phe Lys Asn Val Phe
```

245 250 255

Gly Leu Glu Glu Ala Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu Glu
260 265 270

Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly Asp Asp Tyr Ile Asp Leu
275 280 285

Phe Val Gln Ala Lys Asn Val Tyr Asp Ala Val Leu Leu Ser Glu Ile
290 295 300

Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala Lys Leu Ser Ala Gly Met
305 310 315 320

Ile Arg Arg Tyr Asp Ala His Lys Glu Asp Leu Val Leu Leu Lys Arg
325 330 335

Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr Arg Ala Phe Phe Gly Asp
340 345 350

Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile Glu Gly His Ala Thr Gln
355 360 365

Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu Leu Thr Gly Ile Arg Gly
370 375 380

Ser Glu Val Phe Leu Thr Lys Ile Glu Gln Glu Asn Phe Leu Arg Lys
385 390 395 400

Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His Leu Thr
405 410 415

Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys Lys His Tyr Pro Phe Leu
420 425 430

Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu Leu Thr Phe Lys Ile Pro
435 440 445

Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln Glu Asn Ser Pro Phe Ala

```
    450                 455                 460

Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile Lys Pro Trp Asn Leu Pro
465                 470                 475                 480

Glu Ile Val Asp Met Glu Gly Ser Ala Val Arg Phe Ile Glu Arg Met
                485                 490                 495

Ile Asn Thr Asp Met Tyr Met Pro His Asn Lys Val Leu Pro Lys Asn
            500                 505                 510

Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr Asn Glu Leu Thr Lys Val
        515                 520                 525

Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn Tyr Phe Ser Ser Ile Glu
    530                 535                 540

Lys Lys Glu Ile Phe His Glu Leu Phe Glu Lys Asn Arg Lys Val Thr
545                 550                 555                 560

Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu Lys Tyr Asp Ile Lys His
                565                 570                 575

Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Thr Thr
            580                 585                 590

Tyr His Asp Phe Leu Thr Met Ser Glu Asn Lys Gln Trp Leu Glu Asp
        595                 600                 605

Pro Glu Leu Ala Ser Met Phe Glu Glu Ile Ile Lys Thr Leu Thr Val
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Lys Thr Arg Leu Ser His His Glu Ala
625                 630                 635                 640

Thr Leu Gly Lys His Ile Ile Lys Lys Leu Thr Lys Lys His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Lys Glu Leu Ile Gln Gly Ile Arg Asp Lys
```

660 665 670

Gln Ser Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Phe Pro
675 680 685

His His Arg Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu
690 695 700

Ser Phe Lys Lys Glu Ile Lys Lys Ala Gln Met Ile Thr Asp Thr Glu
705 710 715 720

Asn Leu Glu Glu Ile Val Lys Glu Leu Thr Gly Ser Pro Ala Ile Lys
725 730 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Ile Val Gly Ile
740 745 750

Met Gly Tyr Glu Pro Ala Asn Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Gly Arg Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys Ala
770 775 780

Leu Glu Glu Ser Leu Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu Tyr
785 790 795 800

Pro Thr Asp Asn Ser Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr
805 810 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile His
820 825 830

Arg Leu Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Arg Ser Phe Thr
835 840 845

Thr Asp Asn Ser Ile Asp Asn Lys Val Leu Val Ser Ser Lys Glu Asn
850 855 860

Arg Leu Lys Lys Asp Asp Val Pro Ser Glu Lys Val Val Lys Lys Met

865 870 875 880

Arg Ser Phe Trp Tyr Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys Arg
885 890 895

Lys Leu Asp Asn Leu Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys Ala
900 905 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
915 920 925

Val Ala Gly Ile Leu His His Arg Phe Asn Lys Ala Glu Asp Thr Asn
930 935 940

Glu Pro Ile Arg Lys Val Arg Ile Ile Thr Leu Lys Ser Ala Leu Val
945 950 955 960

Ser Gln Phe Arg Asn Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile Asn
965 970 975

Glu Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Leu
980 985 990

Ala Leu Leu Lys Lys Tyr Pro Gln Leu Ala Pro Glu Phe Val Tyr Gly
995 1000 1005

Glu Tyr Leu Lys Phe Asn Ala His Lys Ala Asn Lys Ala Thr Val
1010 1015 1020

Lys Lys Glu Phe Tyr Ser Asn Ile Met Lys Phe Phe Glu Ser Asp
1025 1030 1035

Thr Pro Val Cys Asp Glu Asn Gly Glu Ile Phe Trp Asp Lys Ser
1040 1045 1050

Lys Ser Ile Ala Gln Val Lys Lys Val Ile Asn His His His Met
1055 1060 1065

Asn Ile Val Lys Lys Thr Glu Ile Gln Lys Gly Gly Phe Ser Lys

1070 1075 1080

Glu Thr Val Glu Pro Lys Lys Asp Ser Ser Lys Leu Leu Pro Arg
1085 1090 1095

Lys Asn Asn Trp Asp Pro Ala Lys Tyr Gly Gly Leu Gly Ser Pro
1100 1105 1110

Asn Val Ala Tyr Thr Val Ala Phe Thr Tyr Glu Lys Gly Lys Ala
1115 1120 1125

Arg Lys Arg Thr Asn Ala Leu Glu Gly Ile Thr Ile Met Glu Arg
1130 1135 1140

Glu Ala Phe Glu Gln Ser Pro Val Leu Phe Leu Lys Asn Lys Gly
1145 1150 1155

Tyr Glu Gln Ala Glu Ile Glu Met Lys Leu Pro Lys Tyr Ala Leu
1160 1165 1170

Phe Glu Leu Glu Asn Gly Arg Lys Arg Met Val Ala Ser Lys Glu
1175 1180 1185

Ala Gln Lys Ala Asn Ser Phe Leu Leu Pro Glu His Leu Val Thr
1190 1195 1200

Leu Leu Tyr His Ala Lys Gln Tyr Asp Glu Ile Ser His Lys Glu
1205 1210 1215

Ser Phe Asp Tyr Val Asn Glu His His Lys Glu Phe Ser Glu Val
1220 1225 1230

Phe Ala Arg Val Leu Glu Phe Ala Gly Lys Tyr Thr Leu Ala Glu
1235 1240 1245

Lys Asn Ile Glu Lys Leu Glu Lys Ile Tyr Lys Glu Asn Gln Thr
1250 1255 1260

Asp Asp Leu Ala Lys Leu Ala Ser Ser Phe Val Asn Leu Met Gln

1265 1270 1275

Phe Asn Ala Met Gly Ala Pro Ala Asp Phe Lys Phe Phe Asp Val
1280 1285 1290

Thr Ile Pro Arg Lys Arg Tyr Thr Ser Leu Thr Glu Ile Trp Gln
1295 1300 1305

Ser Thr Ile Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg
1310 1315 1320

Ile Arg Met Gly Lys
1325

<210> 227
<211> 1329
<212> PRT
<213> Enterococcus faecium

<400> 227

Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
20 25 30

Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
35 40 45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
50 55 60

Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65 70 75 80

Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
85 90 95

Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Pro Asp Glu Lys Lys
100 105 110

```
Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
        115                 120                 125

His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
    130                 135                 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Gly Lys Leu Asp Glu Ala Val Asp Cys
        195                 200                 205

Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr Lys Lys Ala Glu Thr
    210                 215                 220

Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn Gly Tyr Leu Ser Gln
225                 230                 235                 240

Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn Phe Lys Asn Val Phe
                245                 250                 255

Gly Leu Glu Glu Glu Ala Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly Asp Asp Tyr Ile Asp
        275                 280                 285

Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala Val Leu Leu Ser Glu
    290                 295                 300

Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala Lys Leu Ser Ala Gly
305                 310                 315                 320
```

```
Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp Leu Val Leu Leu Lys
                325                 330                 335

Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr Arg Ala Phe Phe Gly
            340                 345                 350

Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile Glu Gly His Ala Thr
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Phe Val Lys Lys Glu Leu Thr Gly Ile Arg
    370                 375                 380

Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His Leu
                405                 410                 415

Ser Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys Lys His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu Leu Thr Phe Lys Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln Glu Asn Ser Pro Phe
    450                 455                 460

Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile Lys Pro Trp Asn Leu
465                 470                 475                 480

Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val Arg Phe Ile Glu Arg
                485                 490                 495

Met Ile Asn Thr Asp Met Tyr Met Pro His Asn Lys Val Leu Pro Lys
            500                 505                 510

Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr Asn Glu Leu Thr Lys
        515                 520                 525
```

```
Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn Tyr Phe Ser Ser Ile
    530                 535                 540

Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu Lys Asn Arg Lys Val
545                 550                 555                 560

Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu Lys Tyr Asp Ile Lys
                565                 570                 575

His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Thr
            580                 585                 590

Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn Lys Gln Trp Leu Glu
        595                 600                 605

Asp Pro Glu Leu Ala Ser Met Phe Glu Glu Ile Ile Lys Thr Leu Thr
    610                 615                 620

Val Phe Glu Asp Arg Glu Met Ile Lys Thr Arg Leu Ser His His Glu
625                 630                 635                 640

Ala Thr Leu Gly Lys His Ile Ile Lys Lys Leu Thr Lys Lys His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Lys Glu Leu Ile Gln Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Phe
        675                 680                 685

Pro His His Arg Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser
    690                 695                 700

Leu Ser Phe Lys Lys Glu Ile Lys Lys Ala Gln Met Ile Thr Asp Thr
705                 710                 715                 720

Glu Asn Leu Glu Glu Ile Val Lys Glu Leu Thr Gly Ser Pro Ala Ile
                725                 730                 735
```

```
Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Ile Val Gly
            740                 745                 750

Ile Met Gly Tyr Glu Pro Ala Asn Ile Val Val Glu Met Ala Arg Glu
        755                 760                 765

Asn Gln Thr Thr Gly Arg Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys
    770                 775                 780

Ala Leu Glu Glu Ser Leu Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu
785                 790                 795                 800

Tyr Pro Thr Asp Asn Ser Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr
                805                 810                 815

Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile
            820                 825                 830

His Arg Leu Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Arg Ser Phe
        835                 840                 845

Thr Thr Asp Asn Ser Ile Asp Asn Lys Val Leu Val Ser Ser Lys Glu
    850                 855                 860

Asn Arg Leu Lys Lys Asp Asp Val Pro Ser Glu Lys Val Val Lys Lys
865                 870                 875                 880

Met Arg Ser Phe Trp Tyr Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys
                885                 890                 895

Arg Lys Leu Asp Asn Leu Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gly Ile Leu His His Arg Phe Asn Lys Ala Glu Asp Thr
    930                 935                 940
```

```
Asn Asp Pro Ile Arg Lys Val Arg Ile Ile Thr Leu Lys Ser Ala Leu
945                 950                 955                 960

Val Ser Gln Phe Arg Asn Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Glu Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala
            980                 985                 990

Leu Ala Leu Leu Lys Lys Tyr Pro  Gln Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005

Gly Glu  Tyr Leu Lys Phe Asn  Ala His Lys Ala Asn  Lys Ala Thr
    1010                1015                1020

Val Lys  Lys Glu Phe Tyr Ser  Asn Ile Met Lys Phe  Phe Glu Ser
    1025                1030                1035

Asp Thr  Pro Val Cys Asp Glu  Asn Gly Glu Ile Phe  Trp Asp Lys
    1040                1045                1050

Ser Lys  Ser Ile Ala Gln Val  Lys Lys Val Ile Asn  His His His
    1055                1060                1065

Met Asn  Ile Val Lys Lys Thr  Glu Ile Gln Lys Gly  Gly Phe Ser
    1070                1075                1080

Lys Glu  Thr Val Glu Pro Lys  Lys Asp Ser Ser Lys  Leu Leu Pro
    1085                1090                1095

Arg Lys  Asn Asn Trp Asp Pro  Ala Lys Tyr Gly Gly  Leu Gly Ser
    1100                1105                1110

Pro Asn  Val Ala Tyr Thr Val  Ala Phe Thr Tyr Glu  Lys Gly Lys
    1115                1120                1125

Ala Arg  Lys Arg Thr Asn Ala  Leu Glu Gly Ile Thr  Ile Met Glu
    1130                1135                1140
```

```
Arg Glu  Ala Phe Glu Gln Ser  Pro Val Leu Phe Leu  Lys Asn Lys
    1145                1150                1155

Gly Tyr  Glu Gln Ala Glu Ile  Glu Met Lys Leu Pro  Lys Tyr Ala
    1160                1165                1170

Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg Met Val  Ala Ser Lys
    1175                1180                1185

Glu Ala  Gln Lys Ala Asn Ser  Phe Leu Leu Pro Glu  His Leu Val
    1190                1195                1200

Thr Leu  Leu Tyr His Ala Lys  Gln Tyr Asp Glu Ile  Ser His Lys
    1205                1210                1215

Glu Ser  Phe Asp Tyr Val Asn  Glu His His Lys Glu  Phe Ser Glu
    1220                1225                1230

Val Phe  Ala Arg Val Leu Glu  Phe Ala Gly Lys Tyr  Thr Leu Ala
    1235                1240                1245

Glu Lys  Asn Ile Glu Lys Leu  Glu Lys Ile Tyr Lys  Glu Asn Gln
    1250                1255                1260

Thr Asp  Asp Leu Ala Lys Leu  Ala Ser Ser Phe Val  Asn Leu Met
    1265                1270                1275

Gln Phe  Asn Ala Met Gly Ala  Pro Ala Asp Phe Lys  Phe Phe Asp
    1280                1285                1290

Val Thr  Ile Pro Arg Lys Arg  Tyr Thr Ser Leu Thr  Glu Ile Trp
    1295                1300                1305

Gln Ser  Thr Ile Ile His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320

Arg Ile  Arg Met Gly Lys
    1325
```

<210> 228
<211> 1329
<212> PRT
<213> Enterococcus faecium

<400> 228

```
Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65                  70                  75                  80


Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
                85                  90                  95


Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
            100                 105                 110


Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
        115                 120                 125


His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
    130                 135                 140


Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160


Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175
```

```
Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190


Asn Gln Gln Phe Ser Glu Ala Asp Lys Leu Asp Glu Ala Val Asp Cys
        195                 200                 205


Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr Lys Lys Ala Glu Thr
    210                 215                 220


Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn Gly Tyr Leu Ser Gln
225                 230                 235                 240


Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn Phe Lys Asn Val Phe
                245                 250                 255


Gly Leu Glu Glu Glu Ala Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu
            260                 265                 270


Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly Asp Asp Tyr Ile Asp
        275                 280                 285


Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala Val Leu Leu Ser Glu
    290                 295                 300


Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala Lys Leu Ser Ala Gly
305                 310                 315                 320


Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp Leu Val Leu Leu Lys
                325                 330                 335


Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr Arg Ala Phe Phe Gly
            340                 345                 350


Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile Glu Gly His Ala Thr
        355                 360                 365


Gln Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu Leu Thr Gly Ile Arg
    370                 375                 380
```

```
Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His Leu
                405                 410                 415

Thr Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys Lys His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu Leu Thr Phe Lys Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln Glu Asn Ser Pro Phe
    450                 455                 460

Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile Lys Pro Trp Asn Leu
465                 470                 475                 480

Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val Arg Phe Ile Glu Arg
                485                 490                 495

Met Asn Asn Thr Asp Met Tyr Ile Pro His Asn Lys Val Leu Pro Lys
            500                 505                 510

Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr Asn Glu Leu Thr Lys
        515                 520                 525

Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn Tyr Phe Ser Ser Ile
    530                 535                 540

Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu Lys Asn Arg Lys Val
545                 550                 555                 560

Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu Lys Tyr Asp Ile Lys
                565                 570                 575

His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Thr
            580                 585                 590
```

```
Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn Lys Gln Trp Leu Glu
        595                 600                 605

Asp Pro Glu Leu Ala Ser Met Phe Glu Glu Ile Ile Lys Thr Leu Thr
    610                 615                 620

Val Phe Glu Asp Arg Glu Met Ile Lys Thr Arg Leu Ser His His Glu
625                 630                 635                 640

Ala Thr Leu Gly Lys His Ile Ile Lys Lys Leu Thr Lys Lys His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Lys Glu Leu Ile Gln Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Phe
        675                 680                 685

Pro His His Arg Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser
    690                 695                 700

Leu Ser Phe Lys Lys Glu Ile Lys Lys Ala Gln Met Ile Thr Asp Thr
705                 710                 715                 720

Glu Asn Leu Glu Glu Ile Val Lys Glu Leu Thr Gly Ser Pro Ala Ile
                725                 730                 735

Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Ile Val Gly
            740                 745                 750

Ile Met Gly Tyr Glu Pro Ala Asn Ile Val Val Glu Met Ala Arg Glu
        755                 760                 765

Asn Gln Thr Thr Gly Arg Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys
    770                 775                 780

Ala Leu Glu Glu Ser Leu Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu
785                 790                 795                 800
```

```
Tyr Pro Thr Asp Asn Ser Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr
                805                 810                 815

Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile
            820                 825                 830

His Arg Leu Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Arg Ser Phe
        835                 840                 845

Thr Thr Asp Asn Ser Ile Asp Asn Lys Val Leu Val Ser Ser Lys Glu
    850                 855                 860

Asn Arg Leu Lys Lys Asp Asp Val Pro Ser Glu Lys Val Val Lys Lys
865                 870                 875                 880

Met Arg Ser Phe Trp Tyr Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys
                885                 890                 895

Arg Lys Leu Asp Asn Leu Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gly Ile Leu His His Arg Phe Asn Lys Ala Glu Asp Thr
    930                 935                 940

Asn Glu Pro Ile Arg Lys Val Arg Ile Ile Thr Leu Lys Ser Ala Leu
945                 950                 955                 960

Val Ser Gln Phe Arg Asn Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Glu Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala
            980                 985                 990

Leu Ala Leu Leu Lys Lys Tyr Pro  Gln Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005
```

```
Gly Glu  Tyr Leu Lys Phe Asn  Ala His Lys Ala Asn  Lys Ala Thr
    1010                1015                1020

Val Lys  Lys Glu Phe Tyr Ser  Asn Ile Met Lys Phe  Phe Glu Ser
    1025                1030                1035

Asp Thr  Pro Val Cys Asp Glu  Asn Gly Glu Ile Phe  Trp Asp Lys
    1040                1045                1050

Ser Lys  Ser Ile Ala Gln Val  Lys Lys Val Ile Asn  His His His
    1055                1060                1065

Met Asn  Ile Val Lys Lys Thr  Glu Ile Gln Lys Gly  Gly Phe Ser
    1070                1075                1080

Lys Glu  Thr Val Glu Pro Lys  Lys Asp Ser Ser Lys  Leu Leu Pro
    1085                1090                1095

Arg Lys  Asn Asn Trp Asp Pro  Ala Lys Tyr Gly Gly  Leu Gly Ser
    1100                1105                1110

Pro Asn  Val Ala Tyr Thr Val  Ala Phe Thr Tyr Glu  Lys Gly Lys
    1115                1120                1125

Ala Arg  Lys Arg Thr Asn Ala  Leu Glu Gly Ile Thr  Ile Met Glu
    1130                1135                1140

Arg Glu  Ala Phe Glu Gln Ser  Pro Val Leu Phe Leu  Lys Asn Lys
    1145                1150                1155

Gly Tyr  Glu Gln Ala Glu Ile  Glu Met Lys Leu Pro  Lys Tyr Ala
    1160                1165                1170

Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg Met Val  Ala Ser Lys
    1175                1180                1185

Glu Ala  Gln Lys Ala Asn Ser  Phe Leu Leu Pro Glu  His Leu Val
    1190                1195                1200
```

```
Thr Leu  Leu Tyr His Ala Lys  Gln Tyr Asp Glu Ile  Ser His Lys
    1205                 1210                 1215


Glu Ser  Phe Asp Tyr Val Asn  Glu His His Lys Glu  Phe Ser Glu
    1220                 1225                 1230


Val Phe  Ala Arg Val Leu Glu  Phe Ala Gly Lys Tyr  Thr Leu Ala
    1235                 1240                 1245


Glu Lys  Asn Ile Glu Lys Leu  Glu Lys Ile Tyr Lys  Glu Asn Gln
    1250                 1255                 1260


Thr Asp  Asp Leu Ala Lys Leu  Ala Ser Ser Phe Val  Asn Leu Met
    1265                 1270                 1275


Gln Phe  Asn Ala Met Gly Ala  Pro Ala Asp Phe Lys  Phe Phe Asp
    1280                 1285                 1290


Val Thr  Ile Pro Arg Lys Arg  Tyr Thr Ser Leu Thr  Glu Ile Trp
    1295                 1300                 1305


Gln Ser  Thr Ile Ile His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr
    1310                 1315                 1320


Arg Ile  Arg Met Gly Lys
    1325


<210>  229
<211>  1329
<212>  PRT
<213>  Enterococcus faecium

<400>  229

Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
            20                  25                  30
```

```
Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65                  70                  75                  80

Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
                85                  90                  95

Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
            100                 105                 110

Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
        115                 120                 125

His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
    130                 135                 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Asp Lys Leu Asp Glu Ala Val Asp Cys
        195                 200                 205

Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr Lys Lys Ala Glu Thr
    210                 215                 220

Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn Gly Tyr Leu Ser Gln
225                 230                 235                 240
```

```
Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn Phe Lys Asn Val Phe
                245                 250                 255

Gly Leu Glu Glu Glu Ala Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly Asp Asp Tyr Ile Asp
        275                 280                 285

Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala Val Leu Leu Ser Glu
    290                 295                 300

Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala Lys Leu Ser Ala Gly
305                 310                 315                 320

Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp Leu Val Leu Leu Lys
                325                 330                 335

Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr Arg Ala Phe Phe Gly
            340                 345                 350

Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile Glu Gly His Ala Thr
        355                 360                 365

Gln Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu Leu Thr Gly Ile Arg
    370                 375                 380

Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His Leu
                405                 410                 415

Thr Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys Lys His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu Leu Thr Phe Lys Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln Glu Asn Ser Pro Phe
    450                 455                 460

Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile Lys Pro Trp Asn Leu
465                 470                 475                 480

Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val Arg Phe Ile Glu Arg
                485                 490                 495

Met Ile Asn Thr Asp Met Tyr Ile Pro His Asn Lys Val Leu Pro Lys
            500                 505                 510

Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr Asn Glu Leu Thr Lys
        515                 520                 525

Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn Tyr Phe Ser Ser Ile
    530                 535                 540

Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu Lys Asn Arg Lys Val
545                 550                 555                 560

Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu Lys Tyr Asp Ile Lys
                565                 570                 575

His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Thr
            580                 585                 590

Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn Lys Gln Trp Leu Glu
        595                 600                 605

Asp Pro Glu Leu Ala Ser Met Phe Glu Glu Ile Ile Lys Thr Leu Thr
    610                 615                 620

Val Phe Glu Asp Arg Glu Met Ile Lys Thr Arg Leu Ser His His Glu
625                 630                 635                 640

Ala Thr Leu Gly Lys His Ile Ile Lys Lys Leu Thr Lys Lys His Tyr
                645                 650                 655
```

```
Thr Gly Trp Gly Arg Leu Ser Lys Glu Leu Ile Gln Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Phe
        675                 680                 685

Pro His His Arg Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser
    690                 695                 700

Leu Ser Phe Lys Lys Glu Ile Lys Lys Ala Gln Met Ile Thr Asp Thr
705                 710                 715                 720

Glu Asn Leu Glu Glu Ile Val Lys Glu Leu Thr Gly Ser Pro Ala Ile
                725                 730                 735

Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Ile Val Gly
            740                 745                 750

Ile Met Gly Tyr Glu Pro Ala Asn Ile Val Val Glu Met Ala Arg Glu
        755                 760                 765

Asn Gln Thr Thr Gly Arg Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys
    770                 775                 780

Ala Leu Glu Glu Ser Leu Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu
785                 790                 795                 800

Tyr Pro Thr Asp Asn Ser Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr
                805                 810                 815

Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile
            820                 825                 830

His Arg Leu Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Arg Ser Phe
        835                 840                 845

Thr Thr Asp Asn Ser Ile Asp Asn Lys Val Leu Val Ser Ser Lys Glu
    850                 855                 860
```

```
Asn Arg Leu Lys Lys Asp Asp Val Pro Ser Glu Lys Val Val Lys Lys
865                 870                 875                 880


Met Arg Ser Phe Trp Tyr Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys
                885                 890                 895


Arg Lys Leu Asp Asn Leu Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys
            900                 905                 910


Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925


His Val Ala Gly Ile Leu His His Arg Phe Asn Lys Ala Glu Asp Thr
    930                 935                 940


Asn Glu Pro Ile Arg Lys Val Arg Ile Ile Thr Leu Lys Ser Ala Leu
945                 950                 955                 960


Val Ser Gln Phe Arg Asn Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile
                965                 970                 975


Asn Glu Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala
            980                 985                 990


Leu Ala Leu Leu Lys Lys Tyr Pro  Gln Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005


Gly Glu  Tyr Leu Lys Phe Asn  Ala His Lys Ala Asn  Lys Ala Thr
    1010                1015                1020


Val Lys  Lys Glu Phe Tyr Ser  Asn Ile Met Lys Phe  Phe Glu Ser
    1025                1030                1035


Asp Thr  Pro Val Cys Asp Glu  Asn Gly Glu Ile Phe  Trp Asp Lys
    1040                1045                1050


Ser Lys  Ser Ile Ala Gln Val  Lys Lys Val Ile Asn  His His His
    1055                1060                1065
```

```
Met Asn  Ile Val Lys Lys Thr  Glu Ile Gln Lys Gly  Gly Phe Ser
    1070                1075                1080

Lys Glu  Thr Val Glu Pro Lys  Lys Asp Ser Ser Lys  Leu Leu Pro
    1085                1090                1095

Arg Lys  Asn Asn Trp Asp Pro  Ala Lys Tyr Gly Gly  Leu Gly Ser
    1100                1105                1110

Pro Asn  Val Ala Tyr Thr Val  Ala Phe Thr Tyr Glu  Lys Gly Lys
    1115                1120                1125

Ala Arg  Lys Arg Thr Asn Ala  Leu Glu Gly Ile Thr  Ile Met Glu
    1130                1135                1140

Arg Glu  Ala Phe Glu Gln Ser  Pro Val Leu Phe Leu  Lys Asn Lys
    1145                1150                1155

Gly Tyr  Glu Gln Ala Glu Ile  Glu Met Lys Leu Pro  Lys Tyr Ala
    1160                1165                1170

Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg Met Val  Ala Ser Lys
    1175                1180                1185

Glu Ala  Gln Lys Ala Asn Ser  Phe Leu Leu Pro Glu  His Leu Val
    1190                1195                1200

Thr Leu  Leu Tyr His Ala Lys  Gln Tyr Asp Glu Ile  Ser His Lys
    1205                1210                1215

Glu Ser  Phe Asp Tyr Val Asn  Glu His His Lys Glu  Phe Ser Glu
    1220                1225                1230

Val Phe  Ala Arg Val Leu Glu  Phe Ala Gly Lys Tyr  Thr Leu Ala
    1235                1240                1245

Glu Lys  Asn Ile Glu Lys Leu  Glu Lys Ile Tyr Lys  Glu Asn Gln
    1250                1255                1260
```

```
Thr Asp  Asp Leu Ala Lys Leu  Ala Ser Ser Phe Val  Asn Leu Met
    1265                1270                1275


Gln Phe  Asn Ala Met Gly Ala  Pro Ala Asp Phe Lys  Phe Phe Asp
    1280                1285                1290


Val Thr  Ile Pro Arg Lys Arg  Tyr Thr Ser Leu Thr  Glu Ile Trp
    1295                1300                1305


Gln Ser  Thr Ile Ile His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr
    1310                1315                1320


Arg Ile  Arg Met Gly Lys
    1325


<210>  230
<211>  1328
<212>  PRT
<213>  Enterococcus faecium

<400>  230

Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65                  70                  75                  80


Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
                85                  90                  95


Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
```

100 105 110

Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
115 120 125

His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
130 135 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145 150 155 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
165 170 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
180 185 190

Asn Gln Gln Phe Ser Glu Ala Asp Lys Leu Asp Glu Ala Val Asp Cys
195 200 205

Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr Lys Lys Ala Glu Thr
210 215 220

Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn Gly Tyr Leu Ser Gln
225 230 235 240

Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn Phe Lys Asn Val Phe
245 250 255

Gly Leu Glu Glu Ala Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu Glu
260 265 270

Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly Asp Asp Tyr Ile Asp Leu
275 280 285

Phe Val Gln Ala Lys Asn Val Tyr Asp Ala Val Leu Leu Ser Glu Ile
290 295 300

Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala Lys Leu Ser Ala Gly Met

305 310 315 320

Ile Arg Arg Tyr Asp Ala His Lys Glu Asp Leu Val Leu Leu Lys Arg
325 330 335

Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr Arg Ala Phe Phe Gly Asp
340 345 350

Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile Glu Gly His Ala Thr Gln
355 360 365

Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu Leu Thr Gly Ile Arg Gly
370 375 380

Ser Glu Val Phe Leu Thr Lys Ile Glu Gln Glu Asn Phe Leu Arg Lys
385 390 395 400

Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His Leu Thr
405 410 415

Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys Lys His Tyr Pro Phe Leu
420 425 430

Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu Leu Thr Phe Lys Ile Pro
435 440 445

Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln Glu Asn Ser Pro Phe Ala
450 455 460

Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile Lys Pro Trp Asn Leu Pro
465 470 475 480

Glu Ile Val Asp Met Glu Gly Ser Ala Val Arg Phe Ile Glu Arg Met
485 490 495

Ile Asn Thr Asp Met Tyr Ile Pro His Asn Lys Val Leu Pro Lys Asn
500 505 510

Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr Asn Glu Leu Thr Lys Val

515 520 525

Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn Tyr Phe Ser Ser Ile Glu
530 535 540

Lys Lys Glu Ile Phe His Glu Leu Phe Glu Lys Asn Arg Lys Val Thr
545 550 555 560

Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu Lys Tyr Asp Ile Lys His
565 570 575

Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Thr Thr
580 585 590

Tyr His Asp Phe Leu Thr Met Ser Glu Asn Lys Gln Trp Leu Glu Asp
595 600 605

Pro Glu Leu Ala Ser Met Phe Glu Glu Ile Ile Lys Thr Leu Thr Val
610 615 620

Phe Glu Asp Arg Glu Met Ile Lys Thr Arg Leu Ser His His Glu Ala
625 630 635 640

Thr Leu Gly Lys His Ile Ile Lys Lys Leu Thr Lys Lys His Tyr Thr
645 650 655

Gly Trp Gly Arg Leu Ser Lys Glu Leu Ile Gln Gly Ile Arg Asp Lys
660 665 670

Gln Ser Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Phe Pro
675 680 685

His His Arg Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser Leu
690 695 700

Ser Phe Lys Lys Glu Ile Lys Lys Ala Gln Met Ile Thr Asp Thr Glu
705 710 715 720

Asn Leu Glu Glu Ile Val Lys Glu Leu Thr Gly Ser Pro Ala Ile Lys

725 730 735

Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Ile Val Gly Ile
740 745 750

Met Gly Tyr Glu Pro Ala Asn Ile Val Val Glu Met Ala Arg Glu Asn
755 760 765

Gln Thr Thr Gly Arg Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys Ala
770 775 780

Leu Glu Glu Ser Leu Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu Tyr
785 790 795 800

Pro Thr Asp Asn Ser Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr
805 810 815

Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile His
820 825 830

Arg Leu Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Arg Ser Phe Thr
835 840 845

Thr Asp Asn Ser Ile Asp Asn Lys Val Leu Val Ser Ser Lys Glu Asn
850 855 860

Arg Leu Lys Lys Asp Asp Val Pro Ser Glu Lys Val Val Lys Lys Met
865 870 875 880

Arg Ser Phe Trp Tyr Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys Arg
885 890 895

Lys Leu Asp Asn Leu Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys Ala
900 905 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
915 920 925

Val Ala Gly Ile Leu His His Arg Phe Asn Lys Ala Glu Asp Thr Asn

```
    930                 935                 940

Glu Pro Ile Arg Lys Val Arg Ile Ile Thr Leu Lys Ser Ala Leu Val
945                 950                 955                 960

Ser Gln Phe Arg Asn Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile Asn
                965                 970                 975

Glu Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Leu
            980                 985                 990

Ala Leu Leu Lys Lys Tyr Pro Gln  Leu Ala Pro Glu Phe  Val Tyr Gly
        995                 1000                1005

Glu Tyr  Leu Lys Phe Asn Ala  His Lys Ala Asn Lys  Ala Thr Val
    1010                1015                1020

Lys Lys  Glu Phe Tyr Ser Asn  Ile Met Lys Phe Phe  Glu Ser Asp
    1025                1030                1035

Thr Pro  Val Cys Asp Glu Asn  Gly Glu Ile Phe Trp  Asp Lys Ser
    1040                1045                1050

Lys Ser  Ile Ala Gln Val Lys  Lys Val Ile Asn His  His His Met
    1055                1060                1065

Asn Ile  Val Lys Lys Thr Glu  Ile Gln Lys Gly Gly  Phe Ser Glu
    1070                1075                1080

Glu Thr  Val Glu Pro Lys Lys  Asp Ser Ser Lys Leu  Leu Pro Arg
    1085                1090                1095

Lys Asn  Asn Trp Asp Pro Ala  Lys Tyr Gly Gly Leu  Gly Ser Pro
    1100                1105                1110

Asn Val  Ala Tyr Thr Val Ala  Phe Thr Tyr Glu Lys  Gly Lys Ala
    1115                1120                1125

Arg Lys  Arg Thr Asn Ala Leu  Glu Gly Ile Thr Ile  Met Glu Arg
```

1130 1135 1140

Glu Ala Phe Glu Gln Ser Pro Val Leu Phe Leu Lys Asn Lys Gly
1145 1150 1155

Tyr Glu Gln Ala Glu Ile Glu Met Lys Leu Pro Lys Tyr Ala Leu
1160 1165 1170

Phe Glu Leu Glu Asn Gly Arg Lys Arg Met Val Ala Ser Lys Glu
1175 1180 1185

Ala Gln Lys Ala Asn Ser Phe Leu Leu Pro Glu His Leu Val Thr
1190 1195 1200

Leu Leu Tyr His Ala Lys Gln Tyr Asp Glu Ile Ser His Lys Glu
1205 1210 1215

Ser Phe Asp Tyr Val Asn Glu His His Lys Glu Phe Ser Glu Val
1220 1225 1230

Phe Ala Arg Val Leu Glu Phe Ala Gly Lys Tyr Thr Leu Ala Glu
1235 1240 1245

Lys Asn Ile Glu Lys Leu Glu Lys Ile Tyr Lys Glu Asn Gln Thr
1250 1255 1260

Asp Asp Leu Ala Lys Leu Ala Ser Ser Phe Val Asn Leu Met Gln
1265 1270 1275

Phe Asn Ala Met Gly Ala Pro Ala Asp Phe Lys Phe Phe Asp Val
1280 1285 1290

Thr Ile Pro Arg Lys Arg Tyr Thr Ser Leu Thr Glu Ile Trp Gln
1295 1300 1305

Ser Thr Ile Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg
1310 1315 1320

Ile Arg Met Gly Lys

1325

<210> 231
<211> 1329
<212> PRT
<213> Enterococcus faecium

<400> 231

Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
20 25 30

Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
35 40 45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
50 55 60

Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65 70 75 80

Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
85 90 95

Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
100 105 110

Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
115 120 125

His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
130 135 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145 150 155 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
165 170 175

```
Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Asp Lys Leu Asp Glu Ala Val Asp Cys
        195                 200                 205

Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr Lys Lys Ala Glu Thr
    210                 215                 220

Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn Gly Tyr Leu Ser Gln
225                 230                 235                 240

Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn Phe Lys Asn Val Phe
                245                 250                 255

Gly Leu Glu Glu Glu Ala Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly Asp Asp Tyr Ile Asp
        275                 280                 285

Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala Val Leu Leu Ser Glu
    290                 295                 300

Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala Lys Leu Ser Ala Gly
305                 310                 315                 320

Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp Leu Val Leu Leu Lys
                325                 330                 335

Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr Arg Ala Phe Phe Gly
            340                 345                 350

Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile Glu Gly His Ala Thr
        355                 360                 365

Gln Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu Leu Thr Gly Ile Arg
    370                 375                 380
```

```
Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His Leu
                405                 410                 415

Thr Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys Lys His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu Leu Thr Phe Lys Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln Glu Asn Ser Pro Phe
    450                 455                 460

Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile Lys Pro Trp Asn Leu
465                 470                 475                 480

Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val Arg Phe Ile Glu Arg
                485                 490                 495

Met Ile Asn Thr Asp Met Tyr Met Pro His Asn Lys Val Leu Pro Lys
            500                 505                 510

Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr Asn Glu Leu Thr Lys
        515                 520                 525

Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn Tyr Phe Ser Ser Ile
    530                 535                 540

Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu Lys Asn Arg Lys Val
545                 550                 555                 560

Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu Lys Tyr Asp Ile Lys
                565                 570                 575

His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Thr
            580                 585                 590
```

```
Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn Lys Gln Trp Leu Glu
        595                 600                 605

Asp Pro Glu Leu Ala Ser Met Phe Glu Glu Ile Ile Lys Thr Leu Thr
    610                 615                 620

Val Phe Glu Asp Arg Glu Met Ile Lys Thr Arg Leu Ser His His Glu
625                 630                 635                 640

Ala Thr Leu Gly Lys His Ile Ile Lys Lys Leu Thr Lys Lys His Tyr
                645                 650                 655

Thr Gly Trp Gly Arg Leu Ser Lys Glu Leu Ile Gln Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Phe
        675                 680                 685

Pro His His Arg Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser
    690                 695                 700

Leu Ser Phe Lys Lys Glu Ile Lys Lys Ala Gln Met Ile Thr Asp Thr
705                 710                 715                 720

Glu Asn Leu Glu Glu Ile Val Lys Glu Leu Thr Gly Ser Pro Ala Ile
                725                 730                 735

Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Ile Val Gly
            740                 745                 750

Ile Met Gly Tyr Glu Pro Ala Asn Ile Val Val Glu Met Ala Arg Glu
        755                 760                 765

Asn Gln Thr Thr Gly Arg Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys
    770                 775                 780

Ala Leu Glu Glu Ser Leu Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu
785                 790                 795                 800
```

```
Tyr Pro Thr Asp Asn Ser Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr
                805                 810                 815

Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile
            820                 825                 830

His Arg Leu Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Arg Ser Phe
        835                 840                 845

Thr Thr Asp Asn Ser Ile Asp Asn Lys Val Leu Val Ser Ser Lys Glu
    850                 855                 860

Asn Arg Leu Lys Lys Asp Asp Val Pro Ser Glu Lys Val Val Lys Lys
865                 870                 875                 880

Met Arg Ser Phe Trp Tyr Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys
                885                 890                 895

Arg Lys Leu Asp Asn Leu Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925

His Val Ala Gly Ile Leu His His Arg Phe Asn Lys Ala Glu Asp Thr
    930                 935                 940

Asn Glu Pro Ile Arg Lys Val Arg Ile Ile Thr Leu Lys Ser Ala Leu
945                 950                 955                 960

Val Ser Gln Phe Arg Asn Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Glu Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala
            980                 985                 990

Leu Ala Leu Leu Lys Lys Tyr Pro  Gln Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005
```

```
Gly Glu  Tyr Leu Lys Phe Asn  Ala His Lys Ala Asn  Lys Ala Thr
    1010                1015                1020

Val Lys  Lys Glu Phe Tyr Ser  Asn Ile Met Lys Phe  Phe Glu Ser
    1025                1030                1035

Asp Thr  Pro Val Cys Asp Glu  Asn Gly Glu Ile Phe  Trp Asp Lys
    1040                1045                1050

Ser Lys  Ser Ile Ala Gln Val  Lys Lys Val Ile Asn  His His His
    1055                1060                1065

Met Asn  Ile Val Lys Lys Thr  Glu Ile Gln Lys Gly  Gly Phe Ser
    1070                1075                1080

Lys Glu  Thr Val Glu Pro Lys  Lys Asp Ser Ser Lys  Leu Leu Pro
    1085                1090                1095

Arg Lys  Asn Asn Trp Asp Pro  Ala Lys Tyr Gly Gly  Leu Gly Ser
    1100                1105                1110

Pro Asn  Val Ala Tyr Thr Val  Ala Phe Thr Tyr Glu  Lys Gly Lys
    1115                1120                1125

Ala Arg  Lys Arg Thr Asn Ala  Leu Glu Gly Ile Thr  Ile Met Glu
    1130                1135                1140

Arg Glu  Ala Phe Glu Gln Ser  Pro Val Leu Phe Leu  Lys Asn Lys
    1145                1150                1155

Gly Tyr  Glu Gln Ala Glu Ile  Glu Met Lys Leu Pro  Lys Tyr Ala
    1160                1165                1170

Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg Met Val  Ala Ser Lys
    1175                1180                1185

Glu Ala  Gln Lys Ala Asn Ser  Phe Leu Leu Pro Glu  His Leu Val
    1190                1195                1200
```

```
Thr Leu  Leu Tyr His Ala Lys  Gln Tyr Asp Glu Ile  Ser His Lys
    1205                 1210                 1215


Glu Ser  Phe Asp Tyr Val Asn  Glu His His Lys Glu  Phe Ser Glu
    1220                 1225                 1230


Val Phe  Ala Arg Val Leu Glu  Phe Ala Gly Lys Tyr  Thr Leu Ala
    1235                 1240                 1245


Glu Lys  Asn Ile Glu Lys Leu  Glu Lys Ile Tyr Lys  Glu Asn Gln
    1250                 1255                 1260


Thr Asp  Asp Leu Ala Lys Leu  Ala Ser Ser Phe Val  Asn Leu Met
    1265                 1270                 1275


Gln Phe  Asn Ala Met Gly Ala  Pro Ala Asp Phe Lys  Phe Phe Asp
    1280                 1285                 1290


Val Thr  Ile Pro Arg Lys Arg  Tyr Thr Ser Leu Thr  Glu Ile Trp
    1295                 1300                 1305


Gln Ser  Thr Ile Ile His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr
    1310                 1315                 1320


Arg Ile  Arg Met Gly Lys
    1325


<210>  232
<211>  1329
<212>  PRT
<213>  Enterococcus faecium

<400>  232

Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
            20                  25                  30
```

```
Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65                  70                  75                  80

Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
                85                  90                  95

Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
            100                 105                 110

Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
        115                 120                 125

His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
    130                 135                 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
            180                 185                 190

Asn Gln Gln Phe Ser Glu Ala Asp Lys Leu Asp Glu Ala Val Asp Cys
        195                 200                 205

Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr Lys Lys Ala Glu Thr
    210                 215                 220

Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn Gly Tyr Leu Ser Gln
225                 230                 235                 240
```

```
Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn Phe Lys Asn Val Phe
                245                 250                 255

Gly Leu Glu Glu Glu Ala Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu
            260                 265                 270

Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly Asp Asp Tyr Ile Asp
        275                 280                 285

Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala Val Leu Leu Ser Glu
    290                 295                 300

Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala Lys Leu Ser Ala Gly
305                 310                 315                 320

Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp Leu Val Leu Leu Lys
                325                 330                 335

Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr Arg Ala Phe Phe Gly
            340                 345                 350

Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile Glu Gly His Ala Thr
        355                 360                 365

Gln Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu Leu Thr Gly Ile Arg
    370                 375                 380

Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His Leu
                405                 410                 415

Thr Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys Lys His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu Leu Thr Phe Lys Ile
        435                 440                 445
```

```
Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln Glu Asn Ser Pro Phe
    450                 455                 460

Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile Lys Pro Trp Asn Leu
465                 470                 475                 480

Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val Arg Phe Ile Glu Arg
                485                 490                 495

Met Ile Asn Thr Asp Met Tyr Ile Pro His Asn Lys Val Leu Pro Lys
            500                 505                 510

Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr Asn Glu Leu Thr Lys
        515                 520                 525

Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn Tyr Phe Ser Ser Ile
    530                 535                 540

Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu Lys Asn Arg Lys Val
545                 550                 555                 560

Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu Lys Tyr Asp Ile Lys
                565                 570                 575

His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Thr
            580                 585                 590

Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn Lys Gln Trp Leu Glu
        595                 600                 605

Asp Pro Glu Leu Ala Ser Met Phe Glu Glu Ile Ile Lys Thr Leu Thr
    610                 615                 620

Val Phe Glu Asp Arg Glu Met Ile Lys Thr Arg Leu Ser His His Glu
625                 630                 635                 640

Ala Thr Leu Gly Lys His Ile Ile Lys Lys Leu Thr Lys Lys His Tyr
                645                 650                 655
```

```
Thr Gly Trp Gly Arg Leu Ser Lys Glu Leu Ile Gln Gly Ile Arg Asp
            660                 665                 670

Lys Gln Ser Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Phe
        675                 680                 685

Pro His His Arg Asn Arg Asn Cys Met Gln Leu Ile Asn Asp Asp Ser
    690                 695                 700

Leu Ser Phe Lys Lys Glu Ile Lys Lys Ala Gln Met Ile Thr Asp Thr
705                 710                 715                 720

Glu Asn Leu Glu Glu Ile Val Lys Glu Leu Thr Gly Ser Pro Ala Ile
                725                 730                 735

Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Ile Val Gly
            740                 745                 750

Ile Met Gly Tyr Glu Pro Ala Asn Ile Val Val Glu Met Ala Arg Glu
        755                 760                 765

Asn Gln Thr Thr Gly Arg Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys
    770                 775                 780

Ala Leu Glu Glu Ser Leu Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu
785                 790                 795                 800

Tyr Pro Thr Asp Asn Ser Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr
                805                 810                 815

Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile
            820                 825                 830

His Arg Leu Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Arg Ser Phe
        835                 840                 845

Thr Thr Asp Asn Ser Ile Asp Asn Lys Val Leu Val Ser Ser Lys Glu
    850                 855                 860
```

```
Asn Arg Leu Lys Lys Asp Asp Val Pro Ser Glu Lys Val Val Lys Lys
865                 870                 875                 880


Met Arg Ser Phe Trp Tyr Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys
                885                 890                 895


Arg Lys Leu Asp Asn Leu Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys
            900                 905                 910


Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
        915                 920                 925


His Val Ala Gly Ile Leu His His Arg Phe Asn Lys Ala Glu Asp Thr
    930                 935                 940


Asn Glu Pro Ile Arg Lys Val Arg Ile Ile Thr Leu Lys Ser Ala Leu
945                 950                 955                 960


Val Ser Gln Phe Arg Asn Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile
                965                 970                 975


Asn Glu Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala
            980                 985                 990


Leu Ala Leu Leu Lys Lys Tyr Pro  Gln Leu Ala Pro Glu  Phe Val Tyr
        995                 1000                1005


Gly Glu  Tyr Leu Lys Phe Asn  Ala His Lys Ala Asn  Lys Ala Thr
    1010                1015                1020


Val Lys  Lys Glu Phe Tyr Ser  Asn Ile Met Lys Phe  Phe Glu Ser
    1025                1030                1035


Asp Thr  Pro Val Cys Asp Glu  Asn Gly Glu Ile Phe  Trp Asp Lys
    1040                1045                1050


Ser Lys  Ser Ile Ala Gln Val  Lys Lys Val Ile Asn  His His His
    1055                1060                1065
```

```
Met Asn  Ile Val Lys Lys Thr  Glu Ile Gln Lys Gly  Gly Phe Ser
    1070                1075                1080

Lys Glu  Thr Val Glu Pro Lys  Lys Asp Ser Ser Lys  Leu Leu Pro
    1085                1090                1095

Arg Lys  Asn Asn Trp Asp Pro  Thr Lys Tyr Gly Gly  Leu Gly Ser
    1100                1105                1110

Pro Asn  Val Ala Tyr Thr Val  Ala Phe Thr Tyr Glu  Lys Gly Lys
    1115                1120                1125

Ala Arg  Lys Arg Thr Asn Ala  Leu Glu Gly Ile Thr  Ile Met Glu
    1130                1135                1140

Arg Glu  Ala Phe Glu Gln Ser  Pro Val Leu Phe Leu  Lys Asn Lys
    1145                1150                1155

Gly Tyr  Glu Gln Ala Glu Ile  Glu Met Lys Leu Pro  Lys Tyr Ala
    1160                1165                1170

Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg Met Val  Ala Ser Lys
    1175                1180                1185

Glu Ala  Gln Lys Ala Asn Ser  Phe Leu Leu Pro Glu  His Leu Val
    1190                1195                1200

Thr Leu  Leu Tyr His Ala Lys  Gln Tyr Asp Glu Ile  Ser His Lys
    1205                1210                1215

Glu Ser  Phe Asp Tyr Val Asn  Glu His His Lys Glu  Phe Ser Glu
    1220                1225                1230

Val Phe  Ala Arg Val Leu Glu  Phe Ala Gly Lys Tyr  Thr Leu Ala
    1235                1240                1245

Glu Lys  Asn Ile Glu Lys Leu  Glu Lys Ile Tyr Lys  Glu Asn Gln
    1250                1255                1260
```

```
Thr Asp  Asp Leu Ala Lys Leu  Ala Ser Ser Phe Val  Asn Leu Met
    1265                 1270                 1275


Gln Phe  Asn Ala Met Gly Ala  Pro Ala Asp Phe Lys  Phe Phe Asp
    1280                 1285                 1290


Val Thr  Ile Pro Arg Lys Arg  Tyr Thr Ser Leu Thr  Glu Ile Trp
    1295                 1300                 1305


Gln Ser  Thr Ile Ile His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr
    1310                 1315                 1320


Arg Ile  Arg Met Gly Lys
    1325


<210>  233
<211>  1329
<212>  PRT
<213>  Enterococcus faecium

<400>  233

Met Thr Lys Asp Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Leu Thr Asp Asp Tyr Gln Leu Met Lys Arg Lys Met
            20                  25                  30


Ser Val His Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Ala Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Phe Arg Arg Thr
    50                  55                  60


Lys Arg Thr Asn Arg Arg Arg Leu Ala Arg Arg Lys Tyr Arg Leu Ser
65                  70                  75                  80


Lys Leu Gln Asp Leu Phe Ala Glu Glu Leu Cys Lys Gln Asp Asp Cys
                85                  90                  95
```

```
Phe Phe Val Arg Leu Glu Glu Ser Phe Leu Val Pro Glu Glu Lys Gln
            100                 105                 110

Tyr Lys Pro Ala Ser Ile Phe Pro Thr Leu Glu Glu Glu Lys Glu Tyr
        115                 120                 125

Tyr Gln Lys Tyr Pro Thr Ile Tyr His Leu Arg Gln Lys Leu Val Asp
    130                 135                 140

Ser Thr Glu Lys Glu Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Asp Leu Asp Thr
                165                 170                 175

Glu Asn Thr Ser Ile Glu Glu Ser Phe Arg Val Phe Leu Glu Gln Tyr
            180                 185                 190

Ser Lys Gln Ser Asp Gln Pro Leu Ile Val His Gln Pro Val Leu Thr
        195                 200                 205

Ile Leu Thr Asp Lys Leu Ser Lys Thr Lys Lys Val Glu Glu Ile Leu
    210                 215                 220

Lys Tyr Tyr Pro Thr Glu Lys Ile Asn Ser Phe Phe Ala Gln Cys Leu
225                 230                 235                 240

Lys Leu Ile Val Gly Asn Gln Ala Asn Phe Lys Arg Ile Phe Asp Leu
                245                 250                 255

Glu Ala Glu Val Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu Glu Asp
            260                 265                 270

Leu Glu Ser Leu Leu Glu Lys Ile Gly Asp Glu Tyr Leu Asp Ile Phe
        275                 280                 285

Leu Gln Ala Lys Lys Val His Asp Ala Ile Leu Leu Ser Glu Ile Ile
    290                 295                 300
```

```
Ser Ser Thr Val Lys His Thr Lys Ala Lys Leu Ser Ser Gly Met Val
305                 310                 315                 320


Glu Arg Tyr Glu Arg His Lys Ala Asp Leu Ala Lys Phe Lys Gln Phe
                325                 330                 335


Val Lys Glu Asn Val Pro Gln Lys Ala Thr Val Phe Phe Lys Asp Thr
            340                 345                 350


Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Lys Gly Lys Thr Thr Gln Glu
        355                 360                 365


Glu Phe Tyr Lys Phe Val Lys Lys Glu Leu Ser Gly Val Val Gly Ser
    370                 375                 380


Glu Pro Phe Leu Glu Lys Ile Asp Gln Glu Thr Phe Leu Leu Lys Gln
385                 390                 395                 400


Arg Thr Tyr Thr Asn Gly Val Ile Pro His Gln Val His Leu Ile Glu
                405                 410                 415


Leu Lys Ala Ile Ile Asp Gln Gln Lys Gln His Tyr Pro Phe Leu Glu
            420                 425                 430


Glu Ala Gly Pro Lys Ile Ile Ala Leu Phe Lys Phe Arg Ile Pro Tyr
        435                 440                 445


Tyr Val Gly Pro Leu Ala Lys Glu Gln Glu Ala Ser Ser Phe Ala Trp
    450                 455                 460


Ile Glu Arg Lys Thr Ala Glu Lys Ile Asn Pro Trp Asn Phe Ser Glu
465                 470                 475                 480


Val Val Asp Ile Glu Lys Ser Ala Met Arg Phe Ile Gln Arg Met Thr
                485                 490                 495


Lys Gln Asp Thr Tyr Leu Pro Thr Glu Lys Val Leu Pro Lys Asn Ser
            500                 505                 510
```

```
Leu Leu Tyr Gln Lys Tyr Met Ile Phe Asn Glu Leu Thr Lys Val Ser
        515                 520                 525

Tyr Lys Asp Glu Arg Gly Val Lys Gln Tyr Phe Ser Gly Asp Glu Lys
    530                 535                 540

Gln Gln Ile Phe Lys Gln Leu Phe Gln Lys Glu Arg Gly Lys Ile Thr
545                 550                 555                 560

Val Lys Lys Leu Gln Asn Phe Leu Tyr Thr His Tyr His Ile Glu Asn
                565                 570                 575

Ala Gln Ile Phe Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Ser Thr
            580                 585                 590

Tyr His Asp Phe Met Lys Leu Ala Lys Thr Asn Glu Trp Leu Glu Gln
        595                 600                 605

Pro Glu Met Glu Pro Ile Phe Glu Asp Ile Val Lys Ile Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Gln Met Ile Lys His Gln Leu Ser Lys Tyr Gln Glu
625                 630                 635                 640

Val Phe Gly Glu Lys Leu Leu Lys Glu Phe Ala Arg Lys His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Phe Ser Ala Lys Leu Ile His Gly Ile Arg Asp Arg
            660                 665                 670

Lys Thr Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Val Pro
        675                 680                 685

Ala Asn Arg Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Glu His Leu
    690                 695                 700

Ser Phe Lys Glu Glu Ile Ala Lys Ala Thr Val Phe Ser Lys His Lys
705                 710                 715                 720
```

```
Ser Leu Val Asp Val Ile Gln Asp Leu Pro Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Trp Gln Ser Leu Lys Ile Val Glu Glu Leu Ile Ala Ile
            740                 745                 750

Ile Gly Tyr Lys Pro Lys Asn Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Lys Thr His Arg Thr Ser Pro Arg Leu Lys Ala Leu Glu Asn Gly
    770                 775                 780

Leu Lys Gln Ile Gly Ser Thr Leu Leu Lys Glu Gln Pro Thr Asp Asn
785                 790                 795                 800

Lys Ala Leu Gln Lys Glu Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Thr Gly Glu Pro Leu Glu Ile Glu Asn Leu His Gln
            820                 825                 830

Tyr Glu Val Asp His Ile Ile Pro Arg Ser Phe Ile Val Asp Asn Ser
        835                 840                 845

Ile Asp Asp Lys Val Leu Val Ala Ser Lys Gln Asn Gln Lys Lys Arg
    850                 855                 860

Asp Asp Val Pro Lys Lys Gln Ile Val Asn Glu Gln Arg Ile Phe Trp
865                 870                 875                 880

Asn Gln Leu Lys Glu Ala Lys Leu Ile Ser Thr Lys Lys Tyr Ala Tyr
                885                 890                 895

Leu Thr Lys Ile Glu Leu Thr Pro Glu Asp Lys Ala Arg Phe Ile Gln
            900                 905                 910

Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Asn Ile
        915                 920                 925
```

```
Leu His Gln Ser Phe Asn Gln Glu Glu Glu Gly Thr Asp Cys Asp Gly
    930                 935                 940

Val Gln Ile Ile Thr Leu Lys Ala Thr Leu Thr Ser Gln Phe Arg Gln
945                 950                 955                 960

Thr Phe Gly Leu Tyr Lys Val Arg Glu Ile Asn Pro His His His Ala
                965                 970                 975

His Asp Ala Tyr Leu Asn Gly Phe Ile Ala Asn Val Leu Leu Lys Arg
            980                 985                 990

Tyr Pro Lys Leu Ala Pro Glu Phe  Val Tyr Gly Lys Tyr  Val Lys Tyr
        995                 1000                1005

Ser Leu  Ala Arg Glu Asn Lys  Ala Thr Ala Lys Lys  Glu Phe Tyr
    1010                1015                1020

Ser Asn  Ile Leu Lys Phe Leu  Glu Ser Asp Glu Pro  Phe Cys Asp
    1025                1030                1035

Glu Asn  Gly Glu Ile Tyr Trp  Glu Lys Ser His His  Leu Pro Arg
    1040                1045                1050

Ile Lys  Lys Val Leu Ser Ser  His Gln Val Asn Val  Val Lys Lys
    1055                1060                1065

Val Glu  Gln Gln Lys Gly Gly  Phe Tyr Lys Glu Thr  Val Asn Ser
    1070                1075                1080

Lys Glu  Lys Pro Asp Lys Leu  Ile Glu Arg Lys Asn  Asn Trp Asp
    1085                1090                1095

Val Thr  Lys Tyr Gly Gly Phe  Gly Ser Pro Val Ile  Ala Tyr Ala
    1100                1105                1110

Ile Ala  Phe Val Tyr Ala Lys  Gly Lys Thr Gln Lys  Lys Thr Arg
    1115                1120                1125
```

```
Ala Ile  Glu Gly Ile Thr Ile  Met Glu Gln Ala Ala  Phe Glu Lys
    1130                1135                1140


Asp Pro  Thr Thr Phe Leu Lys  Glu Lys Gly Phe Pro  Gln Val Thr
    1145                1150                1155


Glu Phe  Ile Lys Leu Pro Lys  Tyr Thr Leu Phe Glu  Phe Asp Asn
    1160                1165                1170


Gly Arg  Arg Arg Phe Leu Ala  Ser Lys Glu Ser Gln  Lys Gly Asn
    1175                1180                1185


Pro Phe  Ile Leu Ser Asp Gln  Leu Val Thr Leu Leu  Tyr His Ala
    1190                1195                1200


Gln His  Tyr Asp Lys Ile Thr  Tyr Gln Glu Ser Phe  Asp Tyr Val
    1205                1210                1215


Asn Thr  His Leu Ser Asp Phe  Ser Ala Ile Leu Thr  Glu Val Leu
    1220                1225                1230


Ala Phe  Ala Glu Lys Tyr Thr  Leu Ala Asp Lys Asn  Ile Glu Arg
    1235                1240                1245


Ile Gln  Glu Leu Tyr Glu Glu  Asn Lys Tyr Gly Glu  Thr Ser Met
    1250                1255                1260


Ile Ala  Gln Ser Phe Leu Gln  Leu Leu Gln Phe Asn  Ala Ile Gly
    1265                1270                1275


Ala Pro  Ala Asp Phe Lys Phe  Phe Gly Val Thr Ile  Pro Arg Lys
    1280                1285                1290


Arg Tyr  Thr Ser Leu Thr Glu  Ile Trp Asp Ala Thr  Ile Ile Tyr
    1295                1300                1305


Gln Ser  Val Thr Gly Leu Tyr  Glu Thr Arg Ile Arg  Met Gly Asp
    1310                1315                1320
```

Leu Trp Ala Gly Glu Gln
1325

<210> 234
<211> 1329
<212> PRT
<213> Enterococcus faecium

<400> 234

Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ser Val Leu Thr Asp Asp Tyr Arg Leu Val Ser Lys Lys Met
20 25 30

Lys Val Ala Gly Asn Thr Glu Lys Ser Ser Thr Lys Lys Asn Phe Trp
35 40 45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Ala Arg Arg Ser
50 55 60

Lys Arg Thr Ala Arg Arg Arg Leu Ala Arg Arg Arg Gln Arg Ile Leu
65 70 75 80

Glu Leu Gln Lys Ile Phe Ala Pro Glu Ile Leu Lys Ile Asp Glu His
85 90 95

Phe Phe Ala Arg Leu Asn Glu Ser Phe Leu Val Leu Asp Glu Lys Lys
100 105 110

Gln Ser Arg His Pro Val Phe Ala Thr Ile Lys Gln Glu Lys Ser Tyr
115 120 125

His Gln Thr Tyr Pro Thr Ile Tyr His Leu Arg Gln Ala Leu Ala Asp
130 135 140

Ser Ser Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Met Ala His
145 150 155 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr

165 170 175

Glu Asn Ser Ser Val Thr Glu Thr Phe Arg Gln Phe Leu Ser Thr Tyr
180 185 190

Asn Gln Gln Phe Ser Glu Ala Asp Lys Leu Asp Glu Ala Val Asp Cys
195 200 205

Ser Phe Val Phe Thr Glu Lys Met Ser Lys Thr Lys Lys Ala Glu Thr
210 215 220

Leu Leu Lys Tyr Phe Pro His Glu Lys Ser Asn Gly Tyr Leu Ser Gln
225 230 235 240

Phe Ile Lys Leu Met Val Gly Asn Gln Gly Asn Phe Lys Asn Val Phe
245 250 255

Gly Leu Glu Glu Glu Ala Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu
260 265 270

Glu Asp Leu Glu Glu Leu Leu Glu Lys Ile Gly Asp Asp Tyr Ile Asp
275 280 285

Leu Phe Val Gln Ala Lys Asn Val Tyr Asp Ala Val Leu Leu Ser Glu
290 295 300

Ile Leu Ser Asp Ser Thr Lys Asn Thr Arg Ala Lys Leu Ser Ala Gly
305 310 315 320

Met Ile Arg Arg Tyr Asp Ala His Lys Glu Asp Leu Val Leu Leu Lys
325 330 335

Arg Phe Val Lys Glu Asn Leu Pro Lys Lys Tyr Arg Ala Phe Phe Gly
340 345 350

Asp Asn Ser Val Asn Gly Tyr Ala Gly Tyr Ile Glu Gly His Ala Thr
355 360 365

Gln Glu Asp Phe Tyr Lys Phe Val Lys Lys Glu Leu Thr Gly Ile Arg

```
    370                 375                 380

Gly Ser Glu Val Phe Leu Thr Lys Ile Glu Gln Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Ile His Leu
                405                 410                 415

Thr Glu Leu Arg Ala Ile Ile Ala Asn Gln Lys Lys His Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Glu Gln Glu Lys Leu Glu Ser Leu Leu Thr Phe Lys Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Lys Lys Gln Glu Asn Ser Pro Phe
    450                 455                 460

Ala Trp Leu Ile Arg Lys Ser Glu Glu Lys Ile Lys Pro Trp Asn Leu
465                 470                 475                 480

Pro Glu Ile Val Asp Met Glu Gly Ser Ala Val Arg Phe Ile Glu Arg
                485                 490                 495

Met Ile Asn Thr Asp Met Tyr Met Pro His Asn Lys Val Leu Pro Lys
            500                 505                 510

Asn Ser Leu Leu Tyr Gln Lys Phe Ser Ile Tyr Asn Glu Leu Thr Lys
        515                 520                 525

Val Arg Tyr Gln Asp Glu Arg Gly Gln Met Asn Tyr Phe Ser Ser Ile
    530                 535                 540

Glu Lys Lys Glu Ile Phe His Glu Leu Phe Glu Lys Asn Arg Lys Val
545                 550                 555                 560

Thr Lys Lys Asp Leu Gln Glu Phe Leu Tyr Leu Lys Tyr Asp Ile Lys
                565                 570                 575

His Ala Glu Leu Ser Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Thr
```

580 585 590

Thr Tyr His Asp Phe Leu Thr Met Ser Glu Asn Lys Gln Trp Leu Glu
595 600 605

Asp Pro Glu Leu Ala Ser Met Phe Glu Glu Ile Ile Lys Thr Leu Thr
610 615 620

Val Phe Glu Asp Arg Glu Met Ile Lys Thr Arg Leu Ser His His Glu
625 630 635 640

Ala Thr Leu Gly Lys His Ile Ile Lys Lys Leu Thr Lys Lys His Tyr
645 650 655

Thr Gly Trp Gly Arg Leu Ser Lys Glu Leu Ile Gln Gly Ile Arg Asp
660 665 670

Lys Gln Ser Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Phe
675 680 685

Pro His His Arg Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp Ser
690 695 700

Leu Ser Phe Lys Lys Glu Ile Lys Lys Ala Gln Met Ile Thr Asp Thr
705 710 715 720

Glu Asn Leu Glu Glu Ile Val Lys Glu Leu Thr Gly Ser Pro Ala Ile
725 730 735

Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Ile Val Gly
740 745 750

Ile Met Gly Tyr Glu Pro Ala Asn Ile Val Val Glu Met Ala Arg Glu
755 760 765

Asn Gln Thr Thr Gly Arg Gly Leu Lys Ser Ser Arg Pro Arg Leu Lys
770 775 780

Ala Leu Glu Glu Ser Leu Lys Asp Phe Gly Ser Gln Leu Leu Lys Glu

785 790 795 800

Tyr Pro Thr Asp Asn Ser Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr
805 810 815

Tyr Leu Gln Asn Gly Arg Asp Met Tyr Thr Gly Ala Pro Leu Asp Ile
820 825 830

His Arg Leu Ser Asp Tyr Asp Ile Asp His Ile Ile Pro Arg Ser Phe
835 840 845

Thr Thr Asp Asn Ser Ile Asp Asn Lys Val Leu Val Ser Ser Lys Glu
850 855 860

Asn Arg Leu Lys Lys Asp Asp Val Pro Ser Glu Lys Val Val Lys Lys
865 870 875 880

Met Arg Ser Phe Trp Tyr Asp Leu Tyr Ser Ser Lys Leu Ile Ser Lys
885 890 895

Arg Lys Leu Asp Asn Leu Thr Lys Ile Lys Leu Thr Glu Glu Asp Lys
900 905 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
915 920 925

His Val Ala Gly Ile Leu His His Arg Phe Asn Lys Ala Glu Asp Thr
930 935 940

Asn Glu Pro Ile Arg Lys Val Arg Ile Ile Thr Leu Lys Ser Ala Leu
945 950 955 960

Val Ser Gln Phe Arg Asn Arg Phe Gly Ile Tyr Lys Val Arg Glu Ile
965 970 975

Asn Glu Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Ile Ala
980 985 990

Leu Ala Leu Leu Lys Lys Tyr Pro Gln Leu Ala Pro Glu Phe Val Tyr

995 1000 1005

Gly Glu Tyr Leu Lys Phe Asn Ala His Lys Ala Asn Lys Ala Thr
1010 1015 1020

Val Lys Lys Glu Phe Tyr Ser Asn Ile Met Lys Phe Phe Glu Ser
1025 1030 1035

Asp Thr Pro Val Cys Asp Glu Asn Gly Glu Ile Phe Trp Asp Lys
1040 1045 1050

Ser Lys Ser Ile Ala Gln Val Lys Lys Val Ile Asn His His His
1055 1060 1065

Met Asn Ile Val Lys Lys Thr Glu Ile Gln Lys Gly Gly Phe Ser
1070 1075 1080

Lys Glu Thr Val Glu Pro Lys Lys Asp Ser Ser Lys Leu Leu Pro
1085 1090 1095

Arg Lys Asn Asn Trp Asp Pro Ala Lys Tyr Gly Gly Leu Gly Ser
1100 1105 1110

Pro Asn Val Ala Tyr Thr Val Ala Phe Thr Tyr Glu Lys Gly Lys
1115 1120 1125

Ala Arg Lys Arg Thr Asn Ala Leu Glu Gly Ile Thr Ile Met Glu
1130 1135 1140

Arg Glu Ala Phe Glu Gln Ser Pro Val Leu Phe Leu Lys Asn Lys
1145 1150 1155

Gly Tyr Glu Gln Ala Glu Ile Glu Met Lys Leu Pro Lys Tyr Ala
1160 1165 1170

Leu Phe Glu Leu Glu Asn Gly Arg Lys Arg Met Val Ala Ser Lys
1175 1180 1185

Glu Ala Gln Lys Ala Asn Ser Phe Leu Leu Pro Glu His Leu Val

1190 1195 1200

Thr Leu Leu Tyr His Ala Lys Gln Tyr Asp Glu Ile Ser His Lys
1205 1210 1215

Glu Ser Phe Asp Tyr Val Asn Glu His His Lys Glu Phe Ser Glu
1220 1225 1230

Val Phe Ala Arg Val Leu Glu Phe Ala Gly Lys Tyr Thr Leu Ala
1235 1240 1245

Glu Lys Asn Ile Glu Lys Leu Glu Lys Ile Tyr Lys Glu Asn Gln
1250 1255 1260

Thr Asp Asp Leu Ala Lys Leu Ala Ser Ser Phe Val Asn Leu Met
1265 1270 1275

Gln Phe Asn Ala Met Gly Ala Pro Ala Asp Phe Lys Phe Phe Asp
1280 1285 1290

Val Thr Ile Pro Arg Lys Arg Tyr Thr Ser Leu Thr Glu Ile Trp
1295 1300 1305

Gln Ser Thr Ile Ile His Gln Ser Ile Thr Gly Leu Tyr Glu Thr
1310 1315 1320

Arg Ile Arg Met Gly Lys
1325

<210> 235
<211> 1329
<212> PRT
<213> Enterococcus faecium

<400> 235

Met Thr Lys Asp Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Leu Thr Asp Asp Tyr Gln Leu Met Lys Arg Lys Met
20 25 30

```
Ser Val His Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Ala Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Phe Arg Arg Thr
    50                  55                  60

Lys Arg Thr Asn Arg Arg Arg Leu Ala Arg Arg Lys Tyr Arg Leu Ser
65                  70                  75                  80

Lys Leu Gln Asp Leu Phe Ala Glu Glu Leu Cys Lys Gln Asp Asp Cys
                85                  90                  95

Phe Phe Val Arg Leu Glu Glu Ser Phe Leu Val Pro Glu Glu Lys Gln
            100                 105                 110

Tyr Lys Pro Ala Ser Ile Phe Pro Thr Leu Glu Glu Glu Lys Glu Tyr
        115                 120                 125

Tyr Gln Lys Tyr Pro Thr Ile Tyr His Leu Arg Gln Lys Leu Val Asp
    130                 135                 140

Ser Thr Glu Lys Gly Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Asp Leu Asp Thr
                165                 170                 175

Glu Asn Thr Ser Ile Glu Glu Ser Phe Arg Val Phe Leu Glu Gln Tyr
            180                 185                 190

Gly Lys Gln Ser Asp Gln Pro Leu Ile Val His Gln Pro Val Leu Thr
        195                 200                 205

Ile Leu Thr Asp Lys Leu Ser Lys Thr Lys Lys Val Glu Glu Ile Leu
    210                 215                 220

Lys Tyr Tyr Pro Thr Glu Lys Ile Asn Ser Phe Phe Ala Gln Cys Leu
225                 230                 235                 240
```

```
Lys Leu Ile Val Gly Asn Gln Ala Asn Phe Lys Arg Ile Phe Asp Leu
                245                 250                 255

Glu Ala Glu Val Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu Glu Asp
            260                 265                 270

Leu Glu Ser Leu Leu Glu Lys Ile Gly Asp Glu Tyr Leu Asp Ile Phe
        275                 280                 285

Leu Gln Ala Lys Lys Val His Asp Ala Ile Leu Leu Ser Glu Ile Ile
    290                 295                 300

Ser Ser Thr Val Lys His Thr Gln Ala Lys Leu Ser Ser Gly Met Val
305                 310                 315                 320

Glu Arg Tyr Glu Arg His Lys Ala Asp Leu Ala Lys Phe Lys Gln Phe
                325                 330                 335

Val Lys Glu Asn Val Pro Gln Lys Ala Thr Val Phe Phe Lys Asp Thr
            340                 345                 350

Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Lys Gly Lys Thr Thr Gln Glu
        355                 360                 365

Glu Phe Tyr Lys Phe Val Lys Lys Glu Leu Ser Gly Val Val Gly Ser
    370                 375                 380

Glu Pro Phe Leu Glu Lys Ile Asp Gln Glu Thr Phe Leu Leu Lys Gln
385                 390                 395                 400

Arg Thr Tyr Thr Asn Gly Val Ile Pro His Gln Val His Leu Ile Glu
                405                 410                 415

Leu Lys Ala Ile Ile Asp Gln Gln Lys Gln His Tyr Pro Phe Leu Glu
            420                 425                 430

Glu Ala Gly Pro Lys Ile Ile Ala Leu Phe Lys Phe Arg Ile Pro Tyr
        435                 440                 445
```

```
Tyr Val Gly Pro Leu Ala Lys Glu Gln Glu Ala Ser Ser Phe Ala Trp
    450                 455                 460

Ile Glu Arg Lys Thr Ala Glu Lys Ile Asn Pro Trp Asn Phe Ser Glu
465                 470                 475                 480

Val Val Asp Ile Glu Lys Ser Ala Met Arg Phe Ile Gln Arg Met Thr
                485                 490                 495

Lys Gln Asp Thr Tyr Leu Pro Thr Glu Lys Val Leu Pro Lys Asn Ser
            500                 505                 510

Leu Phe Tyr Gln Lys Tyr Met Ile Phe Asn Glu Leu Thr Lys Val Ser
        515                 520                 525

Tyr Lys Asp Glu Arg Gly Val Lys Gln Tyr Phe Ser Gly Asp Glu Lys
    530                 535                 540

Gln Gln Ile Phe Lys Gln Leu Phe Gln Lys Glu Arg Gly Lys Ile Thr
545                 550                 555                 560

Val Lys Lys Leu Gln Asn Phe Leu Tyr Thr His Tyr His Ile Glu Asn
                565                 570                 575

Ala Gln Ile Phe Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Ser Thr
            580                 585                 590

Tyr His Asp Phe Met Lys Leu Ala Lys Thr Asn Glu Trp Leu Glu Gln
        595                 600                 605

Pro Glu Met Glu Pro Ile Phe Glu Asp Ile Val Lys Ile Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Gln Met Ile Lys His Gln Leu Ser Lys Tyr Gln Glu
625                 630                 635                 640

Val Phe Gly Glu Lys Leu Leu Lys Glu Phe Ala Arg Lys His Tyr Thr
                645                 650                 655
```

```
Gly Trp Gly Arg Phe Ser Ala Lys Leu Ile His Gly Ile Arg Asp Arg
            660                 665                 670

Lys Thr Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Val Pro
        675                 680                 685

Ala Asn Arg Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Glu His Leu
    690                 695                 700

Ser Phe Lys Glu Glu Ile Ala Lys Ala Thr Val Phe Ser Lys His Lys
705                 710                 715                 720

Ser Leu Val Asp Val Ile Gln Asp Leu Pro Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Trp Gln Ser Leu Lys Ile Val Glu Glu Leu Ile Ala Ile
            740                 745                 750

Ile Gly Tyr Lys Pro Lys Asn Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Lys Thr His Arg Thr Lys Pro Arg Leu Lys Ala Leu Glu Asn Gly
    770                 775                 780

Leu Lys Gln Ile Gly Ser Thr Leu Leu Lys Glu Gln Pro Thr Asp Asn
785                 790                 795                 800

Lys Ala Leu Gln Lys Glu Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Thr Gly Glu Pro Leu Glu Ile Glu Asn Leu His Gln
            820                 825                 830

Tyr Glu Val Asp His Ile Ile Pro Arg Ser Phe Ile Val Asp Asn Ser
        835                 840                 845

Ile Asp Asn Lys Val Leu Val Ala Ser Lys Gln Asn Gln Lys Lys Arg
    850                 855                 860
```

```
Asp Asp Val Pro Lys Lys Gln Ile Val Asn Glu Gln Arg Ile Phe Trp
865                 870                 875                 880

Asn Gln Leu Lys Glu Ala Lys Leu Ile Ser Pro Lys Lys Tyr Ala Tyr
                885                 890                 895

Leu Thr Lys Ile Glu Leu Thr Pro Glu Asp Lys Ala Arg Phe Ile Gln
            900                 905                 910

Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Asn Ile
        915                 920                 925

Leu His Gln Ser Phe Asn Gln Glu Glu Glu Gly Thr Asp Cys Asp Gly
    930                 935                 940

Val Gln Ile Ile Thr Leu Lys Ala Thr Leu Thr Ser Gln Phe Arg Gln
945                 950                 955                 960

Thr Phe Gly Leu Tyr Lys Val Arg Glu Ile Asn Pro His His His Ala
                965                 970                 975

His Asp Ala Tyr Leu Asn Gly Phe Ile Ala Asn Val Leu Leu Lys Arg
            980                 985                 990

Tyr Pro Lys Leu Ala Pro Glu Phe  Val Tyr Gly Lys Tyr  Val Lys Tyr
        995                 1000                1005

Ser Leu  Ala Arg Glu Asn Lys  Ala Thr Ala Lys Lys  Glu Phe Tyr
    1010                1015                1020

Ser Asn  Ile Leu Lys Phe Leu  Glu Ser Asp Glu Pro  Phe Cys Asp
    1025                1030                1035

Glu Asn  Gly Glu Ile Tyr Trp  Glu Lys Ser His His  Leu Pro Arg
    1040                1045                1050

Ile Lys  Lys Val Leu Ser Ser  His Gln Val Asn Val  Val Lys Lys
    1055                1060                1065
```

```
Val Glu  Gln Gln Lys Gly Gly  Phe Tyr Lys Glu Thr  Val Asn Ser
    1070                1075                1080

Lys Glu  Lys Pro Asp Lys Leu  Ile Glu Arg Lys Asn  Asn Trp Asp
    1085                1090                1095

Val Thr  Lys Tyr Gly Gly Phe  Gly Ser Pro Val Ile  Ala Tyr Ala
    1100                1105                1110

Ile Ala  Phe Val Tyr Ala Lys  Gly Lys Thr Gln Lys  Lys Thr Lys
    1115                1120                1125

Ala Ile  Glu Gly Ile Thr Ile  Met Glu Gln Ala Ala  Phe Glu Lys
    1130                1135                1140

Asp Pro  Thr Thr Phe Leu Lys  Asp Lys Gly Phe Pro  Gln Val Thr
    1145                1150                1155

Glu Phe  Ile Lys Leu Pro Lys  Tyr Thr Leu Phe Glu  Phe Asp Asn
    1160                1165                1170

Gly Arg  Arg Arg Phe Leu Ala  Ser Lys Glu Ser Gln  Lys Gly Asn
    1175                1180                1185

Pro Phe  Ile Leu Ser Asp Gln  Leu Val Thr Leu Leu  Tyr His Ala
    1190                1195                1200

Gln His  Tyr Asp Lys Ile Thr  Tyr Gln Glu Ser Phe  Asp Tyr Val
    1205                1210                1215

Asn Thr  His Leu Ser Asp Phe  Ser Ala Ile Leu Thr  Glu Val Leu
    1220                1225                1230

Ala Phe  Ala Glu Lys Tyr Thr  Leu Ala Asp Lys Asn  Ile Glu Arg
    1235                1240                1245

Ile Gln  Glu Leu Tyr Glu Glu  Asn Lys Tyr Gly Glu  Ile Ser Met
    1250                1255                1260
```

```
Ile Ala  Gln Ser Phe Leu Gln  Leu Leu Gln Phe Asn  Ala Ile Gly
    1265                1270                1275


Ala Pro  Ala Asp Phe Lys Phe  Phe Gly Val Thr Ile  Pro Arg Lys
    1280                1285                1290


Arg Tyr  Thr Ser Leu Thr Glu  Ile Trp Asp Ala Thr  Ile Ile Tyr
    1295                1300                1305


Gln Ser  Val Thr Gly Leu Tyr  Glu Thr Arg Ile Arg  Met Gly Asp
    1310                1315                1320


Leu Trp  Ala Gly Glu Gln
    1325


<210>  236
<211>  1329
<212>  PRT
<213>  Enterococcus faecium

<400>  236

Met Thr Lys Asp Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Leu Thr Asp Asp Tyr Gln Leu Met Lys Arg Lys Met
            20                  25                  30


Ser Val His Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Ala Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Phe Arg Arg Thr
    50                  55                  60


Lys Arg Thr Asn Arg Arg Arg Leu Ala Arg Arg Lys Tyr Arg Leu Ser
65                  70                  75                  80


Lys Leu Gln Asp Leu Phe Ala Glu Glu Leu Cys Lys Gln Asp Asp Cys
                85                  90                  95
```

```
Phe Phe Val Arg Leu Glu Glu Ser Phe Leu Val Pro Glu Glu Lys Gln
            100                 105                 110

Tyr Lys Pro Ala Ser Ile Phe Pro Thr Leu Glu Glu Glu Lys Glu Tyr
        115                 120                 125

Tyr Gln Lys Tyr Pro Thr Ile Tyr His Leu Arg Gln Lys Leu Val Asp
    130                 135                 140

Ser Thr Glu Lys Glu Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Leu Leu Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Asp Leu Asp Thr
                165                 170                 175

Glu Asn Thr Ser Ile Glu Glu Ser Phe Arg Val Phe Leu Glu Gln Tyr
            180                 185                 190

Ser Lys Gln Ser Asp Gln Pro Leu Ile Val His Gln Pro Val Leu Thr
        195                 200                 205

Ile Leu Thr Asp Lys Leu Ser Lys Thr Lys Lys Val Glu Glu Ile Leu
    210                 215                 220

Lys Tyr Tyr Pro Thr Glu Lys Ile Asn Ser Phe Phe Ala Gln Cys Leu
225                 230                 235                 240

Lys Leu Ile Val Gly Asn Gln Ala Asn Phe Lys Arg Ile Phe Asp Leu
                245                 250                 255

Glu Ala Glu Val Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu Glu Asp
            260                 265                 270

Leu Glu Ser Leu Leu Glu Lys Ile Gly Asp Glu Tyr Leu Asp Ile Phe
        275                 280                 285

Leu Gln Ala Lys Lys Val His Asp Ala Ile Leu Leu Ser Glu Ile Ile
    290                 295                 300
```

```
Ser Ser Thr Val Lys His Thr Lys Ala Lys Leu Ser Ser Gly Met Val
305                 310                 315                 320

Glu Arg Tyr Glu Arg His Lys Ala Asp Leu Ala Lys Phe Lys Gln Phe
                325                 330                 335

Val Lys Glu Asn Val Pro Gln Lys Ala Thr Val Phe Phe Lys Asp Thr
            340                 345                 350

Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Lys Gly Lys Thr Thr Gln Glu
        355                 360                 365

Glu Phe Tyr Lys Phe Val Lys Lys Glu Leu Ser Gly Val Val Gly Ser
    370                 375                 380

Glu Pro Phe Leu Glu Lys Ile Asp Gln Glu Thr Phe Leu Leu Lys Gln
385                 390                 395                 400

Arg Thr Tyr Thr Asn Gly Val Ile Pro His Gln Val His Leu Ile Glu
                405                 410                 415

Leu Lys Ala Ile Ile Asp Gln Gln Lys Gln His Tyr Pro Phe Leu Glu
            420                 425                 430

Glu Ala Gly Pro Lys Ile Ile Ala Leu Phe Lys Phe Arg Ile Pro Tyr
        435                 440                 445

Tyr Val Gly Pro Leu Ala Lys Glu Gln Glu Ala Ser Ser Phe Ala Trp
    450                 455                 460

Ile Glu Arg Lys Thr Ala Glu Lys Ile Asn Pro Trp Asn Phe Ser Glu
465                 470                 475                 480

Val Val Asp Ile Glu Lys Ser Ala Met Arg Phe Ile Gln Arg Met Thr
                485                 490                 495

Lys Gln Asp Thr Tyr Leu Pro Thr Glu Lys Val Leu Pro Lys Asn Ser
            500                 505                 510
```

```
Leu Leu Tyr Gln Lys Tyr Met Ile Phe Asn Glu Leu Thr Lys Val Ser
        515                 520                 525

Tyr Lys Asp Glu Arg Gly Val Lys Gln Tyr Phe Ser Gly Asp Glu Lys
    530                 535                 540

Gln Gln Ile Phe Lys Gln Leu Phe Gln Lys Glu Arg Gly Lys Ile Thr
545                 550                 555                 560

Val Lys Lys Leu Gln Asn Phe Leu Tyr Thr His Tyr His Ile Glu Asn
                565                 570                 575

Ala Gln Ile Phe Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Ser Thr
            580                 585                 590

Tyr His Asp Phe Met Lys Leu Ala Lys Thr Asn Glu Trp Leu Glu Gln
        595                 600                 605

Pro Glu Met Glu Pro Ile Phe Glu Asp Ile Val Lys Ile Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Gln Met Ile Lys His Gln Leu Ser Lys Tyr Gln Glu
625                 630                 635                 640

Val Phe Gly Glu Lys Leu Leu Lys Glu Phe Ala Arg Lys His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Phe Ser Ala Lys Leu Ile His Gly Ile Arg Asp Arg
            660                 665                 670

Lys Thr Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Val Pro
        675                 680                 685

Ala Asn Arg Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Glu His Leu
    690                 695                 700

Ser Phe Lys Glu Glu Ile Ala Lys Ala Thr Val Phe Ser Lys His Lys
705                 710                 715                 720
```

```
Ser Leu Val Asp Val Ile Gln Asp Leu Pro Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Trp Gln Ser Leu Lys Ile Val Glu Glu Leu Ile Ala Ile
            740                 745                 750

Ile Gly Tyr Lys Pro Lys Asn Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Lys Thr His Arg Thr Ser Pro Arg Leu Lys Ala Leu Glu Asn Gly
    770                 775                 780

Leu Lys Gln Ile Gly Ser Thr Leu Leu Lys Glu Gln Pro Thr Asp Asn
785                 790                 795                 800

Lys Ala Leu Gln Lys Glu Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815

Arg Asp Met Tyr Thr Gly Glu Pro Leu Glu Ile Glu Asn Leu His Gln
            820                 825                 830

Tyr Glu Val Asp His Ile Ile Pro Arg Ser Phe Ile Val Asp Asn Ser
        835                 840                 845

Ile Asp Asn Lys Val Leu Val Ala Ser Lys Gln Asn Gln Lys Lys Arg
    850                 855                 860

Asp Asp Val Pro Lys Lys Gln Ile Val Asn Glu Gln Arg Ile Phe Trp
865                 870                 875                 880

Asn Gln Leu Lys Glu Ala Lys Leu Ile Ser Pro Lys Lys Tyr Ala Tyr
                885                 890                 895

Leu Thr Lys Ile Glu Leu Thr Pro Glu Asp Lys Ala Arg Phe Ile Gln
            900                 905                 910

Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Asn Ile
        915                 920                 925
```

```
Leu His Gln Ser Phe Asn Gln Glu Glu Glu Gly Thr Asp Cys Asp Gly
    930                 935                 940


Val Gln Ile Ile Thr Leu Lys Ala Thr Leu Thr Ser Gln Phe Arg Gln
945                 950                 955                 960


Thr Phe Gly Leu Tyr Lys Val Arg Glu Ile Asn Pro His His His Ala
                965                 970                 975


His Asp Ala Tyr Leu Asn Gly Phe Ile Ala Asn Val Leu Leu Lys Arg
            980                 985                 990


Tyr Pro Lys Leu Ala Pro Glu Phe  Val Tyr Gly Lys Tyr  Val Lys Tyr
        995                 1000                1005


Ser Leu  Ala Arg Glu Asn Lys  Ala Thr Ala Lys Lys  Glu Phe Tyr
    1010                1015                1020


Ser Asn  Ile Leu Lys Phe Leu  Glu Ser Asp Glu Pro  Phe Cys Asp
    1025                1030                1035


Glu Asn  Gly Glu Ile Tyr Trp  Glu Lys Ser His His  Leu Pro Arg
    1040                1045                1050


Ile Lys  Lys Val Leu Ser Ser  His Gln Val Asn Val  Val Lys Lys
    1055                1060                1065


Val Glu  Gln Gln Lys Gly Gly  Phe Tyr Lys Glu Thr  Val Asn Ser
    1070                1075                1080


Lys Glu  Lys Pro Asp Lys Leu  Ile Glu Arg Lys Asn  Asn Trp Asp
    1085                1090                1095


Val Thr  Lys Tyr Gly Gly Phe  Gly Ser Pro Val Ile  Ala Tyr Ala
    1100                1105                1110


Ile Ala  Phe Val Tyr Ala Lys  Gly Lys Thr Gln Lys  Lys Thr Arg
    1115                1120                1125
```

```
Ala Ile  Glu Gly Ile Thr Ile  Met Glu Gln Ala Ala  Phe Glu Lys
    1130                1135                1140


Asp Pro  Thr Thr Phe Leu Lys  Glu Lys Gly Phe Pro  Gln Val Thr
    1145                1150                1155


Glu Phe  Ile Lys Leu Pro Lys  Tyr Thr Leu Phe Glu  Phe Asp Asn
    1160                1165                1170


Gly Arg  Arg Arg Phe Leu Ala  Ser Lys Glu Ser Gln  Lys Gly Asn
    1175                1180                1185


Pro Phe  Ile Leu Ser Asp Gln  Leu Val Thr Leu Leu  Tyr His Ala
    1190                1195                1200


Gln His  Tyr Asp Lys Ile Thr  Tyr Gln Glu Ser Phe  Asp Tyr Val
    1205                1210                1215


Asn Thr  His Leu Ser Asp Phe  Ser Ala Ile Leu Thr  Glu Val Leu
    1220                1225                1230


Ala Phe  Ala Glu Lys Tyr Thr  Leu Ala Asp Lys Asn  Ile Glu Arg
    1235                1240                1245


Ile Gln  Glu Leu Tyr Glu Glu  Asn Lys Tyr Gly Glu  Thr Ser Met
    1250                1255                1260


Ile Ala  Gln Ser Phe Leu Gln  Leu Leu Gln Phe Asn  Ala Ile Gly
    1265                1270                1275


Ala Pro  Ala Asp Phe Lys Phe  Phe Gly Val Thr Ile  Pro Arg Lys
    1280                1285                1290


Arg Tyr  Thr Ser Leu Thr Glu  Ile Trp Asp Ala Thr  Ile Ile Tyr
    1295                1300                1305


Gln Ser  Val Thr Gly Leu Tyr  Glu Thr Arg Ile Arg  Met Gly Asp
    1310                1315                1320
```

Leu Trp Ala Gly Glu Gln
    1325

<210> 237
<211> 1329
<212> PRT
<213> Enterococcus faecium

<400> 237

Met Thr Lys Asp Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Leu Thr Asp Asp Tyr Gln Leu Met Lys Arg Lys Met
            20   25   30

Ser Val His Gly Asn Thr Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35   40   45

Gly Ala Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Phe Arg Arg Thr
    50   55   60

Lys Arg Thr Asn Arg Arg Arg Leu Ala Arg Arg Lys Tyr Arg Leu Ser
65   70   75   80

Lys Leu Gln Asp Leu Phe Ala Glu Glu Leu Cys Lys Gln Asp Asp Cys
                85   90   95

Phe Phe Val Arg Leu Glu Glu Ser Phe Leu Val Pro Glu Glu Lys Gln
            100   105   110

Tyr Lys Pro Ala Ser Ile Phe Pro Thr Leu Glu Glu Glu Lys Glu Tyr
        115   120   125

Tyr Gln Lys Tyr Pro Thr Ile Tyr His Leu Arg Gln Lys Leu Val Asp
    130   135   140

Ser Thr Glu Lys Glu Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145   150   155   160

```
Leu Leu Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Asp Leu Asp Thr
                165                 170                 175

Glu Asn Thr Ser Ile Glu Glu Ser Phe Arg Val Phe Leu Glu Gln Tyr
            180                 185                 190

Gly Lys Gln Ser Asp Gln Pro Leu Ile Val His Gln Pro Val Leu Thr
        195                 200                 205

Ile Leu Thr Asp Lys Leu Ser Lys Thr Lys Lys Val Glu Glu Ile Leu
    210                 215                 220

Lys Tyr Tyr Pro Thr Glu Lys Ile Asn Ser Phe Phe Ala Gln Cys Leu
225                 230                 235                 240

Lys Leu Ile Val Gly Asn Gln Ala Asn Phe Lys Arg Ile Phe Asp Leu
                245                 250                 255

Glu Ala Glu Val Lys Leu Gln Phe Ser Lys Glu Thr Tyr Glu Glu Asp
            260                 265                 270

Leu Glu Ser Leu Leu Glu Lys Ile Gly Asp Glu Tyr Leu Asp Ile Phe
        275                 280                 285

Leu Gln Ala Lys Lys Val His Asp Ala Ile Leu Leu Ser Glu Ile Ile
    290                 295                 300

Ser Ser Thr Val Lys His Thr Gln Ala Lys Leu Ser Ser Gly Met Val
305                 310                 315                 320

Glu Arg Tyr Glu Arg His Lys Ala Asp Leu Ala Lys Phe Lys Gln Phe
                325                 330                 335

Val Lys Glu Asn Val Pro Gln Lys Ala Thr Val Phe Phe Lys Asp Thr
            340                 345                 350

Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Lys Gly Lys Thr Thr Gln Glu
        355                 360                 365
```

```
Glu Phe Tyr Lys Phe Val Lys Lys Glu Leu Ser Gly Val Val Gly Ser
    370                 375                 380

Glu Pro Phe Leu Glu Lys Ile Asp Gln Glu Thr Phe Leu Leu Lys Gln
385                 390                 395                 400

Arg Thr Tyr Thr Asn Gly Val Ile Pro His Gln Val His Leu Ile Glu
                405                 410                 415

Leu Lys Ala Ile Ile Asp Gln Gln Lys Gln His Tyr Pro Phe Leu Glu
            420                 425                 430

Glu Ala Gly Pro Lys Ile Ile Ala Leu Phe Lys Phe Arg Ile Pro Tyr
        435                 440                 445

Tyr Val Gly Pro Leu Ala Lys Glu Gln Glu Ala Ser Ser Phe Ala Trp
    450                 455                 460

Ile Glu Arg Lys Thr Ala Glu Lys Ile Asn Pro Trp Asn Phe Ser Glu
465                 470                 475                 480

Val Val Asp Ile Glu Lys Ser Ala Met Arg Phe Ile Gln Arg Met Thr
                485                 490                 495

Lys Gln Asp Thr Tyr Leu Pro Thr Glu Lys Val Leu Pro Lys Asn Ser
            500                 505                 510

Leu Leu Tyr Gln Lys Tyr Met Ile Phe Asn Glu Leu Thr Lys Val Ser
        515                 520                 525

Tyr Lys Asp Glu Arg Gly Val Lys Gln Tyr Phe Ser Gly Asp Glu Lys
    530                 535                 540

Gln Gln Ile Phe Lys Gln Leu Phe Gln Lys Glu Arg Gly Lys Ile Thr
545                 550                 555                 560

Val Lys Lys Leu Gln Asn Phe Leu Tyr Thr His Tyr His Ile Glu Asn
                565                 570                 575
```

```
Ala Gln Ile Phe Gly Ile Glu Lys Ala Phe Asn Ala Ser Tyr Ser Thr
            580                 585                 590

Tyr His Asp Phe Met Lys Leu Ala Lys Thr Asn Glu Trp Leu Glu Gln
        595                 600                 605

Pro Glu Met Glu Pro Ile Phe Glu Asp Ile Val Lys Ile Leu Thr Ile
    610                 615                 620

Phe Glu Asp Arg Gln Met Ile Lys His Gln Leu Ser Lys Tyr Gln Glu
625                 630                 635                 640

Val Phe Gly Glu Lys Leu Leu Lys Glu Phe Ala Arg Lys His Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Phe Ser Ala Lys Leu Ile His Gly Ile Arg Asp Arg
            660                 665                 670

Lys Thr Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Val Pro
        675                 680                 685

Ala Asn Arg Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Glu His Leu
    690                 695                 700

Ser Phe Lys Glu Glu Ile Ala Lys Ala Thr Val Phe Ser Lys His Lys
705                 710                 715                 720

Ser Leu Val Asp Val Ile Gln Asp Leu Pro Gly Ser Pro Ala Ile Lys
                725                 730                 735

Lys Gly Ile Trp Gln Ser Leu Lys Ile Val Glu Glu Leu Ile Ala Ile
            740                 745                 750

Ile Gly Tyr Lys Pro Lys Asn Ile Val Ile Glu Met Ala Arg Glu Asn
        755                 760                 765

Gln Lys Thr His Arg Thr Lys Pro Arg Leu Lys Ala Leu Glu Asn Gly
    770                 775                 780
```

```
Leu Lys Gln Ile Gly Ser Thr Leu Leu Lys Glu Gln Pro Thr Asp Asn
785                 790                 795                 800


Lys Ala Leu Gln Lys Glu Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly
                805                 810                 815


Arg Asp Met Tyr Thr Gly Glu Pro Leu Glu Ile Glu Asn Leu His Gln
            820                 825                 830


Tyr Glu Val Asp His Ile Ile Pro Arg Ser Phe Ile Val Asp Asn Ser
        835                 840                 845


Ile Asp Asn Lys Val Leu Val Ala Ser Lys Gln Asn Gln Lys Lys Arg
    850                 855                 860


Asp Asp Val Pro Asn Lys Gln Ile Val Asn Glu Gln Arg Ile Phe Trp
865                 870                 875                 880


Asn Gln Leu Lys Glu Ala Lys Leu Ile Ser Pro Lys Lys Tyr Ala Tyr
                885                 890                 895


Leu Thr Lys Ile Glu Leu Thr Pro Glu Asp Lys Ala Arg Phe Ile Gln
            900                 905                 910


Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Asn Ile
        915                 920                 925


Leu His Gln Ser Phe Asn Gln Glu Glu Glu Gly Thr Asp Cys Asp Gly
    930                 935                 940


Val Gln Ile Ile Thr Leu Lys Ala Thr Leu Thr Ser Gln Phe Arg Gln
945                 950                 955                 960


Thr Phe Gly Leu Tyr Lys Val Arg Glu Ile Asn Pro His His His Ala
                965                 970                 975


His Asp Ala Tyr Leu Asn Gly Phe Ile Ala Asn Val Leu Leu Lys Arg
            980                 985                 990
```

```
Tyr Pro Lys Leu Ala Pro Glu Phe  Val Tyr Gly Lys Tyr  Val Lys Tyr
        995                 1000                1005


Ser Leu  Ala Arg Glu Asn Lys  Ala Thr Ala Lys Lys  Glu Phe Tyr
    1010                1015                1020


Ser Asn  Ile Leu Lys Phe Leu  Glu Ser Asp Glu Pro  Phe Cys Asp
    1025                1030                1035


Glu Asn  Gly Glu Ile Tyr Trp  Glu Lys Ser His His  Leu Pro Arg
    1040                1045                1050


Ile Lys  Lys Val Leu Ser Ser  His Gln Val Asn Val  Val Lys Lys
    1055                1060                1065


Val Glu  Gln Gln Lys Gly Gly  Phe Tyr Lys Glu Thr  Val Asn Ser
    1070                1075                1080


Lys Glu  Lys Pro Asp Lys Leu  Ile Glu Arg Lys Asn  Asn Trp Asp
    1085                1090                1095


Val Thr  Lys Tyr Gly Gly Phe  Gly Ser Pro Val Ile  Ala Tyr Ala
    1100                1105                1110


Ile Ala  Phe Val Tyr Ala Lys  Gly Lys Thr Gln Lys  Lys Thr Arg
    1115                1120                1125


Ala Ile  Glu Gly Ile Thr Ile  Met Glu Gln Ala Ala  Phe Glu Lys
    1130                1135                1140


Asp Pro  Thr Thr Phe Leu Lys  Asp Lys Gly Phe Pro  His Val Thr
    1145                1150                1155


Glu Phe  Ile Lys Leu Pro Lys  Tyr Thr Leu Phe Glu  Phe Asp Asn
    1160                1165                1170


Gly Arg  Arg Arg Phe Leu Ala  Ser Lys Glu Ser Gln  Lys Gly Asn
    1175                1180                1185
```

```
Pro Phe  Ile Leu Ser Asp Gln  Leu Val Thr Leu Leu  Tyr His Ala
    1190                1195                1200


Gln His  Tyr Asp Lys Ile Thr  Tyr Gln Glu Ser Phe  Asp Tyr Val
    1205                1210                1215


Asn Thr  His Leu Ser Asp Phe  Ser Ala Ile Leu Thr  Glu Val Leu
    1220                1225                1230


Ala Phe  Ala Glu Lys Tyr Thr  Leu Ala Asp Lys Asn  Ile Glu Arg
    1235                1240                1245


Ile Gln  Glu Leu Tyr Glu Glu  Asn Lys Tyr Gly Glu  Ile Ser Met
    1250                1255                1260


Ile Ala  Gln Ser Phe Leu Gln  Leu Leu Gln Phe Asn  Ala Ile Gly
    1265                1270                1275


Ala Pro  Ala Asp Phe Lys Phe  Phe Gly Val Thr Ile  Pro Arg Lys
    1280                1285                1290


Arg Tyr  Thr Ser Leu Thr Glu  Ile Trp Asp Ala Thr  Ile Ile Tyr
    1295                1300                1305


Gln Ser  Val Thr Gly Leu Tyr  Glu Thr Arg Ile Arg  Met Gly Asp
    1310                1315                1320


Leu Trp  Ala Gly Glu Gln
    1325


<210>  238
<211>  1324
<212>  PRT
<213>  Enterococcus italicus

<400>  238

Met Lys Asn Asp Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Tyr Ser Val Val Thr Asp Asp Tyr Lys Val Ile Ser Lys Lys Met
```

```
            20                  25                  30

Asn Val Phe Gly Asn Thr Glu Lys Lys Ser Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Glu Ser Gly Gln Thr Ala Gln Glu Ala Arg Met
    50                  55                  60

Lys Arg Thr Ser Arg Arg Arg Ile Ala Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Gln Pro Glu Met Asn His Leu Asp Asn Asn
                85                  90                  95

Phe Phe Tyr Arg Leu Asn Glu Ser Phe Leu Val Ala Asp Asp Ala Lys
            100                 105                 110

Tyr Asp Lys His Pro Ile Phe Gly Thr Leu Asp Glu Glu Ile His Phe
        115                 120                 125

His Glu Gln Phe Pro Thr Ile Tyr His Leu Arg Lys Tyr Leu Ala Asp
    130                 135                 140

Gly Asp Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Ile Ala His
145                 150                 155                 160

Ile Ile Lys Phe Arg Gly Asn Phe Leu Ile Glu Gly Glu Leu Asn Thr
                165                 170                 175

Glu Asn Asn Ser Val Ile Glu Leu Ser Lys Val Phe Val Gln Leu Tyr
            180                 185                 190

Asn Gln Thr Leu Ser Glu Leu Glu Phe Ile Asp Glu Ser Ile Asp Phe
        195                 200                 205

Ser Glu Val Leu Thr Gln Gln Leu Ser Lys Ser Glu Arg Ala Asp Asn
    210                 215                 220

Val Leu Lys Leu Phe Pro Asp Glu Lys Gly Thr Gly Ile Phe Ala Gln
```

225 230 235 240

Phe Ile Lys Leu Ile Val Gly Asn Gln Gly Asn Phe Lys Lys Val Phe
245 250 255

Gln Leu Glu Glu Asp Gln Lys Leu Gln Leu Ser Thr Asp Asp Tyr Glu
260 265 270

Glu Asn Ile Glu Asn Leu Leu Ala Ile Ile Gly Asp Glu Tyr Gly Asp
275 280 285

Ile Phe Val Ala Ala Gln Asn Leu Tyr Gln Ala Ile Leu Leu Ala Gly
290 295 300

Ile Leu Thr Ser Thr Glu Lys Thr Arg Ala Lys Leu Ser Ala Ser Met
305 310 315 320

Ile Gln Arg Tyr Glu Glu His Ala Lys Asp Leu Lys Leu Leu Lys Arg
325 330 335

Phe Val Lys Glu His Ile Pro Asp Lys Tyr Ala Glu Ile Phe Asn Asp
340 345 350

Ala Thr Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Lys Glu
355 360 365

Glu Glu Phe Tyr Lys Tyr Leu Lys Thr Thr Leu Val Gln Lys Ser Gly
370 375 380

Tyr Gln Tyr Phe Ile Glu Lys Ile Glu Gln Glu Asn Phe Leu Arg Lys
385 390 395 400

Gln Arg Ile Tyr Asp Asn Gly Val Ile Pro His Gln Val His Ala Glu
405 410 415

Glu Leu Arg Ala Ile Leu Arg Lys Gln Glu Lys Tyr Tyr Ser Phe Leu
420 425 430

Lys Glu Asn His Glu Lys Ile Glu Gln Ile Phe Lys Val Arg Ile Pro

```
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Lys His Asn Glu Gln Ser Arg Phe Ala
    450                 455                 460

Trp Asn Ile Arg Lys Ser Asp Glu Pro Ile Arg Pro Trp Asn Met Asn
465                 470                 475                 480

Asp Val Val Asp Glu Asn Ala Ser Ala Val Ala Phe Ile Glu Arg Met
                485                 490                 495

Thr Ile Lys Asp Ile Tyr Leu Asn Glu Asn Val Leu Pro Arg His Ser
            500                 505                 510

Leu Ile Tyr Glu Lys Phe Thr Val Phe Asn Glu Leu Thr Lys Val Leu
        515                 520                 525

Tyr Ala Asp Asp Arg Gly Val Phe Gln Arg Phe Ser Ala Glu Glu Lys
    530                 535                 540

Glu Asp Ile Phe Glu Lys Leu Phe Lys Ser Glu Arg Lys Val Thr Lys
545                 550                 555                 560

Lys Lys Leu Glu Asn Tyr Leu Arg Ile Glu Leu Ser Ile Ser Ser Pro
                565                 570                 575

Ser Val Lys Gly Ile Glu Glu Gln Phe Asn Ala Asn Phe Gly Thr Tyr
            580                 585                 590

Leu Asp Leu Lys Lys Phe Asp Glu Leu His Pro Tyr Leu Asp Asp Glu
        595                 600                 605

Lys Tyr Gln Asp Thr Leu Glu Glu Val Ile Lys Val Leu Thr Val Phe
    610                 615                 620

Glu Asp Arg Ser Met Ile Gln Asn Gln Leu Glu Gln Leu Pro Leu Asn
625                 630                 635                 640

Leu Ser Thr Lys Thr Ile Lys Ala Leu Ser Arg Arg Lys Tyr Thr Gly
```

645 650 655

Trp Gly Arg Leu Ser Ala Arg Leu Ile Asp Gly Ile His Asp Lys Asn
660 665 670

Ser Gly Lys Thr Ile Leu Asp Tyr Leu Ile Asp Glu Ser Asp Ser Tyr
675 680 685

Ile Val Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp His Leu Ser
690 695 700

Phe Lys Lys Ile Ile Glu Asp Ser Gln Pro Tyr Lys Glu Gln Gln Ser
705 710 715 720

Ala Glu Glu Ile Val Ser Glu Leu Ser Gly Ser Pro Ala Ile Lys Lys
725 730 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Ala Ile Met
740 745 750

Gly Tyr Lys Pro Lys Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
755 760 765

Thr Thr Gly Arg Gly Lys Gln Asn Ser Lys Pro Arg Leu Lys Gly Ile
770 775 780

Glu Asn Gly Leu Lys Glu Phe Ser Asp Ser Val Leu Lys Gly Ser Ser
785 790 795 800

Ile Asp Asn Lys Gln Leu Gln Asn Asp Arg Leu Tyr Leu Tyr Tyr Leu
805 810 815

Gln Asn Gly Lys Asp Met Tyr Thr Gly His Glu Leu Asp Ile Asp His
820 825 830

Leu Ser Thr Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Leu Thr
835 840 845

Asp Asn Ser Ile Asp Asn Arg Val Leu Thr Thr Ser Lys Ser Asn Arg

```
    850                 855                 860

Gly Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Arg Lys Met Asp
865                 870                 875                 880

Arg Phe Trp Arg Lys Leu Leu Asn Ala Lys Leu Ile Ser Glu Arg Lys
                885                 890                 895

Tyr Thr Asn Leu Thr Lys Lys Glu Leu Thr Glu Ser Asp Lys Ala Gly
            900                 905                 910

Phe Leu Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Thr Ile Leu Asp Ser Lys Phe Asn Glu Asp Ser Asn Asn Arg Asp
    930                 935                 940

Val Gln Ile Ile Thr Leu Lys Ser Ala Leu Val Ser Glu Phe Arg Lys
945                 950                 955                 960

Thr Phe Asn Leu Tyr Lys Val Arg Glu Ile Asn Asp Leu His His Ala
                965                 970                 975

His Asp Ala Tyr Leu Asn Ala Val Val Ala Leu Ser Leu Leu Arg Val
            980                 985                 990

Tyr Pro Gln Leu Lys Pro Glu Phe  Val Tyr Gly Glu Tyr  Gly Lys Asn
        995                 1000                1005

Ser Ile  His Asp Gln Asn Lys  Ala Thr Ile Lys Lys  Gln Phe Tyr
    1010                1015                1020

Ser Asn  Ile Thr Arg Tyr Phe  Ala Ser Lys Asp Ile  Ile Asn Asp
    1025                1030                1035

Asp Gly  Glu Ile Leu Trp Asn  Lys Gln Glu Thr Ile  Ala Gln Val
    1040                1045                1050

Ile Lys  Thr Leu Gly Met His  Gln Val Asn Val Val  Lys Lys Val
```

1055 1060 1065

Glu Ile Gln Lys Gly Gly Phe Ser Lys Glu Ser Ile Gln Pro Lys
1070 1075 1080

Gly Glu Ser Gln Lys Leu Ile Arg Arg Lys Gln Gln Trp Asn Thr
1085 1090 1095

Lys Lys Tyr Gly Gly Phe Asp Ser Pro Val Val Ala Tyr Ala Ile
1100 1105 1110

Leu Leu Ser Phe Asp Lys Gly Lys Arg Lys Ala Arg Ser Phe Lys
1115 1120 1125

Ile Val Gly Ile Thr Ile Gln Asp Arg Glu Ser Phe Glu Gly Asn
1130 1135 1140

Pro Ile Leu Tyr Leu Ser Lys Lys Asp Tyr His Asn Pro Lys Val
1145 1150 1155

Glu Ala Ile Leu Pro Lys Tyr Ser Leu Phe Glu Phe Glu Asn Gly
1160 1165 1170

Arg Arg Arg Met Val Ala Ser Ser Glu Thr Gln Lys Gly Asn Gln
1175 1180 1185

Leu Ile Ile Pro Gly His Leu Met Glu Leu Leu Tyr His Ser Lys
1190 1195 1200

Lys Ile Ile Asn Gly Lys Asn Ser Asp Ser Val Ser Tyr Ile Gln
1205 1210 1215

Asn Asn Lys Glu Lys Phe Arg Glu Ile Phe Glu Tyr Ile Val Asp
1220 1225 1230

Phe Ser Ser Lys Tyr Ile Ser Ala Asp Ala Asn Leu Asn Lys Ile
1235 1240 1245

Glu Lys Ile Phe Glu Asn Asn Phe His Lys Ala Ser Glu Gln Glu

1250 1255 1260

Ile Ala Lys Ser Phe Ile Asn Leu Leu Thr Phe Thr Ala Met Gly
1265 1270 1275

Ala Pro Ala Asp Phe Glu Phe Phe Gly Glu Lys Ile Pro Arg Lys
1280 1285 1290

Arg Tyr Val Ser Ile Ser Glu Ile Ile Asp Ala Val Phe Ile His
1295 1300 1305

Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Val Arg Leu Thr Glu
1310 1315 1320

Val

<210> 239
<211> 1323
<212> PRT
<213> Enterococcus mundtii

<400> 239

Met Glu Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Leu Thr Asp Asp Tyr Arg Leu Val Ala Arg Lys Met
20 25 30

Ser Ile Gln Gly Asp Ser Asn Arg Lys Lys Ile Lys Lys Asn Phe Trp
35 40 45

Gly Ala Arg Leu Phe Glu Glu Gly Lys Thr Ala Gln Phe Arg Arg Ile
50 55 60

Lys Arg Thr Asn Arg Arg Arg Arg Ile Ala Arg Arg Arg Gln Arg Val Leu
65 70 75 80

Ala Leu Gln Asp Ile Phe Ala Glu Glu Ile His Lys Lys Asp Pro Asn
85 90 95

```
Phe Phe Ala Arg Leu Glu Glu Gly Asp Arg Val Glu Ala Asp Lys Arg
            100                 105                 110

Phe Ala Lys Phe Pro Val Phe Ala Thr Leu Ser Glu Glu Lys Asn Tyr
        115                 120                 125

His Arg Gln Tyr Pro Thr Ile Tyr His Leu Arg His Asp Leu Ala Asn
    130                 135                 140

Ser Lys Glu Gln Ala Asp Ile Arg Leu Val Tyr Leu Ala Ile Ala His
145                 150                 155                 160

Cys Leu Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Glu Leu Asp Thr
                165                 170                 175

Glu Asn Thr Ser Val Thr Glu Asn Tyr Gln Gln Phe Leu Gln Ala Tyr
            180                 185                 190

Gln Gln Phe Phe Pro Glu Pro Ile Gly Asp Leu Asp Asp Ala Val Pro
        195                 200                 205

Ile Leu Thr Glu Arg Leu Ser Lys Ala Lys Arg Val Glu Lys Val Leu
    210                 215                 220

Ala Tyr Tyr Pro Ser Glu Lys Ser Thr Gly Asn Phe Ala Gln Phe Leu
225                 230                 235                 240

Lys Leu Met Val Gly Asn Gln Ala Asn Phe Lys Lys Thr Phe Asp Leu
                245                 250                 255

Glu Glu Glu Met Lys Leu Asn Phe Thr Arg Asp Cys Tyr Glu Glu Asp
            260                 265                 270

Leu Asn Glu Leu Leu Glu Lys Thr Ser Asp Asp Tyr Ala Glu Leu Phe
        275                 280                 285

Leu Lys Ala Lys Gly Val Tyr Asp Ala Ile Leu Leu Ser Gln Ile Leu
    290                 295                 300
```

```
Ser Lys Ser Asp Asp Glu Thr Lys Ala Lys Leu Ser Ala Asn Met Lys
305                 310                 315                 320

Leu Arg Phe Glu Glu His Gln Arg Asp Leu Lys Gln Leu Lys Glu Leu
                325                 330                 335

Val Arg Arg Asp Leu Pro Lys Lys Tyr Asp Asp Phe Phe Lys Asn Arg
            340                 345                 350

Ser Lys Asn Gly Tyr Ala Gly Tyr Val Lys Gly Lys Ala Thr Gln Glu
        355                 360                 365

Asp Phe Tyr Lys Phe Leu Arg Thr Glu Leu Ala Gly Leu Glu Glu Ser
    370                 375                 380

Gln Ser Ile Met Glu Lys Ile Asp Leu Glu Ile Tyr Leu Leu Lys Gln
385                 390                 395                 400

Arg Thr Phe Ala Asn Gly Val Ile Pro His Gln Ile His Leu Val Glu
                405                 410                 415

Met Arg Glu Ile Met Asp Arg Gln Lys Arg Phe Tyr Pro Phe Leu Lys
            420                 425                 430

Gly Ala Gln Gly Lys Ile Glu Lys Leu Leu Thr Phe Arg Ile Pro Tyr
        435                 440                 445

Tyr Val Gly Pro Leu Ala Gln Glu Gly Gln Ser Pro Phe Ala Trp Ile
    450                 455                 460

Lys Arg Lys Ser Pro Ser Gln Ile Thr Pro Trp Asn Phe Ala Glu Val
465                 470                 475                 480

Val Asp Lys Glu Asn Ser Ala Ile Glu Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Gln Asp Thr Tyr Leu Pro Lys Glu Lys Val Leu Pro Lys Gln Ser Leu
            500                 505                 510
```

```
Ile Tyr Gln Arg Phe Met Ile Phe Asn Glu Leu Thr Lys Val Ser Tyr
        515                 520                 525

Thr Asp Glu Arg Gly Lys Ser His Tyr Phe Ser Ser Glu Gln Lys Arg
    530                 535                 540

Lys Ile Phe Asn Glu Leu Phe Lys Gln His Pro Arg Val Thr Glu Lys
545                 550                 555                 560

Gln Leu Arg Lys Phe Leu Glu Leu Asn Glu Gln Ile Asp Ser Thr Glu
                565                 570                 575

Ile Lys Gly Ile Glu Thr Ser Phe Asn Ala Ser Tyr Ser Thr Tyr His
            580                 585                 590

Asp Leu Leu Lys Leu Ser Thr Leu Leu Asp Asp Pro Asp Met Thr Thr
        595                 600                 605

Met Phe Glu Glu Ile Ile Lys Ile Leu Thr Ile Phe Glu Asp Arg Glu
    610                 615                 620

Met Ile Arg Glu Gln Leu Lys Pro Tyr Glu Thr Val Leu Gly Leu Pro
625                 630                 635                 640

Ala Ile Lys Lys Leu Ala Lys Lys His Tyr Thr Gly Trp Gly Arg Leu
                645                 650                 655

Ser Glu Lys Met Ile Gln Gly Met Arg Glu Lys Gln Ser Arg Lys Thr
            660                 665                 670

Ile Leu Asp Tyr Leu Ile Asp Asp Asp Phe Pro Cys Asn Arg Asn Arg
        675                 680                 685

Asn Phe Met Gln Leu Ile Asn Asp Asp His Leu Ser Phe Lys Glu Thr
    690                 695                 700

Ile Ala Asn Glu Leu Ile Met Ser Asp Ser Asn Val Leu Leu Asp Gln
705                 710                 715                 720
```

```
Val Lys Ala Ile Pro Gly Ser Pro Ala Val Lys Lys Gly Ile Trp Gln
                725                 730                 735

Ser Ile Lys Ile Val Glu Glu Ile Ile Gly Ile Ile Gly Lys Ala Pro
            740                 745                 750

Lys Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Arg Thr Ser Arg
        755                 760                 765

Ser Arg Pro Arg Leu Lys Ala Leu Glu Glu Ala Leu Lys Asn Ile Asp
    770                 775                 780

Ser Pro Leu Leu Lys Asp Tyr Pro Thr Asp Asn Gln Ala Leu Gln Lys
785                 790                 795                 800

Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr
                805                 810                 815

Gly Glu Pro Leu Glu Ile His Arg Leu Ser Glu Tyr Asp Ile Asp His
            820                 825                 830

Ile Ile Pro Arg Ser Phe Ile Val Asp Asn Ser Leu Asp Asn Lys Val
        835                 840                 845

Leu Val Ser Ser Lys Val Asn Arg Gly Lys Leu Asp Asn Ala Pro Asp
    850                 855                 860

Pro Leu Val Val Lys Arg Met Arg Ser His Trp Glu Lys Leu His Gln
865                 870                 875                 880

Ala Lys Leu Ile Ser Asp Lys Lys Leu Ala Asn Leu Thr Lys Gln Asn
                885                 890                 895

Leu Thr Glu Ala Asp Lys Ala Arg Phe Ile Gln Arg Gln Leu Val Glu
            900                 905                 910

Thr Arg Gln Ile Thr Lys His Val Ala Asn Leu Leu His Gln His Phe
        915                 920                 925
```

```
Asn Leu Pro Glu Glu Val Ser Ala Thr Glu Lys Thr Ser Ile Ile Thr
    930                 935                 940

Leu Lys Ser Thr Leu Thr Ser Gln Phe Arg Gln Met Phe Asp Ile Tyr
945                 950                 955                 960

Lys Val Arg Glu Ile Asn His His His His Ala His Asp Ala Tyr Leu
                965                 970                 975

Asn Gly Val Val Ala Met Thr Leu Leu Lys Lys Tyr Pro Lys Leu Ala
            980                 985                 990

Pro Glu Phe Val Tyr Gly Ser Tyr  Ile Lys Gly Asp Ile  Asn Gln Ile
        995                 1000                1005

Asn Lys  Ala Thr Ala Lys Lys  Glu Phe Tyr Ser Asn  Ile Met Lys
    1010                1015                1020

Phe Phe  Glu Ser Glu Glu Ile  Ile Cys Asp Glu Gln  Gly Glu Val
    1025                1030                1035

Ile Trp  Asn Lys Lys Arg Asp  Leu Ser Thr Ile Lys  Lys Thr Ile
    1040                1045                1050

Gly Ala  His Gln Val Asn Ile  Val Lys Lys Val Glu  Lys Gln Lys
    1055                1060                1065

Gly Gly  Phe Tyr Lys Glu Thr  Ile Asn Ser Lys Ala  Asn Pro Glu
    1070                1075                1080

Lys Leu  Ile Pro Arg Lys Ala  Ser Leu Asp Pro Leu  Lys Tyr Gly
    1085                1090                1095

Gly Tyr  Gly Ser Pro Leu Val  Ala Tyr Thr Val Ile  Phe Ile Phe
    1100                1105                1110

Glu Lys  Gly Lys Gln Lys Lys  Val Thr Lys Gly Ile  Glu Gly Ile
    1115                1120                1125
```

```
Thr Val  Met Glu Gln Leu Arg  Phe Glu Gln Asp Pro  Arg Glu Phe
    1130                1135                1140

Leu Lys  Thr Lys Gly Tyr Glu  Gly Val Lys Gln Trp  Leu Ile Leu
    1145                1150                1155

Pro Lys  Tyr Ile Leu Phe Glu  Ala Gln Gly Gly Tyr  Arg Arg Met
    1160                1165                1170

Ile Ala  Ser Gln Glu Thr Gln  Lys Ala Asn Ser Leu  Ile Leu Pro
    1175                1180                1185

Glu Asn  Leu Val Thr Leu Leu  Tyr His Ala Arg His  Tyr Asp Glu
    1190                1195                1200

Ile Asn  His Lys Val Ser Phe  Asp Tyr Val Asn Ala  His Lys Glu
    1205                1210                1215

Gly Phe  Asn Asp Ile Phe Asp  Phe Ile Ser Asp Phe  Gly Val Arg
    1220                1225                1230

Tyr Ile  Leu Ala Pro Gln His  Leu Glu Lys Ile Lys  Val Ala Tyr
    1235                1240                1245

Glu Lys  Asn Lys Glu Val Asp  Leu Lys Glu Met Ile  Asp Ala Ile
    1250                1255                1260

Leu Ser  Leu Leu Lys Phe Thr  Leu Phe Gly Ala Ser  Val Glu Phe
    1265                1270                1275

Lys Phe  Phe Asp Ile Lys Ile  Leu Lys Arg Tyr Lys  Ser Leu Thr
    1280                1285                1290

Asp Ile  Trp Glu Ala Thr Ile  Ile Tyr Gln Ser Val  Thr Gly Leu
    1295                1300                1305

Tyr Glu  Arg Arg Val Glu Val  Arg Lys Leu Trp Asp  Gly Glu Arg
    1310                1315                1320
```

<210> 240
<211> 1330
<212> PRT
<213> Enterococcus phoeniculicola

<400> 240

Met Lys Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Leu Thr Glu Asn Tyr Asp Leu Val Lys Lys Lys Met
20 25 30

Lys Val Tyr Gly Asn Thr Glu Thr Lys Tyr Leu Lys Lys Asn Leu Trp
35 40 45

Gly Val Arg Leu Phe Asp Glu Gly Glu Thr Ala Ala Asp Arg Arg Leu
50 55 60

Lys Arg Thr Thr Arg Arg Arg Tyr Ser Arg Arg Arg Asn Arg Ile Cys
65 70 75 80

Arg Leu Gln Asp Leu Phe Thr Glu Glu Met Asn Gln Val Asp Ala Asn
85 90 95

Phe Phe His Arg Leu Gln Glu Ser Phe Leu Val Pro Asp Glu Lys Glu
100 105 110

Phe Glu Arg His Ala Ile Phe Gly Lys Met Glu Glu Glu Val Ser Tyr
115 120 125

Tyr Arg Glu Phe Pro Thr Ile Tyr His Leu Arg Lys His Leu Ala Asp
130 135 140

Thr Ser Glu Gln Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

Ile Val Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Glu Leu Asn Thr
165 170 175

```
Glu Asn Ser Ser Val Ser Glu Thr Phe Arg Thr Phe Ile Gln Val Tyr
            180                 185                 190

Asn Gln Ile Phe Arg Glu Asn Glu Pro Leu Ala Val Pro Asp Asn Ile
        195                 200                 205

Glu Glu Leu Phe Ser Glu Lys Val Ser Arg Ala Arg Lys Val Glu Ala
    210                 215                 220

Ile Leu Ser Val Tyr Ser Glu Glu Lys Ser Thr Gly Thr Leu Ala Gln
225                 230                 235                 240

Phe Leu Lys Leu Met Val Gly Asn Gln Gly Arg Phe Lys Lys Thr Phe
                245                 250                 255

Asp Leu Glu Glu Asp Gly Ile Ile Gln Ile Pro Lys Glu Glu Tyr Glu
            260                 265                 270

Glu Glu Leu Glu Thr Leu Leu Ala Ile Ile Gly Asp Glu Tyr Ala Glu
        275                 280                 285

Ile Phe Ser Ala Thr Lys Ser Val Tyr Asp Ala Val Ala Leu Ser Gly
    290                 295                 300

Ile Leu Ser Val Thr Asp Gly Asp Thr Lys Ala Lys Leu Ser Ala Ser
305                 310                 315                 320

Met Val Glu Arg Tyr Glu Ala His Gln Lys Asp Leu Val Gln Phe Lys
                325                 330                 335

Gln Phe Ile Arg Lys Glu Leu Pro Glu Met Tyr Ala Pro Ile Phe Arg
            340                 345                 350

Asp Asn Ser Val Ser Gly Tyr Ala Gly Tyr Val Glu Asn Ser Val Thr
        355                 360                 365

Gln Ala Glu Phe Tyr Lys Tyr Ile Lys Lys Ala Ile Glu Lys Val Pro
    370                 375                 380
```

```
Gly Ala Glu Tyr Phe Leu Glu Lys Ile Glu Gln Glu Thr Phe Leu Asp
385                 390                 395                 400

Lys Gln Arg Thr Phe Asn Asn Gly Val Ile Pro His Gln Ile His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Ile Gln Lys Gln Ala Thr Tyr Tyr Pro Phe
            420                 425                 430

Leu Ala Asp Asn Lys Glu Glu Met Lys Gln Leu Val Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Tyr Val Gly Pro Leu Ala Asp Gly Asn Ser Pro Phe Ala Trp
    450                 455                 460

Leu Glu Arg Ile Ser Ser Glu Pro Ile Arg Pro Gly Asn Leu Ala Glu
465                 470                 475                 480

Val Val Asp Ile Lys Lys Ser Ala Thr Lys Phe Ile Glu Arg Met Thr
                485                 490                 495

Asn Phe Asp Thr Tyr Leu Pro Thr Glu Lys Val Leu Pro Lys His Ser
            500                 505                 510

Met Ile Tyr Glu Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Val Ser
        515                 520                 525

Tyr Val Asp Glu Arg Gly Met Asn Gln Arg Phe Ser Gly Glu Glu Lys
    530                 535                 540

Lys Gln Ile Val Glu Glu Leu Phe Lys Gln Ser Arg Lys Val Thr Lys
545                 550                 555                 560

Lys Leu Leu Glu Lys Phe Leu Ser Asn Glu Phe Gly Leu Val Asp Val
                565                 570                 575

Ala Ile Lys Gly Ile Glu Thr Ser Phe Asn Ala Gly Tyr Gly Thr Tyr
            580                 585                 590
```

```
His Asp Phe Leu Lys Ile Gly Ile Thr Arg Glu Gln Leu Asp Lys Glu
        595                 600                 605

Glu Asn Ser Glu Thr Leu Glu Glu Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Arg Lys Met Ile Arg Glu Gln Leu Lys Lys Tyr Thr Tyr Leu
625                 630                 635                 640

Phe Asp Glu Glu Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Ile Gly Ile Lys Glu Lys Arg
            660                 665                 670

Thr His Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Gly Gly Lys Gln
        675                 680                 685

Pro Ile Asn Arg Asn Leu Met Gln Leu Ile Asn Asp Ser Asp Leu Ser
    690                 695                 700

Phe Lys Ser Glu Ile Ala Glu Ala Gln Ser Asp Met Asn Thr Glu Asp
705                 710                 715                 720

Leu His Glu Val Val Gln Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys
                725                 730                 735

Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu Leu Val Asp Ile Met
            740                 745                 750

Gly Ser Leu Pro Lys Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Ser Arg Gly Arg Thr Asn Ser Asn Pro Arg Met Lys Ala Leu
    770                 775                 780

Glu Glu Ala Met Arg Asn Leu Arg Ser Asn Leu Leu Lys Glu Tyr Pro
785                 790                 795                 800
```

```
Thr Asp Asn Gln Ala Leu Gln Asn Asp Arg Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Lys Asp Met Tyr Thr Gly Leu Asp Leu Ser Leu His Asn
            820                 825                 830

Leu Ser Ser Tyr Asp Ile Asp His Ile Val Pro Gln Ser Phe Thr Thr
        835                 840                 845

Asp Asn Ser Leu Asp Asn Arg Val Leu Val Ser Ser Lys Glu Asn Arg
    850                 855                 860

Gly Lys Lys Asp Asp Val Pro Ser Lys Glu Val Val Gln Lys Asn Ile
865                 870                 875                 880

Thr Leu Trp Glu Thr Leu Lys Asn Ser Asn Leu Ile Ser Gln Lys Lys
                885                 890                 895

Tyr Asp Asn Leu Thr Lys Gly Leu Arg Gly Gly Leu Thr Glu Asp Asp
            900                 905                 910

Arg Ala His Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
        915                 920                 925

Lys His Val Ala Arg Ile Leu Asp Gln Arg Phe Asn Ser Gln Lys Asp
    930                 935                 940

Glu Glu Gly Lys Thr Ile Arg Ala Val Arg Val Val Thr Leu Lys Ser
945                 950                 955                 960

Ser Leu Thr Ser Gln Phe Arg Lys Gln Phe Ala Ile His Lys Val Arg
                965                 970                 975

Glu Ile Asn Asp Tyr His His Gly His Asp Ala Tyr Leu Asn Gly Val
            980                 985                 990

Val Ala Asn Ser Leu Leu Arg Val  Tyr Pro Gln Leu Gln  Pro Glu Phe
        995                 1000                1005
```

```
Val Tyr  Gly Asp Tyr Pro Lys  Phe Asn Ala Tyr Lys  Ala Asn Lys
    1010                1015                1020

Ala Thr  Ala Lys Lys Gln Leu  Tyr Thr Asn Ile Met  Lys Phe Phe
    1025                1030                1035

Ala Glu  Asp Ala Val Ile Ile  Asp Glu Asn Gly Glu  Ile Leu Trp
    1040                1045                1050

Asp Lys  Lys Asn Ile Ala Thr  Val Lys Lys Val Met  Ser Tyr Pro
    1055                1060                1065

Gln Met  Asn Ile Val Lys Lys  Pro Glu Ile Gln Thr  Gly Ser Phe
    1070                1075                1080

Ser Lys  Glu Thr Ile Lys Pro  Lys Gly Asp Ser Asp  Lys Leu Ile
    1085                1090                1095

Ser Arg  Lys Thr Asn Trp Ser  Pro Lys Leu Tyr Gly  Gly Phe Asp
    1100                1105                1110

Ser Pro  Gln Val Ala Tyr Ser  Val Ile Ile Thr Tyr  Glu Lys Gly
    1115                1120                1125

Lys Lys  Lys Val Arg Ala Lys  Ala Ile Val Gly Ile  Thr Ile Met
    1130                1135                1140

Glu Gln  Ser Leu Phe Lys Lys  Asp Pro Val Ser Leu  Leu Glu Glu
    1145                1150                1155

Lys Gly  Tyr Ala Asn Pro Glu  Val Leu Ile His Leu  Pro Lys Tyr
    1160                1165                1170

Thr Leu  Tyr Glu Leu Glu Asn  Gly Arg Arg Arg Leu  Leu Ala Ser
    1175                1180                1185

Ala Asn  Glu Ala Gln Lys Gly  Asn Gln Leu Val Leu  Pro Ala Ser
    1190                1195                1200
```

```
Leu Val  Thr Leu Leu Tyr His  Ala Lys Gln Val Asp  Glu Asp Ser
    1205                 1210                 1215


Gly Lys  Ser Glu Glu Tyr Val  Arg Glu His Arg Ala  Glu Phe Ala
    1220                 1225                 1230


Glu Ile  Leu Asn Tyr Val Gln  Ala Phe Ser Glu Thr  Lys Ile Leu
    1235                 1240                 1245


Ala Asn  Lys Asn Leu Gln Thr  Ile Leu Lys Leu Tyr  Glu Glu Asn
    1250                 1255                 1260


Lys Glu  Ala Asp Ile Lys Glu  Ile Ala Glu Ser Phe  Val Asn Leu
    1265                 1270                 1275


Met Lys  Phe Ser Ala Tyr Gly  Ala Pro Met Asp Phe  Lys Phe Phe
    1280                 1285                 1290


Gly Lys  Thr Ile Pro Arg Ser  Arg Tyr Thr Ser Val  Gly Glu Leu
    1295                 1300                 1305


Leu Ser  Ala Thr Ile Ile Asn  Gln Ser Ile Thr Gly  Leu Tyr Glu
    1310                 1315                 1320


Thr Arg  Arg Lys Leu Val Asp
    1325                 1330


<210>  241
<211>  1327
<212>  PRT
<213>  Enterococcus sp. AM1

<400>  241

Met Gly Lys Glu Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Leu Gln Glu Asp Leu Asp Leu Val Arg Arg Lys Met
            20                  25                  30
```

```
Lys Val Tyr Gly Asn Thr Glu Lys Asn Tyr Leu Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Asp Leu Phe Asp Glu Gly Met Thr Ala Lys Asp Thr Arg Leu
    50                  55                  60

Lys Arg Thr Thr Arg Arg Arg Tyr Phe Arg Arg Arg Gln Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Thr Phe Phe Gln Glu Glu Met Asn Arg Ile Asp Pro Asn
                85                  90                  95

Phe Phe Asn Arg Leu Asp Glu Ser Phe Leu Ile Glu Glu Asp Lys Leu
            100                 105                 110

Ser Glu Arg His Pro Ile Phe Gly Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Lys Asn Tyr Ala Thr Ile Tyr His Leu Arg Lys Glu Leu Ala Asp
    130                 135                 140

Ala Glu Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Arg Leu Ser Thr
                165                 170                 175

Glu Asn Thr Ser Thr Glu Glu Thr Phe Lys Thr Phe Leu Gln Lys Tyr
            180                 185                 190

Asn Gln Thr Phe Asn Pro Val Asp Glu Thr Ile Ser Ile Gly Ser Ile
        195                 200                 205

Phe Ala Asp Lys Val Ser Arg Ala Lys Lys Ala Glu Gly Val Leu Ala
    210                 215                 220

Leu Phe Pro Asp Glu Lys Arg Asn Gly Thr Phe Asp Gln Phe Leu Lys
225                 230                 235                 240
```

```
Met Ile Val Gly Asn Gln Gly Asn Phe Lys Lys Thr Phe Glu Leu Glu
                245                 250                 255

Glu Asp Ala Lys Leu Gln Phe Ser Lys Glu Glu Tyr Asp Glu Ser Leu
            260                 265                 270

Glu Ala Leu Leu Gly Glu Ile Gly Asp Glu Tyr Ala Asp Val Phe Glu
        275                 280                 285

Ala Ala Lys Asn Val Tyr Asn Ala Val Glu Leu Ser Gly Ile Leu Thr
    290                 295                 300

Val Thr Asp Asn Ser Thr Lys Ala Lys Leu Ser Ala Ser Met Ile Lys
305                 310                 315                 320

Arg Tyr Glu Asp His Lys Thr Asp Leu Lys Leu Phe Lys Glu Phe Ile
                325                 330                 335

Arg Lys Asn Leu Pro Glu Lys Tyr His Glu Ile Phe Asn Asp Lys Asn
            340                 345                 350

Thr Asp Gly Tyr Ala Gly Tyr Ile Asp Asn Ser Thr Ser Gln Glu Lys
        355                 360                 365

Phe Tyr Lys Tyr Ile Thr Asn Leu Ile Glu Lys Ile Asp Gly Ala Glu
    370                 375                 380

Tyr Phe Leu Lys Lys Ile Glu Asn Glu Asp Phe Leu Arg Lys Gln Arg
385                 390                 395                 400

Thr Phe Asp Asn Gly Ile Ile Pro His Gln Ile His Leu Glu Glu Leu
                405                 410                 415

Lys Ala Ile Leu His His Gln Ala Met Tyr Tyr Pro Phe Leu Gln Glu
            420                 425                 430

Lys Phe Ser Asn Phe Val Asp Leu Leu Thr Phe Arg Ile Pro Tyr Tyr
        435                 440                 445
```

```
Val Gly Pro Leu Ala Asn Gly Asn Ser Arg Phe Ser Trp Leu Ser Arg
    450                 455                 460

Lys Ser Asp Glu Pro Ile Arg Pro Trp Asn Leu Ala Glu Val Val Asp
465                 470                 475                 480

Leu Ser Lys Ser Ala Glu Leu Phe Ile Glu Arg Met Thr Asn Phe Asp
                485                 490                 495

Leu Tyr Leu Pro Ser Glu Lys Val Leu Pro Lys His Ser Met Leu Tyr
            500                 505                 510

Glu Lys Tyr Thr Val Tyr Asn Glu Leu Thr Lys Val Thr Tyr Lys Asp
        515                 520                 525

Glu Gln Gly Lys Val Gln Asn Phe Ser Ser Glu Glu Lys Glu Arg Ile
    530                 535                 540

Phe Ile Asp Leu Phe Lys Gln His Arg Lys Val Thr Lys Lys Asp Leu
545                 550                 555                 560

Ser Asn Phe Leu Arg Asn Glu Tyr Asn Leu Asp Asp Val Ile Ile Asp
                565                 570                 575

Gly Ile Glu Asn Lys Phe Asn Ala Ser Phe Asn Thr Tyr His Asp Phe
            580                 585                 590

Leu Lys Leu Lys Ile Asp Pro Lys Val Leu Asp Asp Pro Ala Asn Glu
        595                 600                 605

Pro Met Phe Glu Glu Ile Val Lys Ile Leu Thr Ile Phe Glu Asp Arg
    610                 615                 620

Lys Met Leu Arg Glu Gln Leu Ser Lys Phe Ser Asp Arg Leu Ser Glu
625                 630                 635                 640

Lys Thr Ile Lys Asp Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg
                645                 650                 655
```

```
Leu Ser Ala Lys Leu Ile Asn Gly Ile His Asp Lys Gln Ser Asn Lys
            660                 665                 670

Thr Ile Leu Asp Tyr Leu Ile Asp Asp Ala Pro Lys Lys Asn Ile Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile Asn Asp Asn Arg Leu Thr Phe Lys Glu
    690                 695                 700

Glu Ile Glu Lys Glu Gln Leu Lys Ala Asn Ser Glu Glu Ser Leu Ile
705                 710                 715                 720

Glu Ile Val Gln Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Phe Gln Ser Leu Lys Ile Val Asp Glu Leu Val Glu Ile Met Gly Tyr
            740                 745                 750

Ala Pro Thr Asn Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Ala Asn Gly Arg Arg Asn Ser Arg Pro Arg Leu Lys Asn Leu Glu Lys
    770                 775                 780

Ala Ile Asp Asp Leu Asp Ser Glu Ile Leu Lys Lys His Pro Val Asp
785                 790                 795                 800

Asn Lys Ala Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Lys Asp Met Tyr Thr Asn Glu Glu Leu Asp Ile His Lys Leu Ser
            820                 825                 830

Thr Tyr Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Val Asp Asn
        835                 840                 845

Ser Leu Asp Asn Arg Val Leu Val Ser Ser Ser Lys Asn Arg Gly Lys
    850                 855                 860
```

```
Leu Asp Asp Val Pro Ser Lys Glu Val Val Lys Lys Met Arg Ala Phe
865                 870                 875                 880


Trp Glu Ser Leu Tyr Arg Ser Gly Leu Ile Ser Lys Lys Lys Phe Asp
                885                 890                 895


Asn Leu Val Lys Ala Glu Ser Gly Gly Leu Ser Glu Asp Asp Lys Ala
            900                 905                 910


Gly Phe Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn
        915                 920                 925


Val Ala Arg Ile Leu His Gln Arg Phe Asn Ser Glu Lys Asp Glu Glu
    930                 935                 940


Gly Asn Leu Ile Arg Lys Val Arg Ile Ile Thr Leu Lys Ser Ala Leu
945                 950                 955                 960


Thr Ser Gln Phe Arg Lys Asn Tyr Gly Ile Tyr Lys Ile Arg Glu Ile
                965                 970                 975


Asn Asp Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala
            980                 985                 990


Thr Ala Leu Leu Lys Ile Tyr Pro  Gln Leu Glu Pro Glu  Phe Val Tyr
        995                 1000                1005


Gly Glu  Phe His Arg Phe Asn  Ala Phe Lys Glu Asn  Lys Ala Thr
    1010                1015                1020


Ala Lys  Lys Gln Phe Tyr Ser  Asn Leu Met Glu Phe  Ser Lys Ser
    1025                1030                1035


Asp Lys  Val Ile Ile Asp Glu  Asn Gly Glu Ile Leu  Trp Asn Gln
    1040                1045                1050


Lys Lys  Ile Val Thr Val Lys  Lys Val Met Asn Tyr  Arg Gln Met
    1055                1060                1065
```

```
Asn Ile  Val Lys Lys Val Glu  Ile Gln Lys Gly Gly  Phe Ser Lys
    1070                1075                1080

Glu Ser  Ile Leu Pro Lys Gly  Asp Ser Asp Lys Leu  Ile Ser Arg
    1085                1090                1095

Lys Lys  Glu Trp Asp Thr Thr  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1100                1105                1110

Asn Val  Ala Tyr Ser Val Val  Ile Arg Tyr Glu Lys  Gly Lys Thr
    1115                1120                1125

Arg Lys  Leu Val Lys Thr Ile  Val Gly Ile Thr Ile  Met Glu Arg
    1130                1135                1140

Ala Ala  Phe Glu Lys Asn Glu  Arg Glu Phe Leu Lys  Asn Lys Gly
    1145                1150                1155

Tyr Gln  Asn Pro Gln Ile Cys  Met Lys Leu Pro Lys  Tyr Ser Leu
    1160                1165                1170

Tyr Glu  Phe Asp Asp Gly Arg  Arg Arg Leu Leu Ala  Ser Ala Lys
    1175                1180                1185

Glu Ala  Gln Lys Gly Asn Gln  Met Val Leu Pro Ala  His Leu Val
    1190                1195                1200

Thr Phe  Leu Tyr His Ala Lys  His Cys Asn Glu Lys  Pro Asp Ser
    1205                1210                1215

Leu Lys  Tyr Val Thr Glu His  Gln Ser Gly Phe Ser  Glu Ile Met
    1220                1225                1230

Ala His  Val Lys Asp Phe Ala  Glu Lys Tyr Thr Leu  Val Asp Lys
    1235                1240                1245

Asn Leu  Glu Lys Ile Leu Ser  Leu Tyr Ala Lys Asn  Met Asp Ser
    1250                1255                1260
```

```
Glu Val  Lys Glu Ile Ala Gln  Ser Phe Val Asp Leu  Met Gln Leu
    1265                1270                1275


Asn Ala  Phe Gly Ala Pro Ala  Asp Phe Lys Phe Phe  Gly Glu Thr
    1280                1285                1290


Ile Pro  Arg Lys Arg Tyr Thr  Ser Val Asn Glu Leu  Leu Glu Ala
    1295                1300                1305


Thr Ile  Ile Asn Gln Ser Ile  Thr Gly Leu Tyr Glu  Thr Arg Arg
    1310                1315                1320


Arg Leu  Gly Asp
    1325


<210>  242
<211>  1332
<212>  PRT
<213>  Enterococcus villorum

<400>  242

Met Asn Lys Ala Tyr Thr Leu Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Thr Asp Asp Tyr Arg Leu Met Ala Lys Lys Met
            20                  25                  30


Pro Val His Ser Lys Met Glu Lys Lys Lys Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Ala Arg Leu Phe Asp Glu Gly Gln Thr Ala Glu Glu Arg Arg Asn
    50                  55                  60


Lys Arg Ala Thr Arg Arg Arg Leu Arg Arg Arg Lys Tyr Arg Ile Leu
65                  70                  75                  80


Glu Leu Gln Lys Ile Phe Ser Glu Glu Ile Leu Lys Lys Asp Ser His
                85                  90                  95


Phe Phe Ala Arg Leu Asp Glu Ser Phe Leu Ile Pro Glu Asp Lys Gln
```

100 105 110

Tyr Ala Arg Phe Pro Ile Phe Pro Thr Leu Leu Glu Glu Lys Ala Tyr
115 120 125

Tyr Gln Asn Tyr Pro Thr Ile Tyr His Leu Arg Gln Lys Leu Ala Asp
130 135 140

Ser Thr Glu Lys Ala Asp Ile Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

Met Ile Lys Tyr Arg Gly His Phe Leu Phe Glu Gly Glu Leu Asp Thr
165 170 175

Glu Asn Thr Ser Val Glu Glu Thr Phe Lys Glu Phe Ile Asp Ile Tyr
180 185 190

Asn Glu Gln Phe Glu Glu Gly Ile Ile Phe Tyr Lys Asp Ile Pro Leu
195 200 205

Ile Leu Thr Asp Lys Leu Ser Lys Ser Lys Lys Val Glu Lys Ile Leu
210 215 220

Gln Tyr Tyr Pro Lys Glu Lys Thr Thr Gly Cys Leu Ala Gln Phe Leu
225 230 235 240

Lys Leu Ile Val Gly Asn Gln Gly Asn Phe Lys Gln Ala Phe His Leu
245 250 255

Asp Glu Glu Val Lys Ile Gln Ile Ser Lys Glu Thr Tyr Glu Glu Asp
260 265 270

Leu Glu Lys Leu Leu Arg Lys Ser Asn Glu Glu Met Ile Asp Val Phe
275 280 285

Leu Gln Val Lys Lys Val Tyr Asp Ala Ile Leu Leu Ser Asp Ile Leu
290 295 300

Ser Thr Lys Met Lys Asp Thr Lys Ala Lys Leu Ser Ala Gly Met Ile

305 310 315 320

Glu Arg Tyr Gln Asn His Lys Lys Asp Leu Glu Glu Leu Lys Gln Phe
325 330 335

Val Arg Ala His Leu His Glu Lys Val Thr Val Phe Phe Lys Asp Ser
340 345 350

Ser Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Thr Thr Gln Ala
355 360 365

Asp Phe Tyr Lys Phe Leu Lys Lys Glu Leu Thr Gly Val Pro Gly Ser
370 375 380

Glu Pro Met Leu Ala Lys Ile Asp Gln Glu Asn Phe Leu Leu Lys Gln
385 390 395 400

Arg Thr Pro Thr Asn Gly Val Ile Pro His Gln Val His Leu Thr Glu
405 410 415

Phe Lys Ala Ile Ile Asp Gln Gln Lys Gln Tyr Tyr Pro Phe Leu Glu
420 425 430

Lys Ser Lys Glu Lys Met Ile Gln Leu Leu Thr Phe Arg Ile Pro Tyr
435 440 445

Tyr Val Gly Pro Leu Ala Gln Asp Lys Glu Thr Ser Ser Phe Ala Trp
450 455 460

Leu Glu Arg Lys Thr Thr Glu Lys Ile Lys Pro Trp Asn Ala Lys Asp
465 470 475 480

Val Ile Asp Tyr Gly Ala Ser Ala Thr Lys Phe Ile Gln Arg Met Ile
485 490 495

Asn Tyr Asp Thr Tyr Leu Pro Thr Glu Lys Val Leu Pro Lys Tyr Ser
500 505 510

Met Leu Tyr Gln Lys Tyr Thr Ile Phe Asn Glu Leu Thr Lys Val Ala

515 520 525

Tyr Lys Asp Asp Arg Gly Ile Lys His Gln Phe Ser Ser Glu Glu Lys
530 535 540

Leu Arg Ile Phe Gln Glu Leu Phe Lys Lys Gln Arg Arg Val Thr Lys
545 550 555 560

Lys Lys Leu Gln His Phe Leu Ser Ala Asn Tyr Asn Ile Glu Asp Ala
565 570 575

Glu Ile Leu Gly Val Asp Lys Val Phe Asn Ser Ser Tyr Ala Thr Tyr
580 585 590

His Asp Phe Leu Glu Leu Ala Lys Pro Tyr Glu Leu Leu Glu Gln Pro
595 600 605

Glu Met Glu Glu Met Phe Glu Asp Ile Val Lys Ile Ile Thr Ile Phe
610 615 620

Glu Asp Arg Glu Met Val Arg Thr Gln Leu Lys Lys Tyr Gln Arg Ile
625 630 635 640

Leu Gly Glu Glu Ile Phe Lys Lys Leu Val Lys Lys Lys Tyr Thr Gly
645 650 655

Trp Gly Arg Leu Ser Lys Arg Leu Ile Asn Gly Ile Arg Asp Gln Lys
660 665 670

Thr Asn Lys Thr Ile Leu Asp Tyr Leu Ile Asp Asp Asp Phe Pro Tyr
675 680 685

Asn Arg Asn Arg Asn Phe Met Gln Leu Ile Asn Asp Asp His Leu Ser
690 695 700

Phe Lys Glu Glu Ile Ala Lys Glu Leu Thr Leu Ser Asp Lys Gln Ser
705 710 715 720

Leu Leu Glu Val Val Glu Ala Ile Pro Gly Ser Pro Ala Ile Lys Lys

```
                725                 730                 735

Gly Ile Trp Gln Thr Leu Lys Ile Val Glu Glu Leu Ile Ala Ile Ile
            740                 745                 750

Gly Tyr Lys Pro Lys Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln
        755                 760                 765

Thr Thr Thr Gly Gly Lys Asn Arg Ser Lys Pro Arg Leu Lys Ser Leu
    770                 775                 780

Glu Glu Ala Leu Lys Asn Phe Asp Ser Gln Leu Leu Lys Glu Arg Pro
785                 790                 795                 800

Val Asp Asn Gln Ser Leu Gln Lys Asp Arg Leu Tyr Leu Tyr Tyr Leu
                805                 810                 815

Gln Asn Gly Lys Asp Met Tyr Thr Gly Glu Ser Leu Asp Ile Asp Arg
            820                 825                 830

Leu Ser Glu Tyr Asp Ile Asp His Ile Ile Pro Arg Ser Phe Ile Val
        835                 840                 845

Asp His Ser Leu Asp Asn Lys Val Leu Val Ser Ser Lys Glu Asn Arg
    850                 855                 860

Leu Lys Lys Asp Asp Val Pro Asp Ser Lys Val Val Lys Arg Met Lys
865                 870                 875                 880

Ala Tyr Trp Glu Lys Leu Leu Arg Ala Asn Leu Ile Ser Glu Arg Lys
                885                 890                 895

Phe Ser Tyr Leu Thr Lys Leu Glu Leu Thr Asp Asp Asp Lys Ala Arg
            900                 905                 910

Phe Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His Val
        915                 920                 925

Ala Ala Ile Leu His Gln Tyr Phe Asn Gln Thr Gln Glu Leu Glu Lys
```

```
    930                 935                 940

Glu Lys Asp Ile Arg Ile Ile Thr Leu Lys Ser Ser Leu Val Ser Gln
945                 950                 955                 960

Phe Arg Gln Val Phe Gly Ile His Lys Val Arg Glu Ile Asn His His
                965                 970                 975

His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala Leu Ala Leu
            980                 985                 990

Leu Lys Lys Tyr Pro Arg Leu Ala  Pro Glu Phe Val Tyr  Gly Ser Phe
        995                 1000                1005

Ala Lys  Phe His Leu Val Lys  Glu Asn Lys Ala Thr  Ala Lys Lys
    1010                1015                1020

Glu Phe  Tyr Ser Asn Ile Leu  Lys Phe Phe Glu Lys  Glu Glu Gln
    1025                1030                1035

Phe Cys  Asp Glu Asn Gly Glu  Ile Phe Trp Asp Lys  Arg Lys His
    1040                1045                1050

Ile Gln  Gln Ile Lys Lys Val  Ile Ser Ser His Gln  Val Asn Ile
    1055                1060                1065

Val Lys  Lys Val Glu Val Gln  Thr Gly Ser Phe Tyr  Lys Glu Thr
    1070                1075                1080

Val Asn  Thr Lys Glu Lys Pro  Asp Lys Leu Ile Lys  Arg Lys Asn
    1085                1090                1095

Asn Trp  Asp Val Thr Lys Tyr  Gly Gly Phe Gly Ser  Pro Val Val
    1100                1105                1110

Ala Tyr  Ala Val Val Phe Thr  Tyr Glu Lys Gly Lys  Asn His Lys
    1115                1120                1125

Lys Ala  Lys Ala Ile Glu Gly  Ile Thr Ile Met Glu  Gln Ala Leu
```

```
    1130                1135                1140

Phe Glu  Lys Asp Pro Ile Ser  Phe Leu Ile Glu Lys  Gly Tyr Ser
    1145                1150                1155

Asn Val  Asn Gln Phe Ile Lys  Leu Pro Lys Tyr Thr  Leu Phe Glu
    1160                1165                1170

Leu Ala  Asn Gly Gln Arg Arg  Met Leu Ala Ser Gln  Glu Leu Gln
    1175                1180                1185

Lys Ala  Asn Ser Phe Ile Leu  Pro Glu Lys Leu Val  Thr Leu Leu
    1190                1195                1200

Tyr His  Ala Asn His Tyr Asp  Glu Ile Ala Tyr Lys  Asp Ser Tyr
    1205                1210                1215

Asp Tyr  Val Asn Glu His Phe  Ser Asn Phe Gln Asp  Ile Leu Asp
    1220                1225                1230

Lys Val  Ile Ile Phe Ala Glu  Lys Tyr Thr Ser Ala  Pro Gln Lys
    1235                1240                1245

Leu Asn  Gln Ile Ile Ala Thr  Tyr Glu Lys Asn Gln  Glu Ala Asp
    1250                1255                1260

Arg Lys  Ile Met Ala His Ser  Phe Val Asn Leu Met  Gln Phe Asn
    1265                1270                1275

Ala Leu  Gly Ala Pro Ala Asp  Phe Lys Phe Phe Asp  Thr Thr Ile
    1280                1285                1290

Thr Arg  Lys Arg Tyr Thr Ser  Leu Thr Glu Ile Trp  Gln Ser Thr
    1295                1300                1305

Ile Ile  Tyr Gln Ser Val Thr  Gly Leu Tyr Glu Thr  Arg Arg Arg
    1310                1315                1320

Met Ala  Asp Leu Trp Asp Gly  Val Gln
```

1325 1330

<210> 243
<211> 1359
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 243

Ala Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
20 25 30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
35 40 45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
50 55 60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
85 90 95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
100 105 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
115 120 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
130 135 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145 150 155 160

```
Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365
```

```
Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575
```

```
Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780
```

```
Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990
```

```
Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005


Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020


Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050


Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065


Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080


Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095


Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110


Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125


Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140


Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155


Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170


Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                1180                1185
```

```
Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200


Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215


Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230


Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  244
<211>  1300
<212>  PRT
```

<213> Kandleria vitulina

<400> 244

```
Asn Asn Lys Ile Tyr Asn Ile Gly Leu Asp Ile Gly Asp Ala Ser Val
1               5                  10                  15

Gly Trp Ala Val Val Asp Glu His Tyr Asn Leu Leu Lys Arg His Gly
            20                  25                  30

Lys His Met Trp Gly Ser Arg Leu Phe Thr Gln Ala Asn Thr Ala Val
        35                  40                  45

Glu Arg Arg Ser Ser Arg Ser Thr Arg Arg Arg Tyr Asn Lys Arg Arg
    50                  55                  60

Glu Arg Ile Arg Leu Leu Arg Gly Ile Met Glu Asp Met Val Leu Asp
65                  70                  75                  80

Val Asp Pro Thr Phe Phe Ile Arg Leu Ala Asn Val Ser Phe Leu Asp
                85                  90                  95

Gln Glu Asp Lys Lys Asp Tyr Leu Lys Ser Asn Tyr Asn Leu Phe Ile
            100                 105                 110

Asp Lys Asp Phe Asn Asp Lys Thr Tyr Tyr Asp Lys Tyr Pro Thr Ile
        115                 120                 125

Tyr His Leu Arg Lys His Leu Cys Glu Ser Lys Glu Lys Glu Asp Pro
    130                 135                 140

Arg Leu Ile Tyr Leu Ala Leu His His Ile Val Lys Tyr Arg Gly Asn
145                 150                 155                 160

Phe Leu Tyr Glu Gly Gln Lys Phe Ser Met Asp Val Ser Asn Ile Glu
                165                 170                 175

Asp Lys Met Ile Asp Val Leu Arg Gln Phe Asn Glu Ile Asn Leu Phe
            180                 185                 190
```

```
Glu Tyr Val Glu Asp Lys Lys Ile Asp Glu Val Leu Asn Val Leu Lys
        195                 200                 205

Glu Pro Leu Ser Lys Lys His Lys Ala Asp Lys Ala Phe Ala Leu Phe
    210                 215                 220

Asp Thr Thr Lys Asp Asn Lys Ala Ala Tyr Lys Glu Leu Cys Ala Ala
225                 230                 235                 240

Leu Ala Gly Asn Lys Phe Asn Val Thr Lys Met Leu Lys Glu Ala Glu
                245                 250                 255

Leu His Asp Glu Asp Glu Lys Asp Ile Ser Phe Lys Phe Ser Asp Ala
            260                 265                 270

Thr Phe Asp Asp Ala Phe Val Glu Lys Gln Pro Leu Leu Gly Asp Cys
        275                 280                 285

Val Glu Phe Ile Asp Leu Leu His Asp Ile Tyr Ser Trp Val Glu Leu
    290                 295                 300

Gln Asn Ile Leu Gly Ser Ala His Thr Ser Glu Pro Ser Ile Ser Ala
305                 310                 315                 320

Ala Met Ile Gln Arg Tyr Glu Asp His Lys Asn Asp Leu Lys Leu Leu
                325                 330                 335

Lys Asp Val Ile Arg Lys Tyr Leu Pro Lys Lys Tyr Phe Glu Val Phe
            340                 345                 350

Arg Asp Glu Lys Ser Lys Lys Asn Asn Tyr Cys Asn Tyr Ile Asn His
        355                 360                 365

Lys Thr Pro Val Asp Glu Phe Tyr Lys Tyr Ile Lys Lys Leu Ile Glu
    370                 375                 380

Lys Ile Asp Asp Pro Asp Val Lys Thr Ile Leu Asn Lys Ile Glu Leu
385                 390                 395                 400
```

```
Glu Ser Phe Met Leu Lys Gln Asn Ser Arg Thr Asn Gly Ala Val Pro
                405                 410                 415

Tyr Gln Met Gln Leu Asp Glu Leu Asn Lys Ile Leu Glu Asn Gln Ser
            420                 425                 430

Val Tyr Tyr Ser Asp Leu Lys Asp Asn Glu Asp Lys Ile Arg Ser Ile
        435                 440                 445

Leu Thr Phe Arg Ile Pro Tyr Tyr Phe Gly Pro Leu Ile Thr Lys Asp
    450                 455                 460

Arg Gln Phe Asp Trp Ile Ile Lys Lys Glu Gly Lys Glu Asn Glu Arg
465                 470                 475                 480

Ile Leu Pro Trp Asn Ala Asn Glu Ile Val Asp Val Asp Lys Thr Ala
                485                 490                 495

Asp Glu Phe Ile Lys Arg Met Arg Asn Phe Cys Thr Tyr Phe Pro Asp
            500                 505                 510

Glu Pro Val Leu Ala Lys Asn Ser Leu Thr Val Ser Lys Tyr Glu Val
        515                 520                 525

Leu Asn Glu Ile Asn Lys Leu Arg Ile Asn Asp His Leu Ile Lys Arg
    530                 535                 540

Asp Ile Lys Asp Lys Met Leu His Thr Leu Phe Met Asp His Lys Ser
545                 550                 555                 560

Ile Ser Ala Asn Ala Met Lys Lys Trp Leu Val Lys Asn Gln Tyr Phe
                565                 570                 575

Ser Asn Thr Asp Asp Ile Lys Ile Glu Gly Phe Gln Lys Glu Asn Ala
            580                 585                 590

Cys Ser Thr Ser Leu Thr Pro Trp Ile Asp Phe Thr Lys Ile Phe Gly
        595                 600                 605
```

```
Glu Ile Asn Asn Ser Asn Tyr Glu Leu Ile Glu Lys Ile Ile Tyr Asp
    610                 615                 620

Val Thr Val Phe Glu Asp Lys Lys Ile Leu Arg Arg Arg Leu Lys Lys
625                 630                 635                 640

Glu Tyr Asp Leu Asp Glu Glu Lys Ile Lys Lys Ile Leu Lys Leu Lys
                645                 650                 655

Tyr Ser Gly Trp Ser Arg Leu Ser Lys Lys Leu Leu Ser Gly Ile Lys
            660                 665                 670

Thr Lys Arg Thr Pro Glu Thr Val Leu Glu Val Met Glu Thr Asn Met
        675                 680                 685

Asn Leu Met Gln Val Ile Asn Asp Glu Lys Leu Gly Phe Lys Lys Thr
    690                 695                 700

Ile Asp Asp Ala Asn Ser Thr Ser Val Ser Gly Lys Phe Ser Tyr Ala
705                 710                 715                 720

Glu Val Gln Glu Leu Ala Gly Ser Pro Ala Ile Lys Arg Gly Ile Trp
                725                 730                 735

Gln Ala Leu Leu Ile Val Asp Glu Ile Lys Lys Ile Met Lys His Glu
            740                 745                 750

Pro Ala His Val Tyr Ile Glu Phe Ala Arg Asn Glu Asp Lys Glu Arg
        755                 760                 765

Lys Asp Ser Phe Val Asn Gln Met Leu Lys Leu Tyr Lys Asp Phe Glu
    770                 775                 780

Asp Glu Ala Asn Lys His Leu Lys Gly Glu Asp Ala Lys Ser Lys Ile
785                 790                 795                 800

Arg Ser Glu Arg Leu Lys Leu Tyr Tyr Thr Gln Met Gly Lys Cys Met
                805                 810                 815
```

```
Tyr Thr Gly Lys Ser Leu Asp Ile Asp Arg Leu Asp Thr Tyr Gln Val
            820                 825                 830

Asp His Ile Val Pro Gln Ser Leu Leu Lys Asp Asp Ser Ile Asp Asn
        835                 840                 845

Lys Val Leu Val Leu Ser Ser Glu Asn Gln Arg Lys Leu Asp Asp Leu
    850                 855                 860

Val Ile Pro Glu Met Ile Arg Asn Lys Met Phe Gly Phe Trp Asn Lys
865                 870                 875                 880

Leu Tyr Glu Asn Lys Ile Ile Ser Pro Lys Lys Phe Tyr Ser Leu Ile
                885                 890                 895

Lys Ser Glu Tyr Ser Asp Lys Asp Lys Glu Arg Phe Ile Asn Arg Gln
            900                 905                 910

Ile Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile Ile Ser
        915                 920                 925

Asn His Tyr Glu Thr Thr Lys Val Val Thr Val Arg Ala Asp Leu Ser
    930                 935                 940

His Ala Phe Arg Glu Arg Tyr His Ile Tyr Lys Asn Arg Asp Ile Asn
945                 950                 955                 960

Asp Phe His His Ala His Asp Ala Tyr Ile Ala Thr Ile Leu Gly Thr
                965                 970                 975

Tyr Ile Gly His Arg Phe Glu Ser Leu Asp Ala Lys Tyr Ile Tyr Gly
            980                 985                 990

Glu Tyr Gln Lys Ile Phe Arg Asn  Lys Asn Lys Asp Lys  Lys Asp Gly
        995                 1000                1005

Phe Ile  Leu Asn Ser Met Arg  Asn Leu Tyr Ala Asp  Lys Asp Thr
    1010                1015                1020
```

```
Gly Glu  Val Val Trp Asp Pro  Glu Trp Ile Ser Arg  Ile Lys Lys
    1025                1030                1035

Cys Phe  Tyr Tyr Lys Asp Cys  Phe Val Thr Lys Lys  Leu Glu Glu
    1040                1045                1050

Asn Asn  Gly Ser Phe Phe Asn  Thr Val Arg Pro Asn  Asp Glu His
    1055                1060                1065

Ser Glu  Lys Gly Ala Lys Val  Pro Val Asn Lys Leu  Arg Ser Asn
    1070                1075                1080

Val His  Lys Tyr Gly Gly Phe  Glu Gly Leu Lys Tyr  Ser Ile Val
    1085                1090                1095

Ala Ile  Lys Gly Lys Lys Lys  Lys Gly Lys Lys Ile  Ile Asp Val
    1100                1105                1110

Asn Lys  Leu Val Gly Ile Pro  Leu Met Tyr Lys Asn  Val Asp Asp
    1115                1120                1125

Glu Thr  Lys Ile Asn Tyr Ile  Lys Glu Ser Glu Gly  Leu Glu Glu
    1130                1135                1140

Val Lys  Ile Ile Lys Glu Ile  Leu Lys Asn Gln Leu  Ile Glu Ile
    1145                1150                1155

Asn Gly  Gly Leu Phe Tyr Val  Thr Ser Glu Ile Val  Asn Ala Arg
    1160                1165                1170

Gln Leu  Ile Leu Asp Phe Asn  Cys Thr Arg Ile Ile  Asp Gly Ile
    1175                1180                1185

Tyr Lys  Ala Met Lys Tyr Lys  Asn Tyr Ser Glu Leu  Ser Gln Glu
    1190                1195                1200

Glu Ile  Met Asn Val Tyr Asp  Ile Phe Val Glu Lys  Leu Lys Leu
    1205                1210                1215
```

```
Tyr Tyr  Pro Thr Tyr Lys Asn  Ile Ala Thr Asn Phe  Glu Asn Phe
    1220                1225                1230


Glu Asn  Ile Ser Asp Glu Glu  Lys Cys Glu Val Ile  Gln Met Leu
    1235                1240                1245


Val Val  Met His Ala Gly Pro  Gln Asn Gly Asn Ile  Thr Phe Asp
    1250                1255                1260


Asp Phe  Lys Leu Ser Asn Arg  Leu Gly Arg Leu Asn  Cys Lys Thr
    1265                1270                1275


Ile Ser  Leu Thr Thr Val Phe  Ile Ala Asp Ser Pro  Thr Gly Met
    1280                1285                1290


Tyr Ser  Lys Lys Tyr Lys Leu
    1295                1300


<210>  245
<211>  1301
<212>  PRT
<213>  Kandleria vitulina

<400>  245

Asn Asn Lys Ile Tyr Asn Ile Gly Leu Asp Ile Gly Asp Ala Ser Val
1               5                   10                  15


Gly Trp Ala Val Val Asp Glu His Tyr Asn Leu Leu Lys Arg His Gly
            20                  25                  30


Lys His Met Trp Gly Ser Arg Leu Phe Thr Gln Ala Asn Thr Ala Val
        35                  40                  45


Glu Arg Arg Ser Ser Arg Ser Thr Arg Arg Arg Tyr Asn Lys Arg Arg
    50                  55                  60


Glu Arg Ile Arg Leu Leu Arg Glu Ile Met Glu Asp Met Val Leu Asp
65                  70                  75                  80


Val Asp Pro Thr Phe Phe Ile Arg Leu Ala Asn Val Ser Phe Leu Asp
```

```
                85                  90                  95

Gln Glu Asp Lys Lys Asp Tyr Leu Lys Ser Asn Tyr Asn Leu Phe Ile
            100                 105                 110

Asp Lys Asp Phe Asn Asp Lys Thr Tyr Tyr Asp Lys Tyr Pro Thr Ile
        115                 120                 125

Tyr His Leu Arg Lys His Leu Cys Glu Ser Lys Glu Lys Glu Asp Pro
    130                 135                 140

Arg Leu Ile Tyr Leu Ala Leu His His Ile Val Lys Tyr Arg Gly Asn
145                 150                 155                 160

Phe Leu Tyr Glu Gly Gln Lys Phe Ser Met Asp Val Ser Asn Ile Glu
                165                 170                 175

Asp Lys Met Ile Asp Val Leu Arg Gln Phe Asn Glu Ile Asn Leu Phe
            180                 185                 190

Glu Tyr Val Glu Asp Lys Lys Ile Asp Glu Val Leu Asn Val Leu Lys
        195                 200                 205

Glu Pro Leu Ser Lys Lys His Lys Ala Glu Lys Ala Phe Ala Leu Phe
    210                 215                 220

Asp Thr Thr Lys Asp Asn Lys Ala Ala Tyr Lys Glu Leu Cys Ala Ala
225                 230                 235                 240

Leu Ala Gly Asn Lys Phe Asn Val Thr Lys Met Leu Lys Glu Ala Glu
                245                 250                 255

Leu His Asp Glu Asp Glu Lys Asp Ile Ser Phe Lys Phe Ser Asp Ala
            260                 265                 270

Thr Phe Asp Asp Ala Phe Val Glu Lys Gln Pro Leu Leu Gly Asp Cys
        275                 280                 285

Val Glu Phe Ile Asp Leu Leu His Asp Ile Tyr Ser Trp Val Glu Leu
```

```
    290                 295                 300

Gln Asn Ile Leu Gly Ser Ala His Thr Ser Glu Pro Ser Ile Ser Ala
305                 310                 315                 320

Ala Met Ile Gln Arg Tyr Glu Asp His Lys Asn Asp Leu Lys Leu Leu
                325                 330                 335

Lys Asp Val Ile Arg Lys Tyr Leu Pro Lys Lys Tyr Phe Glu Val Phe
            340                 345                 350

Arg Asp Glu Lys Ser Lys Lys Asn Asn Tyr Cys Asn Tyr Ile Asn His
        355                 360                 365

Lys Thr Pro Val Asp Glu Phe Tyr Lys Tyr Ile Lys Lys Leu Ile Glu
    370                 375                 380

Lys Ile Asp Asp Pro Asp Val Lys Thr Ile Leu Asn Lys Ile Glu Leu
385                 390                 395                 400

Glu Ser Phe Met Leu Lys Gln Asn Ser Arg Thr Asn Gly Ala Val Pro
                405                 410                 415

Tyr Gln Met Gln Leu Asp Glu Leu Asn Lys Ile Leu Glu Asn Gln Ser
            420                 425                 430

Val Tyr Tyr Ser Asp Leu Lys Asp Asn Glu Asp Lys Ile Arg Ser Ile
        435                 440                 445

Leu Thr Phe Arg Ile Pro Tyr Tyr Phe Gly Pro Leu Ile Thr Lys Asp
    450                 455                 460

Arg Gln Phe Asp Trp Ile Ile Lys Lys Glu Gly Lys Glu Asn Glu Arg
465                 470                 475                 480

Ile Leu Pro Trp Asn Ala Asn Glu Ile Val Asp Val Asp Lys Thr Ala
                485                 490                 495

Asp Glu Phe Ile Lys Arg Met Arg Asn Phe Cys Thr Tyr Phe Pro Asp
```

```
            500                 505                 510

Glu Pro Val Met Ala Lys Asn Ser Leu Thr Val Ser Lys Tyr Glu Val
        515                 520                 525

Leu Asn Glu Ile Asn Lys Leu Arg Ile Asn Asp His Leu Ile Lys Arg
    530                 535                 540

Asp Met Lys Asp Lys Met Leu His Thr Leu Phe Met Asp His Lys Ser
545                 550                 555                 560

Ile Ser Ala Asn Ala Met Lys Lys Trp Leu Val Lys Asn Gln Tyr Phe
                565                 570                 575

Ser Asn Thr Asp Asp Ile Lys Ile Glu Gly Phe Gln Lys Glu Asn Ala
            580                 585                 590

Cys Ser Thr Ser Leu Thr Pro Trp Ile Asp Phe Thr Lys Ile Phe Gly
        595                 600                 605

Lys Ile Asn Glu Ser Asn Tyr Asp Phe Ile Glu Lys Ile Ile Tyr Asp
    610                 615                 620

Val Thr Val Phe Glu Asp Lys Lys Ile Leu Arg Arg Arg Leu Lys Lys
625                 630                 635                 640

Glu Tyr Asp Leu Asp Glu Glu Lys Ile Lys Lys Ile Leu Lys Leu Lys
                645                 650                 655

Tyr Ser Gly Trp Ser Arg Leu Ser Lys Lys Leu Leu Ser Gly Ile Lys
            660                 665                 670

Thr Lys Arg Thr Pro Glu Thr Val Leu Glu Val Met Glu Thr Asn Met
        675                 680                 685

Asn Leu Met Gln Val Ile Asn Asp Glu Lys Leu Gly Phe Lys Lys Thr
    690                 695                 700

Ile Asp Asp Ala Asn Ser Thr Ser Val Ser Gly Lys Phe Ser Tyr Ala
```

```
705                 710                 715                 720

Glu Val Gln Glu Leu Ala Gly Ser Pro Ala Ile Lys Arg Gly Ile Trp
                725                 730                 735

Gln Ala Leu Leu Ile Val Asp Glu Ile Lys Lys Ile Met Lys His Glu
            740                 745                 750

Pro Ala His Val Tyr Ile Glu Phe Ala Arg Asn Glu Asp Lys Glu Arg
        755                 760                 765

Lys Asp Ser Phe Val Asn Gln Met Leu Lys Leu Tyr Lys Asp Phe Glu
    770                 775                 780

Asp Glu Ala Asn Lys His Leu Lys Gly Glu Asp Ala Lys Ser Lys Ile
785                 790                 795                 800

Arg Ser Glu Arg Leu Lys Leu Tyr Tyr Thr Gln Met Gly Lys Cys Met
                805                 810                 815

Tyr Thr Gly Lys Ser Leu Asp Ile Asp Arg Leu Asp Thr Tyr Gln Val
            820                 825                 830

Asp His Ile Val Pro Gln Ser Leu Leu Lys Asp Asp Ser Ile Asp Asn
        835                 840                 845

Lys Val Leu Val Leu Ser Ser Glu Asn Gln Arg Lys Leu Asp Asp Leu
    850                 855                 860

Val Ile Pro Ser Ser Ile Arg Asn Lys Met Tyr Gly Phe Trp Glu Lys
865                 870                 875                 880

Leu Phe Asn Asn Lys Ile Ile Ser Pro Lys Lys Phe Tyr Ser Leu Ile
                885                 890                 895

Lys Thr Glu Phe Asn Glu Lys Asp Gln Glu Arg Phe Ile Asn Arg Gln
            900                 905                 910

Ile Val Glu Thr Arg Gln Ile Thr Lys His Val Ala Gln Ile Ile Asp
```

915 920 925

Asn His Tyr Glu Asn Thr Lys Val Val Thr Val Arg Ala Asp Leu Ser
930 935 940

His Gln Phe Arg Glu Arg Tyr His Ile Tyr Lys Asn Arg Asp Ile Asn
945 950 955 960

Asp Phe His His Ala His Asp Ala Tyr Ile Ala Thr Ile Leu Gly Thr
965 970 975

Tyr Ile Gly His Arg Phe Glu Ser Leu Asp Ala Lys Tyr Ile Tyr Gly
980 985 990

Glu Tyr Lys Arg Ile Phe Arg Gln Lys Asn Lys Gly Lys Asn Asp Gly
995 1000 1005

Phe Ile Leu Asn Ser Met Arg Asn Ile Tyr Ala Asp Lys Asp Thr
1010 1015 1020

Gly Glu Ile Val Trp Asp Pro Asn Tyr Ile Asp Arg Ile Lys Lys
1025 1030 1035

Cys Phe Tyr Tyr Lys Asp Cys Phe Val Thr Lys Lys Leu Glu Glu
1040 1045 1050

Asn Asn Gly Thr Phe Phe Asn Thr Val Leu Pro Asn Asp Thr Asn
1055 1060 1065

Ser Asp Lys Asp Ala Thr Val Pro Val Asn Lys Tyr Arg Ser Asn
1070 1075 1080

Val Asn Lys Tyr Gly Gly Phe Ser Gly Val Asn Ser Phe Ile Val
1085 1090 1095

Ala Ile Lys Gly Lys Lys Lys Lys Gly Lys Lys Val Ile Glu Val
1100 1105 1110

Asn Lys Leu Thr Gly Ile Pro Leu Met Tyr Lys Asn Ala Asp Glu

1115 1120 1125

Glu Ile Lys Ile Asn Tyr Leu Lys Gln Ala Glu Asp Leu Glu Glu
1130 1135 1140

Val Gln Ile Gly Lys Glu Ile Leu Lys Asn Gln Leu Ile Glu Lys
1145 1150 1155

Asp Gly Gly Leu Tyr Tyr Ile Val Ala Glu Ile Ile Asn Ala Lys
1160 1165 1170

Gln Leu Ile Leu Asn Glu Ser Gln Thr Lys Leu Val Cys Glu Ile
1175 1180 1185

Tyr Lys Ala Met Lys Tyr Lys Asn Tyr Asp Asn Leu Asp Ser Glu
1190 1195 1200

Lys Ile Ile Asp Leu Tyr Arg Leu Leu Ile Asn Lys Met Glu Leu
1205 1210 1215

Tyr Tyr Pro Glu Tyr Arg Lys Gln Leu Val Lys Lys Phe Glu Asp
1220 1225 1230

Leu Lys Val Ile Ser Ile Glu Glu Lys Cys Asn Ile Ile Gln Ile
1235 1240 1245

Leu Ala Thr Leu His Cys Asn Ser Ser Ile Gly Lys Ile Met Tyr
1250 1255 1260

Ser Asp Phe Lys Ile Ser Thr Thr Ile Gly Arg Leu Asn Gly Arg
1265 1270 1275

Thr Ile Ser Leu Asp Ile Ser Phe Ile Ala Glu Ser Pro Thr Gly
1280 1285 1290

Met Tyr Ser Lys Lys Tyr Lys Leu
1295 1300

<210> 246

<211> 1304
<212> PRT
<213> Lactobacillus animalis

<400> 246

```
Leu Lys Lys Asp Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly His Ala Val Val Thr Asp Asp Tyr Lys Val Pro Thr Lys Lys Met
            20                  25                  30

Lys Val Phe Gly Asp Thr Ser Lys Lys Thr Ile Lys Lys Asn Met Leu
        35                  40                  45

Gly Val Leu Leu Phe Asn Glu Gly Gln Thr Ala Ala Asp Thr Arg Leu
    50                  55                  60

Lys Arg Gly Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Leu Arg
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Pro Ala Leu Ala Lys Val Asp Pro Asn
                85                  90                  95

Phe Phe Tyr Arg Leu Glu Glu Ser Ser Leu Val Ala Glu Asp Lys Lys
            100                 105                 110

Tyr Asp Val Tyr Pro Ile Phe Gly Lys Arg Glu Glu Glu Leu Leu Tyr
        115                 120                 125

His Asp Thr His Lys Thr Ile Tyr His Leu Arg Ser Glu Leu Ala Asn
    130                 135                 140

Asn Asp Arg Pro Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Leu Glu Gly Glu Ile Asp Leu
                165                 170                 175

Arg Thr Thr Asp Ile Asn Lys Val Phe Ala Glu Phe Ser Glu Thr Leu
            180                 185                 190
```

```
Asn Glu Asn Ser Asp Glu Asn Leu Gly Lys Leu Asp Val Ala Asp Ile
        195                 200                 205

Phe Lys Asp Asn Thr Phe Ser Lys Thr Lys Lys Ser Glu Glu Leu Leu
    210                 215                 220

Lys Leu Ser Gly Lys Lys Asn Gln Leu Ala His Gln Leu Phe Lys Met
225                 230                 235                 240

Met Val Gly Asn Met Gly Ser Phe Lys Lys Val Leu Gly Thr Asp Glu
                245                 250                 255

Glu His Lys Leu Ser Phe Gly Lys Asp Thr Tyr Glu Asp Asp Leu Asn
            260                 265                 270

Asp Leu Leu Ala Glu Ala Gly Asp Gln Tyr Leu Asp Ile Phe Val Ala
        275                 280                 285

Ala Lys Lys Val Tyr Asp Ala Ala Ile Leu Ala Ser Ile Leu Asp Val
    290                 295                 300

Lys Asp Thr Gln Thr Lys Thr Val Phe Ser Gln Ala Met Ile Glu Arg
305                 310                 315                 320

Tyr Glu Glu His Gln Lys Asp Leu Ile Glu Leu Lys Arg Val Phe Lys
                325                 330                 335

Lys Tyr Leu Pro Glu Lys Cys His Asp Phe Phe Ser Glu Pro Lys Ile
            340                 345                 350

Ser Gly Tyr Ala Gly Tyr Ile Asp Gly Lys Val Ser Glu Glu Asp Phe
        355                 360                 365

Tyr Lys Tyr Thr Lys Lys Thr Leu Lys Gly Ile Pro Glu Thr Glu Glu
    370                 375                 380

Ile Leu Gln Lys Ile Asp Ala Asn Asn Tyr Leu Arg Lys Gln Arg Thr
385                 390                 395                 400
```

```
Phe Asp Asn Gly Ala Ile Pro His Gln Val His Leu Lys Glu Leu Val
                405                 410                 415

Ala Ile Val Glu Asn Gln Gly Lys Tyr Tyr Pro Phe Leu Arg Glu Asn
            420                 425                 430

Lys Asp Lys Phe Glu Lys Ile Leu Asn Phe Arg Ile Pro Tyr Tyr Val
        435                 440                 445

Gly Pro Leu Ala Arg Gly Asn Ser Lys Phe Ala Trp Leu Thr Arg Ala
    450                 455                 460

Gly Glu Gly Lys Ile Thr Pro Tyr Asn Phe Asp Glu Met Ile Asp Lys
465                 470                 475                 480

Glu Thr Ser Ala Glu Asp Phe Ile Lys Arg Met Thr Ile Asn Asp Leu
                485                 490                 495

Tyr Leu Pro Thr Glu Pro Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            500                 505                 510

Arg Tyr Thr Ile Phe Asn Glu Leu Ala Gly Val Arg Tyr Val Thr Glu
        515                 520                 525

Asn Gly Glu Ala Lys Tyr Phe Asp Ala Gln Thr Lys Arg Ser Ile Phe
    530                 535                 540

Glu Leu Phe Lys Leu Asp Arg Lys Val Ser Glu Lys Met Val Ile Lys
545                 550                 555                 560

His Leu Lys Val Val Met Pro Ala Ile Arg Ile Gln Ala Leu Lys Gly
                565                 570                 575

Leu Asp Asn Gly Lys Phe Asn Ala Ser Tyr Gly Thr Tyr Lys Asp Leu
            580                 585                 590

Val Asp Met Gly Val Ala Pro Glu Leu Leu Asn Asp Glu Val Asn Ser
        595                 600                 605
```

```
Glu Lys Trp Glu Asp Ile Ile Lys Thr Leu Thr Ile Phe Glu Gly Arg
    610                 615                 620

Lys Leu Ile Lys Arg Arg Leu Glu Asn Tyr Arg Asp Phe Leu Gly Glu
625                 630                 635                 640

Asp Ile Leu Arg Lys Leu Ser Arg Lys Lys Tyr Thr Gly Trp Gly Arg
                645                 650                 655

Leu Ser Ala Lys Leu Leu Asp Gly Ile Tyr Asp Lys Lys Thr His Lys
            660                 665                 670

Thr Ile Leu Asp Cys Leu Met Glu Asp Tyr Ser Gln Asn Phe Met Gln
        675                 680                 685

Leu Ile Asn Asp Asp Thr Tyr Ser Phe Lys Glu Thr Ile Lys Asn Ala
    690                 695                 700

Gln Val Ile Glu Lys Glu Glu Thr Leu Ala Lys Thr Val Gln Glu Leu
705                 710                 715                 720

Pro Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu Glu Ile
                725                 730                 735

Val Asp Glu Ile Ile Lys Val Met Gly Tyr Lys Pro Lys Ser Ile Val
            740                 745                 750

Val Glu Met Ala Arg Glu Thr Gln Thr His Gly Thr Arg Lys Arg Glu
        755                 760                 765

Asp Arg Val Gln Gln Ile Val Lys Asn Leu Lys Glu Leu Pro Lys Pro
    770                 775                 780

Ser Asn Ala Glu Leu Ser Asp Glu Arg Lys Tyr Leu Tyr Cys Leu Gln
785                 790                 795                 800

Asn Gly Arg Asp Met Tyr Thr Gly Ala Pro Leu Asp Tyr Asp His Leu
                805                 810                 815
```

```
Gln Phe Tyr Asp Val Asp His Ile Ile Pro Gln Ser Phe Leu Lys Asp
            820                 825                 830

Asp Ser Ile Glu Asn Lys Val Leu Thr Ile Lys Lys Glu Asn Val Arg
        835                 840                 845

Lys Thr Asn Gly Leu Pro Ser Glu Ala Val Ile Gln Lys Met Gly Ser
    850                 855                 860

Phe Trp Lys Lys Leu Leu Asp Ala Gly Ala Met Thr Asn Lys Lys Tyr
865                 870                 875                 880

Asp Asn Leu Arg Arg Asn Leu His Gly Gly Leu Asn Glu Lys Leu Lys
                885                 890                 895

Glu Arg Phe Ile Glu Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys
            900                 905                 910

Tyr Val Ala Gln Leu Leu Asp Gln Arg Leu Asn Tyr Asp Gly Asn Gly
        915                 920                 925

Val Glu Leu Asp Glu Lys Ile Ala Ile Val Thr Leu Lys Ala Gln Leu
    930                 935                 940

Ala Ser Gln Phe Arg Ser Glu Phe Lys Leu Arg Lys Val Arg Ala Leu
945                 950                 955                 960

Asn Asn Leu His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Ala
                965                 970                 975

Asn Leu Ile Met Ala Lys Tyr Pro Glu Leu Glu Pro Glu Phe Val Tyr
            980                 985                 990

Gly Lys Tyr Arg Lys Thr Lys Phe  Lys Gly Leu Gly Lys  Ala Thr Ala
        995                 1000                1005

Lys Asn  Thr Leu Tyr Ala Asn  Val Leu Tyr Phe Leu  Lys Glu Asn
    1010                1015                1020
```

```
Glu Val  Tyr Pro Phe Trp Asp  Lys Ala Arg Asp Leu  Pro Thr Ile
    1025                1030                1035

Lys Arg  Tyr Leu Tyr Arg Ala  Gln Val Asn Lys Val  Arg Lys Ala
    1040                1045                1050

Glu Arg  Gln Thr Gly Gly Phe  Ser Asp Glu Met Leu  Val Pro Lys
    1055                1060                1065

Ser Asp  Ser Gly Lys Leu Leu  Pro Arg Lys Glu Gly  Leu Asp Pro
    1070                1075                1080

Val Lys  Tyr Gly Gly Tyr Ala  Lys Ala Val Glu Ser  Tyr Ala Val
    1085                1090                1095

Leu Ile  Thr Ala Asp Glu Val  Lys Lys Gly Lys Thr  Lys Lys Val
    1100                1105                1110

Lys Thr  Leu Val Asn Ile Pro  Ile Ile Asp Ser Lys  Lys Tyr Glu
    1115                1120                1125

Ala Asp  Pro Thr Ala Tyr Leu  Ala Ser Arg Gly Tyr  Thr Asn Val
    1130                1135                1140

Thr Asn  Ser Phe Ile Leu Pro  Lys Tyr Ser Leu Leu  Glu Asp Pro
    1145                1150                1155

Glu Gly  Arg Arg Arg Tyr Leu  Ala Ser Lys Glu Phe  Gln Lys Ala
    1160                1165                1170

Asn Glu  Leu Ile Leu Pro Gln  His Leu Val Glu Leu  Leu Tyr Trp
    1175                1180                1185

Val Asn  Ala Lys Asp Gly Glu  Gln Lys Leu Glu Asp  His Lys Ala
    1190                1195                1200

Glu Phe  Lys Glu Leu Phe Asp  Lys Ile Met Glu Phe  Ala Asp Lys
    1205                1210                1215
```

```
Tyr Val  Val Ala Pro Lys Asn  Ser Glu Lys Ile Arg  Arg Leu Tyr
    1220                1225                1230


Glu Glu  Asn Gln Asp Ala Thr  Pro Met Glu Leu Gly  Lys Asn Phe
    1235                1240                1245


Val Glu  Leu Leu Arg Tyr Thr  Ala Asp Gly Ala Ala  Ser Asp Phe
    1250                1255                1260


Lys Phe  Phe Gly Glu Asn Ile  Pro Arg Lys Arg Tyr  Asn Ser Ala
    1265                1270                1275


Gly Ser  Leu Leu Asn Gly Thr  Leu Ile Tyr Gln Ser  Lys Thr Gly
    1280                1285                1290


Leu Tyr  Glu Thr Arg Ile Asp  Leu Gly Lys Leu
    1295                1300


<210>  247
<211>  1292
<212>  PRT
<213>  Lactobacillus curvatus

<400>  247

Met Ser Arg Pro Tyr Asn Ile Gly Leu Asp Ile Gly Thr Ser Ser Ile
1               5                   10                  15


Gly Trp Ser Val Val Asp Asp Gln Ser Lys Leu Val Ser Val Arg Gly
            20                  25                  30


Lys Tyr Gly Tyr Gly Val Arg Leu Tyr Asp Glu Gly Gln Thr Ala Ala
        35                  40                  45


Glu Arg Arg Ser Phe Arg Thr Thr Arg Arg Arg Leu Lys Arg Arg Lys
    50                  55                  60


Trp Arg Leu Gly Leu Leu Arg Glu Ile Phe Glu Pro Tyr Ile Thr Pro
65                  70                  75                  80
```

```
Val Asp Asp Thr Phe Phe Leu Arg Lys Lys Gln Ser Asn Leu Ser Pro
                85                  90                  95

Lys Asp Gln Arg Lys Gln Thr Ser Leu Phe Asn Asp Arg Thr Asp Arg
            100                 105                 110

Ala Phe Tyr Asp Asp Tyr Pro Thr Ile Tyr His Leu Arg Tyr Lys Leu
        115                 120                 125

Met Thr Glu Lys Arg Gln Phe Asp Ile Arg Glu Ile Tyr Leu Ala Met
    130                 135                 140

His His Ile Val Lys Tyr Arg Gly His Phe Leu Asn Glu Ala Pro Val
145                 150                 155                 160

Ser Ser Phe Lys Ser Ser Glu Ile Asn Leu Val Ala His Phe Asp Arg
                165                 170                 175

Leu Asn Thr Ile Phe Ala Asp Leu Phe Ser Glu Ser Gly Phe Thr Asp
            180                 185                 190

Lys Leu Ala Glu Val Lys Ala Leu Leu Leu Asp Asn His Gln Ser Ala
        195                 200                 205

Ser Asn Arg Gln Arg Gln Ala Leu Leu Leu Ile Tyr Thr Pro Ser Lys
    210                 215                 220

Gln Asn Lys Ala Ile Ala Thr Glu Leu Leu Lys Ala Ile Leu Gly Leu
225                 230                 235                 240

Lys Ala Lys Phe Asn Val Leu Thr Gly Ile Glu Ala Glu Asp Val Lys
                245                 250                 255

Thr Trp Thr Leu Thr Phe Asn Ala Glu Asn Phe Asp Glu Glu Met Val
            260                 265                 270

Lys Leu Glu Ser Ser Leu Asp Asp Asn Ala His Gln Ile Ile Glu Ser
        275                 280                 285
```

```
Leu Gln Glu Leu Tyr Ser Gly Val Leu Leu Ala Gly Ile Val Pro Glu
    290                 295                 300

Asn Gln Ser Leu Ser Gln Ala Met Ile Thr Lys Tyr Asp Asp His Gln
305                 310                 315                 320

Lys His Leu Lys Met Leu Lys Ala Val Arg Glu Ala Leu Ala Pro Glu
                325                 330                 335

Asp Arg Gln Arg Leu Lys Gln Ala Tyr Asp Gln Tyr Val Asp Gly Lys
            340                 345                 350

Ser Lys Glu Asp Phe Tyr Gly Asp Ile Thr Lys Ala Leu Lys Asn Asn
        355                 360                 365

Pro Asp His Pro Ile Val Ser Glu Ile Lys Lys Leu Ile Glu Leu Asp
    370                 375                 380

Gln Phe Met Pro Lys Gln Arg Thr Lys Asp Asn Gly Ala Ile Pro His
385                 390                 395                 400

Gln Leu His Gln Gln Glu Leu Asp Arg Ile Ile Glu Asn Gln Gln Gln
                405                 410                 415

Tyr Tyr Pro Trp Leu Ala Glu Leu Asn Pro Asn Lys Leu Asp Glu Leu
            420                 425                 430

Val Ala Phe Arg Val Pro Tyr Tyr Val Gly Pro Leu Gln Gln Gln Ser
        435                 440                 445

Ser Asp Ala Lys Phe Ala Trp Met Ile Arg Lys Ala Glu Gly Gln Ile
    450                 455                 460

Thr Pro Trp Asn Phe Asp Asp Lys Val Asp Arg Gln Ala Ser Ala Asn
465                 470                 475                 480

Glu Phe Ile Lys Arg Met Thr Thr Thr Asp Thr Tyr Leu Leu Ala Glu
                485                 490                 495
```

```
Asp Val Leu Pro Lys Gln Ser Leu Ile Tyr Gln Arg Phe Glu Val Leu
            500                 505                 510

Asn Glu Leu Asn Gly Leu Lys Ile Asp Asp Gln Pro Ile Thr Thr Glu
        515                 520                 525

Leu Lys Gln Ala Ile Phe Thr Asp Leu Phe Met Gln Lys Thr Ser Val
    530                 535                 540

Thr Val Lys Asn Ile Gln Asp Tyr Leu Val Ser Glu Lys Arg Tyr Ala
545                 550                 555                 560

Ser Arg Pro Ala Ile Thr Gly Leu Ser Asp Glu Asn Lys Phe Asn Ser
                565                 570                 575

Arg Leu Ser Thr Tyr His Asp Leu Lys Thr Ile Val Gly Asp Ala Val
            580                 585                 590

Asp Asp Val Asp Lys Gln Ala Asp Leu Glu Lys Cys Ile Glu Trp Ser
        595                 600                 605

Thr Ile Phe Glu Asp Gly Lys Ile Tyr Ser Ala Lys Leu Asn Glu Ile
    610                 615                 620

Asp Trp Leu Thr Asp Gln Gln Arg Val Gln Leu Ala Ala Lys Arg Tyr
625                 630                 635                 640

Arg Gly Trp Gly Arg Leu Ser Ala Lys Leu Leu Thr Gln Ile Val Asn
                645                 650                 655

Ala Asn Gly Gln Arg Ile Met Asp Leu Leu Trp Thr Thr Asp Asn Phe
            660                 665                 670

Met Arg Ile Val His Ser Glu Asp Phe Asp Lys Leu Ile Thr Glu Ala
        675                 680                 685

Asn Gln Met Met Leu Ala Glu Asn Asp Val Gln Asp Val Ile Asn Asp
    690                 695                 700
```

```
Leu Tyr Thr Ser Pro Gln Asn Lys Lys Ala Leu Arg Gln Ile Leu Leu
705                 710                 715                 720


Val Val Asn Asp Ile Gln Lys Ala Met Lys Gly Gln Ala Pro Glu Arg
                725                 730                 735


Ile Leu Ile Glu Phe Ala Arg Glu Asp Glu Val Asn Pro Arg Leu Ser
            740                 745                 750


Val Gln Arg Lys Arg Gln Val Glu Gln Val Tyr Gln Asn Ile Ser Glu
        755                 760                 765


Leu Glu Ile Arg Asn Glu Leu Lys Asp Leu Ser Asn Ser Ala Leu Ser
    770                 775                 780


Asn Thr Arg Leu Phe Leu Tyr Phe Met Gln Gly Gly Arg Asp Met Tyr
785                 790                 795                 800


Thr Gly Asp Ser Leu Asn Ile Asp Arg Leu Ser Thr Tyr Asp Ile Asp
                805                 810                 815


His Ile Leu Pro Gln Ser Phe Ile Lys Asp Asn Ser Leu Asp Asn Arg
            820                 825                 830


Val Leu Val Ser Gln Arg Met Asn Arg Ser Lys Ala Asp Gln Val Pro
        835                 840                 845


Ser Val Glu Leu Gly Gln Lys Met Gln Ile Gln Trp Glu Gln Met Leu
    850                 855                 860


Arg Ala Gly Leu Ile Thr Lys Lys Lys Tyr Asp Asn Leu Thr Leu Asn
865                 870                 875                 880


Pro Asp Met Lys Gly Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln
                885                 890                 895


Val Ile Lys Leu Ala Thr Asn Leu Leu Met Glu Gln Tyr Gly Glu Asp
            900                 905                 910
```

```
Asn Ile Glu Leu Ile Thr Val Lys Ser Gly Leu Thr His Gln Met Arg
        915                 920                 925


Thr Glu Phe Asp Phe Pro Lys Asn Arg Asn Leu Asn Asn His His His
    930                 935                 940


Ala Phe Asp Ala Tyr Leu Thr Ala Phe Val Gly Leu Tyr Leu Leu Lys
945                 950                 955                 960


Arg Tyr Pro Lys Leu Lys Pro Tyr Phe Val Tyr Gly Glu Tyr Gln Lys
                965                 970                 975


Ala Ser Gln Gln Asp Lys Arg Asn Phe Asn Phe Leu Asn Gly Leu Lys
            980                 985                 990


Lys Asp Glu Leu Val Asp Glu Asn  Thr Glu Ala Val Ile  Trp Asn Lys
        995                 1000                1005


Glu Ser  Gly Leu Ala Tyr Leu  Asn Lys Ile Tyr Gln  Phe Lys Lys
    1010                1015                1020


Ile Leu  Val Thr Arg Glu Val  His Glu Asn Ser Gly  Ala Leu Phe
    1025                1030                1035


Asn Gln  Thr Leu Tyr Ala Ala  Lys Asp Asp Lys Ala  Ser Gly Gln
    1040                1045                1050


Leu Ile  Pro Ala Lys Gln Asp  Arg Pro Thr Ala Leu  Tyr Gly Gly
    1055                1060                1065


Tyr Ser  Gly Lys Thr Val Ala  Tyr Met Cys Ile Val  Arg Ile Lys
    1070                1075                1080


Asn Lys  Lys Gly Asp Leu Tyr  Lys Val Cys Gly Val  Glu Thr Ser
    1085                1090                1095


Trp Leu  Ala Gln Leu Lys Gln  Lys Lys Ala Phe Leu  Lys Gln Lys
    1100                1105                1110
```

```
Ile Ser  Pro Gln Phe Thr Lys  Val Lys Lys Gln Lys  Gly Thr Ile
    1115                1120                1125


Val Lys  Val Val Glu Asp Phe  Glu Val Ile Ala Pro  His Ile Leu
    1130                1135                1140


Ile Asn  Gln Arg Phe Phe Asp  Asn Gly Gln Glu Leu  Thr Leu Gly
    1145                1150                1155


Ser His  Asn Glu Gln Glu Leu  Ile Leu Asp Lys Thr  Ala Val Lys
    1160                1165                1170


Leu Leu  Asn Gly Ala Leu Pro  Leu Thr Gln Ser Glu  Glu Leu Ala
    1175                1180                1185


Glu Gln  Val Tyr Asp Glu Ile  Leu Asp Gln Val Met  His Tyr Phe
    1190                1195                1200


Pro Leu  Tyr Asp Thr Asn Gln  Phe Arg Ala Lys Leu  Ser Ala Gly
    1205                1210                1215


Lys Ala  Ala Asp Gly Asn Lys  Met Val Gln Val Gly  Gln Gln Val
    1220                1225                1230


Ile Leu  Asp Arg Val Leu Ile  Gly Leu His Ala Asn  Ala Ala Val
    1235                1240                1245


Ser Asp  Leu Gly Val Leu Lys  Ile Ser Thr Pro Leu  Gly Lys Met
    1250                1255                1260


Gln Gln  Pro Ser Gly Ile Ser  Asp Thr Gln Ile Ile  Tyr Gln Ser
    1265                1270                1275


Pro Thr  Gly Leu Phe Glu Arg  Arg Val Ala Leu Arg  Asp Leu
    1280                1285                1290


<210>  248
<211>  1291
<212>  PRT
```

<213> Lactobacillus farciminis

<400> 248

```
Lys Glu Gln Pro Tyr Asn Ile Gly Leu Asp Ile Gly Thr Gly Ser Val
1               5                  10                  15


Gly Trp Ala Val Thr Asn Asp Asn Tyr Asp Leu Leu Asn Ile Lys Lys
            20                  25                  30


Lys Asn Leu Trp Gly Val Arg Leu Phe Glu Gly Ala Gln Thr Ala Lys
        35                  40                  45


Glu Thr Arg Leu Asn Arg Ser Thr Arg Arg Arg Tyr Arg Arg Arg Lys
    50                  55                  60


Asn Arg Ile Asn Trp Leu Asn Glu Ile Phe Ser Glu Glu Leu Ala Asn
65                  70                  75                  80


Thr Asp Pro Ser Phe Leu Ile Arg Leu Gln Asn Ser Trp Val Ser Lys
                85                  90                  95


Lys Asp Pro Asp Arg Lys Arg Asp Lys Tyr Asn Leu Phe Ile Asp Asn
            100                 105                 110


Pro Tyr Thr Asp Lys Glu Tyr Tyr Arg Glu Phe Pro Thr Ile Phe His
        115                 120                 125


Leu Arg Lys Glu Leu Ile Ile Asn Lys Asn Lys Ala Asp Ile Arg Leu
    130                 135                 140


Val Tyr Leu Ala Leu His Asn Ile Leu Lys Tyr Arg Gly Asn Phe Thr
145                 150                 155                 160


Tyr Glu His Gln Lys Phe Asn Ile Ser Thr Leu Asn Ser Asn Leu Ser
                165                 170                 175


Lys Glu Leu Ile Glu Leu Asn Gln Gln Leu Ile Lys Tyr Asp Ile Ser
            180                 185                 190
```

```
Phe Pro Asp Asn Cys Asp Trp Asn His Ile Ser Asp Ile Leu Ile Gly
        195                 200                 205

Arg Gly Asn Ala Thr Gln Lys Ser Ser Asn Ile Leu Asn Asn Phe Thr
    210                 215                 220

Lys Glu Thr Lys Lys Leu Leu Lys Glu Val Ile Asn Leu Ile Leu Gly
225                 230                 235                 240

Asn Val Ala His Leu Asn Thr Ile Phe Lys Thr Ser Leu Thr Lys Asp
                245                 250                 255

Glu Glu Lys Leu Ser Phe Ser Gly Lys Asp Ile Glu Ser Lys Leu Asp
            260                 265                 270

Asp Leu Asp Ser Ile Leu Asp Asp Asp Gln Phe Thr Val Leu Asp Thr
        275                 280                 285

Ala Asn Arg Ile Tyr Ser Thr Ile Thr Leu Asn Glu Ile Leu Asn Gly
    290                 295                 300

Glu Ser Tyr Phe Ser Met Ala Lys Val Asn Gln Tyr Glu Asn His Ala
305                 310                 315                 320

Ile Asp Leu Cys Lys Leu Arg Asp Met Trp His Thr Thr Lys Asn Glu
                325                 330                 335

Lys Ala Val Gly Leu Ser Arg Gln Ala Tyr Asp Asp Tyr Ile Asn Lys
            340                 345                 350

Lys Lys Glu Leu Tyr Thr Ser Leu Lys Lys Phe Leu Lys Val Ala Leu
        355                 360                 365

Pro Thr Asn Leu Ala Lys Glu Ala Glu Glu Lys Ile Ser Lys Gly Thr
    370                 375                 380

Tyr Leu Val Lys Pro Arg Asn Ser Glu Asn Gly Val Val Pro Tyr Gln
385                 390                 395                 400
```

```
Leu Asn Lys Ile Glu Met Glu Lys Ile Ile Asp Asn Gln Ser Gln Tyr
                405                 410                 415

Tyr Pro Phe Leu Lys Glu Asn Lys Glu Lys Leu Leu Ser Ile Leu Ser
            420                 425                 430

Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Gln Ser Ser Glu Lys Asn
        435                 440                 445

Pro Phe Ala Trp Met Glu Arg Lys Ser Asn Gly His Ala Arg Pro Trp
    450                 455                 460

Asn Phe Asp Glu Ile Val Asp Arg Glu Lys Ser Ser Asn Lys Phe Ile
465                 470                 475                 480

Arg Arg Met Thr Val Thr Asp Ser Tyr Leu Val Gly Glu Pro Val Leu
                485                 490                 495

Pro Lys Asn Ser Leu Ile Tyr Gln Arg Tyr Glu Val Leu Asn Glu Leu
            500                 505                 510

Asn Asn Ile Arg Ile Thr Glu Asn Leu Lys Thr Asn Pro Thr Gly Ser
        515                 520                 525

Arg Leu Thr Val Glu Thr Lys Gln His Ile Tyr Asn Glu Leu Phe Lys
    530                 535                 540

Asn Tyr Lys Lys Ile Thr Val Lys Lys Leu Thr Lys Trp Leu Ile Ala
545                 550                 555                 560

Gln Gly Tyr Tyr Lys Asn Pro Ile Leu Ile Gly Leu Ser Gln Lys Asp
                565                 570                 575

Glu Phe Asn Ser Thr Leu Thr Thr Tyr Leu Asp Met Lys Lys Ile Phe
            580                 585                 590

Gly Ser Ser Phe Met Glu Asn Asn Lys Asn Tyr Asn Gln Ile Glu Glu
        595                 600                 605
```

```
Leu Ile Glu Trp Leu Thr Ile Phe Glu Asp Lys Gln Ile Leu Asn Glu
    610                 615                 620

Lys Leu His Ser Ser Asn Tyr Ser Tyr Thr Ser Asp Gln Ile Lys Lys
625                 630                 635                 640

Ile Ser Asn Met Arg Tyr Lys Gly Trp Gly Arg Leu Ser Lys Lys Ile
                645                 650                 655

Leu Thr Cys Ile Thr Thr Glu Thr Asn Thr Pro Lys Ser Leu Gln Leu
            660                 665                 670

Ser Asn Asp Leu Met Trp Thr Thr Asn Asn Asn Phe Ile Ser Ile Ile
        675                 680                 685

Ser Asn Asp Lys Tyr Asp Phe Lys Asn Tyr Ile Glu Asn His Asn Leu
    690                 695                 700

Asn Lys Asn Glu Asp Gln Asn Ile Ser Asn Leu Val Asn Asp Ile His
705                 710                 715                 720

Val Ser Pro Ala Leu Lys Arg Gly Ile Thr Gln Ser Ile Lys Ile Val
                725                 730                 735

Gln Glu Ile Val Lys Phe Met Gly His Ala Pro Lys Tyr Ile Phe Ile
            740                 745                 750

Glu Val Thr Arg Glu Thr Lys Thr Thr Ser Arg Gly Lys Arg Ile Gln
        755                 760                 765

Arg Leu Gln Ser Lys Leu Leu Asn Lys Ala Asn Gly Leu Val Pro Glu
    770                 775                 780

Glu Leu Lys Lys His Lys Asn Asp Leu Ser Ser Glu Arg Ile Met Leu
785                 790                 795                 800

Tyr Phe Leu Gln Asn Gly Lys Ser Leu Tyr Ser Glu Glu Ser Leu Asn
                805                 810                 815
```

```
Ile Asn Lys Leu Ser Asp Tyr Gln Val Asp His Ile Leu Pro Arg Thr
            820                 825                 830

Tyr Ile Pro Asp Asp Ser Leu Glu Asn Lys Ala Leu Val Leu Ala Lys
        835                 840                 845

Glu Asn Gln Arg Lys Ala Asp Asp Leu Leu Leu Asn Ser Asn Val Ile
    850                 855                 860

Asp Lys Asn Leu Glu Arg Trp Thr Tyr Met Leu Asn Asn Asn Met Met
865                 870                 875                 880

Gly Leu Lys Lys Phe Lys Asn Leu Thr Arg Arg Val Ile Thr Asp Lys
                885                 890                 895

Asp Lys Leu Gly Phe Ile His Arg Gln Leu Val Gln Thr Ser Gln Met
            900                 905                 910

Val Lys Gly Val Ala Asn Ile Leu Asn Ser Met Tyr Lys Asn Gln Gly
        915                 920                 925

Thr Thr Cys Ile Gln Ala Arg Ala Asn Leu Ser Thr Ala Phe Arg Lys
    930                 935                 940

Ala Leu Glu Leu Val Lys Asn Arg Asn Ile Asn Asp Phe His His Ala
945                 950                 955                 960

Gln Asp Ala Tyr Leu Ala Ser Phe Leu Gly Thr Tyr Arg Leu Arg Arg
                965                 970                 975

Phe Pro Thr Asp Glu Met Leu Leu Met Asn Gly Glu Tyr Asn Lys Phe
            980                 985                 990

Tyr Gly Lys Glu Leu Tyr Ser Lys  Lys Ser Arg Lys Asn  Gly Phe Ile
        995                 1000                1005

Ile Ser  Pro Leu Val Asn Gly  Thr Thr Gln Asp Arg  Asn Thr Gly
    1010                1015                1020
```

```
Glu Ile  Ile Trp Asn Val Gly  Phe Arg Asp Lys Ile  Leu Lys Ile
    1025                1030                1035

Phe Asn  Tyr His Gln Cys Asn  Val Thr Arg Lys Thr  Glu Ile Lys
    1040                1045                1050

Thr Gly  Gln Phe Tyr Asp Gln  Thr Ile Tyr Ser Pro  Lys Asn Pro
    1055                1060                1065

Lys Lys  Leu Ile Ala Gln Lys  Lys Asp Met Asp Pro  Asn Ile Tyr
    1070                1075                1080

Gly Gly  Phe Ser Gly Asp Asn  Lys Ser Ser Ile Thr  Ile Val Lys
    1085                1090                1095

Ile Asp  Asn Asn Lys Ile Lys  Pro Val Ala Ile Pro  Ile Arg Leu
    1100                1105                1110

Ile Asn  Asp Lys Lys Thr Leu  Gln Asn Trp Leu Glu  Glu Asn Val
    1115                1120                1125

Lys His  Lys Lys Ser Ile Gln  Ile Ile Lys Asn Asn  Val Pro Ile
    1130                1135                1140

Gly Gln  Ile Ile Tyr Ser Lys  Lys Val Gly Leu Leu  Ser Arg Glu
    1145                1150                1155

Ile Ala  Asn Arg Gln Gln Leu  Ile Leu Pro Pro Glu  His Ser Ala
    1160                1165                1170

Leu Leu  Arg Ile Leu Gln Ile  Pro Asp Glu Asp Pro  Asp Gln Ile
    1175                1180                1185

Leu Ala  Phe Tyr Asp Lys Asn  Ile Leu Val Glu Ile  Leu Gln Glu
    1190                1195                1200

Leu Ile  Thr Lys Met Lys Lys  Phe Tyr Pro Phe Tyr  Lys Asn Glu
    1205                1210                1215
```

```
Gln Glu  Phe Leu Ala Ser Phe  Asn Gln Ala Thr Thr  Ser Glu Lys
    1220                1225                1230


Ile Asn  Ser Leu Glu Glu Leu  Ile Thr Leu Leu His  Ala Asn Ser
    1235                1240                1245


Thr Ser  Ala His Leu Ile Phe  Asn Asn Ile Glu Lys  Lys Ala Phe
    1250                1255                1260


Gly Arg  Lys Thr His Gly Leu  Thr Asp Thr Asp Phe  Ile Tyr Gln
    1265                1270                1275


Ser Val  Thr Gly Leu Tyr Glu  Thr Arg Ile His Ile  Glu
    1280                1285                1290


<210>  249
<211>  1327
<212>  PRT
<213>  Listeria innocua

<400>  249

Met Lys Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30


Lys Ile Ala Gly Asp Ser Glu Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Ala Asp Arg Arg Met
    50                  55                  60


Ala Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80


Tyr Leu Gln Gly Ile Phe Ala Glu Glu Met Ser Lys Thr Asp Ala Asn
                85                  90                  95


Phe Phe Cys Arg Leu Ser Asp Ser Phe Tyr Val Asp Asn Glu Lys Arg
```

100 105 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Glu Tyr
115 120 125

His Lys Asn Tyr Pro Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
130 135 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
165 170 175

Gln Asn Thr Ser Val Asp Gly Ile Tyr Lys Gln Phe Ile Gln Thr Tyr
180 185 190

Asn Gln Val Phe Ala Ser Gly Ile Glu Lys Leu Glu Asp Asn Lys Asp
195 200 205

Val Ala Lys Ile Leu Val Glu Lys Val Thr Arg Lys Glu Lys Leu Glu
210 215 220

Arg Ile Leu Lys Leu Tyr Pro Gly Glu Lys Ser Ala Gly Met Phe Ala
225 230 235 240

Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Pro
245 250 255

Phe Asp Leu Ile Glu Lys Ser Asp Ile Glu Cys Ala Lys Asp Ser Tyr
260 265 270

Glu Glu Asp Leu Glu Ser Leu Leu Ala Leu Ile Gly Asp Glu Tyr Ala
275 280 285

Glu Leu Phe Val Ala Ala Lys Asn Ala Tyr Ser Ala Val Val Leu Ser
290 295 300

Ser Ile Ile Thr Val Ala Glu Thr Glu Thr Asn Ala Lys Leu Ser Ala

305 310 315 320

Ser Met Ile Glu Arg Phe Asp Thr His Glu Glu Asp Leu Gly Glu Leu
325 330 335

Lys Ala Phe Ile Lys Leu His Leu Pro Lys His Tyr Glu Glu Ile Phe
340 345 350

Ser Asn Thr Glu Lys His Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
355 360 365

Gln Ala Asp Phe Tyr Lys Tyr Met Lys Met Thr Leu Glu Asn Ile Glu
370 375 380

Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu Lys Glu Asn Phe Leu Arg
385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu
405 410 415

Glu Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe
420 425 430

Leu Lys Glu Asn Tyr Asp Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
435 440 445

Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly Gln Ser Glu Phe Ala Trp
450 455 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465 470 475 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
485 490 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
500 505 510

Leu Cys Tyr Gln Lys Tyr Leu Val Tyr Asn Glu Leu Thr Lys Val Arg

515 520 525

Tyr Ile Asn Asp Gln Gly Lys Thr Ser Tyr Phe Ser Gly Gln Glu Lys
530 535 540

Glu Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545 550 555 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Met Ser His Val Glu Ser Pro
565 570 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ser Ser Tyr Ser Thr Tyr
580 585 590

His Asp Leu Leu Lys Val Gly Ile Lys Gln Glu Ile Leu Asp Asn Pro
595 600 605

Val Asn Thr Glu Met Leu Glu Asn Ile Val Lys Ile Leu Thr Val Phe
610 615 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625 630 635 640

Leu Asp Gly Val Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
645 650 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Met Gly Ile Arg Asp Lys Gln
660 665 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
675 680 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
690 695 700

Ile Glu Lys Glu Gln Val Thr Thr Ala Asp Lys Asp Ile Gln Ser Ile
705 710 715 720

Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln

```
                725                 730                 735

Ser Leu Lys Ile Val Asp Glu Leu Val Ser Val Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
        755                 760                 765

Gly Lys Asn Asn Ser Arg Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800

Glu Leu Arg Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Asp Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp
    850                 855                 860

Asp Val Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu
865                 870                 875                 880

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925

Asn Ile Leu His Gln Arg Phe Asn Tyr Glu Lys Asp Asp His Gly Asn
```

```
    930                 935                 940

Thr Met Lys Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Asp Val Asn Asp
                965                 970                 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990

Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Asp
        995                 1000                1005

Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020

Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Asp
    1025                1030                1035

Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050

Leu Asp  Thr Val Lys Lys Val  Met Ser Tyr Arg Gln  Met Asn Ile
    1055                1060                1065

Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Lys Ala Thr
    1070                1075                1080

Ile Lys  Pro Lys Gly Asn Ser  Ser Lys Leu Ile Pro  Arg Lys Thr
    1085                1090                1095

Asn Trp  Asp Pro Met Lys Tyr  Gly Gly Leu Asp Ser  Pro Asn Met
    1100                1105                1110

Ala Tyr  Ala Val Val Ile Glu  Tyr Ala Lys Gly Lys  Asn Lys Leu
    1115                1120                1125

Val Phe  Glu Lys Lys Ile Ile  Arg Val Thr Ile Met  Glu Arg Lys
```

1130 1135 1140

Ala Phe Glu Lys Asp Glu Lys Ala Phe Leu Glu Glu Gln Gly Tyr
1145 1150 1155

Arg Gln Pro Lys Val Leu Ala Lys Leu Pro Lys Tyr Thr Leu Tyr
1160 1165 1170

Glu Cys Glu Glu Gly Arg Arg Arg Met Leu Ala Ser Ala Asn Glu
1175 1180 1185

Ala Gln Lys Gly Asn Gln Gln Val Leu Pro Asn His Leu Val Thr
1190 1195 1200

Leu Leu His His Ala Ala Asn Cys Glu Val Ser Asp Gly Lys Ser
1205 1210 1215

Leu Asp Tyr Ile Glu Ser Asn Arg Glu Met Phe Ala Glu Leu Leu
1220 1225 1230

Ala His Val Ser Glu Phe Ala Lys Arg Tyr Thr Leu Ala Glu Ala
1235 1240 1245

Asn Leu Asn Lys Ile Asn Gln Leu Phe Glu Gln Asn Lys Glu Gly
1250 1255 1260

Asp Ile Lys Ala Ile Ala Gln Ser Phe Val Asp Leu Met Ala Phe
1265 1270 1275

Asn Ala Met Gly Ala Pro Ala Ser Phe Lys Phe Phe Glu Thr Thr
1280 1285 1290

Ile Glu Arg Lys Arg Tyr Asn Asn Leu Lys Glu Leu Leu Asn Ser
1295 1300 1305

Thr Ile Ile Tyr Gln Ser Ile Thr Gly Leu Tyr Glu Ser Arg Lys
1310 1315 1320

Arg Leu Asp Asp

1325

<210> 250
<211> 1327
<212> PRT
<213> Listeria innocua

<400> 250

```
Met Lys Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30

Lys Ile Ala Gly Asp Ser Glu Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Ala Asp Arg Arg Met
    50                  55                  60

Ala Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Gly Ile Phe Ala Glu Glu Met Ser Lys Thr Asp Ala Asn
                85                  90                  95

Phe Phe Cys Arg Leu Ser Asp Ser Phe Tyr Val Asp Asn Glu Lys Arg
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Glu Tyr
        115                 120                 125

His Lys Asn Tyr Pro Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175
```

```
Gln Asn Thr Ser Val Asp Gly Ile Tyr Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Ala Ser Gly Ile Glu Lys Leu Glu Asp Asn Lys Asp
        195                 200                 205

Val Ala Lys Ile Leu Val Glu Lys Val Thr Arg Lys Glu Lys Leu Glu
    210                 215                 220

Arg Ile Leu Lys Leu Tyr Pro Gly Glu Lys Ser Ala Gly Met Phe Ala
225                 230                 235                 240

Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Pro
                245                 250                 255

Phe Asp Leu Ile Glu Lys Ser Asp Ile Glu Cys Ala Lys Asp Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Ser Leu Leu Ala Leu Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Glu Leu Phe Val Ala Ala Lys Asn Ala Tyr Ser Ala Val Val Leu Ser
    290                 295                 300

Ser Ile Ile Thr Val Ala Glu Thr Glu Thr Asn Ala Lys Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Phe Asp Thr His Glu Glu Asp Leu Gly Glu Leu
                325                 330                 335

Lys Ala Phe Ile Lys Leu His Leu Pro Lys His Tyr Glu Glu Ile Phe
            340                 345                 350

Ser Asn Thr Glu Lys His Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
        355                 360                 365

Gln Ala Asp Phe Tyr Lys Tyr Met Lys Met Thr Leu Glu Asn Ile Glu
    370                 375                 380
```

```
Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu Lys Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Tyr Asp Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly Gln Ser Glu Phe Ala Trp
    450                 455                 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Cys Tyr Gln Lys Tyr Leu Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Tyr Ile Asn Asp Gln Gly Lys Thr Ser Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Glu Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Met Ser His Val Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ser Ser Tyr Ser Thr Tyr
            580                 585                 590
```

```
His Asp Leu Leu Lys Val Gly Ile Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605

Val Asn Thr Glu Met Leu Glu Asn Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Val Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Met Gly Ile Arg Asp Lys Gln
            660                 665                 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Thr Thr Ala Asp Lys Asp Ile Gln Ser Ile
705                 710                 715                 720

Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735

Ser Leu Lys Ile Val Asp Glu Leu Val Ser Val Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
        755                 760                 765

Gly Lys Asn Asn Ser Arg Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800
```

```
Glu Leu Arg Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Asp Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp
    850                 855                 860

Asp Val Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu
865                 870                 875                 880

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925

Asn Ile Leu His Gln Arg Phe Asn Tyr Glu Lys Asp Asp His Gly Asn
    930                 935                 940

Thr Met Lys Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Asp Val Asn Asp
                965                 970                 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990

Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Asp
        995                 1000                1005
```

```
Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020

Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Asp
    1025                1030                1035

Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050

Leu Asp  Thr Val Lys Lys Val  Met Ser Tyr Arg Gln  Met Asn Ile
    1055                1060                1065

Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Lys Ala Thr
    1070                1075                1080

Ile Lys  Pro Lys Gly Asn Ser  Ser Lys Leu Ile Ser  Arg Lys Thr
    1085                1090                1095

Asn Trp  Asp Pro Met Lys Tyr  Gly Gly Leu Asp Ser  Pro Asn Met
    1100                1105                1110

Ala Tyr  Ala Val Val Ile Glu  Tyr Ala Lys Gly Lys  Asn Lys Leu
    1115                1120                1125

Val Phe  Glu Lys Lys Ile Ile  Arg Val Thr Ile Met  Glu Arg Lys
    1130                1135                1140

Ala Phe  Glu Lys Asp Glu Lys  Ala Phe Leu Glu Glu  Gln Gly Tyr
    1145                1150                1155

Arg Gln  Pro Lys Val Leu Ala  Lys Leu Pro Lys Tyr  Thr Leu Tyr
    1160                1165                1170

Glu Cys  Glu Glu Gly Arg Arg  Arg Met Leu Ala Ser  Ala Asn Glu
    1175                1180                1185

Ala Gln  Lys Gly Asn Gln Gln  Val Leu Pro Asn His  Leu Val Thr
    1190                1195                1200
```

```
Leu Leu  His His Val Ala Asn  Cys Glu Val Ser Asp  Gly Lys Ser
    1205                 1210                 1215


Leu Asp  Tyr Ile Glu Ser Asn  Arg Glu Met Phe Ala  Glu Leu Leu
    1220                 1225                 1230


Ala His  Val Ser Glu Phe Ala  Lys Arg Tyr Thr Leu  Ala Glu Ala
    1235                 1240                 1245


Asn Leu  Asn Lys Ile Asn Gln  Leu Phe Glu Gln Asn  Lys Glu Gly
    1250                 1255                 1260


Asp Ile  Lys Ala Ile Ala Gln  Ser Phe Val Asp Leu  Met Ala Phe
    1265                 1270                 1275


Asn Ala  Met Gly Ala Pro Ala  Ser Phe Lys Phe Phe  Glu Thr Thr
    1280                 1285                 1290


Ile Glu  Arg Lys Arg Tyr Asn  Asn Leu Lys Glu Leu  Leu Asn Ser
    1295                 1300                 1305


Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ser Arg Lys
    1310                 1315                 1320


Arg Leu  Asp Asp
    1325


<210>  251
<211>  1327
<212>  PRT
<213>  Listeria innocua

<400>  251

Met Lys Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30
```

```
Lys Ile Ala Gly Asp Ser Glu Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Glu Gly Gln Thr Ala Ala Asp Arg Arg Met
    50                  55                  60

Ala Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Gly Ile Phe Ala Glu Glu Met Ser Lys Thr Asp Ala Asn
                85                  90                  95

Phe Phe Cys Arg Leu Ser Asp Ser Phe Tyr Val Asp Asn Glu Lys Arg
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Glu Tyr
        115                 120                 125

His Lys Asn Tyr Pro Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Gln Asn Thr Ser Val Asp Gly Ile Tyr Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Ala Ser Gly Ile Glu Lys Leu Glu Asp Asn Lys Asp
        195                 200                 205

Val Ala Lys Ile Leu Val Glu Lys Val Thr Arg Lys Glu Lys Leu Glu
    210                 215                 220

Arg Ile Leu Lys Leu Tyr Pro Gly Glu Lys Ser Ala Gly Met Phe Ala
225                 230                 235                 240
```

```
Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Pro
                245                 250                 255

Phe Asp Leu Ile Glu Lys Ser Asp Ile Glu Cys Ala Lys Asp Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Ser Leu Leu Ala Leu Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Glu Leu Phe Val Ala Ala Lys Asn Ala Tyr Ser Ala Val Val Leu Ser
    290                 295                 300

Ser Ile Ile Thr Val Ala Glu Thr Glu Thr Asn Ala Lys Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Phe Asp Thr His Glu Glu Asp Leu Gly Glu Leu
                325                 330                 335

Lys Ala Phe Ile Lys Leu His Leu Pro Lys His Tyr Glu Glu Ile Phe
            340                 345                 350

Ser Asn Thr Glu Lys His Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
        355                 360                 365

Gln Ala Asp Phe Tyr Lys Tyr Met Lys Met Thr Leu Glu Asn Ile Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu Lys Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asn Tyr Asp Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly Gln Ser Glu Phe Ala Trp
    450                 455                 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Cys Tyr Gln Lys Tyr Leu Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Tyr Ile Asn Asp Gln Gly Lys Thr Ser Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Glu Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Met Ser His Val Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ser Ser Tyr Ser Thr Tyr
            580                 585                 590

His Asp Leu Leu Lys Val Gly Ile Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605

Val Asn Thr Glu Met Leu Glu Asn Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Val Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655
```

```
Trp Gly Arg Leu Ser Ala Lys Leu Leu Met Gly Ile Arg Asp Lys Gln
            660                 665                 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Thr Thr Ala Asp Lys Asp Ile Gln Ser Ile
705                 710                 715                 720

Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735

Ser Leu Lys Ile Val Asp Glu Leu Val Ser Val Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
        755                 760                 765

Gly Lys Asn Asn Ser Arg Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800

Glu Leu Arg Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Asp Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp
    850                 855                 860
```

```
Asp Val Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu
865                 870                 875                 880


Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895


Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910


Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925


Asn Ile Leu His Gln Arg Phe Asn Tyr Glu Lys Asp Asp His Gly Asn
    930                 935                 940


Thr Met Lys Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960


Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Asp Val Asn Asp
                965                 970                 975


Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990


Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Asp
        995                 1000                1005


Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020


Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Asp
    1025                1030                1035


Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050


Leu Asp  Thr Val Lys Lys Val  Met Ser Tyr Arg Gln  Met Asn Ile
    1055                1060                1065
```

```
Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Lys Ala Thr
    1070                1075                1080

Ile Lys  Pro Lys Gly Asn Ser  Ser Lys Leu Ile Ser  Arg Lys Thr
    1085                1090                1095

Asn Trp  Asp Pro Met Lys Tyr  Gly Gly Leu Asp Ser  Pro Asn Met
    1100                1105                1110

Ala Tyr  Ala Val Val Ile Glu  Tyr Ala Lys Gly Lys  Asn Lys Leu
    1115                1120                1125

Val Phe  Glu Lys Lys Ile Ile  Arg Val Thr Ile Met  Glu Arg Lys
    1130                1135                1140

Ala Phe  Glu Lys Asp Glu Lys  Ala Phe Leu Glu Glu  Gln Gly Tyr
    1145                1150                1155

Arg Gln  Pro Lys Val Leu Ala  Lys Leu Pro Lys Tyr  Thr Leu Tyr
    1160                1165                1170

Glu Cys  Glu Glu Gly Arg Arg  Arg Met Leu Ala Ser  Ala Asn Glu
    1175                1180                1185

Ala Gln  Lys Gly Asn Gln Gln  Val Leu Pro Asn His  Leu Val Thr
    1190                1195                1200

Leu Leu  His His Val Ala Asn  Cys Glu Val Ser Asp  Gly Lys Ser
    1205                1210                1215

Leu Asp  Tyr Ile Glu Ser Asn  Arg Glu Met Phe Ala  Glu Leu Leu
    1220                1225                1230

Ala His  Val Ser Glu Phe Ala  Lys Arg Tyr Thr Leu  Ala Glu Ala
    1235                1240                1245

Asn Leu  Asn Lys Ile Asn Gln  Leu Phe Glu Gln Asn  Lys Glu Gly
    1250                1255                1260
```

```
Asp Ile  Lys Ala Ile Ala Gln  Ser Phe Val Asp Leu  Met Ala Phe
    1265                 1270                 1275


Asn Ala  Met Gly Ala Pro Ala  Ser Phe Lys Phe Phe  Glu Thr Thr
    1280                 1285                 1290


Ile Glu  Arg Lys Arg Tyr Asn  Asn Leu Lys Glu Leu  Leu Asn Ser
    1295                 1300                 1305


Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ser Arg Lys
    1310                 1315                 1320


Arg Leu  Asp Asp
    1325
```

<210> 252
<211> 1101
<212> PRT
<213> Listeria innocua

<400> 252

```
Leu Lys Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala Gln Phe
1               5                   10                  15


Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Pro Phe Asp
            20                  25                  30


Leu Ile Glu Lys Ser Asp Ile Glu Cys Ala Lys Asp Ser Tyr Glu Glu
        35                  40                  45


Asp Leu Glu Ser Leu Leu Ala Leu Ile Gly Asp Glu Tyr Ala Glu Leu
    50                  55                  60


Phe Val Ala Ala Lys Asn Ala Tyr Ser Ala Val Val Leu Ser Ser Ile
65                  70                  75                  80


Ile Thr Val Ala Glu Thr Glu Thr Asn Ala Lys Leu Ser Ala Ser Met
                85                  90                  95
```

```
Ile Glu Arg Phe Asp Thr His Glu Glu Asp Leu Gly Glu Leu Lys Ala
            100                 105                 110

Phe Ile Lys Leu His Leu Pro Lys His Tyr Glu Glu Ile Phe Ser Asn
        115                 120                 125

Thr Glu Lys His Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys Gln Ala
    130                 135                 140

Asp Phe Tyr Lys Tyr Met Lys Thr Thr Leu Glu Asn Ile Glu Gly Ala
145                 150                 155                 160

Asp Tyr Phe Ile Ala Lys Ile Glu Lys Glu Asn Phe Leu Arg Lys Gln
                165                 170                 175

Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu Glu Glu
            180                 185                 190

Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe Leu Lys
        195                 200                 205

Glu Asn Tyr Asp Lys Ile Lys Ser Leu Val Thr Phe Arg Ile Pro Tyr
    210                 215                 220

Phe Val Gly Pro Leu Ala Asn Gly Gln Ser Glu Phe Ala Trp Leu Thr
225                 230                 235                 240

Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu Lys Val
                245                 250                 255

Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr Asn Lys
            260                 265                 270

Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser Leu Cys
        275                 280                 285

Tyr Gln Lys Tyr Leu Val Tyr Asn Glu Leu Thr Lys Val Arg Tyr Ile
    290                 295                 300
```

```
Asn Asp Gln Gly Lys Thr Ser Tyr Phe Ser Gly Gln Glu Lys Glu Gln
305                 310                 315                 320

Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys Lys Asp
                325                 330                 335

Leu Glu Leu Phe Leu Arg Asn Met Ser His Val Glu Ser Pro Thr Ile
            340                 345                 350

Glu Gly Leu Glu Asp Ser Phe Asn Ser Ser Tyr Ser Thr Tyr His Asp
        355                 360                 365

Leu Leu Lys Val Gly Ile Lys Gln Glu Ile Leu Asp Asn Pro Val Asn
    370                 375                 380

Thr Glu Met Leu Glu Asn Ile Val Lys Ile Leu Thr Val Phe Glu Asp
385                 390                 395                 400

Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val Leu Asp
                405                 410                 415

Gly Val Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly
            420                 425                 430

Arg Leu Ser Ala Lys Leu Leu Met Gly Ile Arg Asp Lys Gln Ser His
        435                 440                 445

Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg Asn Leu
    450                 455                 460

Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile Ile Glu
465                 470                 475                 480

Lys Glu Gln Val Thr Thr Ala Asp Lys Asp Ile Gln Ser Ile Val Ala
                485                 490                 495

Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu
            500                 505                 510
```

```
Lys Ile Val Asp Glu Leu Val Ser Val Met Gly Tyr Pro Pro Gln Thr
        515                 520                 525

Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys Gly Lys
    530                 535                 540

Asn Asn Ser Arg Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile Lys Glu
545                 550                 555                 560

Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln Glu Leu
                565                 570                 575

Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met
            580                 585                 590

Tyr Thr Gly Gln Asp Leu Asp Ile His Asn Leu Ser Asn Tyr Asp Ile
        595                 600                 605

Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile Asp Asn
    610                 615                 620

Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asn Asp Val
625                 630                 635                 640

Pro Pro Leu Glu Ile Val Gln Lys Arg Lys Val Phe Trp Glu Lys Leu
                645                 650                 655

Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu Thr Lys
            660                 665                 670

Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe Ile His
        675                 680                 685

Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Asn Ile
    690                 695                 700

Leu His Gln Arg Phe Asn Tyr Gly Lys Asp Asp His Gly Asn Thr Met
705                 710                 715                 720
```

```
Lys Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser Gln Phe
                725                 730                 735

Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Gly Val Asn Asp Tyr His
            740                 745                 750

His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr Leu Leu
        755                 760                 765

Lys Val Tyr Pro Gln Leu Glu Pro Glu Phe Val Tyr Gly Asp Tyr His
    770                 775                 780

Gln Phe Asp Trp Phe Lys Ala Asn Lys Ala Thr Ala Lys Lys Gln Phe
785                 790                 795                 800

Tyr Thr Asn Ile Met Leu Phe Phe Ala Gln Lys Asp Arg Ile Ile Asp
                805                 810                 815

Glu Asn Gly Glu Ile Leu Trp Asp Lys Lys Tyr Leu Asp Thr Val Lys
            820                 825                 830

Lys Val Met Ser Tyr Arg Gln Met Asn Ile Val Lys Lys Thr Glu Ile
        835                 840                 845

Gln Lys Gly Glu Phe Ser Lys Ala Thr Ile Lys Pro Lys Gly Asn Ser
    850                 855                 860

Ser Lys Leu Ile Pro Arg Lys Thr Asn Trp Asp Pro Met Lys Tyr Gly
865                 870                 875                 880

Gly Leu Asp Ser Pro Asn Met Ala Tyr Ala Val Val Ile Glu Tyr Ala
                885                 890                 895

Lys Gly Lys Asn Lys Leu Val Phe Glu Lys Lys Ile Ile Arg Val Thr
            900                 905                 910

Ile Met Glu Arg Lys Ala Phe Glu Lys Asp Glu Lys Ala Phe Leu Glu
        915                 920                 925
```

```
Glu Gln Gly Tyr Arg Gln Pro Lys Val Leu Ala Lys Leu Pro Lys Tyr
    930                 935                 940

Thr Leu Tyr Glu Cys Glu Glu Gly Arg Arg Arg Met Leu Ala Ser Ala
945                 950                 955                 960

Asn Glu Ala Gln Lys Gly Asn Gln Gln Val Leu Pro Asn His Leu Val
                965                 970                 975

Thr Leu Leu His His Ala Ala Asn Cys Glu Val Ser Asp Gly Lys Ser
            980                 985                 990

Leu Asp Tyr Ile Glu Ser Asn Arg  Glu Met Phe Ala Glu  Leu Leu Ala
        995                 1000                1005

His Val  Ser Glu Phe Ala Lys  Arg Tyr Thr Leu Ala  Glu Ala Asn
    1010                1015                1020

Leu Asn  Lys Ile Asn Gln Leu  Phe Glu Gln Asn Lys  Glu Gly Asp
    1025                1030                1035

Ile Lys  Ala Ile Ala Gln Ser  Phe Val Asp Leu Met  Ala Phe Asn
    1040                1045                1050

Ala Met  Gly Ala Pro Ala Ser  Phe Lys Phe Phe Glu  Thr Thr Ile
    1055                1060                1065

Glu Arg  Lys Arg Tyr Asn Asn  Leu Lys Glu Leu Leu  Asn Ser Thr
    1070                1075                1080

Ile Ile  Tyr Gln Ser Ile Thr  Gly Leu Tyr Glu Ser  Arg Lys Arg
    1085                1090                1095

Leu Asp  Asp
    1100
```

<210> 253
<211> 1327
<212> PRT
<213> Listeria ivanovii

<400> 253

```
Met Arg Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Leu Thr Asp Gln Tyr Asn Leu Val Lys Arg Lys Met
            20                  25                  30

Lys Val Ala Gly Ser Ala Glu Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Glu Gly Glu Val Ala Ala Gly Arg Arg Met
    50                  55                  60

Asn Arg Thr Thr Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ala
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Ala Glu Met Ala Glu Val Asp Ala Asn
                85                  90                  95

Phe Phe Tyr Arg Leu Glu Asp Ser Phe Tyr Ile Glu Ser Glu Lys Arg
            100                 105                 110

His Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Glu Glu Tyr Lys Thr Ile Tyr His Leu Arg Glu Lys Leu Val Asn
    130                 135                 140

Ser Ser Asp Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Met Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Glu Val Phe Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Ile Phe Ala Ser Asp Ile Glu Arg Leu Glu Glu Asn Lys Glu
```

195 200 205

Val Ala Glu Ile Leu Ser Glu Lys Leu Thr Arg Arg Glu Lys Leu Asp
210 215 220

Lys Ile Leu Lys Leu Tyr Thr Gly Glu Lys Ser Thr Gly Met Phe Ala
225 230 235 240

Arg Phe Ile Asn Leu Ile Ile Gly Ser Lys Gly Asp Phe Lys Lys Val
245 250 255

Phe Asp Leu Asp Glu Lys Ala Glu Ile Glu Cys Ala Lys Asp Thr Tyr
260 265 270

Glu Glu Asp Leu Glu Ala Leu Leu Ala Lys Ile Gly Asp Glu Tyr Ala
275 280 285

Glu Ile Phe Val Ala Ala Lys Ser Thr Tyr Asn Ala Val Val Leu Ser
290 295 300

Asn Ile Ile Thr Val Thr Asp Thr Glu Thr Lys Ala Lys Leu Ser Ala
305 310 315 320

Ser Met Ile Glu Arg Phe Asp Lys His Ala Lys Asp Leu Lys Arg Leu
325 330 335

Lys Ala Phe Phe Lys Met Gln Leu Pro Glu Lys Phe Asn Glu Val Phe
340 345 350

Asn Asp Ile Glu Lys Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Thr
355 360 365

Gln Glu Lys Phe Tyr Lys Tyr Met Lys Lys Met Leu Ala Asn Ile Asp
370 375 380

Gly Ala Asp Tyr Phe Ile Asp Gln Ile Glu Glu Glu Asn Phe Leu Arg
385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Thr Ile Pro His Gln Leu His Leu

405 410 415

Glu Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe
420 425 430

Leu Arg Lys Asp Tyr Glu Lys Ile Arg Ser Leu Val Thr Phe Arg Ile
435 440 445

Pro Tyr Phe Ile Gly Pro Leu Ala Asn Gly Gln Ser Asp Phe Ala Trp
450 455 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465 470 475 480

Lys Val Asp Phe Gly Lys Ser Ala Ile Asp Phe Ile Glu Lys Met Thr
485 490 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
500 505 510

Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Ile Arg
515 520 525

Tyr Ile Asp Asp Gln Gly Lys Thr His His Phe Ser Gly Gln Glu Lys
530 535 540

Gln Gln Ile Phe Asn Gly Leu Phe Lys Gln Gln Arg Lys Val Lys Lys
545 550 555 560

Lys Asp Leu Glu Arg Phe Leu Tyr Thr Ile Asn His Ile Glu Ser Pro
565 570 575

Thr Ile Glu Gly Val Glu Asp Ala Phe Asn Ser Ser Phe Ala Thr Tyr
580 585 590

His Asp Leu Gln Lys Gly Gly Val Thr Gln Glu Ile Leu Asp Asn Pro
595 600 605

Leu Asn Ala Asp Met Leu Glu Glu Ile Val Lys Ile Leu Thr Val Phe

610 615 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Ser Phe Ser Asp Val
625 630 635 640

Leu Asp Gly Thr Ile Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
645 650 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Thr Gly Ile Arg Asp Lys His
660 665 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
675 680 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
690 695 700

Ile Glu Lys Glu Gln Val Ser Thr Ala Asp Lys Gly Ile Gln Ser Ile
705 710 715 720

Val Ala Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
725 730 735

Ser Leu Lys Ile Val Asp Glu Leu Val Gly Ile Met Gly Tyr Pro Pro
740 745 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
755 760 765

Gly Lys Asn Asn Ser Lys Pro Arg Phe Ile Ser Leu Glu Lys Ala Ile
770 775 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785 790 795 800

Cys Leu Lys Asn Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
805 810 815

Asp Met Tyr Thr Gly Lys Glu Leu Asp Ile His Asn Leu Ser Asn Tyr

820 825 830

Asp Ile Asp His Ile Ile Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
835 840 845

Asp Asn Arg Val Leu Val Ser Ser Thr Ala Asn Arg Glu Lys Gly Asp
850 855 860

Asn Val Pro Leu Leu Glu Val Val Arg Lys Arg Lys Ala Phe Trp Glu
865 870 875 880

Lys Leu Tyr Gln Ala Lys Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
885 890 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Asn Phe
900 905 910

Ile Gln Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
915 920 925

Asn Ile Leu Tyr Gln Arg Phe Asn Cys Lys Gln Asp Glu Asn Gly Asn
930 935 940

Glu Val Glu Gln Val Arg Ile Val Thr Leu Lys Ser Thr Leu Val Ser
945 950 955 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp
965 970 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
980 985 990

Leu Leu Lys Val Tyr Pro Gln Leu Glu Pro Glu Phe Val Tyr Gly Asp
995 1000 1005

Tyr His Gln Phe Asp Trp Phe Lys Ala Asn Lys Ala Thr Ala Lys
1010 1015 1020

Lys Gln Phe Tyr Thr Asn Ile Met Arg Phe Phe Ala Lys Glu Asn

1025 1030 1035

Gln Ile Ile Asp Lys Asn Gly Glu Ile Leu Trp Asp Asn Arg Tyr
1040 1045 1050

Leu Asp Thr Ile Lys Lys Val Leu Ser Tyr Arg Gln Met Asn Ile
1055 1060 1065

Val Lys Lys Thr Glu Ile Gln Lys Gly Glu Phe Ser Asn Ala Thr
1070 1075 1080

Val Asn Pro Lys Gly Asn Ser Ser Lys Leu Ile Ser Arg Lys Ala
1085 1090 1095

Asp Trp Asn Pro Ile Lys Tyr Gly Gly Phe Asp Gly Ser Asn Met
1100 1105 1110

Ala Tyr Ser Ile Val Ile Glu Tyr Glu Lys Arg Lys Lys Lys Thr
1115 1120 1125

Val Ile Lys Lys Glu Leu Ile Gln Ile Asn Ile Met Glu Arg Val
1130 1135 1140

Ala Phe Glu Lys Asp Gln Lys Ala Phe Leu Glu Glu Lys Gly Tyr
1145 1150 1155

Tyr Ser Pro Lys Val Leu Thr Lys Ile Pro Lys Tyr Thr Leu Tyr
1160 1165 1170

Glu Cys Glu Asn Gly Arg Arg Arg Met Leu Gly Ser Ala Asn Glu
1175 1180 1185

Ala Gln Lys Gly Asn Gln Met Val Leu Pro Asn His Leu Met Thr
1190 1195 1200

Leu Leu Tyr His Ala Lys Asn Cys Glu Ala Asn Asp Gly Glu Ser
1205 1210 1215

Leu Ala Tyr Ile Glu Met His Arg Glu Met Phe Ala Glu Leu Leu

1220 1225 1230

Ala Tyr Ile Ser Glu Phe Ala Lys Arg Tyr Thr Leu Ala Asn Asp
1235 1240 1245

Arg Leu Glu Lys Ile Asn Met Phe Phe Glu Gln Asn Lys Lys Gly
1250 1255 1260

Asp Ile Lys Val Ile Ala Lys Ser Phe Asp Lys Leu Lys Val Phe
1265 1270 1275

Asn Ala Phe Gly Ala Pro Arg Asp Phe Glu Phe Phe Glu Thr Thr
1280 1285 1290

Ile Lys Arg Lys Arg Tyr Tyr Asn Ile Lys Glu Leu Leu Asn Ala
1295 1300 1305

Thr Ile Ile Tyr Gln Ser Ile Thr Gly Leu Tyr Glu Ala Arg Lys
1310 1315 1320

Arg Leu Glu Asp
1325

<210> 254
<211> 952
<212> PRT
<213> Listeria ivanovii

<400> 254

Met Lys Lys Met Leu Ala Asn Ile Asp Gly Ala Asp Tyr Phe Ile Asp
1 5 10 15

Gln Ile Glu Glu Glu Asn Phe Leu Arg Lys Gln Arg Thr Phe Asp Asn
20 25 30

Gly Thr Ile Pro His Gln Leu His Leu Glu Glu Leu Glu Ala Ile Leu
35 40 45

His Gln Gln Ala Lys Tyr Tyr Pro Phe Leu Arg Lys Asp Tyr Glu Lys
50 55 60

```
Ile Arg Ser Leu Val Thr Phe Arg Ile Pro Tyr Phe Ile Gly Pro Leu
65                  70                  75                  80

Ala Asn Gly Gln Ser Asp Phe Ala Trp Leu Thr Arg Lys Ala Asp Gly
                85                  90                  95

Glu Ile Arg Pro Trp Asn Ile Glu Glu Lys Val Asp Phe Gly Lys Ser
            100                 105                 110

Ala Ile Asp Phe Ile Glu Lys Met Thr Asn Lys Asp Thr Tyr Leu Pro
        115                 120                 125

Lys Glu Asn Val Leu Pro Lys His Ser Leu Cys Tyr Gln Lys Tyr Met
    130                 135                 140

Val Tyr Asn Glu Leu Thr Lys Ile Arg Tyr Ile Asp Asp Gln Gly Lys
145                 150                 155                 160

Thr His His Phe Ser Gly Gln Glu Lys Gln Gln Ile Phe Asn Gly Leu
                165                 170                 175

Phe Lys Gln Gln Arg Lys Val Lys Lys Lys Asp Leu Glu Arg Phe Leu
            180                 185                 190

Tyr Thr Ile Asn His Ile Glu Ser Pro Thr Ile Glu Gly Val Glu Asp
        195                 200                 205

Ala Phe Asn Ser Ser Phe Ala Thr Tyr His Asp Leu Gln Lys Gly Gly
    210                 215                 220

Val Thr Gln Glu Ile Leu Asp Asn Pro Leu Asn Ala Asp Met Leu Glu
225                 230                 235                 240

Glu Ile Val Lys Ile Leu Thr Val Phe Glu Asp Lys Arg Met Ile Lys
                245                 250                 255

Glu Gln Leu Gln Ser Phe Ser Asp Val Leu Asp Gly Thr Ile Leu Lys
            260                 265                 270
```

```
Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly Arg Leu Ser Ala Lys
        275                 280                 285

Leu Leu Thr Gly Ile Arg Asp Lys His Ser His Leu Thr Ile Leu Asp
    290                 295                 300

Tyr Leu Met Asp Asp Gly Leu Asn Arg Asn Leu Met Gln Leu Ile Asn
305                 310                 315                 320

Asp Ser Asn Leu Ser Phe Lys Ser Ile Ile Glu Lys Glu Gln Val Ser
                325                 330                 335

Thr Ala Asp Lys Gly Ile Gln Ser Ile Val Ala Glu Leu Ala Gly Ser
            340                 345                 350

Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu Lys Ile Val Asp Glu
        355                 360                 365

Leu Val Gly Ile Met Gly Tyr Pro Pro Gln Thr Ile Val Val Glu Met
    370                 375                 380

Ala Arg Glu Asn Gln Thr Thr Gly Lys Gly Lys Asn Asn Ser Lys Pro
385                 390                 395                 400

Arg Phe Ile Ser Leu Glu Lys Ala Ile Lys Glu Phe Gly Ser Gln Ile
                405                 410                 415

Leu Lys Glu His Pro Thr Asp Asn Gln Cys Leu Lys Asn Asp Arg Leu
            420                 425                 430

Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Met Tyr Thr Gly Lys Glu
        435                 440                 445

Leu Asp Ile His Asn Leu Ser Asn Tyr Asp Ile Asp His Ile Ile Pro
    450                 455                 460

Gln Ser Phe Ile Thr Asp Asn Ser Ile Asp Asn Arg Val Leu Val Ser
465                 470                 475                 480
```

```
Ser Thr Ala Asn Arg Glu Lys Gly Asp Asn Val Pro Leu Leu Glu Val
                485                 490                 495

Val Arg Lys Arg Lys Ala Phe Trp Glu Lys Leu Tyr Gln Ala Lys Leu
            500                 505                 510

Met Ser Lys Arg Lys Phe Asp Tyr Leu Thr Lys Ala Glu Arg Gly Gly
        515                 520                 525

Leu Thr Glu Ala Asp Lys Ala Asn Phe Ile Gln Arg Gln Leu Val Glu
    530                 535                 540

Thr Arg Gln Ile Thr Lys Asn Val Ala Asn Ile Leu Tyr Gln Arg Phe
545                 550                 555                 560

Asn Cys Lys Gln Asp Glu Asn Gly Asn Glu Val Glu Gln Val Arg Ile
                565                 570                 575

Val Thr Leu Lys Ser Thr Leu Val Ser Gln Phe Arg Lys Gln Phe Gln
            580                 585                 590

Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His His Ala His Asp Ala
        595                 600                 605

Tyr Leu Asn Gly Val Val Ala Asn Thr Leu Leu Lys Val Tyr Pro Gln
    610                 615                 620

Leu Glu Pro Glu Phe Val Tyr Gly Asp Tyr His Gln Phe Asp Trp Phe
625                 630                 635                 640

Lys Ala Asn Lys Ala Thr Ala Lys Lys Gln Phe Tyr Thr Asn Ile Met
                645                 650                 655

Arg Phe Phe Ala Lys Glu Asn Gln Ile Ile Asp Lys Asn Gly Glu Ile
            660                 665                 670

Leu Trp Asp Asn Arg Tyr Leu Asp Thr Ile Lys Lys Val Leu Ser Tyr
        675                 680                 685
```

```
Arg Gln Met Asn Ile Val Lys Lys Thr Glu Ile Gln Lys Gly Glu Phe
    690                 695                 700

Ser Asn Ala Thr Val Asn Pro Lys Gly Asn Ser Ser Lys Leu Ile Ser
705                 710                 715                 720

Arg Lys Ala Asp Trp Asn Pro Ile Lys Tyr Gly Gly Phe Asp Gly Ser
                725                 730                 735

Asn Met Ala Tyr Ser Ile Val Ile Glu Tyr Glu Lys Arg Lys Lys Lys
            740                 745                 750

Thr Val Ile Lys Lys Glu Leu Ile Gln Ile Asn Ile Met Glu Arg Val
        755                 760                 765

Ala Phe Glu Lys Asp Gln Lys Ala Phe Leu Glu Glu Lys Gly Tyr Tyr
    770                 775                 780

Ser Pro Lys Val Leu Thr Lys Ile Pro Lys Tyr Thr Leu Tyr Glu Cys
785                 790                 795                 800

Glu Asn Gly Arg Arg Arg Met Leu Gly Ser Ala Asn Glu Ala Gln Lys
                805                 810                 815

Gly Asn Gln Met Val Leu Pro Asn His Leu Met Thr Leu Leu Tyr His
            820                 825                 830

Ala Lys Asn Cys Glu Ala Asn Asp Gly Glu Ser Leu Ala Tyr Ile Glu
        835                 840                 845

Met His Arg Glu Met Phe Ala Glu Leu Leu Ala Tyr Ile Ser Glu Phe
    850                 855                 860

Ala Lys Arg Tyr Thr Leu Ala Asn Asp Arg Leu Glu Lys Ile Asn Met
865                 870                 875                 880

Phe Phe Glu Gln Asn Lys Lys Gly Asp Ile Lys Val Ile Ala Lys Ser
                885                 890                 895
```

```
Phe Asp Lys Leu Lys Val Phe Asn Ala Phe Gly Ala Pro Arg Asp Phe
            900                 905                 910

Glu Phe Phe Glu Thr Thr Ile Lys Arg Lys Arg Tyr Tyr Asn Ile Lys
        915                 920                 925

Glu Leu Leu Asn Ala Thr Ile Ile Tyr Gln Ser Ile Thr Gly Leu Tyr
    930                 935                 940

Glu Ala Arg Lys Arg Leu Glu Asp
945                 950
```

<210> 255
<211> 1327
<212> PRT
<213> Listeria monocytogenes

<400> 255

```
Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15

Gly Trp Ala Val Leu Thr Asn Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30

Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50                  55                  60

Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95

Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110
```

```
Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Asp Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Lys Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Glu Val Tyr Lys Gln Phe Ile Glu Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Lys Val Glu Glu Asn Ile Glu
        195                 200                 205

Val Ala Asn Ile Leu Ala Gly Lys Phe Thr Arg Arg Glu Lys Phe Glu
    210                 215                 220

Arg Ile Leu Gln Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala
225                 230                 235                 240

Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Val
                245                 250                 255

Phe Asp Leu Ile Glu Lys Thr Asp Ile Glu Cys Ala Lys Asp Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Thr Leu Leu Ala Ile Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn Ala Val Val Leu Ser
    290                 295                 300

Ser Ile Ile Thr Val Thr Asp Thr Glu Thr Asn Ala Lys Leu Ser Ala
305                 310                 315                 320
```

```
Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys Asp Leu Val Glu Leu
                325                 330                 335

Lys Ala Phe Ile Lys Leu Asn Leu Pro Lys Gln Tyr Glu Glu Ile Phe
            340                 345                 350

Ser Asn Ala Ala Ile Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
        355                 360                 365

Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr Ile Leu Glu Asn Ile Glu
    370                 375                 380

Gly Ser Asp Tyr Phe Ile Ala Lys Ile Glu Glu Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Ile His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Asp Tyr Asp Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly Gln Ser Glu Phe Ala Trp
    450                 455                 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Ile Arg
        515                 520                 525
```

```
Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Arg Glu Lys
    530                 535                 540

Gln Gln Val Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile Asn His Ile Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr
            580                 585                 590

His Asp Leu Leu Lys Val Gly Met Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605

Leu Asn Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Pro Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Gly Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Glu Lys Gln
            660                 665                 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Ser Thr Thr Asp Lys Asp Leu Gln Ser Ile
705                 710                 715                 720

Val Ala Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735
```

```
Ser Leu Lys Ile Val Asp Glu Leu Val Ser Ile Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
        755                 760                 765

Gly Lys Asn Asn Ser Lys Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800

Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Gly
    850                 855                 860

Asp Val Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu
865                 870                 875                 880

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925

Asn Ile Leu Tyr Gln Arg Phe Asn Lys Glu Thr Asp Asn His Gly Asn
    930                 935                 940
```

```
Thr Met Glu Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960


Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Gly
                965                 970                 975


Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990


Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005


Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020


Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Glu
    1025                1030                1035


Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050


Leu Glu  Thr Ile Lys Lys Val  Leu Asp Tyr Arg Gln  Met Asn Ile
    1055                1060                1065


Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Lys Ala Thr
    1070                1075                1080


Ile Lys  Pro Lys Gly Asn Ser  Ser Lys Leu Ile Pro  Arg Lys Glu
    1085                1090                1095


Asn Trp  Asp Pro Met Lys Tyr  Gly Gly Leu Asp Ser  Pro Asn Met
    1100                1105                1110


Ala Tyr  Ala Val Ile Ile Glu  His Ala Lys Gly Lys  Lys Lys Ile
    1115                1120                1125


Val Ile  Glu Lys Lys Leu Ile  Gln Ile Asn Ile Met  Glu Arg Lys
    1130                1135                1140
```

```
Met Phe  Glu Lys Asp Glu Glu  Ala Phe Leu Glu Glu  Lys Gly Tyr
    1145                1150                1155


Arg His  Pro Lys Val Leu Thr  Lys Leu Pro Lys Tyr  Thr Leu Tyr
    1160                1165                1170


Glu Cys  Glu Lys Gly Arg Arg  Arg Met Leu Ala Ser  Ala Asn Glu
    1175                1180                1185


Ala Gln  Lys Gly Asn Gln Leu  Val Leu Ser Asn His  Leu Val Ser
    1190                1195                1200


Leu Leu  Tyr His Ala Lys Asn  Cys Glu Ala Ser Asp  Gly Lys Ser
    1205                1210                1215


Leu Lys  Tyr Ile Glu Ala His  Arg Glu Thr Phe Ser  Glu Leu Leu
    1220                1225                1230


Ala Gln  Val Ser Glu Phe Ala  Thr Arg Tyr Thr Leu  Ala Asp Ala
    1235                1240                1245


Asn Leu  Ser Lys Ile Asn Asn  Leu Phe Glu Gln Asn  Lys Glu Gly
    1250                1255                1260


Asp Ile  Lys Ala Ile Ala Gln  Ser Phe Val Asp Leu  Met Ala Phe
    1265                1270                1275


Asn Ala  Met Gly Ala Pro Ala  Ser Phe Lys Phe Phe  Glu Ala Thr
    1280                1285                1290


Ile Asp  Arg Lys Arg Tyr Thr  Asn Leu Lys Glu Leu  Leu Ser Ser
    1295                1300                1305


Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ser Arg Lys
    1310                1315                1320


Arg Leu  Asp Asp
    1325
```

<210> 256
<211> 1327
<212> PRT
<213> Listeria monocytogenes

<400> 256

```
Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50                  55                  60


Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95


Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110


Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125


His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140


Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175
```

```
Lys Asn Thr Ser Val Asp Glu Val Tyr Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Lys Val Glu Glu Asn Thr Glu
        195                 200                 205

Val Ala Ser Ile Leu Ala Gly Lys Phe Thr Arg Arg Glu Lys Phe Glu
    210                 215                 220

Arg Ile Leu Arg Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala
225                 230                 235                 240

Gln Phe Ile Ser Leu Ile Val Gly Asn Lys Gly Asn Phe Gln Lys Val
                245                 250                 255

Phe Asn Leu Val Glu Lys Thr Asp Ile Glu Cys Ala Lys Asp Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Ala Leu Leu Ala Ile Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn Ala Val Val Leu Ser
    290                 295                 300

Ser Ile Ile Thr Val Thr Ala Thr Glu Thr Asn Ala Lys Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys Glu Leu Gly Glu Leu
                325                 330                 335

Lys Ala Phe Ile Lys Leu His Leu Pro Lys Gln Tyr Gln Glu Ile Phe
            340                 345                 350

Asn Asn Ala Glu Ile Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
        355                 360                 365

Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr Thr Leu Glu Asn Val Glu
    370                 375                 380
```

```
Gly Ala Asp Tyr Phe Ile Thr Lys Ile Glu Glu Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430

Leu Arg Glu Gly Tyr Asp Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly Gln Ser Glu Phe Ala Trp
    450                 455                 460

Leu Thr Arg Lys Asp Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Ile Arg
        515                 520                 525

Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Arg Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile Asn His Ile Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr
            580                 585                 590
```

```
His Asp Leu Leu Lys Val Gly Leu Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605


Leu Asn Thr Glu Ile Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620


Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Glu Gln Phe Ser Asp Val
625                 630                 635                 640


Leu Asp Gly Val Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655


Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Asp Lys Gln
            660                 665                 670


Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685


Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700


Ile Glu Lys Glu Gln Val Ser Thr Thr Asp Lys Asp Leu Gln Ser Ile
705                 710                 715                 720


Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735


Ser Leu Lys Ile Val Asp Glu Leu Val Ser Ile Met Gly Tyr Pro Pro
            740                 745                 750


Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
        755                 760                 765


Gly Lys Asn Asn Ser Lys Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780


Lys Asp Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800
```

```
Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Ile Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Gly
    850                 855                 860

Asp Val Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu
865                 870                 875                 880

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925

Asn Ile Leu His Gln Arg Phe Asn Lys Glu Thr Asp Asn His Gly Asn
    930                 935                 940

Thr Met Glu Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp
                965                 970                 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990

Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005
```

```
Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020

Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Glu
    1025                1030                1035

Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050

Leu Glu  Thr Ile Lys Lys Val  Leu Asp Tyr Arg Gln  Ile Asn Ile
    1055                1060                1065

Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Lys Ala Thr
    1070                1075                1080

Ile Lys  Pro Lys Gly Asn Ser  Ser Lys Leu Ile Pro  Arg Lys Glu
    1085                1090                1095

Asn Trp  Asp Pro Met Lys Tyr  Gly Gly Leu Asp Ser  Pro Asn Met
    1100                1105                1110

Ala Tyr  Ala Val Ile Ile Glu  His Ala Lys Gly Lys  Lys Lys Ile
    1115                1120                1125

Val Ile  Glu Lys Lys Leu Ile  Gln Ile Asn Ile Met  Glu Arg Lys
    1130                1135                1140

Met Phe  Glu Lys Asp Glu Glu  Ala Phe Leu Glu Glu  Lys Gly Tyr
    1145                1150                1155

His Gln  Pro Lys Val Leu Thr  Lys Leu Pro Lys Tyr  Thr Leu Tyr
    1160                1165                1170

Glu Cys  Glu Lys Gly Arg Arg  Arg Met Leu Ser Ser  Ala Asn Glu
    1175                1180                1185

Ala Gln  Lys Gly Asn Gln Leu  Val Leu Ser Asn His  Leu Val Ser
    1190                1195                1200
```

```
Leu Leu  Tyr His Ala Lys Asn  Cys Glu Ala Ser Asp  Gly Lys Ser
    1205                 1210                 1215


Leu Lys  Tyr Ile Glu Ala His  Arg Glu Thr Phe Ser  Glu Leu Leu
    1220                 1225                 1230


Ala Gln  Val Ser Glu Phe Ala  Thr Lys Tyr Thr Leu  Ala Asp Ala
    1235                 1240                 1245


Asn Leu  Ser Lys Ile Asn Asn  Leu Phe Glu Gln Asn  Lys Glu Gly
    1250                 1255                 1260


Asp Ile  Lys Ala Ile Ala Gln  Ser Phe Val Asp Leu  Met Ala Phe
    1265                 1270                 1275


Asn Ala  Met Gly Ala Pro Ala  Ser Phe Lys Phe Phe  Glu Ala Thr
    1280                 1285                 1290


Ile Asp  Arg Lys Arg Tyr Thr  Asn Leu Lys Glu Leu  Leu Ser Ser
    1295                 1300                 1305


Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ser Arg Lys
    1310                 1315                 1320


Arg Leu  Asp Asp
    1325


<210>  257
<211>  1327
<212>  PRT
<213>  Listeria monocytogenes

<400>  257

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
```

```
        35                  40                  45

Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50                  55                  60

Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95

Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Glu Val Tyr Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Lys Val Glu Glu Asn Thr Glu
        195                 200                 205

Val Ala Ser Ile Leu Ala Gly Lys Phe Thr Arg Arg Glu Lys Phe Glu
    210                 215                 220

Arg Ile Leu Arg Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala
225                 230                 235                 240

Gln Phe Ile Ser Leu Ile Val Gly Asn Lys Gly Asn Phe Gln Lys Val
```

245 250 255

Phe Asn Leu Val Glu Lys Thr Asp Ile Glu Cys Ala Lys Asp Ser Tyr
260 265 270

Glu Glu Asp Leu Glu Ala Leu Leu Ala Ile Ile Gly Asp Glu Tyr Ala
275 280 285

Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn Ala Val Val Leu Ser
290 295 300

Ser Ile Ile Thr Val Thr Ala Thr Glu Thr Asn Ala Lys Leu Ser Ala
305 310 315 320

Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys Glu Leu Gly Glu Leu
325 330 335

Lys Ala Phe Ile Lys Leu His Leu Pro Lys Gln Tyr Gln Glu Ile Phe
340 345 350

Asn Asn Ala Glu Ile Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
355 360 365

Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr Thr Leu Glu Asn Val Glu
370 375 380

Gly Ala Asp Tyr Phe Ile Thr Lys Ile Glu Glu Glu Asn Phe Leu Arg
385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Leu His Leu
405 410 415

Glu Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe
420 425 430

Leu Arg Glu Gly Tyr Asp Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
435 440 445

Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly Gln Ser Glu Phe Ala Trp

```
    450                 455                 460

Leu Thr Arg Lys Asp Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Ile Arg
        515                 520                 525

Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Arg Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile Asn His Ile Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr
            580                 585                 590

His Asp Leu Leu Lys Val Gly Leu Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605

Leu Asn Thr Glu Ile Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Glu Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Val Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Asp Lys Gln
```

660 665 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
675 680 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
690 695 700

Ile Glu Lys Glu Gln Val Ser Thr Thr Asp Lys Asp Leu Gln Ser Ile
705 710 715 720

Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
725 730 735

Ser Leu Lys Ile Val Asp Glu Leu Val Ser Ile Met Gly Tyr Pro Pro
740 745 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
755 760 765

Gly Lys Asn Asn Ser Lys Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
770 775 780

Lys Asp Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785 790 795 800

Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
805 810 815

Asp Ile Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
820 825 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
835 840 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Gly
850 855 860

Asp Val Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu

865 870 875 880

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
885 890 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
900 905 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
915 920 925

Asn Ile Leu His Gln Arg Phe Asn Lys Glu Thr Asp Asn His Gly Asn
930 935 940

Thr Met Glu Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945 950 955 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp
965 970 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
980 985 990

Leu Leu Lys Val Tyr Pro Gln Leu Glu Pro Glu Phe Val Tyr Gly Glu
995 1000 1005

Tyr His Gln Phe Asp Trp Phe Lys Ala Asn Lys Ala Thr Ala Lys
1010 1015 1020

Lys Gln Phe Tyr Thr Asn Ile Met Leu Phe Phe Ala Gln Lys Glu
1025 1030 1035

Arg Ile Ile Asp Glu Asn Gly Glu Ile Leu Trp Asp Lys Lys Tyr
1040 1045 1050

Leu Glu Thr Ile Lys Lys Val Leu Asp Tyr Arg Gln Ile Asn Ile
1055 1060 1065

Val Lys Lys Thr Glu Ile Gln Lys Gly Glu Phe Ser Lys Ala Thr

1070 1075 1080

Ile Lys Pro Lys Gly Asn Ser Ser Lys Leu Ile Pro Arg Lys Glu
1085 1090 1095

Asn Trp Asp Pro Val Lys Tyr Gly Gly Leu Asp Ser Pro Asn Met
1100 1105 1110

Ala Tyr Ala Val Ile Ile Glu His Ala Lys Gly Lys Lys Lys Ile
1115 1120 1125

Val Ile Glu Lys Lys Leu Ile Gln Ile Asn Ile Met Glu Arg Lys
1130 1135 1140

Met Phe Glu Lys Asp Glu Glu Ala Phe Leu Glu Glu Lys Gly Tyr
1145 1150 1155

His Gln Pro Lys Val Leu Thr Lys Leu Pro Lys Tyr Thr Leu Tyr
1160 1165 1170

Glu Cys Glu Lys Gly Arg Arg Arg Met Leu Ser Ser Ala Asn Glu
1175 1180 1185

Ala Gln Lys Gly Asn Gln Leu Val Leu Ser Asn His Leu Val Ser
1190 1195 1200

Leu Leu Tyr His Ala Lys Asn Cys Glu Ala Ser Asp Gly Lys Ser
1205 1210 1215

Leu Lys Tyr Ile Glu Ala His Arg Glu Thr Phe Ser Glu Leu Leu
1220 1225 1230

Ala Gln Val Ser Glu Phe Ala Thr Lys Tyr Thr Leu Ala Asp Ala
1235 1240 1245

Asn Leu Ser Lys Ile Asn Asn Leu Phe Glu Gln Asn Lys Glu Gly
1250 1255 1260

Asp Ile Lys Ala Ile Ala Gln Ser Phe Val Asp Leu Met Ala Phe

1265 1270 1275

Asn Ala Met Gly Ala Pro Ala Ser Phe Lys Phe Phe Glu Ala Thr
1280 1285 1290

Ile Asp Arg Lys Arg Tyr Thr Asn Leu Lys Glu Leu Leu Ser Ser
1295 1300 1305

Thr Ile Ile Tyr Gln Ser Ile Thr Gly Leu Tyr Glu Ser Arg Lys
1310 1315 1320

Arg Leu Asp Asp
1325

<210> 258
<211> 1327
<212> PRT
<213> Listeria monocytogenes

<400> 258

Met Lys Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
20 25 30

Lys Ile Ser Gly Asp Ser Glu Lys Lys Gln Ile Lys Lys Asn Phe Trp
35 40 45

Gly Val Arg Leu Phe Glu Lys Gly Glu Thr Ala Ala Lys Arg Arg Met
50 55 60

Ser Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Ile Gln Met Asn Glu Val Asp Asp Asn
85 90 95

Phe Phe Asn Arg Leu Lys Glu Ser Phe Tyr Ala Glu Ser Asp Lys Lys
100 105 110

```
Tyr Asn Arg His Pro Phe Phe Gly Thr Val Glu Glu Glu Val Ala Tyr
        115                 120                 125

Tyr Lys Asp Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ile Asp
    130                 135                 140

Ser Gln Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Ile Asp Glu Met Phe Lys Gln Phe Leu Gln Ile Tyr
            180                 185                 190

Asn Gln Val Phe Ala Asn Asp Ile Glu Lys Thr Glu Lys Asn Gln Glu
        195                 200                 205

Val Ala Gln Ile Leu Ala Glu Lys Phe Thr Arg Lys Asp Lys Leu Asp
    210                 215                 220

Lys Ile Leu Ser Leu Tyr Pro Gly Glu Lys Thr Thr Gly Val Phe Ala
225                 230                 235                 240

Gln Phe Val Asn Ile Ile Val Gly Ser Thr Gly Lys Phe Lys Lys His
                245                 250                 255

Phe Asn Leu His Glu Lys Lys Asp Ile Asn Cys Ala Glu Asp Thr Tyr
            260                 265                 270

Asp Thr Asp Leu Glu Ser Leu Leu Ala Ile Ile Gly Asp Glu Phe Ala
        275                 280                 285

Glu Val Phe Val Ala Ala Lys Asn Ala Tyr Asn Ala Val Val Leu Ser
    290                 295                 300

Asn Ile Ile Thr Val Thr Asp Ser Thr Thr Arg Ala Lys Leu Ser Ala
305                 310                 315                 320
```

```
Ser Leu Ile Glu Arg Phe Glu Asn His Lys Glu Asp Leu Lys Lys Met
                325                 330                 335

Lys Arg Phe Val Arg Thr Tyr Leu Pro Glu Lys Tyr Asp Glu Ile Phe
            340                 345                 350

Asp Asp Thr Glu Lys His Gly Tyr Ala Gly Tyr Ile Ser Gly Thr Lys
        355                 360                 365

Gln Ala Asp Phe Tyr Lys Tyr Met Lys Ala Thr Leu Glu Lys Ile Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu Glu Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430

Leu Arg Glu Asp Tyr Glu Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Phe Val Gly Pro Leu Ala Lys Gly Gln Ser Glu Phe Ala Trp
    450                 455                 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525
```

```
Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile Asn Gln Ile Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr
            580                 585                 590

His Asp Leu Leu Lys Val Gly Met Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605

Leu Asn Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Thr Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Asp Lys Gln
            660                 665                 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Ser Thr Thr Asp Lys Asp Leu Gln Ser Ile
705                 710                 715                 720

Val Ala Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735
```

```
Ser Leu Lys Ile Val Asp Glu Leu Val Ser Val Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Asn Lys
        755                 760                 765

Gly Lys Asn Asn Ser Lys Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800

Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Val
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp
    850                 855                 860

Asn Val Pro Pro Leu Glu Ile Val Gln Lys Arg Lys Ile Phe Trp Glu
865                 870                 875                 880

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925

Asn Ile Leu His Gln Arg Phe Asn Tyr Lys Thr Asp Gly Asn Lys Asp
    930                 935                 940
```

```
Thr Met Glu Thr Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960


Gln Phe Arg Lys Gln Phe Gln Phe Tyr Lys Val Arg Glu Val Asn Asp
                965                 970                 975


Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990


Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005


Tyr His  Gln Phe Gly Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020


Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Asp
    1025                1030                1035


Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Arg Tyr
    1040                1045                1050


Leu Glu  Thr Val Lys Lys Val  Leu Gly Tyr Arg Gln  Met Asn Ile
    1055                1060                1065


Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Asn Val Thr
    1070                1075                1080


Pro Asn  Pro Lys Gly Lys Ser  Asn Lys Leu Ile Pro  Arg Lys Lys
    1085                1090                1095


Asp Trp  Asp Pro Ile Lys Tyr  Gly Gly Phe Asp Gly  Ser Lys Met
    1100                1105                1110


Ala Tyr  Ala Ile Ile Ile Glu  Tyr Glu Lys Gln Lys  Arg Lys Val
    1115                1120                1125


Arg Ile  Glu Lys Lys Leu Ile  Gln Ile Asn Ile Met  Glu Arg Glu
    1130                1135                1140
```

```
Ala Phe  Glu Lys Asp Glu Lys  Thr Phe Leu Glu Glu  Lys Gly Tyr
    1145                1150                1155

His Gln  Pro Lys Val Leu Ile  Lys Val Pro Lys Tyr  Thr Leu Tyr
    1160                1165                1170

Glu Cys  Lys Asn Gly Arg Arg  Arg Met Leu Gly Ser  Ala Asn Glu
    1175                1180                1185

Ala His  Lys Gly Asn Gln Met  Leu Leu Pro Asn His  Leu Met Ala
    1190                1195                1200

Leu Leu  Tyr His Ala Glu Lys  Tyr Glu Ala Ile Asp  Gly Glu Ser
    1205                1210                1215

Leu Ala  Tyr Ile Glu Val His  Arg Ala Leu Phe Asp  Glu Leu Leu
    1220                1225                1230

Ala Tyr  Ile Ser Glu Phe Ala  Arg Lys Tyr Thr Leu  Ser Asn Asp
    1235                1240                1245

Arg Leu  Asp Glu Ile Asn Met  Leu Tyr Glu Arg Asn  Lys Asp Gly
    1250                1255                1260

Asp Val  Lys Ser Ile Ala Glu  Ser Phe Val Ser Leu  Lys Lys Phe
    1265                1270                1275

Asn Ala  Phe Gly Val His Gln  Asp Phe Ser Phe Phe  Gly Thr Lys
    1280                1285                1290

Ile Glu  Arg Lys Arg Asp Arg  Lys Leu Asn Glu Leu  Leu Asn Ser
    1295                1300                1305

Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ser Arg Lys
    1310                1315                1320

Arg Leu  Asp Asn
    1325
```

<210> 259
<211> 1327
<212> PRT
<213> Listeria monocytogenes

<400> 259

```
Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15

Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30

Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Glu Gly Glu Thr Ala Ala Asp Arg Arg Met
    50                  55                  60

Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Leu Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95

Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175
```

```
Lys Asn Thr Ser Val Asp Gly Val Tyr Lys Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Ile Ser Asn Ile Glu Lys Met Glu Glu Asn Thr Thr
        195                 200                 205

Val Ala Asp Ile Leu Ala Gly Lys Phe Thr Arg Lys Glu Lys Leu Glu
    210                 215                 220

Arg Ile Leu Gln Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala
225                 230                 235                 240

Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Val
                245                 250                 255

Phe Asp Leu Val Glu Lys Thr Asp Ile Glu Cys Ala Lys Asp Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Ala Leu Leu Ala Ile Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn Ala Val Val Leu Ser
    290                 295                 300

Ser Ile Ile Thr Val Thr Asp Thr Glu Thr Asn Ala Lys Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys Asp Leu Ser Glu Leu
                325                 330                 335

Lys Ala Phe Ile Lys Leu His Leu Pro Lys Gln Tyr Glu Glu Ile Phe
            340                 345                 350

Ser Asn Val Ala Ile Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
        355                 360                 365

Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr Leu Leu Glu Asn Ile Glu
    370                 375                 380
```

```
Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu Glu Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Glu Ala Tyr Asp Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly Gln Ser Asp Phe Ala Trp
    450                 455                 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Tyr Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Tyr Phe Lys Gln Lys Arg Lys Val Ser Lys
545                 550                 555                 560

Lys Asp Leu Glu Gln Phe Leu Arg Asn Met Ser His Ile Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ser Ser Tyr Ala Thr Tyr
            580                 585                 590
```

```
His Asp Leu Leu Lys Val Gly Ile Lys Gln Glu Val Leu Glu Asn Pro
        595                 600                 605

Leu Asn Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Ala Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Asp Lys Gln
            660                 665                 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Ser Thr Thr Asp Lys Asp Leu Gln Ser Ile
705                 710                 715                 720

Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735

Ser Leu Lys Ile Val Asp Glu Leu Val Ser Ile Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Val Lys
        755                 760                 765

Gly Lys Asn Asn Ser Arg Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800
```

```
Glu Leu Arg Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp
    850                 855                 860

Asp Val Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu
865                 870                 875                 880

Lys Leu Phe Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Thr Phe
            900                 905                 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925

Asn Ile Leu His Gln Arg Phe Asn Asn Glu Thr Asp Asn His Gly Asn
    930                 935                 940

Asn Met Glu Gln Val Arg Ile Val Met Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp
                965                 970                 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990

Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005
```

```
Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020

Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Glu
    1025                1030                1035

Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050

Leu Glu  Thr Ile Lys Lys Val  Leu Asp Tyr Arg Gln  Met Asn Ile
    1055                1060                1065

Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Lys Ala Thr
    1070                1075                1080

Ile Lys  Pro Lys Gly Asn Ser  Ser Lys Leu Ile Pro  Arg Lys Glu
    1085                1090                1095

Asn Trp  Asp Pro Met Lys Tyr  Gly Gly Leu Asp Ser  Pro Asn Met
    1100                1105                1110

Ala Tyr  Ala Val Ile Ile Glu  His Ala Lys Gly Lys  Lys Lys Val
    1115                1120                1125

Val Phe  Glu Lys Lys Ile Ile  Arg Ile Thr Ile Met  Glu Arg Lys
    1130                1135                1140

Ala Phe  Glu Lys Asp Glu Lys  Ser Phe Leu Glu Lys  Gln Gly Tyr
    1145                1150                1155

Arg Gln  Pro Lys Val Leu Thr  Lys Leu Pro Lys Tyr  Thr Leu Tyr
    1160                1165                1170

Glu Cys  Glu Asn Gly Arg Arg  Arg Met Leu Ala Ser  Ala Asn Glu
    1175                1180                1185

Ala Gln  Lys Gly Asn Gln Gln  Val Leu Lys Gly Gln  Leu Ile Thr
    1190                1195                1200
```

```
Leu Leu  His His Ala Lys Asn  Cys Glu Ala Ser Asp  Gly Lys Ser
    1205                 1210                 1215


Leu Asp  Tyr Ile Glu Ser Asn  Arg Glu Met Phe Gly  Glu Leu Leu
    1220                 1225                 1230


Ala His  Val Ser Glu Phe Ala  Lys Arg Tyr Thr Leu  Ala Asp Ala
    1235                 1240                 1245


Asn Leu  Ser Lys Ile Asn Gln  Leu Phe Glu Gln Asn  Lys Asp Asn
    1250                 1255                 1260


Asp Ile  Lys Val Ile Ala Gln  Ser Phe Val Asn Leu  Met Ala Phe
    1265                 1270                 1275


Asn Ala  Met Gly Ala Pro Ala  Ser Phe Lys Phe Phe  Glu Ala Thr
    1280                 1285                 1290


Ile Glu  Arg Lys Arg Tyr Thr  Asn Leu Lys Glu Leu  Leu Ser Ala
    1295                 1300                 1305


Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ala Arg Lys
    1310                 1315                 1320


Arg Leu  Asp Gly
    1325


<210>  260
<211>  1327
<212>  PRT
<213>  Listeria monocytogenes

<400>  260

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Leu Thr Asn Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30
```

```
Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50                  55                  60

Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95

Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Gly Val Tyr Glu Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Lys Val Glu Glu Asn Ile Glu
        195                 200                 205

Val Ala Asn Ile Leu Ala Gly Lys Phe Thr Arg Arg Glu Lys Phe Glu
    210                 215                 220

Arg Ile Leu Gln Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala
225                 230                 235                 240
```

```
Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Val
                245                 250                 255

Phe Asp Leu Ile Glu Lys Thr Asp Ile Glu Cys Ala Lys Asp Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Ala Leu Leu Ala Ile Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn Ala Val Val Leu Ser
    290                 295                 300

Ser Ile Ile Thr Val Thr Ala Thr Glu Thr Asn Ala Lys Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys Asp Leu Gly Glu Leu
                325                 330                 335

Lys Ala Phe Ile Lys Leu His Leu Pro Lys Gln Tyr Gln Glu Ile Phe
            340                 345                 350

Asn Asn Ala Ala Ile Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
        355                 360                 365

Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr Ile Leu Glu Asn Ile Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu Glu Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Ile His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430

Leu Arg Glu Asp Tyr Glu Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Phe Val Gly Pro Leu Ala Lys Gly Gln Ser Glu Phe Ala Trp
    450                 455                 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile Asn His Ile Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr
            580                 585                 590

His Asp Leu Leu Lys Val Gly Met Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605

Leu Asn Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Pro Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Gly Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655
```

```
Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Glu Lys Gln
            660                 665                 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Ser Thr Thr Asp Lys Asp Leu Gln Ser Ile
705                 710                 715                 720

Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735

Ser Leu Lys Ile Val Asp Glu Leu Val Ser Ile Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
        755                 760                 765

Gly Lys Asn Asn Ser Lys Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Lys Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800

Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Gly
    850                 855                 860
```

```
Asp Val Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu
865                 870                 875                 880


Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895


Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Ala Asp Lys Ala Arg Phe
            900                 905                 910


Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925


Asn Ile Leu His Gln Arg Phe Asn Asn Glu Thr Asp Asn His Gly Asn
    930                 935                 940


Thr Met Glu Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960


Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp
                965                 970                 975


Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990


Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005


Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020


Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Gly  Gln Lys Glu
    1025                1030                1035


Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050


Leu Glu  Thr Ile Lys Lys Val  Leu Asp Tyr Arg Gln  Met Asn Ile
    1055                1060                1065
```

```
Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Lys Ala Thr
    1070                1075                1080

Ile Lys  Pro Lys Gly Asn Ser  Ser Lys Leu Ile Pro  Arg Lys Glu
    1085                1090                1095

Asn Trp  Asp Pro Met Lys Tyr  Gly Gly Leu Asp Ser  Pro Asn Met
    1100                1105                1110

Ala Tyr  Ala Val Ile Ile Glu  His Ala Lys Gly Lys  Lys Lys Leu
    1115                1120                1125

Ile Phe  Glu Lys Lys Ile Ile  Arg Ile Thr Ile Met  Glu Arg Lys
    1130                1135                1140

Met Phe  Glu Lys Asp Glu Glu  Ala Phe Leu Glu Glu  Lys Gly Tyr
    1145                1150                1155

Arg His  Pro Lys Val Leu Thr  Lys Leu Pro Lys Tyr  Thr Leu Tyr
    1160                1165                1170

Glu Cys  Glu Lys Gly Arg Arg  Arg Met Leu Ala Ser  Ala Asn Glu
    1175                1180                1185

Ala Gln  Lys Gly Asn Gln Leu  Val Leu Ser Asn His  Leu Val Ser
    1190                1195                1200

Leu Leu  Tyr His Ala Lys Asn  Cys Glu Ala Ser Asp  Gly Lys Ser
    1205                1210                1215

Leu Lys  Tyr Ile Glu Ala His  Arg Glu Thr Phe Ser  Glu Leu Leu
    1220                1225                1230

Ala Gln  Val Ser Glu Phe Ala  Thr Arg Tyr Thr Leu  Ala Asp Ala
    1235                1240                1245

Asn Leu  Ser Lys Ile Asn Asn  Leu Phe Glu Gln Asn  Lys Glu Gly
    1250                1255                1260
```

```
Asp Ile  Gln Ala Ile Ala Gln  Ser Phe Val Asp Leu  Met Ala Phe
    1265                1270                1275


Asn Ala  Met Gly Ala Pro Ala  Ser Phe Lys Phe Phe  Glu Ala Thr
    1280                1285                1290


Ile Asp  Arg Lys Arg Tyr Thr  Asn Leu Lys Glu Leu  Leu Ser Ser
    1295                1300                1305


Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ser Arg Lys
    1310                1315                1320


Arg Leu  Asp Asp
    1325


<210>  261
<211>  1327
<212>  PRT
<213>  Listeria monocytogenes

<400>  261

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Leu Thr Asn Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50                  55                  60


Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95


Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
```

```
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Gly Val Tyr Glu Gln Phe Ile Leu Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Lys Val Glu Glu Asn Ile Glu
        195                 200                 205

Val Ala Asn Ile Leu Ala Gly Lys Phe Thr Arg Arg Glu Lys Phe Glu
    210                 215                 220

Arg Ile Leu Gln Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala
225                 230                 235                 240

Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Val
                245                 250                 255

Phe Asp Leu Ile Glu Lys Thr Asp Ile Glu Cys Ala Lys Asp Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Thr Leu Leu Ala Ile Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn Ala Val Val Leu Ser
    290                 295                 300

Ser Ile Ile Thr Val Thr Asp Thr Glu Thr Asn Ala Lys Leu Ser Ala
```

305 310 315 320

Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys Asp Leu Val Glu Leu
325 330 335

Lys Ala Phe Ile Lys Leu Asn Leu Pro Lys Gln Tyr Glu Glu Ile Phe
340 345 350

Ser Asn Ala Ala Ile Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
355 360 365

Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr Thr Leu Glu Asn Val Glu
370 375 380

Gly Ala Asp Tyr Phe Ile Thr Lys Ile Glu Glu Glu Asn Phe Leu Arg
385 390 395 400

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Leu His Leu
405 410 415

Glu Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe
420 425 430

Leu Arg Glu Asp Tyr Glu Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
435 440 445

Pro Tyr Phe Val Gly Pro Leu Ala Lys Gly Gln Ser Glu Phe Ala Trp
450 455 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465 470 475 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
485 490 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
500 505 510

Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Ile Arg

```
        515                 520                 525

Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile Asn His Val Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr
            580                 585                 590

His Asp Leu Met Lys Val Gly Ile Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605

Leu Asn Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Thr Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Asp Lys Gln
            660                 665                 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Ser Thr Ala Asp Lys Asp Leu Gln Ser Ile
705                 710                 715                 720

Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
```

```
                725                 730                 735

Ser Leu Lys Val Val Glu Glu Leu Val Ser Val Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Asn Lys
        755                 760                 765

Gly Lys Asn Asn Ser Lys Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800

Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp
    850                 855                 860

Asn Val Pro Pro Leu Glu Ile Val Gln Lys Arg Lys Ile Phe Trp Glu
865                 870                 875                 880

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925

Asn Ile Leu His Gln Arg Phe Asn Tyr Lys Thr Asp Asp Asn Glu Asp
```

```
    930                 935                 940

Thr Met Glu Pro Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp
                965                 970                 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990

Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005

Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020

Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Glu
    1025                1030                1035

Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050

Leu Glu  Thr Ile Lys Lys Val  Leu Asn Tyr Arg Gln  Met Asn Ile
    1055                1060                1065

Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Asn Gln Asn
    1070                1075                1080

Pro Lys  Pro Arg Gly Asp Ser  Ser Lys Leu Ile Pro  Lys Lys Thr
    1085                1090                1095

Asn Leu  Asn Pro Ile Lys Tyr  Gly Gly Phe Glu Gly  Ser Asn Met
    1100                1105                1110

Ala Tyr  Ala Ile Ile Ile Glu  His Glu Lys Arg Lys  Lys Lys Val
    1115                1120                1125

Thr Ile  Glu Lys Lys Leu Ile  Gln Ile Asn Ile Met  Glu Arg Lys
```

1130 1135 1140

Ala Phe Glu Lys Asp Glu Lys Val Phe Leu Glu Gly Lys Gly Tyr
1145 1150 1155

His Gln Pro Lys Val Leu Thr Lys Leu Pro Lys Tyr Ala Leu Tyr
1160 1165 1170

Glu Cys Glu Asn Gly Arg Arg Arg Met Leu Gly Ser Ala Asn Glu
1175 1180 1185

Val His Lys Gly Asn Gln Met Leu Leu Pro Asn His Leu Met Thr
1190 1195 1200

Leu Leu Tyr His Ala Glu Lys Arg Glu Ala Ile Asp Gly Glu Ser
1205 1210 1215

Leu Ala Tyr Ile Glu Ala His Lys Ala Val Phe Gly Glu Leu Leu
1220 1225 1230

Ala His Ile Ser Glu Phe Ala Arg Lys Tyr Thr Leu Ala Asn Asp
1235 1240 1245

Lys Leu Asp Glu Ile Asn Met Leu Tyr Glu Arg Asn Lys Asp Gly
1250 1255 1260

Asp Val Lys Ser Ile Ala Glu Ser Phe Val Ser Leu Lys Lys Phe
1265 1270 1275

Asn Ala Phe Gly Val His Lys Asp Phe Asn Phe Phe Gly Thr Thr
1280 1285 1290

Ile Lys Arg Lys Arg Asp Arg Lys Leu Lys Glu Leu Leu Asn Ser
1295 1300 1305

Thr Ile Ile Tyr Gln Ser Ile Thr Gly Leu Tyr Glu Ser Arg Lys
1310 1315 1320

Arg Leu Asp Ser

1325

<210> 262
<211> 1327
<212> PRT
<213> Listeria monocytogenes

<400> 262

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
20 25 30

Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
35 40 45

Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
50 55 60

Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65 70 75 80

Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
85 90 95

Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
100 105 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
115 120 125

His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
130 135 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145 150 155 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
165 170 175

```
Lys Asn Thr Ser Val Asp Gly Val Tyr Glu Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Lys Val Glu Glu Asn Ile Glu
        195                 200                 205

Val Ala Asn Ile Leu Ala Gly Lys Phe Thr Arg Arg Glu Lys Phe Glu
    210                 215                 220

Arg Ile Leu Gln Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala
225                 230                 235                 240

Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Val
                245                 250                 255

Phe Asp Leu Ile Glu Lys Thr Asp Ile Glu Cys Ala Lys Asp Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Thr Leu Leu Ala Ile Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn Ala Val Val Leu Ser
    290                 295                 300

Ser Ile Ile Thr Val Asn Asp Thr Glu Thr Asn Ala Lys Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys Asp Leu Val Glu Leu
                325                 330                 335

Lys Ala Phe Ile Lys Leu Asn Leu Pro Lys Gln Tyr Glu Glu Ile Phe
            340                 345                 350

Ser Asn Ala Ala Ile Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
        355                 360                 365

Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr Ile Leu Glu Asn Ile Glu
    370                 375                 380
```

```
Gly Ser Asp Tyr Phe Ile Ala Lys Ile Glu Glu Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Ile His Gln Gln Ala Lys Tyr Tyr Thr Phe
            420                 425                 430

Leu Lys Glu Asp Tyr Asp Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly Gln Ser Glu Phe Ala Trp
    450                 455                 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile Asn Gln Ile Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr
            580                 585                 590
```

```
His Asp Leu Leu Lys Val Gly Met Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605

Leu Asn Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Val Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Asp Lys Gln
            660                 665                 670

Ser His Leu Thr Ile Leu Glu Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Ser Thr Thr Asp Lys Asp Leu Gln Ser Ile
705                 710                 715                 720

Val Ala Glu Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735

Ser Leu Lys Ile Val Asp Glu Leu Val Ser Ile Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
        755                 760                 765

Gly Lys Asn Asn Ser Lys Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800
```

```
Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Gly
    850                 855                 860

Asp Val Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu
865                 870                 875                 880

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925

Asn Ile Leu His Gln Arg Phe Asn Lys Glu Thr Asp Asn His Gly Asn
    930                 935                 940

Thr Met Glu Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp
                965                 970                 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990

Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005
```

```
Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020

Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Glu
    1025                1030                1035

Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050

Leu Glu  Thr Ile Lys Lys Val  Leu Asp Tyr Arg Gln  Met Asn Ile
    1055                1060                1065

Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Lys Ala Thr
    1070                1075                1080

Ile Lys  Pro Lys Gly Asn Ser  Ser Lys Leu Ile Pro  Arg Lys Glu
    1085                1090                1095

Asn Trp  Asp Pro Met Lys Tyr  Gly Gly Leu Asp Ser  Pro Asn Met
    1100                1105                1110

Ala Tyr  Ala Val Ile Ile Glu  His Ala Lys Gly Lys  Lys Arg Ile
    1115                1120                1125

Val Ile  Glu Lys Lys Leu Ile  Gln Ile Asn Ile Met  Glu Arg Lys
    1130                1135                1140

Met Phe  Glu Lys Asp Glu Glu  Ala Phe Leu Glu Glu  Lys Gly Tyr
    1145                1150                1155

Arg His  Pro Lys Val Leu Thr  Lys Leu Pro Lys Tyr  Thr Leu Tyr
    1160                1165                1170

Glu Cys  Glu Lys Gly Arg Arg  Arg Met Leu Ala Ser  Ala Asn Glu
    1175                1180                1185

Ala Gln  Lys Gly Asn Gln Leu  Val Leu Ser Asn His  Leu Val Ser
    1190                1195                1200
```

```
Leu Leu  Tyr His Ala Lys Asn  Cys Glu Ala Ser Asp  Gly Lys Ser
    1205                 1210                 1215


Leu Lys  Tyr Ile Glu Ala His  Arg Glu Thr Phe Ser  Glu Leu Leu
    1220                 1225                 1230


Ala Gln  Val Ser Glu Phe Ala  Thr Arg Tyr Thr Leu  Ala Asp Ala
    1235                 1240                 1245


Asn Leu  Ser Lys Ile Asn Asn  Leu Phe Glu Gln Asn  Lys Glu Gly
    1250                 1255                 1260


Asp Ile  Lys Ala Ile Ala Gln  Ser Phe Val Asp Leu  Met Ala Phe
    1265                 1270                 1275


Asn Ala  Met Gly Ala Pro Ala  Ser Phe Lys Phe Phe  Glu Ala Thr
    1280                 1285                 1290


Ile Asp  Arg Lys Arg Tyr Thr  Asn Leu Lys Glu Leu  Leu Ser Ser
    1295                 1300                 1305


Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ser Arg Lys
    1310                 1315                 1320


Arg Leu  Asp Asp
    1325


<210>  263
<211>  1327
<212>  PRT
<213>  Listeria monocytogenes

<400>  263

Met Lys Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30
```

```
Lys Ile Ser Gly Asp Ser Glu Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Glu Lys Gly Glu Thr Ala Ala Lys Arg Arg Met
    50                  55                  60

Ser Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Ile Gln Met Asn Glu Val Asp Asp Asn
                85                  90                  95

Phe Phe Asn Arg Leu Lys Glu Ser Phe Tyr Ala Glu Ser Asp Lys Lys
            100                 105                 110

Tyr Asn Arg His Pro Phe Phe Gly Thr Val Glu Glu Glu Val Ala Tyr
        115                 120                 125

Tyr Lys Asp Phe Pro Thr Ile Tyr His Leu Arg Lys Glu Leu Ile Asp
    130                 135                 140

Ser Gln Lys Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly His Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Ile Asp Glu Met Phe Lys Gln Phe Leu Gln Ile Tyr
            180                 185                 190

Asn Gln Val Phe Ala Asn Asp Ile Glu Lys Thr Glu Lys Asn Gln Glu
        195                 200                 205

Val Ala Gln Ile Leu Ala Glu Lys Phe Thr Arg Lys Asp Lys Leu Asp
    210                 215                 220

Lys Ile Leu Ser Leu Tyr Pro Gly Glu Lys Thr Thr Gly Val Phe Ala
225                 230                 235                 240
```

```
Gln Phe Val Asn Ile Ile Val Gly Ser Thr Gly Lys Phe Lys Lys His
                245                 250                 255

Phe Asn Leu His Glu Lys Lys Asp Ile Asn Cys Ala Glu Asp Thr Tyr
            260                 265                 270

Asp Thr Asp Leu Glu Ser Leu Leu Ala Ile Ile Gly Asp Glu Phe Ala
        275                 280                 285

Glu Val Phe Val Ala Ala Lys Asn Ala Tyr Asn Ala Val Val Leu Ser
    290                 295                 300

Asn Ile Ile Thr Val Thr Asp Ser Thr Thr Arg Ala Lys Leu Ser Ala
305                 310                 315                 320

Ser Leu Ile Glu Arg Phe Glu Asn His Lys Glu Asp Leu Lys Lys Met
                325                 330                 335

Lys Arg Phe Val Arg Thr Tyr Leu Pro Glu Lys Tyr Asp Glu Ile Phe
            340                 345                 350

Asp Asp Thr Glu Lys His Gly Tyr Ala Gly Tyr Ile Ser Gly Thr Lys
        355                 360                 365

Gln Ala Asp Phe Tyr Lys Tyr Met Lys Ala Thr Leu Glu Lys Ile Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu Glu Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Val Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430

Leu Arg Glu Asp Tyr Glu Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Phe Val Gly Pro Leu Ala Lys Gly Gln Ser Glu Phe Ala Trp
    450                 455                 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile Asn Gln Ile Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr
            580                 585                 590

His Asp Leu Leu Lys Val Gly Met Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605

Leu Asn Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Thr Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655
```

```
Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Asp Lys Gln
            660                 665                 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Ser Thr Ala Asp Lys Asp Leu Gln Ser Ile
705                 710                 715                 720

Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735

Ser Leu Lys Ile Val Asp Glu Leu Val Ser Val Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Asn Lys
        755                 760                 765

Gly Lys Asn Asn Ser Lys Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800

Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Val
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp
    850                 855                 860
```

```
Asn Val Pro Pro Leu Glu Ile Val Gln Lys Arg Lys Ile Phe Trp Glu
865                 870                 875                 880


Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895


Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910


Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925


Asn Ile Leu His Gln Arg Phe Asn Tyr Lys Thr Asp Gly Asn Lys Asp
    930                 935                 940


Thr Met Glu Thr Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960


Gln Phe Arg Lys Gln Phe Gln Phe Tyr Lys Val Arg Glu Val Asn Asp
                965                 970                 975


Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990


Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005


Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020


Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Asp
    1025                1030                1035


Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Arg Tyr
    1040                1045                1050


Leu Glu  Thr Val Lys Lys Val  Leu Gly Tyr Arg Gln  Met Asn Ile
    1055                1060                1065
```

```
Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Asn Val Thr
    1070                1075                1080

Pro Asn  Pro Lys Gly Lys Ser  Asn Lys Leu Ile Pro  Arg Lys Lys
    1085                1090                1095

Asp Trp  Asp Pro Ile Lys Tyr  Gly Gly Phe Asp Gly  Ser Lys Met
    1100                1105                1110

Ala Tyr  Ala Ile Ile Ile Glu  Tyr Glu Lys Gln Lys  Arg Lys Val
    1115                1120                1125

Arg Ile  Glu Lys Lys Leu Ile  Gln Ile Asn Ile Met  Glu Arg Glu
    1130                1135                1140

Ala Phe  Glu Lys Asp Glu Lys  Thr Phe Leu Glu Glu  Lys Gly Tyr
    1145                1150                1155

His Gln  Pro Lys Val Leu Ile  Lys Val Pro Lys Tyr  Thr Leu Tyr
    1160                1165                1170

Glu Cys  Glu Asn Gly Arg Arg  Arg Met Leu Gly Ser  Ala Asn Glu
    1175                1180                1185

Ala His  Lys Gly Asn Gln Met  Leu Leu Pro Asn His  Leu Met Ala
    1190                1195                1200

Leu Leu  Tyr His Ala Glu Lys  Tyr Glu Ala Ile Asp  Gly Glu Ser
    1205                1210                1215

Leu Ala  Tyr Ile Glu Val His  Arg Ala Leu Phe Asp  Glu Leu Leu
    1220                1225                1230

Ala Tyr  Ile Ser Glu Phe Ala  Arg Lys Tyr Thr Leu  Ser Asn Asp
    1235                1240                1245

Arg Leu  Asp Glu Ile Asn Met  Leu Tyr Glu Arg Asn  Lys Asp Gly
    1250                1255                1260
```

```
Asp Val  Lys Ser Ile Ala Glu  Ser Phe Val Ser Leu  Lys Lys Phe
    1265                 1270                 1275


Asn Ala  Phe Gly Val His Gln  Asp Phe Ser Phe Phe  Gly Thr Lys
    1280                 1285                 1290


Ile Glu  Arg Lys Arg Asp Arg  Lys Leu Asn Glu Leu  Leu Asn Ser
    1295                 1300                 1305


Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ser Arg Lys
    1310                 1315                 1320


Arg Leu  Asp Asn
    1325


<210>  264
<211>  1327
<212>  PRT
<213>  Listeria monocytogenes

<400>  264

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Leu Thr Asn Gln Tyr Asp Leu Val Lys Arg Lys Met
            20                  25                  30


Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45


Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50                  55                  60


Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95
```

```
Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Gly Val Tyr Glu Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Lys Val Glu Glu Asn Ile Glu
        195                 200                 205

Val Ala Asn Ile Leu Ala Arg Lys Phe Thr Arg Arg Glu Lys Phe Glu
    210                 215                 220

Arg Ile Leu Gln Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala
225                 230                 235                 240

Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Val
                245                 250                 255

Phe Asp Leu Ile Glu Lys Thr Asp Ile Glu Cys Ala Lys Asp Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Thr Leu Leu Ala Ile Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn Ala Val Val Leu Ser
    290                 295                 300
```

```
Ser Ile Ile Thr Val Thr Asp Thr Glu Thr Asn Ala Lys Leu Ser Ala
305                 310                 315                 320


Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys Asp Leu Val Glu Leu
                325                 330                 335


Lys Ala Phe Ile Lys Leu Asn Leu Pro Lys Gln Tyr Glu Glu Ile Phe
            340                 345                 350


Ser Asn Ala Ala Ile Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
        355                 360                 365


Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr Ile Leu Glu Asn Ile Glu
    370                 375                 380


Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu Glu Glu Asn Phe Leu Arg
385                 390                 395                 400


Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu
                405                 410                 415


Glu Glu Leu Glu Ala Ile Ile His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430


Leu Arg Glu Asp Tyr Glu Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445


Pro Tyr Phe Val Gly Pro Leu Ala Lys Gly Gln Ser Glu Phe Ala Trp
    450                 455                 460


Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480


Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495


Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510
```

```
Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Ile Arg
        515                 520                 525

Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile Asn His Val Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr
            580                 585                 590

His Asp Leu Met Lys Val Gly Ile Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605

Leu Asn Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Thr Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Asp Lys Gln
            660                 665                 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Ser Thr Ala Asp Lys Asp Leu Gln Ser Ile
705                 710                 715                 720
```

```
Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735

Ser Leu Lys Val Val Glu Glu Leu Val Ser Val Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Asn Lys
        755                 760                 765

Gly Lys Asn Asn Ser Lys Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800

Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp
    850                 855                 860

Asn Val Pro Pro Leu Glu Ile Val Gln Lys Arg Lys Ile Phe Trp Glu
865                 870                 875                 880

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925
```

```
Asn Ile Leu His Gln Arg Phe Asn Tyr Lys Thr Asp Asp Asn Glu Asp
    930                 935                 940

Thr Met Glu Pro Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp
                965                 970                 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990

Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005

Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020

Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Glu
    1025                1030                1035

Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050

Leu Glu  Thr Ile Lys Lys Val  Leu Asn Tyr Arg Gln  Met Asn Ile
    1055                1060                1065

Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Asn Gln Asn
    1070                1075                1080

Pro Lys  Pro Arg Gly Asp Ser  Ser Lys Leu Ile Pro  Lys Lys Thr
    1085                1090                1095

Asn Leu  Asn Pro Ile Lys Tyr  Gly Gly Phe Glu Gly  Ser Asn Met
    1100                1105                1110

Ala Tyr  Ala Ile Ile Ile Glu  His Glu Lys Arg Lys  Lys Lys Val
    1115                1120                1125
```

```
Thr Ile  Glu Lys Lys Leu Ile  Gln Ile Asn Ile Met  Glu Arg Lys
    1130                1135                1140

Ala Phe  Glu Lys Asp Glu Lys  Val Phe Leu Glu Gly  Lys Gly Tyr
    1145                1150                1155

His Gln  Pro Lys Val Leu Thr  Lys Leu Pro Lys Tyr  Ala Leu Tyr
    1160                1165                1170

Glu Cys  Glu Asn Gly Arg Arg  Arg Met Leu Gly Ser  Ala Asn Glu
    1175                1180                1185

Val His  Lys Gly Asn Gln Met  Leu Leu Pro Asn His  Leu Met Thr
    1190                1195                1200

Leu Leu  Tyr His Ala Glu Lys  Arg Glu Ala Ile Asp  Gly Glu Ser
    1205                1210                1215

Leu Ala  Tyr Ile Glu Ala His  Lys Ala Val Phe Gly  Glu Leu Leu
    1220                1225                1230

Ala His  Ile Ser Glu Phe Ala  Arg Lys Tyr Thr Leu  Ala Asn Asp
    1235                1240                1245

Lys Leu  Asp Glu Ile Asn Met  Leu Tyr Glu Arg Asn  Lys Asp Gly
    1250                1255                1260

Asp Val  Lys Ser Ile Ala Glu  Ser Phe Val Ser Leu  Lys Lys Phe
    1265                1270                1275

Asn Ala  Phe Gly Val His Lys  Asp Phe Asn Phe Phe  Gly Thr Thr
    1280                1285                1290

Ile Lys  Arg Lys Arg Asp Arg  Lys Leu Lys Glu Leu  Leu Asn Ser
    1295                1300                1305

Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ser Arg Lys
    1310                1315                1320
```

Arg Leu Asp Ser
    1325

<210> 265
<211> 1327
<212> PRT
<213> Listeria monocytogenes

<400> 265

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Leu Thr Asn Gln Tyr Asp Leu Val Lys Arg Lys Met
            20   25   30

Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35   40   45

Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50   55   60

Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85   90   95

Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100   105   110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115   120   125

His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130   135   140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145   150   155   160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr

165 170 175

Lys Asn Thr Ser Val Asp Gly Val Tyr Glu Gln Phe Ile Gln Thr Tyr
180 185 190

Asn Gln Val Phe Met Ser Asn Ile Glu Lys Val Glu Glu Asn Ile Glu
195 200 205

Val Ala Asn Ile Leu Ala Gly Lys Phe Thr Arg Arg Glu Lys Phe Glu
210 215 220

Arg Ile Leu Gln Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala
225 230 235 240

Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Val
245 250 255

Phe Asp Leu Ile Glu Lys Thr Asp Ile Glu Cys Ala Lys Asp Ser Tyr
260 265 270

Glu Glu Asp Leu Glu Ala Leu Leu Ala Ile Ile Gly Asp Glu Tyr Ala
275 280 285

Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn Ala Val Val Leu Ser
290 295 300

Ser Ile Ile Thr Val Thr Ala Thr Glu Thr Asn Ala Lys Leu Ser Ala
305 310 315 320

Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys Asp Leu Gly Glu Leu
325 330 335

Lys Ala Phe Ile Lys Leu His Leu Pro Lys Gln Tyr Gln Glu Ile Phe
340 345 350

Asn Asn Ala Ala Ile Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
355 360 365

Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr Ile Leu Glu Asn Ile Glu

```
    370                 375                 380

Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu Glu Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Ile His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430

Leu Arg Glu Asp Tyr Glu Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Phe Val Gly Pro Leu Ala Lys Gly Gln Ser Glu Phe Ala Trp
    450                 455                 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Val Arg
        515                 520                 525

Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile Asn His Ile Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr
```

580 585 590

His Asp Leu Leu Lys Val Gly Met Lys Gln Glu Ile Leu Asp Asn Pro
595 600 605

Leu Asn Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
610 615 620

Glu Asp Lys Pro Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625 630 635 640

Leu Asp Gly Gly Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
645 650 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Glu Lys Gln
660 665 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
675 680 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
690 695 700

Ile Glu Lys Glu Gln Val Ser Thr Thr Asp Lys Asp Leu Gln Ser Ile
705 710 715 720

Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
725 730 735

Ser Leu Lys Ile Val Asp Glu Leu Val Ser Ile Met Gly Tyr Pro Pro
740 745 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
755 760 765

Gly Lys Asn Asn Ser Lys Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
770 775 780

Lys Glu Phe Gly Ser Lys Ile Leu Lys Glu His Pro Thr Asp Asn Gln

785 790 795 800

Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
805 810 815

Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
820 825 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
835 840 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Gly
850 855 860

Asp Val Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu
865 870 875 880

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
885 890 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Asp Ala Asp Lys Ala Arg Phe
900 905 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
915 920 925

Asn Ile Leu His Gln Arg Phe Asn Asn Glu Thr Asp Asn His Gly Asn
930 935 940

Thr Met Glu Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945 950 955 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp
965 970 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
980 985 990

Leu Leu Lys Val Tyr Pro Gln Leu Glu Pro Glu Phe Val Tyr Gly Glu

995 1000 1005

Tyr His Gln Phe Asp Trp Phe Lys Ala Asn Lys Ala Thr Ala Lys
1010 1015 1020

Lys Gln Phe Tyr Thr Asn Ile Met Leu Phe Phe Gly Gln Lys Glu
1025 1030 1035

Arg Ile Ile Asp Glu Asn Gly Glu Ile Leu Trp Asp Lys Lys Tyr
1040 1045 1050

Leu Glu Thr Ile Lys Lys Val Leu Asp Tyr Arg Gln Met Asn Ile
1055 1060 1065

Val Lys Lys Thr Glu Ile Gln Lys Gly Glu Phe Ser Lys Ala Thr
1070 1075 1080

Ile Lys Pro Lys Gly Asn Ser Ser Lys Leu Ile Pro Arg Lys Glu
1085 1090 1095

Asn Trp Asp Pro Met Lys Tyr Gly Gly Leu Asp Ser Pro Asn Met
1100 1105 1110

Ala Tyr Ala Val Ile Ile Glu His Ala Lys Gly Lys Lys Lys Leu
1115 1120 1125

Ile Phe Glu Lys Lys Ile Ile Arg Ile Thr Ile Met Glu Arg Lys
1130 1135 1140

Met Phe Glu Lys Asp Glu Glu Ala Phe Leu Glu Glu Lys Gly Tyr
1145 1150 1155

Arg His Pro Lys Val Leu Thr Lys Leu Pro Lys Tyr Thr Leu Tyr
1160 1165 1170

Glu Cys Glu Lys Gly Arg Arg Arg Met Leu Ala Ser Ala Asn Glu
1175 1180 1185

Ala Gln Lys Gly Asn Gln Leu Val Leu Ser Asn His Leu Val Ser

1190 1195 1200

Leu Leu Tyr His Ala Lys Asn Cys Glu Ala Ser Asp Gly Lys Ser
1205 1210 1215

Leu Lys Tyr Ile Glu Ala His Arg Glu Thr Phe Ser Glu Leu Leu
1220 1225 1230

Ala Gln Val Ser Glu Phe Ala Thr Arg Tyr Thr Leu Ala Asp Ala
1235 1240 1245

Asn Leu Ser Lys Ile Asn Asn Leu Phe Glu Gln Asn Lys Glu Gly
1250 1255 1260

Asp Ile Gln Ala Ile Ala Gln Ser Phe Val Asp Leu Met Ala Phe
1265 1270 1275

Asn Ala Met Gly Ala Pro Ala Ser Phe Lys Phe Phe Glu Ala Thr
1280 1285 1290

Ile Asp Arg Lys Arg Tyr Thr Asn Leu Lys Glu Leu Leu Ser Ser
1295 1300 1305

Thr Ile Ile Tyr Gln Ser Ile Thr Gly Leu Tyr Glu Ser Arg Lys
1310 1315 1320

Arg Leu Asp Asp
1325

<210> 266
<211> 1327
<212> PRT
<213> Listeria monocytogenes

<400> 266

Met Lys Asn Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Leu Thr Asn Gln Tyr Asp Leu Val Lys Arg Lys Met
20 25 30

```
Lys Val Ala Gly Asn Ser Asp Lys Lys Gln Ile Lys Lys Asn Phe Trp
        35                  40                  45

Gly Val Arg Leu Phe Asp Asp Gly Gln Thr Ala Val Asp Arg Arg Met
    50                  55                  60

Asn Arg Thr Ala Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ala Val Glu Met Ala Asn Ile Asp Ala Asn
                85                  90                  95

Phe Phe Cys Arg Leu Asn Asp Ser Phe Tyr Val Asp Ser Glu Lys Arg
            100                 105                 110

Asn Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Lys Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Glu Leu Val Asn
    130                 135                 140

Ser Ser Glu Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Ala Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Gly Val Tyr Glu Gln Phe Ile Gln Thr Tyr
            180                 185                 190

Asn Gln Val Phe Met Ser Asn Ile Glu Lys Val Glu Glu Asn Ile Glu
        195                 200                 205

Val Ala Asn Ile Leu Ala Arg Lys Phe Thr Arg Arg Glu Lys Phe Glu
    210                 215                 220

Arg Ile Leu Gln Leu Tyr Pro Gly Glu Lys Ser Thr Gly Met Phe Ala
225                 230                 235                 240
```

```
Gln Phe Ile Ser Leu Ile Val Gly Ser Lys Gly Asn Phe Gln Lys Val
                245                 250                 255

Phe Asp Leu Ile Glu Lys Thr Asp Ile Glu Cys Ala Lys Asp Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Thr Leu Leu Ala Ile Ile Gly Asp Glu Tyr Ala
        275                 280                 285

Glu Leu Phe Val Ala Ala Lys Asn Thr Tyr Asn Ala Val Val Leu Ser
    290                 295                 300

Ser Ile Ile Thr Val Thr Asp Thr Glu Thr Asn Ala Lys Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Phe Asp Ala His Glu Lys Asp Leu Val Glu Leu
                325                 330                 335

Lys Ala Phe Ile Lys Leu Asn Leu Pro Lys Gln Tyr Glu Glu Ile Phe
            340                 345                 350

Ser Asn Ala Ala Ile Asp Gly Tyr Ala Gly Tyr Ile Asp Gly Thr Lys
        355                 360                 365

Gln Val Asp Phe Tyr Lys Tyr Leu Lys Thr Ile Leu Glu Asn Ile Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Ile Ala Lys Ile Glu Glu Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Ile His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430

Leu Arg Glu Asp Tyr Glu Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445
```

```
Pro Tyr Phe Val Gly Pro Leu Ala Lys Gly Gln Ser Glu Phe Ala Trp
    450                 455                 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Val Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510

Leu Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Ile Arg
        515                 520                 525

Tyr Ile Asp Asp Gln Gly Lys Thr Asn Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Arg Asn Ile Asn His Val Glu Ser Pro
                565                 570                 575

Thr Ile Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr
            580                 585                 590

His Asp Leu Met Lys Val Gly Ile Lys Gln Glu Ile Leu Asp Asn Pro
        595                 600                 605

Leu Asn Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val
625                 630                 635                 640

Leu Asp Gly Thr Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655
```

```
Trp Gly Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Asp Lys Gln
            660                 665                 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Gly Leu Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Ser Thr Ala Asp Lys Asp Leu Gln Ser Ile
705                 710                 715                 720

Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735

Ser Leu Lys Val Val Glu Glu Leu Val Ser Val Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Asn Lys
        755                 760                 765

Gly Lys Asn Asn Ser Lys Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800

Glu Leu Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp
    850                 855                 860
```

```
Asn Val Pro Pro Leu Glu Ile Val Gln Lys Arg Lys Ile Phe Trp Glu
865                 870                 875                 880

Lys Leu Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925

Asn Ile Leu His Gln Arg Phe Asn Tyr Lys Thr Asp Asp Asn Glu Asp
    930                 935                 940

Thr Met Glu Pro Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser
945                 950                 955                 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp
                965                 970                 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr
            980                 985                 990

Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Glu
        995                 1000                1005

Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020

Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Gln Lys Glu
    1025                1030                1035

Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050

Leu Glu  Thr Ile Lys Lys Val  Leu Asn Tyr Arg Gln  Met Asn Ile
    1055                1060                1065
```

```
Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Asn Gln Asn
    1070                 1075                 1080

Pro Lys  Pro Arg Gly Asp Ser  Ser Lys Leu Ile Pro  Lys Lys Thr
    1085                 1090                 1095

Asn Leu  Asn Pro Ile Lys Tyr  Gly Gly Phe Glu Gly  Ser Asn Met
    1100                 1105                 1110

Ala Tyr  Ala Ile Ile Ile Glu  His Glu Lys Arg Lys  Lys Lys Val
    1115                 1120                 1125

Thr Ile  Glu Lys Lys Leu Ile  Gln Ile Asn Ile Met  Glu Arg Lys
    1130                 1135                 1140

Ala Phe  Glu Lys Asp Glu Lys  Val Phe Leu Glu Gly  Lys Gly Tyr
    1145                 1150                 1155

His Gln  Pro Lys Val Leu Thr  Lys Leu Pro Lys Tyr  Ala Leu Tyr
    1160                 1165                 1170

Glu Cys  Glu Asn Gly Arg Arg  Arg Met Leu Gly Ser  Ala Asn Glu
    1175                 1180                 1185

Val His  Lys Gly Asn Gln Met  Leu Leu Pro Asn His  Leu Met Thr
    1190                 1195                 1200

Leu Leu  Tyr His Ala Glu Lys  Arg Glu Ala Ile Asp  Gly Glu Ser
    1205                 1210                 1215

Leu Ala  Tyr Ile Glu Ala His  Lys Ala Val Phe Gly  Glu Leu Leu
    1220                 1225                 1230

Ala His  Ile Ser Glu Phe Ala  Arg Lys Tyr Thr Leu  Ala Asn Asp
    1235                 1240                 1245

Lys Leu  Asp Glu Ile Asn Met  Leu Tyr Glu Arg Asn  Lys Asp Gly
    1250                 1255                 1260
```

```
Asp Val  Lys Ser Ile Ala Glu  Ser Phe Val Ser Leu  Lys Lys Phe
    1265                1270                1275


Asn Ala  Phe Gly Val His Lys  Asp Phe Asn Phe Phe  Gly Thr Thr
    1280                1285                1290


Ile Lys  Arg Lys Arg Asp Arg  Lys Leu Lys Glu Leu  Leu Asn Ser
    1295                1300                1305


Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ser Arg Lys
    1310                1315                1320


Arg Leu  Asp Ser
    1325


<210>  267
<211>  781
<212>  PRT
<213>  Listeria monocytogenes


<220>
<221>  misc_feature
<222>  (721)..(721)
<223>  Xaa can be any naturally occurring amino acid

<400>  267

Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys Lys Asp
1               5                  10                  15


Leu Glu Leu Phe Leu Arg Asn Ile Asn Gln Ile Glu Ser Pro Thr Ile
            20                  25                  30


Glu Gly Leu Glu Asp Ser Phe Asn Ala Ser Tyr Ala Thr Tyr His Asp
        35                  40                  45


Leu Leu Lys Val Gly Met Lys Gln Glu Ile Leu Asp Asn Pro Leu Asn
    50                  55                  60


Thr Glu Met Leu Glu Asp Ile Val Lys Ile Leu Thr Val Phe Glu Asp
```

```
65                  70                  75                  80

Lys Arg Met Ile Lys Glu Gln Leu Gln Gln Phe Ser Asp Val Leu Asp
                85                  90                  95

Gly Val Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly Trp Gly
            100                 105                 110

Arg Leu Ser Ala Lys Leu Leu Val Gly Ile Arg Asp Lys Gln Ser His
        115                 120                 125

Leu Thr Ile Leu Glu Tyr Leu Met Asp Asp Gly Leu Asn Arg Asn Leu
    130                 135                 140

Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile Ile Glu
145                 150                 155                 160

Lys Glu Gln Val Ser Thr Thr Asp Lys Asp Leu Gln Ser Ile Val Ala
                165                 170                 175

Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Ser Leu
            180                 185                 190

Lys Ile Val Asp Glu Leu Val Ser Ile Met Gly Tyr Pro Pro Gln Thr
        195                 200                 205

Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Val Lys Gly Lys
    210                 215                 220

Asn Asn Ser Arg Pro Arg Tyr Lys Ser Leu Glu Lys Ala Ile Lys Glu
225                 230                 235                 240

Phe Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln Glu Leu
                245                 250                 255

Lys Asn Asn Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys Asp Ile
            260                 265                 270

Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr Asp Ile
```

```
        275                 280                 285

Asp His Ile Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile Asp Asn
    290                 295                 300

Leu Val Leu Thr Ser Ser Ala Gly Asn Arg Glu Lys Gly Asp Asp Val
305                 310                 315                 320

Pro Pro Leu Glu Ile Val Arg Lys Arg Lys Val Phe Trp Glu Lys Leu
                325                 330                 335

Tyr Gln Gly Asn Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu Thr Lys
            340                 345                 350

Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe Ile His
        355                 360                 365

Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala Asn Ile
    370                 375                 380

Leu His Gln Arg Phe Asn Asn Glu Thr Asp Asn His Gly Asn Thr Met
385                 390                 395                 400

Glu Gln Val Arg Ile Val Thr Leu Lys Ser Ala Leu Val Ser Gln Phe
                405                 410                 415

Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp Tyr His
            420                 425                 430

His Ala His Asp Ala Tyr Leu Asn Gly Val Val Ala Asn Thr Leu Leu
        435                 440                 445

Lys Val Tyr Pro Gln Leu Glu Pro Glu Phe Val Tyr Gly Glu Tyr His
    450                 455                 460

Gln Phe Asp Trp Phe Lys Ala Asn Lys Ala Thr Ala Lys Lys Gln Phe
465                 470                 475                 480

Tyr Thr Asn Ile Met Leu Phe Phe Ala Gln Lys Glu Arg Ile Ile Asp
```

485 490 495

Glu Asn Gly Glu Ile Leu Trp Asp Lys Lys Tyr Leu Glu Thr Ile Lys
500 505 510

Lys Val Leu Asp Tyr Arg Gln Met Asn Ile Val Lys Lys Thr Glu Ile
515 520 525

Gln Lys Gly Glu Phe Ser Lys Ala Thr Ile Lys Pro Lys Gly Asn Ser
530 535 540

Ser Lys Leu Ile Pro Arg Lys Glu Asn Trp Asp Pro Met Lys Tyr Gly
545 550 555 560

Gly Leu Asp Ser Pro Asn Met Ala Tyr Ala Val Ile Ile Glu His Ala
565 570 575

Lys Gly Lys Lys Lys Ile Val Ile Glu Lys Lys Leu Ile Gln Ile Asn
580 585 590

Ile Met Glu Arg Lys Met Phe Glu Lys Asp Glu Glu Ala Phe Leu Glu
595 600 605

Glu Lys Gly Tyr Arg His Pro Lys Val Leu Thr Lys Leu Pro Lys Tyr
610 615 620

Thr Leu Tyr Glu Cys Glu Lys Gly Arg Arg Arg Met Leu Ala Ser Ala
625 630 635 640

Asn Glu Ala Gln Lys Gly Asn Gln Leu Val Leu Ser Asn His Leu Val
645 650 655

Ser Leu Leu Tyr His Ala Lys Asn Cys Glu Ala Ser Asp Gly Lys Ser
660 665 670

Leu Lys Tyr Thr Glu Ala His Arg Glu Thr Phe Ser Glu Leu Leu Ala
675 680 685

Gln Val Ser Glu Phe Ala Thr Arg Tyr Thr Leu Ala Asp Ala Asn Leu

690 695 700

Ser Lys Ile Asn Asn Leu Phe Glu Gln Asn Lys Glu Gly Asp Ile Lys
705 710 715 720

Xaa Ile Ala Gln Ser Phe Val Asp Leu Met Val Phe Asn Ala Met Gly
725 730 735

Ala Pro Ala Ser Phe Lys Phe Phe Glu Ala Thr Ile Asp Arg Lys Arg
740 745 750

Tyr Thr Asn Leu Lys Glu Leu Leu Ser Ser Thr Ile Ile Tyr Gln Ser
755 760 765

Ile Thr Gly Leu Tyr Glu Ser Arg Lys Arg Leu Asp Asp
770 775 780

<210> 268
<211> 1327
<212> PRT
<213> Listeria seeligeri

<400> 268

Met Lys Lys Pro Tyr Thr Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Ala Leu Thr Asp Gln Tyr Asp Leu Val Lys Arg Lys Met
20 25 30

Lys Val Ala Gly Asn Ser Glu Lys Lys Gln Ile Lys Lys Asn Leu Trp
35 40 45

Gly Val Arg Leu Val Asp Glu Gly Lys Thr Ala Ala His Arg Arg Val
50 55 60

Asn Arg Thr Thr Arg Arg Arg Ile Glu Arg Arg Arg Asn Arg Ile Ser
65 70 75 80

Tyr Leu Gln Glu Ile Phe Thr Ala Glu Met Phe Glu Val Asp Ala Asn
85 90 95

```
Phe Phe Tyr Arg Leu Glu Asp Ser Phe Tyr Ile Glu Ser Glu Lys Arg
            100                 105                 110

Gln Ser Arg His Pro Phe Phe Ala Thr Ile Glu Glu Glu Val Ala Tyr
        115                 120                 125

His Glu Asn Tyr Arg Thr Ile Tyr His Leu Arg Glu Lys Leu Val Asn
    130                 135                 140

Ser Ser Asp Lys Ala Asp Leu Arg Leu Val Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Ile Ile Lys Tyr Arg Gly Asn Phe Leu Ile Glu Gly Lys Leu Asp Thr
                165                 170                 175

Lys Asn Thr Ser Val Asp Glu Val Phe Lys Gln Phe Ile Lys Thr Tyr
            180                 185                 190

Asn Gln Val Phe Ala Ser Asp Ile Glu Arg Ile Glu Glu Asn Asn Glu
        195                 200                 205

Val Ala Lys Ile Phe Ser Glu Lys Leu Thr Lys Arg Glu Lys Leu Asp
    210                 215                 220

Lys Ile Leu Asn Leu Tyr Pro Asn Glu Lys Ser Thr Asp Leu Phe Ala
225                 230                 235                 240

Gln Phe Ile Ser Leu Ile Ile Gly Ser Lys Gly Asn Phe Lys Lys Phe
                245                 250                 255

Phe Asn Leu Thr Glu Lys Thr Asp Ile Glu Cys Ala Lys Asp Ser Tyr
            260                 265                 270

Glu Glu Asp Leu Glu Val Leu Leu Ala Arg Val Gly Asp Glu Tyr Ala
        275                 280                 285

Glu Ile Phe Val Ala Ala Lys Asn Ala Tyr Asn Ala Val Val Leu Ser
    290                 295                 300
```

```
Ser Ile Ile Thr Val Ser Asn Thr Glu Thr Lys Ala Lys Leu Ser Ala
305                 310                 315                 320

Ser Met Ile Glu Arg Phe Asp Lys His Asp Lys Asp Leu Lys Arg Met
                325                 330                 335

Lys Ala Phe Phe Lys Val Arg Leu Pro Glu Asn Phe Asn Glu Val Phe
            340                 345                 350

Asn Asp Val Glu Lys Asp Gly Tyr Ala Gly Tyr Ile Glu Gly Thr Lys
        355                 360                 365

Gln Glu Ala Phe Tyr Lys Tyr Met Lys Lys Met Leu Glu His Val Glu
    370                 375                 380

Gly Ala Asp Tyr Phe Ile Asn Gln Ile Glu Glu Glu Asn Phe Leu Arg
385                 390                 395                 400

Lys Gln Arg Thr Phe Asp Asn Gly Ala Ile Pro His Gln Leu His Leu
                405                 410                 415

Glu Glu Leu Glu Ala Ile Leu His Gln Gln Ala Lys Tyr Tyr Pro Phe
            420                 425                 430

Leu Lys Val Asp Tyr Glu Lys Ile Lys Ser Leu Val Thr Phe Arg Ile
        435                 440                 445

Pro Tyr Phe Val Gly Pro Leu Ala Asn Gly Gln Ser Glu Phe Ser Trp
    450                 455                 460

Leu Thr Arg Lys Ala Asp Gly Glu Ile Arg Pro Trp Asn Ile Glu Glu
465                 470                 475                 480

Lys Val Asp Phe Gly Lys Ser Ala Ile Asp Phe Ile Glu Lys Met Thr
                485                 490                 495

Asn Lys Asp Thr Tyr Leu Pro Lys Glu Asn Val Leu Pro Lys His Ser
            500                 505                 510
```

```
Met Cys Tyr Gln Lys Tyr Met Val Tyr Asn Glu Leu Thr Lys Ile Arg
        515                 520                 525

Tyr Thr Asp Asp Gln Gly Lys Thr His Tyr Phe Ser Gly Gln Glu Lys
    530                 535                 540

Gln Gln Ile Phe Asn Asp Leu Phe Lys Gln Lys Arg Lys Val Lys Lys
545                 550                 555                 560

Lys Asp Leu Glu Leu Phe Leu Tyr Asn Met Asn His Val Glu Ser Pro
                565                 570                 575

Thr Val Glu Gly Val Glu Asp Ala Phe Asn Ser Ser Phe Thr Thr Tyr
            580                 585                 590

His Asp Leu Gln Lys Val Gly Val Pro Gln Glu Ile Leu Asp Asp Pro
        595                 600                 605

Leu Asn Thr Glu Met Leu Glu Glu Ile Ile Lys Ile Leu Thr Val Phe
    610                 615                 620

Glu Asp Lys Arg Met Ile Asn Glu Arg Leu Gln Glu Phe Ser Asn Val
625                 630                 635                 640

Leu Asp Glu Ala Val Leu Lys Lys Leu Glu Arg Arg His Tyr Thr Gly
                645                 650                 655

Trp Gly Arg Leu Ser Ala Lys Leu Leu Ile Gly Ile Arg Asp Lys Glu
            660                 665                 670

Ser His Leu Thr Ile Leu Asp Tyr Leu Met Asp Asp Lys His Asn Arg
        675                 680                 685

Asn Leu Met Gln Leu Ile Asn Asp Ser Asn Leu Ser Phe Lys Ser Ile
    690                 695                 700

Ile Glu Lys Glu Gln Val Ser Thr Ala Asp Lys Asp Ile Gln Ser Ile
705                 710                 715                 720
```

```
Val Ala Asp Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln
                725                 730                 735

Ser Leu Lys Ile Val Asp Glu Leu Val Gly Ile Met Gly Tyr Pro Pro
            740                 745                 750

Gln Thr Ile Val Val Glu Met Ala Arg Glu Asn Gln Thr Thr Gly Lys
        755                 760                 765

Gly Lys Asn Asn Ser Lys Pro Arg Phe Thr Ser Leu Glu Lys Ala Ile
    770                 775                 780

Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Thr Asp Asn Gln
785                 790                 795                 800

Gly Leu Lys Asn Asp Arg Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Lys
                805                 810                 815

Asp Met Tyr Thr Gly Gln Glu Leu Asp Ile His Asn Leu Ser Asn Tyr
            820                 825                 830

Asp Ile Asp His Val Val Pro Gln Ser Phe Ile Thr Asp Asn Ser Ile
        835                 840                 845

Asp Asn Arg Val Leu Ala Ser Ser Ala Ala Asn Arg Glu Lys Gly Asp
    850                 855                 860

Asn Val Pro Ser Leu Glu Val Val Arg Lys Arg Lys Val Tyr Trp Glu
865                 870                 875                 880

Lys Leu Tyr Gln Ala Lys Leu Met Ser Lys Arg Lys Phe Asp Tyr Leu
                885                 890                 895

Thr Lys Ala Glu Arg Gly Gly Leu Thr Glu Ala Asp Lys Ala Arg Phe
            900                 905                 910

Ile His Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys Asn Val Ala
        915                 920                 925
```

```
Asn Ile Leu His Gln Arg Phe Asn Cys Lys Lys Asp Glu Ser Gly Asn
    930                 935                 940

Val Ile Glu Gln Val Arg Ile Val Thr Leu Lys Ala Ala Leu Val Ser
945                 950                 955                 960

Gln Phe Arg Lys Gln Phe Gln Leu Tyr Lys Val Arg Glu Val Asn Asp
                965                 970                 975

Tyr His His Ala His Asp Ala Tyr Leu Asn Cys Val Val Ala Asn Thr
            980                 985                 990

Leu Leu Lys Val Tyr Pro Gln Leu  Glu Pro Glu Phe Val  Tyr Gly Asp
        995                 1000                1005

Tyr His  Gln Phe Asp Trp Phe  Lys Ala Asn Lys Ala  Thr Ala Lys
    1010                1015                1020

Lys Gln  Phe Tyr Thr Asn Ile  Met Leu Phe Phe Ala  Lys Lys Asp
    1025                1030                1035

Arg Ile  Ile Asp Glu Asn Gly  Glu Ile Leu Trp Asp  Lys Lys Tyr
    1040                1045                1050

Leu Asp  Thr Ile Lys Lys Val  Leu Asn Tyr Arg Gln  Met Asn Ile
    1055                1060                1065

Val Lys  Lys Thr Glu Ile Gln  Lys Gly Glu Phe Ser  Asn Ala Thr
    1070                1075                1080

Ala Asn  Pro Lys Gly Asn Ser  Ser Lys Leu Ile Pro  Arg Lys Ala
    1085                1090                1095

Asp Trp  Asp Pro Ile Lys Tyr  Gly Gly Phe Asp Gly  Ser Asn Met
    1100                1105                1110

Ala Tyr  Ala Ile Val Ile Glu  His Glu Lys Arg Lys  Lys Lys Thr
    1115                1120                1125
```

```
Val Ile  Lys Lys Glu Leu Ile  Gln Ile Asn Ile Met  Glu Arg Thr
    1130                1135                1140

Ala Phe  Glu Lys Asp Gln Lys  Glu Phe Leu Glu Gly  Lys Gly Tyr
    1145                1150                1155

Arg Asn  Pro Lys Val Ile Thr  Lys Ile Pro Lys Tyr  Thr Leu Tyr
    1160                1165                1170

Glu Cys  Glu Asn Gly Arg Arg  Arg Met Leu Gly Ser  Ala Asn Glu
    1175                1180                1185

Ala Gln  Lys Gly Asn Gln Met  Val Leu Pro Asn His  Leu Met Thr
    1190                1195                1200

Leu Leu  Tyr His Ala Lys Asn  Cys Glu Ala Ser Asp  Gly Lys Ser
    1205                1210                1215

Leu Ala  Tyr Ile Glu Ser His  Arg Glu Met Phe Ala  Glu Leu Leu
    1220                1225                1230

Asp Ser  Ile Ser Glu Phe Ala  Ser Arg Tyr Thr Leu  Ala Asp Ala
    1235                1240                1245

Asn Leu  Glu Lys Ile Asn Thr  Ile Phe Glu Gln Asn  Lys Ser Gly
    1250                1255                1260

Asp Val  Lys Val Ile Ala Gln  Ser Phe Val Asn Leu  Leu Glu Phe
    1265                1270                1275

Asn Ala  Met Gly Ala Pro Ala  Ser Phe Lys Tyr Phe  Glu Thr Asn
    1280                1285                1290

Ile Glu  Arg Lys Arg Tyr Asn  Asn Leu Lys Glu Leu  Leu Asn Ala
    1295                1300                1305

Thr Ile  Ile Tyr Gln Ser Ile  Thr Gly Leu Tyr Glu  Ala Arg Lys
    1310                1315                1320
```

Arg Leu Asp Asp
    1325

<210> 269
<211> 1359
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 269

Ala Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1   5   10   15

Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20   25   30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35   40   45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50   55   60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65   70   75   80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85   90   95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100   105   110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115   120   125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130   135   140

```
Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175


Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190


Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205


Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220


Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240


Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255


Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270


Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285


Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300


Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320


Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335


Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350
```

```
Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560
```

```
Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765
```

```
Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975
```

```
Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990


Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005


Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020


Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050


Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065


Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080


Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095


Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110


Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125


Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140


Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155


Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170
```

```
Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                 1180                 1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                 1195                 1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                 1210                 1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                 1225                 1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                 1240                 1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                 1255                 1260

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                 1270                 1275

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                 1285                 1290

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                 1300                 1305

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                 1315                 1320

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                 1330                 1335

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                 1345                 1350

Ser Gln  Leu Gly Gly Asp
    1355
```

<210> 270
<211> 1290
<212> PRT
<213> Roseburia hominis

<400> 270

```
Ile Val Asp Tyr Cys Ile Gly Leu Asp Leu Gly Thr Gly Ser Val Gly
1               5                  10                  15


Trp Ala Val Val Asp Met Asn His Arg Leu Met Lys Arg Asn Gly Lys
            20                  25                  30


His Leu Trp Gly Ser Arg Leu Phe Ser Asn Ala Glu Thr Ala Ala Thr
        35                  40                  45


Arg Arg Ser Ser Arg Ser Ile Arg Arg Arg Tyr Asn Lys Arg Arg Glu
    50                  55                  60


Arg Ile Arg Leu Leu Arg Ala Ile Leu Gln Asp Met Val Leu Glu Lys
65                  70                  75                  80


Asp Pro Thr Phe Phe Ile Arg Leu Glu His Thr Ser Phe Leu Asp Glu
                85                  90                  95


Glu Asp Lys Ala Lys Tyr Leu Gly Asp Asn Tyr Asn Leu Phe Ile Asp
            100                 105                 110


Glu Asp Phe Asn Asp Tyr Thr Tyr Tyr His Lys Tyr Pro Thr Ile Tyr
        115                 120                 125


His Leu Arg Lys Ala Leu Cys Glu Ser Thr Glu Lys Ala Asp Pro Arg
    130                 135                 140


Leu Ile Tyr Leu Ala Leu His His Ile Val Lys Tyr Arg Gly Asn Phe
145                 150                 155                 160


Leu Tyr Glu Gly Gln Lys Phe Asn Met Asp Ala Ser Asn Ile Glu Asp
                165                 170                 175


Lys Leu Ser Asp Val Phe Thr Gln Phe Ala Asp Phe Asn Asn Ile Pro
```

180 185 190

Tyr Glu Asp Asp Lys Lys Asn Leu Glu Ile Leu Glu Ile Leu Lys Lys
195 200 205

Pro Leu Ser Lys Lys Ala Lys Val Asp Glu Val Met Ala Leu Ile Ser
210 215 220

Pro Glu Lys Glu Phe Lys Ser Ala Tyr Lys Glu Leu Val Thr Gly Ile
225 230 235 240

Ala Gly Asn Lys Met Asn Val Thr Lys Met Ile Leu Cys Glu Ser Ile
245 250 255

Lys Gln Gly Asp Ser Glu Ile Lys Leu Lys Phe Ser Asp Ser Asn Tyr
260 265 270

Asp Asp Gln Phe Ser Glu Val Glu Asn Asp Leu Gly Glu Tyr Val Glu
275 280 285

Phe Ile Asp Ser Leu His Asn Ile Tyr Ser Trp Val Glu Leu Gln Thr
290 295 300

Ile Met Gly Ala Thr His Thr Asp Asn Ala Ser Ile Ser Glu Ala Met
305 310 315 320

Val Ser Arg Tyr Asn Lys His His Glu Asp Leu Gln Leu Leu Lys Lys
325 330 335

Cys Ile Lys Asp Asn Val Pro Lys Lys Tyr Phe Asp Met Phe Arg Asn
340 345 350

Asp Ser Glu Lys Val Lys Gly Tyr Tyr Asn Tyr Ile Asn Arg Lys Ala
355 360 365

Pro Val Asp Glu Phe Tyr Lys Phe Val Lys Lys Cys Ile Glu Lys Val
370 375 380

Asp Thr Pro Glu Ala Lys Gln Ile Leu His Asp Ile Glu Leu Glu Asn

385 390 395 400

Phe Leu Leu Lys Gln Asn Ser Arg Thr Asn Gly Ser Val Pro Tyr Gln
405 410 415

Met Gln Leu Asp Glu Met Ile Lys Ile Ile Asp Asn Gln Ala Lys Tyr
420 425 430

Tyr Pro Val Leu Lys Glu Lys Arg Glu Gln Leu Leu Ser Ile Leu Thr
435 440 445

Phe Arg Ile Pro Tyr Tyr Phe Gly Pro Leu Glu Thr Ser Glu His Ala
450 455 460

Trp Ile Lys Arg Leu Glu Gly Lys Glu Asn Gln Arg Ile Leu Pro Trp
465 470 475 480

Asn Tyr Gln Asp Thr Val Asp Val Asp Ala Thr Ala Glu Gly Phe Ile
485 490 495

Lys Arg Met Arg Ser Tyr Cys Thr Tyr Phe Pro Asp Glu Glu Val Leu
500 505 510

Pro Lys Asn Ser Leu Ile Val Ser Lys Tyr Glu Val Tyr Asn Glu Leu
515 520 525

Asn Lys Ile Arg Val Asp Asp Lys Leu Leu Glu Val Asp Val Lys Asn
530 535 540

Asp Ile Tyr Asn Glu Leu Phe Met Lys Asn Lys Thr Val Thr Glu Lys
545 550 555 560

Lys Leu Lys Asn Trp Leu Val Asn Asn Gln Cys Cys Arg Lys Asp Ala
565 570 575

Glu Ile Lys Gly Phe Gln Lys Glu Asn Gln Phe Ser Thr Ser Leu Thr
580 585 590

Pro Trp Ile Asp Phe Thr Asn Ile Phe Gly Lys Ile Asp Gln Ser Asn

595 600 605

Phe Asp Leu Ile Glu Lys Ile Ile Tyr Asp Leu Thr Val Phe Glu Asp
610 615 620

Lys Lys Ile Met Lys Arg Arg Leu Lys Lys Lys Tyr Ala Leu Pro Asp
625 630 635 640

Asp Lys Ile Lys Gln Ile Leu Lys Leu Lys Tyr Lys Asp Trp Ser Arg
645 650 655

Leu Ser Lys Lys Leu Leu Asp Gly Ile Val Ala Asp Ser Val Thr Val
660 665 670

Leu Asp Val Leu Glu Ser Arg Leu Asn Leu Met Glu Ile Ile Asn Asp
675 680 685

Lys Glu Leu Gly Tyr Ala Gln Met Ile Glu Glu Ala Ser Ser Cys Pro
690 695 700

Lys Asp Gly Lys Phe Thr Tyr Glu Glu Val Ala Lys Leu Ala Gly Ser
705 710 715 720

Pro Ala Leu Lys Arg Gly Ile Trp Gln Ser Leu Gln Ile Val Glu Glu
725 730 735

Ile Thr Lys Val Met Lys Cys Arg Pro Lys Tyr Ile Tyr Ile Glu Phe
740 745 750

Glu Arg Ser Glu Glu Lys Glu Arg Thr Glu Ser Lys Ile Lys Lys Leu
755 760 765

Glu Asn Val Tyr Lys Asp Glu Gln Thr Ser Val Leu Glu Glu Leu Lys
770 775 780

Gly Phe Asp Asn Thr Lys Lys Ile Ser Ser Asp Ser Leu Phe Leu Tyr
785 790 795 800

Phe Thr Gln Leu Gly Lys Cys Met Tyr Ser Gly Lys Lys Leu Asp Ile

805 810 815

Asp Ser Leu Asp Lys Tyr Gln Ile Asp His Ile Val Pro Gln Ser Leu
820 825 830

Val Lys Asp Asp Ser Phe Asp Asn Arg Val Leu Val Leu Pro Ser Glu
835 840 845

Asn Gln Arg Lys Leu Asp Asp Leu Val Val Pro Phe Asp Ile Arg Asp
850 855 860

Lys Met Tyr Arg Phe Trp Lys Leu Leu Phe Asp His Glu Leu Ile Ser
865 870 875 880

Pro Lys Lys Phe Tyr Ser Leu Ile Lys Thr Glu Tyr Thr Glu Arg Asp
885 890 895

Glu Glu Arg Phe Ile Asn Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
900 905 910

Lys Asn Val Thr Gln Ile Ile Glu Asp His Tyr Ser Thr Thr Lys Val
915 920 925

Ala Ala Ile Arg Ala Asn Leu Ser His Glu Phe Arg Val Lys Asn His
930 935 940

Ile Tyr Lys Asn Arg Asp Ile Asn Asp Tyr His His Ala His Asp Ala
945 950 955 960

Tyr Ile Val Ala Leu Ile Gly Gly Phe Met Arg Asp Arg Tyr Pro Asn
965 970 975

Met His Asp Ser Lys Ala Val Tyr Ser Glu Tyr Met Lys Met Phe Arg
980 985 990

Asn Lys Asn Asp Gln Lys Gly Phe Val Ile Asn Ser Met Asn Tyr Pro
995 1000 1005

Tyr Glu Val Asp Gly Lys Leu Ile Trp Asn Pro Asp Leu Ile Asn

1010 1015 1020

Glu Ile Lys Lys Cys Phe Tyr Tyr Lys Asp Cys Tyr Cys Thr Thr
1025 1030 1035

Lys Leu Asp Gln Lys Ser Gly Gln Met Phe Asn Thr Val Leu Pro
1040 1045 1050

Asn Asp Ala His Ser Ala Lys Gly Ala Val Ile Pro Val Asn Lys
1055 1060 1065

Asn Arg Lys Asp Val Asn Lys Tyr Gly Gly Phe Ser Gly Leu Gln
1070 1075 1080

Tyr Val Ile Ala Ala Ile Glu Gly Thr Lys Lys Lys Gly Lys Lys
1085 1090 1095

Leu Val Lys Val Arg Lys Leu Ser Gly Ile Pro Leu Tyr Leu Lys
1100 1105 1110

Gln Ala Asp Ile Lys Glu Gln Ile Glu Tyr Val Glu Lys Glu Glu
1115 1120 1125

Lys Leu Ser Asp Val Lys Ile Ile Lys Asn Asn Ile Pro Leu Asn
1130 1135 1140

Gln Leu Ile Glu Ile Asp Gly Arg Gln Tyr Leu Leu Thr Ser Glu
1145 1150 1155

Cys Val Asn Ala Met Gln Leu Val Leu Asn Glu Glu Gln Cys Lys
1160 1165 1170

Leu Ile Ala Asp Ile Tyr Asn Ala Ile Tyr Lys Gln Asp Phe Asp
1175 1180 1185

Gly Leu Asp Asn Met Leu Met Ile Gln Leu Tyr Leu Gln Leu Ile
1190 1195 1200

Asp Lys Leu Lys Thr Leu Tyr Pro Ile Tyr Met Gly Ile Val Glu

1205 1210 1215

Lys Phe Glu Lys Phe Val Ser Ile Ser Lys Glu Glu Lys Ala Asn
1220 1225 1230

Val Ile Gln Met Leu Ile Ile Met His Lys Gly Pro Gln Asn Gly
1235 1240 1245

Asn Ile Ile Tyr Asp Asp Phe Asn Val Gly Lys Arg Ile Gly Arg
1250 1255 1260

Leu Asn Gly Arg Thr Phe Tyr Leu Asn Ile Glu Phe Ile Ser Gln
1265 1270 1275

Ser Pro Thr Gly Ile Tyr Thr Lys Lys Tyr Lys Leu
1280 1285 1290

<210> 271
<211> 1292
<212> PRT
<213> Sharpea azabuensis

<400> 271

Lys Asp Ile Arg Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1 5 10 15

Gly Trp Ala Val Met Asp Glu His Tyr Glu Leu Leu Lys Lys Gly Asn
20 25 30

His His Met Trp Gly Ser Arg Leu Phe Asp Ala Ala Glu Pro Ala Ala
35 40 45

Thr Arg Arg Ala Ser Arg Ser Ile Arg Arg Arg Tyr Asn Lys Arg Arg
50 55 60

Glu Arg Ile Arg Leu Leu Arg Asp Leu Leu Gly Asp Met Val Met Glu
65 70 75 80

Val Asp Pro Thr Phe Phe Ile Arg Leu Leu Asn Val Ser Phe Leu Asp
85 90 95

```
Glu Glu Asp Lys Gln Lys Asn Leu Gly Asp Asn Tyr Asn Leu Phe Ile
            100                 105                 110

Glu Lys Asp Phe Asn Asp Lys Thr Tyr Tyr Asp Lys Tyr Pro Thr Ile
        115                 120                 125

Tyr His Leu Arg Lys Glu Leu Cys Glu Asn Lys Glu Lys Ala Asp Pro
    130                 135                 140

Arg Leu Ile Tyr Leu Ala Leu His His Ile Val Lys Tyr Arg Gly Asn
145                 150                 155                 160

Phe Leu Tyr Glu Gly Gln Ser Phe Thr Met Asp Asn Ser Asp Ile Glu
                165                 170                 175

Glu Arg Leu Asn Ser Ala Ile Glu Lys Phe Met Ser Ile Asn Glu Phe
            180                 185                 190

Asp Asn Arg Ile Val Ser Asp Ile Asn Ser Met Ile Ala Val Leu Ser
        195                 200                 205

Lys Ile Tyr Gln Arg Ser Lys Lys Ala Asp Asp Leu Leu Lys Ile Met
    210                 215                 220

Asn Pro Thr Lys Glu Glu Lys Ala Ala Tyr Lys Glu Phe Thr Lys Ala
225                 230                 235                 240

Leu Val Gly Leu Lys Phe Asn Ile Ser Lys Met Ile Leu Ala Gln Glu
                245                 250                 255

Val Lys Lys Gly Asp Thr Asp Ile Val Leu Glu Phe Ser Asn Ala Asn
            260                 265                 270

Tyr Asp Ser Thr Ile Asp Glu Leu Gln Ser Glu Leu Gly Glu Tyr Ile
        275                 280                 285

Glu Phe Ile Glu Met Leu His Asn Ile Tyr Ser Trp Val Glu Leu Gln
    290                 295                 300
```

```
Ala Ile Leu Gly Ala Thr His Thr Asp Asn Pro Ser Ile Ser Ala Ala
305                 310                 315                 320

Met Val Glu Arg Tyr Glu Glu His Lys Lys Asp Leu Arg Val Leu Lys
                325                 330                 335

Lys Val Ile Arg Glu Glu Leu Pro Asp Lys Tyr Asn Glu Val Phe Arg
            340                 345                 350

Lys Asp Asn Arg Lys Leu His Asn Tyr Leu Gly Tyr Ile Lys Tyr Asp
        355                 360                 365

Thr Pro Val Glu Glu Phe Tyr Lys Tyr Ile Lys Gly Leu Leu Ala Lys
    370                 375                 380

Val Asp Thr Asp Glu Ala Arg Glu Ile Leu Glu Arg Ile Asp Leu Glu
385                 390                 395                 400

Lys Phe Met Leu Lys Gln Asn Ser Arg Thr Asn Gly Ser Ile Pro Tyr
                405                 410                 415

Gln Met Gln Lys Asp Glu Met Ile Gln Ile Ile Asp Asn Gln Ser Val
            420                 425                 430

Tyr Tyr Pro Gln Leu Lys Glu Asn Arg Asp Lys Leu Ile Ser Ile Leu
        435                 440                 445

Glu Phe Arg Ile Pro Tyr Tyr Phe Gly Pro Leu Ala His Ser Glu Phe
    450                 455                 460

Ala Trp Ile Lys Lys Phe Glu Asp Lys Gln Lys Glu Arg Ile Leu Pro
465                 470                 475                 480

Trp Asn Tyr Asp Gln Ile Val Asp Ile Asp Ala Thr Ala Glu Gly Phe
                485                 490                 495

Ile Glu Arg Met Lys Asn Thr Gly Thr Tyr Phe Pro Asp Glu Pro Val
            500                 505                 510
```

```
Met Ala Lys Asn Ser Leu Thr Val Ser Lys Phe Glu Val Leu Asn Glu
        515                 520                 525

Leu Asn Lys Ile Arg Ile Asn Gly Lys Leu Ile Ala Val Glu Thr Lys
    530                 535                 540

Lys Glu Leu Leu Ser Asp Leu Phe Met Lys Asn Lys Thr Ile Thr Asp
545                 550                 555                 560

Lys Lys Leu Lys Asp Trp Leu Val Thr His Gln Tyr Tyr Asp Ile Asn
                565                 570                 575

Glu Glu Leu Lys Ile Glu Gly Tyr Gln Lys Asp Leu Gln Phe Ser Thr
            580                 585                 590

Ser Leu Ala Pro Trp Ile Asp Phe Thr Lys Ile Phe Gly Glu Ile Asn
        595                 600                 605

Ala Ser Asn Tyr Gln Leu Ile Glu Lys Ile Ile Tyr Asp Ile Ser Ile
    610                 615                 620

Phe Glu Asp Lys Lys Ile Leu Lys Arg Arg Leu Lys Lys Val Tyr Gln
625                 630                 635                 640

Leu Asp Asp Leu Leu Val Asp Lys Ile Leu Lys Leu Asn Tyr Thr Gly
                645                 650                 655

Trp Ser Arg Leu Ser Glu Lys Leu Leu Thr Gly Met Thr Ala Asp Lys
            660                 665                 670

Ala Thr Val Leu Phe Val Leu Glu Ser Asn Lys Asn Leu Met Glu Ile
        675                 680                 685

Ile Asn Asp Glu Lys Leu Gly Tyr Lys Gln Ile Ile Glu Glu Ser Asn
    690                 695                 700

Met Gln Asp Ile Glu Gly Pro Phe Lys Tyr Asp Glu Val Lys Lys Leu
705                 710                 715                 720
```

```
Ala Gly Ser Pro Ala Ile Lys Arg Gly Ile Trp Gln Ala Leu Leu Val
                725                 730                 735

Val Arg Glu Ile Thr Lys Phe Met Lys His Glu Pro Ser His Ile Tyr
            740                 745                 750

Ile Glu Phe Ala Arg Glu Glu Gln Lys Val Arg Lys Glu Ser Lys Ile
        755                 760                 765

Ala Lys Leu Gln Lys Ile Tyr Glu Asn Leu Gln Thr Gln Val Tyr Glu
    770                 775                 780

Ser Leu Lys Lys Glu Asp Ala Lys Lys Arg Met Glu Thr Asp Ala Leu
785                 790                 795                 800

Tyr Leu Tyr Tyr Leu Gln Met Gly Lys Ser Met Tyr Ser Gly Lys Pro
                805                 810                 815

Leu Asp Ile Asp Lys Leu Ser Thr Tyr Gln Ile Asp His Ile Leu Pro
            820                 825                 830

Gln Ser Leu Ile Lys Asp Asp Ser Phe Asp Asn Arg Val Leu Val Leu
        835                 840                 845

Pro Glu Glu Asn Gln Trp Lys Leu Asp Ser Glu Thr Val Pro Phe Glu
    850                 855                 860

Ile Arg Asn Lys Met Ile Gly Phe Trp Gln Met Leu His Glu Asn Gly
865                 870                 875                 880

Leu Met Ser Asn Lys Lys Phe Phe Ser Leu Ile Arg Thr Asp Phe Ser
                885                 890                 895

Asp Lys Asp Lys Glu Arg Phe Ile Asn Arg Gln Leu Val Glu Thr Arg
            900                 905                 910

Gln Ile Ile Lys Asn Val Ala Val Ile Ile Asn Asp His Tyr Thr Asn
        915                 920                 925
```

```
Thr Asn Ile Val Thr Val Arg Ala Glu Leu Ser His Gln Phe Arg Glu
    930                 935                 940

Arg Tyr Lys Ile Tyr Lys Asn Arg Asp Ile Asn Asp Phe His His Ala
945                 950                 955                 960

His Asp Ala Tyr Ile Ala Cys Ile Val Gly Gln Phe Met His Gln Asn
                965                 970                 975

Phe Glu His Leu Asp Ala Lys Ile Ile Tyr Gly Gln Tyr Lys Lys Asn
            980                 985                 990

Tyr Lys Lys Asn Tyr Gly Phe Ile  Leu Asn Ser Met Asn  His Leu Gln
        995                 1000                1005

Ser Asp  Ile Asp Thr Gly Glu  Val Met Trp Asp Pro  Ala Lys Ile
    1010                1015                1020

Gly Lys  Ile Lys Ser Cys Phe  Tyr Tyr Lys Asp Val  Tyr Val Thr
    1025                1030                1035

Lys Lys  Leu Glu Gln Asn Ser  Gly Thr Leu Phe Asn  Thr Val Leu
    1040                1045                1050

Pro Asn  Asp Ala His Ser Glu  Lys Gly Ala Thr Val  Pro Leu Asn
    1055                1060                1065

Lys Tyr  Arg Ala Asp Val His  Lys Tyr Gly Gly Phe  Gly Asn Val
    1070                1075                1080

Gln Ser  Ile Ile Val Ala Ile  Glu Gly Lys Lys Lys  Lys Gly Lys
    1085                1090                1095

Lys Leu  Ile Asp Val Arg Lys  Leu Thr Ser Ile Pro  Leu His Leu
    1100                1105                1110

Lys Asn  Ala Pro Val Glu Glu  Gln Leu Ser Tyr Ile  Ala Ser Pro
    1115                1120                1125
```

```
Glu His  Glu Asp Leu Ile Asp  Val Arg Ile Val Lys  Glu Ile Leu
    1130                1135                1140


Lys Asn  Gln Leu Ile Glu Ile  Asp Gly Gly Leu Tyr  Tyr Val Thr
    1145                1150                1155


Ser Glu  Tyr Val Thr Ala Arg  Gln Leu Ser Leu Asn  Glu Gln Ser
    1160                1165                1170


Cys Lys  Leu Ile Ser Glu Ile  Tyr Ala Ala Met Leu  Lys Lys Arg
    1175                1180                1185


Tyr Glu  Tyr Leu Asp Glu Glu  Glu Ile Phe Asp Leu  Tyr Leu Gln
    1190                1195                1200


Leu Leu  Gln Lys Met Asp Thr  Leu Tyr Pro Ala Tyr  Lys Gly Ile
    1205                1210                1215


Ala Lys  Arg Phe Phe Asp Phe  Lys Asn Ile Asp Val  Val Glu Lys
    1220                1225                1230


Cys Asp  Val Ile Gln Ile Leu  Ile Ile Met His Ala  Gly Pro Met
    1235                1240                1245


Asn Gly  Asn Ile Met Tyr Asp  Asp Phe Lys Phe Thr  Asn Arg Ile
    1250                1255                1260


Gly Arg  Phe Thr His Lys Asn  Ile Asp Leu Lys Thr  Thr Phe Ile
    1265                1270                1275


Ser Thr  Ser Val Thr Gly Leu  Phe Ser Lys Lys Tyr  Lys Leu
    1280                1285                1290


<210>  272
<211>  1359
<212>  PRT
<213>  Artificial Sequence

<220>
```

<223> Synthetic Polypeptide

<400> 272

```
Ala Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60


Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80


Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95


Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110


His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125


His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140


Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160


Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175


Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190
```

```
Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400
```

```
Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605
```

```
Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815
```

```
Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020
```

```
Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215
```

```
Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230


Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  273
<211>  1359
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  273

Met Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val
1               5                  10                  15
```

```
Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30

Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220
```

```
Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430
```

```
Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640
```

```
Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp Ala Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845
```

```
Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050
```

```
Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245
```

```
Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                 1255                 1260


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                 1270                 1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                 1285                 1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                 1300                 1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                 1315                 1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                 1330                 1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                 1345                 1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  274
<211>  1359
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  274

Met Asp Lys Lys Tyr Ser Ile Gly Leu Asp Ile Gly Thr Asn Ser Val
1               5                  10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30
```

```
Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45

Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60

Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240
```

```
Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445
```

```
Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655
```

```
Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860
```

```
Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880


Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895


Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910


Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925


Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940


Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960


Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975


Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990


Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005


Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020


Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035


Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050


Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065
```

```
Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095

Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260
```

```
Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                1300                1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                1315                1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                1330                1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                1345                1350


Ser Gln  Leu Gly Gly Asp
    1355
```

<210> 275
<211> 1359
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 275

```
Met Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val
1               5                   10                  15


Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe
            20                  25                  30


Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile
        35                  40                  45


Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu
    50                  55                  60
```

```
Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys
65                  70                  75                  80

Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser
                85                  90                  95

Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys
            100                 105                 110

His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr
        115                 120                 125

His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp
    130                 135                 140

Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His
145                 150                 155                 160

Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro
                165                 170                 175

Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr
            180                 185                 190

Asn Gln Leu Phe Glu Glu Asn Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270
```

```
Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480
```

```
Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Asp Gly Phe Ala Asn
        675                 680                 685
```

```
Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
    690                 695                 700

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
705                 710                 715                 720

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
                725                 730                 735

Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg His
            740                 745                 750

Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr Thr
        755                 760                 765

Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu Glu
    770                 775                 780

Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val Glu
785                 790                 795                 800

Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn
                805                 810                 815

Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser
            820                 825                 830

Asp Tyr Asp Val Asp Ala Ile Val Pro Gln Ser Phe Leu Lys Asp Asp
        835                 840                 845

Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys
    850                 855                 860

Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr
865                 870                 875                 880

Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
                885                 890                 895
```

```
Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys Ala
            900                 905                 910

Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr Lys His
        915                 920                 925

Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu Asn
    930                 935                 940

Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys Leu
945                 950                 955                 960

Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu Ile
                965                 970                 975

Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val Gly
            980                 985                 990

Thr Ala Leu Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
        995                 1000                1005

Gly Asp  Tyr Lys Val Tyr Asp  Val Ser Glu Gln Glu  Ile Gly Lys
    1010                1015                1020

Ala Thr  Ala Lys Tyr Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe
    1025                1030                1035

Lys Thr  Glu Ile Thr Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro
    1040                1045                1050

Leu Ile  Glu Thr Asn Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys
    1055                1060                1065

Gly Arg  Asp Phe Ala Thr Val  Arg Lys Val Leu Ser  Met Pro Gln
    1070                1075                1080

Val Asn  Ile Val Lys Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser
    1085                1090                1095
```

```
Lys Glu  Ser Ile Leu Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala
    1100                1105                1110

Arg Lys  Lys Asp Trp Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser
    1115                1120                1125

Pro Thr  Val Ala Tyr Ser Val  Leu Val Val Ala Lys  Val Glu Lys
    1130                1135                1140

Gly Lys  Ser Lys Lys Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile
    1145                1150                1155

Thr Ile  Met Glu Arg Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe
    1160                1165                1170

Leu Glu  Ala Lys Gly Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile
    1175                1180                1185

Lys Leu  Pro Lys Tyr Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys
    1190                1195                1200

Arg Met  Leu Ala Ser Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1205                1210                1215

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1220                1225                1230

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1235                1240                1245

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1250                1255                1260

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1265                1270                1275

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1280                1285                1290
```

```
Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1295                 1300                 1305


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1310                 1315                 1320


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1325                 1330                 1335


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1340                 1345                 1350


Ser Gln  Leu Gly Gly Asp
    1355


<210>  276
<211>  198
<212>  PRT
<213>  Homo sapiens

<400>  276

Met Asp Ser Leu Leu Met Asn Arg Arg Lys Phe Leu Tyr Gln Phe Lys
1               5                  10                  15


Asn Val Arg Trp Ala Lys Gly Arg Arg Glu Thr Tyr Leu Cys Tyr Val
            20                  25                  30


Val Lys Arg Arg Asp Ser Ala Thr Ser Phe Ser Leu Asp Phe Gly Tyr
        35                  40                  45


Leu Arg Asn Lys Asn Gly Cys His Val Glu Leu Leu Phe Leu Arg Tyr
    50                  55                  60


Ile Ser Asp Trp Asp Leu Asp Pro Gly Arg Cys Tyr Arg Val Thr Trp
65                  70                  75                  80


Phe Thr Ser Trp Ser Pro Cys Tyr Asp Cys Ala Arg His Val Ala Asp
                85                  90                  95
```

```
Phe Leu Arg Gly Asn Pro Asn Leu Ser Leu Arg Ile Phe Thr Ala Arg
            100                 105                 110


Leu Tyr Phe Cys Glu Asp Arg Lys Ala Glu Pro Glu Gly Leu Arg Arg
        115                 120                 125


Leu His Arg Ala Gly Val Gln Ile Ala Ile Met Thr Phe Lys Asp Tyr
    130                 135                 140


Phe Tyr Cys Trp Asn Thr Phe Val Glu Asn His Glu Arg Thr Phe Lys
145                 150                 155                 160


Ala Trp Glu Gly Leu His Glu Asn Ser Val Arg Leu Ser Arg Gln Leu
                165                 170                 175


Arg Arg Ile Leu Leu Pro Leu Tyr Glu Val Asp Asp Leu Arg Asp Ala
            180                 185                 190


Phe Arg Thr Leu Gly Leu
        195


<210>  277
<211>  198
<212>  PRT
<213>  Mus musculus

<400>  277

Met Asp Ser Leu Leu Met Lys Gln Lys Lys Phe Leu Tyr His Phe Lys
1               5                   10                  15


Asn Val Arg Trp Ala Lys Gly Arg His Glu Thr Tyr Leu Cys Tyr Val
            20                  25                  30


Val Lys Arg Arg Asp Ser Ala Thr Ser Cys Ser Leu Asp Phe Gly His
        35                  40                  45


Leu Arg Asn Lys Ser Gly Cys His Val Glu Leu Leu Phe Leu Arg Tyr
    50                  55                  60
```

```
Ile Ser Asp Trp Asp Leu Asp Pro Gly Arg Cys Tyr Arg Val Thr Trp
65                  70                  75                  80


Phe Thr Ser Trp Ser Pro Cys Tyr Asp Cys Ala Arg His Val Ala Glu
                85                  90                  95


Phe Leu Arg Trp Asn Pro Asn Leu Ser Leu Arg Ile Phe Thr Ala Arg
            100                 105                 110


Leu Tyr Phe Cys Glu Asp Arg Lys Ala Glu Pro Glu Gly Leu Arg Arg
        115                 120                 125


Leu His Arg Ala Gly Val Gln Ile Gly Ile Met Thr Phe Lys Asp Tyr
    130                 135                 140


Phe Tyr Cys Trp Asn Thr Phe Val Glu Asn Arg Glu Arg Thr Phe Lys
145                 150                 155                 160


Ala Trp Glu Gly Leu His Glu Asn Ser Val Arg Leu Thr Arg Gln Leu
                165                 170                 175


Arg Arg Ile Leu Leu Pro Leu Tyr Glu Val Asp Asp Leu Arg Asp Ala
            180                 185                 190


Phe Arg Met Leu Gly Phe
        195


<210>  278
<211>  198
<212>  PRT
<213>  Canis lupus

<400>  278

Met Asp Ser Leu Leu Met Lys Gln Arg Lys Phe Leu Tyr His Phe Lys
1               5                   10                  15


Asn Val Arg Trp Ala Lys Gly Arg His Glu Thr Tyr Leu Cys Tyr Val
            20                  25                  30


Val Lys Arg Arg Asp Ser Ala Thr Ser Phe Ser Leu Asp Phe Gly His
```

```
        35                  40                  45

Leu Arg Asn Lys Ser Gly Cys His Val Glu Leu Leu Phe Leu Arg Tyr
    50                  55                  60

Ile Ser Asp Trp Asp Leu Asp Pro Gly Arg Cys Tyr Arg Val Thr Trp
65                  70                  75                  80

Phe Thr Ser Trp Ser Pro Cys Tyr Asp Cys Ala Arg His Val Ala Asp
                85                  90                  95

Phe Leu Arg Gly Tyr Pro Asn Leu Ser Leu Arg Ile Phe Ala Ala Arg
            100                 105                 110

Leu Tyr Phe Cys Glu Asp Arg Lys Ala Glu Pro Glu Gly Leu Arg Arg
        115                 120                 125

Leu His Arg Ala Gly Val Gln Ile Ala Ile Met Thr Phe Lys Asp Tyr
    130                 135                 140

Phe Tyr Cys Trp Asn Thr Phe Val Glu Asn Arg Glu Lys Thr Phe Lys
145                 150                 155                 160

Ala Trp Glu Gly Leu His Glu Asn Ser Val Arg Leu Ser Arg Gln Leu
                165                 170                 175

Arg Arg Ile Leu Leu Pro Leu Tyr Glu Val Asp Asp Leu Arg Asp Ala
            180                 185                 190

Phe Arg Thr Leu Gly Leu
        195
```

<210> 279
<211> 199
<212> PRT
<213> Bos taurus

<400> 279

```
Met Asp Ser Leu Leu Lys Lys Gln Arg Gln Phe Leu Tyr Gln Phe Lys
1               5                   10                  15
```

```
Asn Val Arg Trp Ala Lys Gly Arg His Glu Thr Tyr Leu Cys Tyr Val
            20                  25                  30

Val Lys Arg Arg Asp Ser Pro Thr Ser Phe Ser Leu Asp Phe Gly His
        35                  40                  45

Leu Arg Asn Lys Ala Gly Cys His Val Glu Leu Leu Phe Leu Arg Tyr
    50                  55                  60

Ile Ser Asp Trp Asp Leu Asp Pro Gly Arg Cys Tyr Arg Val Thr Trp
65                  70                  75                  80

Phe Thr Ser Trp Ser Pro Cys Tyr Asp Cys Ala Arg His Val Ala Asp
                85                  90                  95

Phe Leu Arg Gly Tyr Pro Asn Leu Ser Leu Arg Ile Phe Thr Ala Arg
            100                 105                 110

Leu Tyr Phe Cys Asp Lys Glu Arg Lys Ala Glu Pro Glu Gly Leu Arg
        115                 120                 125

Arg Leu His Arg Ala Gly Val Gln Ile Ala Ile Met Thr Phe Lys Asp
    130                 135                 140

Tyr Phe Tyr Cys Trp Asn Thr Phe Val Glu Asn His Glu Arg Thr Phe
145                 150                 155                 160

Lys Ala Trp Glu Gly Leu His Glu Asn Ser Val Arg Leu Ser Arg Gln
                165                 170                 175

Leu Arg Arg Ile Leu Leu Pro Leu Tyr Glu Val Asp Asp Leu Arg Asp
            180                 185                 190

Ala Phe Arg Thr Leu Gly Leu
        195
```

<210> 280
<211> 429

<212> PRT
<213> Mus musculus

<400> 280

```
Met Gly Pro Phe Cys Leu Gly Cys Ser His Arg Lys Cys Tyr Ser Pro
1               5                   10                  15


Ile Arg Asn Leu Ile Ser Gln Glu Thr Phe Lys Phe His Phe Lys Asn
            20                  25                  30


Leu Gly Tyr Ala Lys Gly Arg Lys Asp Thr Phe Leu Cys Tyr Glu Val
        35                  40                  45


Thr Arg Lys Asp Cys Asp Ser Pro Val Ser Leu His His Gly Val Phe
    50                  55                  60


Lys Asn Lys Asp Asn Ile His Ala Glu Ile Cys Phe Leu Tyr Trp Phe
65                  70                  75                  80


His Asp Lys Val Leu Lys Val Leu Ser Pro Arg Glu Glu Phe Lys Ile
                85                  90                  95


Thr Trp Tyr Met Ser Trp Ser Pro Cys Phe Glu Cys Ala Glu Gln Ile
            100                 105                 110


Val Arg Phe Leu Ala Thr His His Asn Leu Ser Leu Asp Ile Phe Ser
        115                 120                 125


Ser Arg Leu Tyr Asn Val Gln Asp Pro Glu Thr Gln Gln Asn Leu Cys
    130                 135                 140


Arg Leu Val Gln Glu Gly Ala Gln Val Ala Ala Met Asp Leu Tyr Glu
145                 150                 155                 160


Phe Lys Lys Cys Trp Lys Lys Phe Val Asp Asn Gly Gly Arg Arg Phe
                165                 170                 175


Arg Pro Trp Lys Arg Leu Leu Thr Asn Phe Arg Tyr Gln Asp Ser Lys
            180                 185                 190
```

```
Leu Gln Glu Ile Leu Arg Pro Cys Tyr Ile Pro Val Pro Ser Ser Ser
        195                 200                 205

Ser Ser Thr Leu Ser Asn Ile Cys Leu Thr Lys Gly Leu Pro Glu Thr
    210                 215                 220

Arg Phe Cys Val Glu Gly Arg Arg Met Asp Pro Leu Ser Glu Glu Glu
225                 230                 235                 240

Phe Tyr Ser Gln Phe Tyr Asn Gln Arg Val Lys His Leu Cys Tyr Tyr
                245                 250                 255

His Arg Met Lys Pro Tyr Leu Cys Tyr Gln Leu Glu Gln Phe Asn Gly
            260                 265                 270

Gln Ala Pro Leu Lys Gly Cys Leu Leu Ser Glu Lys Gly Lys Gln His
        275                 280                 285

Ala Glu Ile Leu Phe Leu Asp Lys Ile Arg Ser Met Glu Leu Ser Gln
    290                 295                 300

Val Thr Ile Thr Cys Tyr Leu Thr Trp Ser Pro Cys Pro Asn Cys Ala
305                 310                 315                 320

Trp Gln Leu Ala Ala Phe Lys Arg Asp Arg Pro Asp Leu Ile Leu His
                325                 330                 335

Ile Tyr Thr Ser Arg Leu Tyr Phe His Trp Lys Arg Pro Phe Gln Lys
            340                 345                 350

Gly Leu Cys Ser Leu Trp Gln Ser Gly Ile Leu Val Asp Val Met Asp
        355                 360                 365

Leu Pro Gln Phe Thr Asp Cys Trp Thr Asn Phe Val Asn Pro Lys Arg
    370                 375                 380

Pro Phe Trp Pro Trp Lys Gly Leu Glu Ile Ile Ser Arg Arg Thr Gln
385                 390                 395                 400
```

```
Arg Arg Leu Arg Arg Ile Lys Glu Ser Trp Gly Leu Gln Asp Leu Val
                405                 410                 415


Asn Asp Phe Gly Asn Leu Gln Leu Gly Pro Pro Met Ser
            420                 425


<210>  281
<211>  429
<212>  PRT
<213>  Rattus rattus

<400>  281

Met Gly Pro Phe Cys Leu Gly Cys Ser His Arg Lys Cys Tyr Ser Pro
1               5                   10                  15


Ile Arg Asn Leu Ile Ser Gln Glu Thr Phe Lys Phe His Phe Lys Asn
            20                  25                  30


Leu Arg Tyr Ala Ile Asp Arg Lys Asp Thr Phe Leu Cys Tyr Glu Val
        35                  40                  45


Thr Arg Lys Asp Cys Asp Ser Pro Val Ser Leu His His Gly Val Phe
    50                  55                  60


Lys Asn Lys Asp Asn Ile His Ala Glu Ile Cys Phe Leu Tyr Trp Phe
65                  70                  75                  80


His Asp Lys Val Leu Lys Val Leu Ser Pro Arg Glu Glu Phe Lys Ile
                85                  90                  95


Thr Trp Tyr Met Ser Trp Ser Pro Cys Phe Glu Cys Ala Glu Gln Val
            100                 105                 110


Leu Arg Phe Leu Ala Thr His His Asn Leu Ser Leu Asp Ile Phe Ser
        115                 120                 125


Ser Arg Leu Tyr Asn Ile Arg Asp Pro Glu Asn Gln Gln Asn Leu Cys
    130                 135                 140
```

```
Arg Leu Val Gln Glu Gly Ala Gln Val Ala Ala Met Asp Leu Tyr Glu
145                 150                 155                 160


Phe Lys Lys Cys Trp Lys Lys Phe Val Asp Asn Gly Gly Arg Arg Phe
                165                 170                 175


Arg Pro Trp Lys Lys Leu Leu Thr Asn Phe Arg Tyr Gln Asp Ser Lys
            180                 185                 190


Leu Gln Glu Ile Leu Arg Pro Cys Tyr Ile Pro Val Pro Ser Ser Ser
        195                 200                 205


Ser Ser Thr Leu Ser Asn Ile Cys Leu Thr Lys Gly Leu Pro Glu Thr
    210                 215                 220


Arg Phe Cys Val Glu Arg Arg Arg Val His Leu Leu Ser Glu Glu Glu
225                 230                 235                 240


Phe Tyr Ser Gln Phe Tyr Asn Gln Arg Val Lys His Leu Cys Tyr Tyr
                245                 250                 255


His Gly Val Lys Pro Tyr Leu Cys Tyr Gln Leu Glu Gln Phe Asn Gly
            260                 265                 270


Gln Ala Pro Leu Lys Gly Cys Leu Leu Ser Glu Lys Gly Lys Gln His
        275                 280                 285


Ala Glu Ile Leu Phe Leu Asp Lys Ile Arg Ser Met Glu Leu Ser Gln
    290                 295                 300


Val Ile Ile Thr Cys Tyr Leu Thr Trp Ser Pro Cys Pro Asn Cys Ala
305                 310                 315                 320


Trp Gln Leu Ala Ala Phe Lys Arg Asp Arg Pro Asp Leu Ile Leu His
                325                 330                 335


Ile Tyr Thr Ser Arg Leu Tyr Phe His Trp Lys Arg Pro Phe Gln Lys
            340                 345                 350
```

Gly Leu Cys Ser Leu Trp Gln Ser Gly Ile Leu Val Asp Val Met Asp
355 360 365

Leu Pro Gln Phe Thr Asp Cys Trp Thr Asn Phe Val Asn Pro Lys Arg
370 375 380

Pro Phe Trp Pro Trp Lys Gly Leu Glu Ile Ile Ser Arg Arg Thr Gln
385 390 395 400

Arg Arg Leu His Arg Ile Lys Glu Ser Trp Gly Leu Gln Asp Leu Val
405 410 415

Asn Asp Phe Gly Asn Leu Gln Leu Gly Pro Pro Met Ser
420 425

<210> 282
<211> 370
<212> PRT
<213> Macaca mulatta

<400> 282

Met Val Glu Pro Met Asp Pro Arg Thr Phe Val Ser Asn Phe Asn Asn
1 5 10 15

Arg Pro Ile Leu Ser Gly Leu Asn Thr Val Trp Leu Cys Cys Glu Val
20 25 30

Lys Thr Lys Asp Pro Ser Gly Pro Pro Leu Asp Ala Lys Ile Phe Gln
35 40 45

Gly Lys Val Tyr Ser Lys Ala Lys Tyr His Pro Glu Met Arg Phe Leu
50 55 60

Arg Trp Phe His Lys Trp Arg Gln Leu His His Asp Gln Glu Tyr Lys
65 70 75 80

Val Thr Trp Tyr Val Ser Trp Ser Pro Cys Thr Arg Cys Ala Asn Ser
85 90 95

Val Ala Thr Phe Leu Ala Lys Asp Pro Lys Val Thr Leu Thr Ile Phe

100 105 110

Val Ala Arg Leu Tyr Tyr Phe Trp Lys Pro Asp Tyr Gln Gln Ala Leu
115 120 125

Arg Ile Leu Cys Gln Lys Arg Gly Gly Pro His Ala Thr Met Lys Ile
130 135 140

Met Asn Tyr Asn Glu Phe Gln Asp Cys Trp Asn Lys Phe Val Asp Gly
145 150 155 160

Arg Gly Lys Pro Phe Lys Pro Arg Asn Asn Leu Pro Lys His Tyr Thr
165 170 175

Leu Leu Gln Ala Thr Leu Gly Glu Leu Leu Arg His Leu Met Asp Pro
180 185 190

Gly Thr Phe Thr Ser Asn Phe Asn Asn Lys Pro Trp Val Ser Gly Gln
195 200 205

His Glu Thr Tyr Leu Cys Tyr Lys Val Glu Arg Leu His Asn Asp Thr
210 215 220

Trp Val Pro Leu Asn Gln His Arg Gly Phe Leu Arg Asn Gln Ala Pro
225 230 235 240

Asn Ile His Gly Phe Pro Lys Gly Arg His Ala Glu Leu Cys Phe Leu
245 250 255

Asp Leu Ile Pro Phe Trp Lys Leu Asp Gly Gln Gln Tyr Arg Val Thr
260 265 270

Cys Phe Thr Ser Trp Ser Pro Cys Phe Ser Cys Ala Gln Glu Met Ala
275 280 285

Lys Phe Ile Ser Asn Asn Glu His Val Ser Leu Cys Ile Phe Ala Ala
290 295 300

Arg Ile Tyr Asp Asp Gln Gly Arg Tyr Gln Glu Gly Leu Arg Ala Leu

305 310 315 320

His Arg Asp Gly Ala Lys Ile Ala Met Met Asn Tyr Ser Glu Phe Glu
325 330 335

Tyr Cys Trp Asp Thr Phe Val Asp Arg Gln Gly Arg Pro Phe Gln Pro
340 345 350

Trp Asp Gly Leu Asp Glu His Ser Gln Ala Leu Ser Gly Arg Leu Arg
355 360 365

Ala Ile
370

<210> 283
<211> 384
<212> PRT
<213> Pan troglodytes

<400> 283

Met Lys Pro His Phe Arg Asn Pro Val Glu Arg Met Tyr Gln Asp Thr
1 5 10 15

Phe Ser Asp Asn Phe Tyr Asn Arg Pro Ile Leu Ser His Arg Asn Thr
20 25 30

Val Trp Leu Cys Tyr Glu Val Lys Thr Lys Gly Pro Ser Arg Pro Pro
35 40 45

Leu Asp Ala Lys Ile Phe Arg Gly Gln Val Tyr Ser Lys Leu Lys Tyr
50 55 60

His Pro Glu Met Arg Phe Phe His Trp Phe Ser Lys Trp Arg Lys Leu
65 70 75 80

His Arg Asp Gln Glu Tyr Glu Val Thr Trp Tyr Ile Ser Trp Ser Pro
85 90 95

Cys Thr Lys Cys Thr Arg Asp Val Ala Thr Phe Leu Ala Glu Asp Pro
100 105 110

```
Lys Val Thr Leu Thr Ile Phe Val Ala Arg Leu Tyr Tyr Phe Trp Asp
        115                 120                 125

Pro Asp Tyr Gln Glu Ala Leu Arg Ser Leu Cys Gln Lys Arg Asp Gly
    130                 135                 140

Pro Arg Ala Thr Met Lys Ile Met Asn Tyr Asp Glu Phe Gln His Cys
145                 150                 155                 160

Trp Ser Lys Phe Val Tyr Ser Gln Arg Glu Leu Phe Glu Pro Trp Asn
                165                 170                 175

Asn Leu Pro Lys Tyr Tyr Ile Leu Leu His Ile Met Leu Gly Glu Ile
            180                 185                 190

Leu Arg His Ser Met Asp Pro Pro Thr Phe Thr Ser Asn Phe Asn Asn
        195                 200                 205

Glu Leu Trp Val Arg Gly Arg His Glu Thr Tyr Leu Cys Tyr Glu Val
    210                 215                 220

Glu Arg Leu His Asn Asp Thr Trp Val Leu Leu Asn Gln Arg Arg Gly
225                 230                 235                 240

Phe Leu Cys Asn Gln Ala Pro His Lys His Gly Phe Leu Glu Gly Arg
                245                 250                 255

His Ala Glu Leu Cys Phe Leu Asp Val Ile Pro Phe Trp Lys Leu Asp
            260                 265                 270

Leu His Gln Asp Tyr Arg Val Thr Cys Phe Thr Ser Trp Ser Pro Cys
        275                 280                 285

Phe Ser Cys Ala Gln Glu Met Ala Lys Phe Ile Ser Asn Asn Lys His
    290                 295                 300

Val Ser Leu Cys Ile Phe Ala Ala Arg Ile Tyr Asp Asp Gln Gly Arg
305                 310                 315                 320
```

```
Cys Gln Glu Gly Leu Arg Thr Leu Ala Lys Ala Gly Ala Lys Ile Ser
                325                 330                 335


Ile Met Thr Tyr Ser Glu Phe Lys His Cys Trp Asp Thr Phe Val Asp
            340                 345                 350


His Gln Gly Cys Pro Phe Gln Pro Trp Asp Gly Leu Glu Glu His Ser
        355                 360                 365


Gln Ala Leu Ser Gly Arg Leu Arg Ala Ile Leu Gln Asn Gln Gly Asn
    370                 375                 380


<210>  284
<211>  377
<212>  PRT
<213>  Chlorocebus sabaeus

<400>  284

Met Asn Pro Gln Ile Arg Asn Met Val Glu Gln Met Glu Pro Asp Ile
1               5                   10                  15


Phe Val Tyr Tyr Phe Asn Asn Arg Pro Ile Leu Ser Gly Arg Asn Thr
            20                  25                  30


Val Trp Leu Cys Tyr Glu Val Lys Thr Lys Asp Pro Ser Gly Pro Pro
        35                  40                  45


Leu Asp Ala Asn Ile Phe Gln Gly Lys Leu Tyr Pro Glu Ala Lys Asp
    50                  55                  60


His Pro Glu Met Lys Phe Leu His Trp Phe Arg Lys Trp Arg Gln Leu
65                  70                  75                  80


His Arg Asp Gln Glu Tyr Glu Val Thr Trp Tyr Val Ser Trp Ser Pro
                85                  90                  95


Cys Thr Arg Cys Ala Asn Ser Val Ala Thr Phe Leu Ala Glu Asp Pro
            100                 105                 110
```

```
Lys Val Thr Leu Thr Ile Phe Val Ala Arg Leu Tyr Tyr Phe Trp Lys
        115                 120                 125

Pro Asp Tyr Gln Gln Ala Leu Arg Ile Leu Cys Gln Glu Arg Gly Gly
    130                 135                 140

Pro His Ala Thr Met Lys Ile Met Asn Tyr Asn Glu Phe Gln His Cys
145                 150                 155                 160

Trp Asn Glu Phe Val Asp Gly Gln Gly Lys Pro Phe Lys Pro Arg Lys
                165                 170                 175

Asn Leu Pro Lys His Tyr Thr Leu Leu His Ala Thr Leu Gly Glu Leu
            180                 185                 190

Leu Arg His Val Met Asp Pro Gly Thr Phe Thr Ser Asn Phe Asn Asn
        195                 200                 205

Lys Pro Trp Val Ser Gly Gln Arg Glu Thr Tyr Leu Cys Tyr Lys Val
    210                 215                 220

Glu Arg Ser His Asn Asp Thr Trp Val Leu Leu Asn Gln His Arg Gly
225                 230                 235                 240

Phe Leu Arg Asn Gln Ala Pro Asp Arg His Gly Phe Pro Lys Gly Arg
                245                 250                 255

His Ala Glu Leu Cys Phe Leu Asp Leu Ile Pro Phe Trp Lys Leu Asp
            260                 265                 270

Asp Gln Gln Tyr Arg Val Thr Cys Phe Thr Ser Trp Ser Pro Cys Phe
        275                 280                 285

Ser Cys Ala Gln Lys Met Ala Lys Phe Ile Ser Asn Asn Lys His Val
    290                 295                 300

Ser Leu Cys Ile Phe Ala Ala Arg Ile Tyr Asp Asp Gln Gly Arg Cys
305                 310                 315                 320
```

```
Gln Glu Gly Leu Arg Thr Leu His Arg Asp Gly Ala Lys Ile Ala Val
                325                 330                 335


Met Asn Tyr Ser Glu Phe Glu Tyr Cys Trp Asp Thr Phe Val Asp Arg
            340                 345                 350


Gln Gly Arg Pro Phe Gln Pro Trp Asp Gly Leu Asp Glu His Ser Gln
        355                 360                 365


Ala Leu Ser Gly Arg Leu Arg Ala Ile
    370                 375


<210>  285
<211>  384
<212>  PRT
<213>  Homo sapiens

<400>  285

Met Lys Pro His Phe Arg Asn Thr Val Glu Arg Met Tyr Arg Asp Thr
1               5                   10                  15


Phe Ser Tyr Asn Phe Tyr Asn Arg Pro Ile Leu Ser Arg Arg Asn Thr
            20                  25                  30


Val Trp Leu Cys Tyr Glu Val Lys Thr Lys Gly Pro Ser Arg Pro Pro
        35                  40                  45


Leu Asp Ala Lys Ile Phe Arg Gly Gln Val Tyr Ser Glu Leu Lys Tyr
    50                  55                  60


His Pro Glu Met Arg Phe Phe His Trp Phe Ser Lys Trp Arg Lys Leu
65                  70                  75                  80


His Arg Asp Gln Glu Tyr Glu Val Thr Trp Tyr Ile Ser Trp Ser Pro
                85                  90                  95


Cys Thr Lys Cys Thr Arg Asp Met Ala Thr Phe Leu Ala Glu Asp Pro
            100                 105                 110
```

```
Lys Val Thr Leu Thr Ile Phe Val Ala Arg Leu Tyr Tyr Phe Trp Asp
        115                 120                 125

Pro Asp Tyr Gln Glu Ala Leu Arg Ser Leu Cys Gln Lys Arg Asp Gly
    130                 135                 140

Pro Arg Ala Thr Met Lys Ile Met Asn Tyr Asp Glu Phe Gln His Cys
145                 150                 155                 160

Trp Ser Lys Phe Val Tyr Ser Gln Arg Glu Leu Phe Glu Pro Trp Asn
                165                 170                 175

Asn Leu Pro Lys Tyr Tyr Ile Leu Leu His Ile Met Leu Gly Glu Ile
            180                 185                 190

Leu Arg His Ser Met Asp Pro Pro Thr Phe Thr Phe Asn Phe Asn Asn
        195                 200                 205

Glu Pro Trp Val Arg Gly Arg His Glu Thr Tyr Leu Cys Tyr Glu Val
    210                 215                 220

Glu Arg Met His Asn Asp Thr Trp Val Leu Leu Asn Gln Arg Arg Gly
225                 230                 235                 240

Phe Leu Cys Asn Gln Ala Pro His Lys His Gly Phe Leu Glu Gly Arg
                245                 250                 255

His Ala Glu Leu Cys Phe Leu Asp Val Ile Pro Phe Trp Lys Leu Asp
            260                 265                 270

Leu Asp Gln Asp Tyr Arg Val Thr Cys Phe Thr Ser Trp Ser Pro Cys
        275                 280                 285

Phe Ser Cys Ala Gln Glu Met Ala Lys Phe Ile Ser Lys Asn Lys His
    290                 295                 300

Val Ser Leu Cys Ile Phe Thr Ala Arg Ile Tyr Asp Asp Gln Gly Arg
305                 310                 315                 320
```

Cys Gln Glu Gly Leu Arg Thr Leu Ala Glu Ala Gly Ala Lys Ile Ser
325 330 335

Ile Met Thr Tyr Ser Glu Phe Lys His Cys Trp Asp Thr Phe Val Asp
340 345 350

His Gln Gly Cys Pro Phe Gln Pro Trp Asp Gly Leu Asp Glu His Ser
355 360 365

Gln Asp Leu Ser Gly Arg Leu Arg Ala Ile Leu Gln Asn Gln Glu Asn
370 375 380

<210> 286
<211> 373
<212> PRT
<213> Homo sapiens

<400> 286

Met Lys Pro His Phe Arg Asn Thr Val Glu Arg Met Tyr Arg Asp Thr
1 5 10 15

Phe Ser Tyr Asn Phe Tyr Asn Arg Pro Ile Leu Ser Arg Arg Asn Thr
20 25 30

Val Trp Leu Cys Tyr Glu Val Lys Thr Lys Gly Pro Ser Arg Pro Arg
35 40 45

Leu Asp Ala Lys Ile Phe Arg Gly Gln Val Tyr Ser Gln Pro Glu His
50 55 60

His Ala Glu Met Cys Phe Leu Ser Trp Phe Cys Gly Asn Gln Leu Pro
65 70 75 80

Ala Tyr Lys Cys Phe Gln Ile Thr Trp Phe Val Ser Trp Thr Pro Cys
85 90 95

Pro Asp Cys Val Ala Lys Leu Ala Glu Phe Leu Ala Glu His Pro Asn
100 105 110

Val Thr Leu Thr Ile Ser Ala Ala Arg Leu Tyr Tyr Tyr Trp Glu Arg

115 120 125

Asp Tyr Arg Arg Ala Leu Cys Arg Leu Ser Gln Ala Gly Ala Arg Val
130 135 140

Lys Ile Met Asp Asp Glu Glu Phe Ala Tyr Cys Trp Glu Asn Phe Val
145 150 155 160

Tyr Ser Glu Gly Gln Pro Phe Met Pro Trp Tyr Lys Phe Asp Asp Asn
165 170 175

Tyr Ala Phe Leu His Arg Thr Leu Lys Glu Ile Leu Arg Asn Pro Met
180 185 190

Glu Ala Met Tyr Pro His Ile Phe Tyr Phe His Phe Lys Asn Leu Arg
195 200 205

Lys Ala Tyr Gly Arg Asn Glu Ser Trp Leu Cys Phe Thr Met Glu Val
210 215 220

Val Lys His His Ser Pro Val Ser Trp Lys Arg Gly Val Phe Arg Asn
225 230 235 240

Gln Val Asp Pro Glu Thr His Cys His Ala Glu Arg Cys Phe Leu Ser
245 250 255

Trp Phe Cys Asp Asp Ile Leu Ser Pro Asn Thr Asn Tyr Glu Val Thr
260 265 270

Trp Tyr Thr Ser Trp Ser Pro Cys Pro Glu Cys Ala Gly Glu Val Ala
275 280 285

Glu Phe Leu Ala Arg His Ser Asn Val Asn Leu Thr Ile Phe Thr Ala
290 295 300

Arg Leu Tyr Tyr Phe Trp Asp Thr Asp Tyr Gln Glu Gly Leu Arg Ser
305 310 315 320

Leu Ser Gln Glu Gly Ala Ser Val Glu Ile Met Gly Tyr Lys Asp Phe

325 330 335

Lys Tyr Cys Trp Glu Asn Phe Val Tyr Asn Asp Asp Glu Pro Phe Lys
340 345 350

Pro Trp Lys Gly Leu Lys Tyr Asn Phe Leu Phe Leu Asp Ser Lys Leu
355 360 365

Gln Glu Ile Leu Glu
370

<210> 287
<211> 382
<212> PRT
<213> Homo sapiens

<400> 287

Met Asn Pro Gln Ile Arg Asn Pro Met Glu Arg Met Tyr Arg Asp Thr
1 5 10 15

Phe Tyr Asp Asn Phe Glu Asn Glu Pro Ile Leu Tyr Gly Arg Ser Tyr
20 25 30

Thr Trp Leu Cys Tyr Glu Val Lys Ile Lys Arg Gly Arg Ser Asn Leu
35 40 45

Leu Trp Asp Thr Gly Val Phe Arg Gly Gln Val Tyr Phe Lys Pro Gln
50 55 60

Tyr His Ala Glu Met Cys Phe Leu Ser Trp Phe Cys Gly Asn Gln Leu
65 70 75 80

Pro Ala Tyr Lys Cys Phe Gln Ile Thr Trp Phe Val Ser Trp Thr Pro
85 90 95

Cys Pro Asp Cys Val Ala Lys Leu Ala Glu Phe Leu Ser Glu His Pro
100 105 110

Asn Val Thr Leu Thr Ile Ser Ala Ala Arg Leu Tyr Tyr Tyr Trp Glu
115 120 125

```
Arg Asp Tyr Arg Arg Ala Leu Cys Arg Leu Ser Gln Ala Gly Ala Arg
    130                 135                 140

Val Thr Ile Met Asp Tyr Glu Glu Phe Ala Tyr Cys Trp Glu Asn Phe
145                 150                 155                 160

Val Tyr Asn Glu Gly Gln Gln Phe Met Pro Trp Tyr Lys Phe Asp Glu
                165                 170                 175

Asn Tyr Ala Phe Leu His Arg Thr Leu Lys Glu Ile Leu Arg Tyr Leu
            180                 185                 190

Met Asp Pro Asp Thr Phe Thr Phe Asn Phe Asn Asn Asp Pro Leu Val
        195                 200                 205

Leu Arg Arg Arg Gln Thr Tyr Leu Cys Tyr Glu Val Glu Arg Leu Asp
    210                 215                 220

Asn Gly Thr Trp Val Leu Met Asp Gln His Met Gly Phe Leu Cys Asn
225                 230                 235                 240

Glu Ala Lys Asn Leu Leu Cys Gly Phe Tyr Gly Arg His Ala Glu Leu
                245                 250                 255

Arg Phe Leu Asp Leu Val Pro Ser Leu Gln Leu Asp Pro Ala Gln Ile
            260                 265                 270

Tyr Arg Val Thr Trp Phe Ile Ser Trp Ser Pro Cys Phe Ser Trp Gly
        275                 280                 285

Cys Ala Gly Glu Val Arg Ala Phe Leu Gln Glu Asn Thr His Val Arg
    290                 295                 300

Leu Arg Ile Phe Ala Ala Arg Ile Tyr Asp Tyr Asp Pro Leu Tyr Lys
305                 310                 315                 320

Glu Ala Leu Gln Met Leu Arg Asp Ala Gly Ala Gln Val Ser Ile Met
                325                 330                 335
```

```
Thr Tyr Asp Glu Phe Glu Tyr Cys Trp Asp Thr Phe Val Tyr Arg Gln
            340                 345                 350


Gly Cys Pro Phe Gln Pro Trp Asp Gly Leu Glu Glu His Ser Gln Ala
        355                 360                 365


Leu Ser Gly Arg Leu Arg Ala Ile Leu Gln Asn Gln Gly Asn
    370                 375                 380


<210>  288
<211>  190
<212>  PRT
<213>  Homo sapiens

<400>  288

Met Asn Pro Gln Ile Arg Asn Pro Met Lys Ala Met Tyr Pro Gly Thr
1               5                   10                  15


Phe Tyr Phe Gln Phe Lys Asn Leu Trp Glu Ala Asn Asp Arg Asn Glu
            20                  25                  30


Thr Trp Leu Cys Phe Thr Val Glu Gly Ile Lys Arg Arg Ser Val Val
        35                  40                  45


Ser Trp Lys Thr Gly Val Phe Arg Asn Gln Val Asp Ser Glu Thr His
    50                  55                  60


Cys His Ala Glu Arg Cys Phe Leu Ser Trp Phe Cys Asp Asp Ile Leu
65                  70                  75                  80


Ser Pro Asn Thr Lys Tyr Gln Val Thr Trp Tyr Thr Ser Trp Ser Pro
                85                  90                  95


Cys Pro Asp Cys Ala Gly Glu Val Ala Glu Phe Leu Ala Arg His Ser
            100                 105                 110


Asn Val Asn Leu Thr Ile Phe Thr Ala Arg Leu Tyr Tyr Phe Gln Tyr
        115                 120                 125
```

```
Pro Cys Tyr Gln Glu Gly Leu Arg Ser Leu Ser Gln Glu Gly Val Ala
    130                 135                 140


Val Glu Ile Met Asp Tyr Glu Asp Phe Lys Tyr Cys Trp Glu Asn Phe
145                 150                 155                 160


Val Tyr Asn Asp Asn Glu Pro Phe Lys Pro Trp Lys Gly Leu Lys Thr
                165                 170                 175


Asn Phe Arg Leu Leu Lys Arg Arg Leu Arg Glu Ser Leu Gln
            180                 185                 190


<210>  289
<211>  199
<212>  PRT
<213>  Homo sapiens

<400>  289

Met Glu Ala Ser Pro Ala Ser Gly Pro Arg His Leu Met Asp Pro His
1               5                   10                  15


Ile Phe Thr Ser Asn Phe Asn Asn Gly Ile Gly Arg His Lys Thr Tyr
            20                  25                  30


Leu Cys Tyr Glu Val Glu Arg Leu Asp Asn Gly Thr Ser Val Lys Met
        35                  40                  45


Asp Gln His Arg Gly Phe Leu His Asn Gln Ala Lys Asn Leu Leu Cys
    50                  55                  60


Gly Phe Tyr Gly Arg His Ala Glu Leu Arg Phe Leu Asp Leu Val Pro
65                  70                  75                  80


Ser Leu Gln Leu Asp Pro Ala Gln Ile Tyr Arg Val Thr Trp Phe Ile
                85                  90                  95


Ser Trp Ser Pro Cys Phe Ser Trp Gly Cys Ala Gly Glu Val Arg Ala
            100                 105                 110
```

```
Phe Leu Gln Glu Asn Thr His Val Arg Leu Arg Ile Phe Ala Ala Arg
        115                 120                 125


Ile Tyr Asp Tyr Asp Pro Leu Tyr Lys Glu Ala Leu Gln Met Leu Arg
    130                 135                 140


Asp Ala Gly Ala Gln Val Ser Ile Met Thr Tyr Asp Glu Phe Lys His
145                 150                 155                 160


Cys Trp Asp Thr Phe Val Asp His Gln Gly Cys Pro Phe Gln Pro Trp
                165                 170                 175


Asp Gly Leu Asp Glu His Ser Gln Ala Leu Ser Gly Arg Leu Arg Ala
            180                 185                 190


Ile Leu Gln Asn Gln Gly Asn
        195


<210>  290
<211>  200
<212>  PRT
<213>  Homo sapiens

<400>  290

Met Ala Leu Leu Thr Ala Glu Thr Phe Arg Leu Gln Phe Asn Asn Lys
1               5                   10                  15


Arg Arg Leu Arg Arg Pro Tyr Tyr Pro Arg Lys Ala Leu Leu Cys Tyr
            20                  25                  30


Gln Leu Thr Pro Gln Asn Gly Ser Thr Pro Thr Arg Gly Tyr Phe Glu
        35                  40                  45


Asn Lys Lys Lys Cys His Ala Glu Ile Cys Phe Ile Asn Glu Ile Lys
    50                  55                  60


Ser Met Gly Leu Asp Glu Thr Gln Cys Tyr Gln Val Thr Cys Tyr Leu
65                  70                  75                  80


Thr Trp Ser Pro Cys Ser Ser Cys Ala Trp Glu Leu Val Asp Phe Ile
```

85 90 95

Lys Ala His Asp His Leu Asn Leu Gly Ile Phe Ala Ser Arg Leu Tyr
100 105 110

Tyr His Trp Cys Lys Pro Gln Gln Lys Gly Leu Arg Leu Leu Cys Gly
115 120 125

Ser Gln Val Pro Val Glu Val Met Gly Phe Pro Lys Phe Ala Asp Cys
130 135 140

Trp Glu Asn Phe Val Asp His Glu Lys Pro Leu Ser Phe Asn Pro Tyr
145 150 155 160

Lys Met Leu Glu Glu Leu Asp Lys Asn Ser Arg Ala Ile Lys Arg Arg
165 170 175

Leu Glu Arg Ile Lys Ile Pro Gly Val Arg Ala Gln Gly Arg Tyr Met
180 185 190

Asp Ile Leu Cys Asp Ala Glu Val
195 200

<210> 291
<211> 386
<212> PRT
<213> Homo sapiens

<400> 291

Met Asn Pro Gln Ile Arg Asn Pro Met Glu Arg Met Tyr Arg Asp Thr
1 5 10 15

Phe Tyr Asp Asn Phe Glu Asn Glu Pro Ile Leu Tyr Gly Arg Ser Tyr
20 25 30

Thr Trp Leu Cys Tyr Glu Val Lys Ile Lys Arg Gly Arg Ser Asn Leu
35 40 45

Leu Trp Asp Thr Gly Val Phe Arg Gly Pro Val Leu Pro Lys Arg Gln
50 55 60

```
Ser Asn His Arg Gln Glu Val Tyr Phe Arg Phe Glu Asn His Ala Glu
65                  70                  75                  80

Met Cys Phe Leu Ser Trp Phe Cys Gly Asn Arg Leu Pro Ala Asn Arg
                85                  90                  95

Arg Phe Gln Ile Thr Trp Phe Val Ser Trp Asn Pro Cys Leu Pro Cys
            100                 105                 110

Val Val Lys Val Thr Lys Phe Leu Ala Glu His Pro Asn Val Thr Leu
        115                 120                 125

Thr Ile Ser Ala Ala Arg Leu Tyr Tyr Tyr Arg Asp Arg Asp Trp Arg
    130                 135                 140

Trp Val Leu Leu Arg Leu His Lys Ala Gly Ala Arg Val Lys Ile Met
145                 150                 155                 160

Asp Tyr Glu Asp Phe Ala Tyr Cys Trp Glu Asn Phe Val Cys Asn Glu
                165                 170                 175

Gly Gln Pro Phe Met Pro Trp Tyr Lys Phe Asp Asp Asn Tyr Ala Ser
            180                 185                 190

Leu His Arg Thr Leu Lys Glu Ile Leu Arg Asn Pro Met Glu Ala Met
        195                 200                 205

Tyr Pro His Ile Phe Tyr Phe His Phe Lys Asn Leu Leu Lys Ala Cys
    210                 215                 220

Gly Arg Asn Glu Ser Trp Leu Cys Phe Thr Met Glu Val Thr Lys His
225                 230                 235                 240

His Ser Ala Val Phe Arg Lys Arg Gly Val Phe Arg Asn Gln Val Asp
                245                 250                 255

Pro Glu Thr His Cys His Ala Glu Arg Cys Phe Leu Ser Trp Phe Cys
            260                 265                 270
```

```
Asp Asp Ile Leu Ser Pro Asn Thr Asn Tyr Glu Val Thr Trp Tyr Thr
        275                 280                 285


Ser Trp Ser Pro Cys Pro Glu Cys Ala Gly Glu Val Ala Glu Phe Leu
    290                 295                 300


Ala Arg His Ser Asn Val Asn Leu Thr Ile Phe Thr Ala Arg Leu Cys
305                 310                 315                 320


Tyr Phe Trp Asp Thr Asp Tyr Gln Glu Gly Leu Cys Ser Leu Ser Gln
                325                 330                 335


Glu Gly Ala Ser Val Lys Ile Met Gly Tyr Lys Asp Phe Val Ser Cys
            340                 345                 350


Trp Lys Asn Phe Val Tyr Ser Asp Asp Glu Pro Phe Lys Pro Trp Lys
        355                 360                 365


Gly Leu Gln Thr Asn Phe Arg Leu Leu Lys Arg Arg Leu Arg Glu Ile
    370                 375                 380


Leu Gln
385


<210>  292
<211>  236
<212>  PRT
<213>  Homo sapiens

<400>  292

Met Thr Ser Glu Lys Gly Pro Ser Thr Gly Asp Pro Thr Leu Arg Arg
1               5                   10                  15


Arg Ile Glu Pro Trp Glu Phe Asp Val Phe Tyr Asp Pro Arg Glu Leu
            20                  25                  30


Arg Lys Glu Ala Cys Leu Leu Tyr Glu Ile Lys Trp Gly Met Ser Arg
        35                  40                  45
```

```
Lys Ile Trp Arg Ser Ser Gly Lys Asn Thr Thr Asn His Val Glu Val
    50                  55                  60

Asn Phe Ile Lys Lys Phe Thr Ser Glu Arg Asp Phe His Pro Ser Met
65                  70                  75                  80

Ser Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Trp Glu Cys
                85                  90                  95

Ser Gln Ala Ile Arg Glu Phe Leu Ser Arg His Pro Gly Val Thr Leu
            100                 105                 110

Val Ile Tyr Val Ala Arg Leu Phe Trp His Met Asp Gln Gln Asn Arg
        115                 120                 125

Gln Gly Leu Arg Asp Leu Val Asn Ser Gly Val Thr Ile Gln Ile Met
    130                 135                 140

Arg Ala Ser Glu Tyr Tyr His Cys Trp Arg Asn Phe Val Asn Tyr Pro
145                 150                 155                 160

Pro Gly Asp Glu Ala His Trp Pro Gln Tyr Pro Pro Leu Trp Met Met
                165                 170                 175

Leu Tyr Ala Leu Glu Leu His Cys Ile Ile Leu Ser Leu Pro Pro Cys
            180                 185                 190

Leu Lys Ile Ser Arg Arg Trp Gln Asn His Leu Thr Phe Phe Arg Leu
        195                 200                 205

His Leu Gln Asn Cys His Tyr Gln Thr Ile Pro Pro His Ile Leu Leu
    210                 215                 220

Ala Thr Gly Leu Ile His Pro Ser Val Ala Trp Arg
225                 230                 235
```

<210> 293
<211> 229
<212> PRT

<213> Mus musculus

<400> 293

```
Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1               5                  10                  15


Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
            20                  25                  30


Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
        35                  40                  45


Ser Val Trp Arg His Thr Ser Gln Asn Thr Ser Asn His Val Glu Val
    50                  55                  60


Asn Phe Leu Glu Lys Phe Thr Thr Glu Arg Tyr Phe Arg Pro Asn Thr
65                  70                  75                  80


Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
                85                  90                  95


Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg His Pro Tyr Val Thr Leu
            100                 105                 110


Phe Ile Tyr Ile Ala Arg Leu Tyr His His Thr Asp Gln Arg Asn Arg
        115                 120                 125


Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
    130                 135                 140


Thr Glu Gln Glu Tyr Cys Tyr Cys Trp Arg Asn Phe Val Asn Tyr Pro
145                 150                 155                 160


Pro Ser Asn Glu Ala Tyr Trp Pro Arg Tyr Pro His Leu Trp Val Lys
                165                 170                 175


Leu Tyr Val Leu Glu Leu Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys
            180                 185                 190
```

Leu Lys Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
195 200 205

Thr Leu Gln Thr Cys His Tyr Gln Arg Ile Pro Pro His Leu Leu Trp
210 215 220

Ala Thr Gly Leu Lys
225

<210> 294
<211> 229
<212> PRT
<213> Rattus rattus

<400> 294

Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1 5 10 15

Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
20 25 30

Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
35 40 45

Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
50 55 60

Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65 70 75 80

Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
85 90 95

Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
100 105 110

Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
115 120 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met

130 135 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145 150 155 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
165 170 175

Leu Tyr Val Leu Glu Leu Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys
180 185 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
195 200 205

Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
210 215 220

Ala Thr Gly Leu Lys
225

<210> 295
<211> 208
<212> PRT
<213> Petromyzon marinus

<400> 295

Met Thr Asp Ala Glu Tyr Val Arg Ile His Glu Lys Leu Asp Ile Tyr
1 5 10 15

Thr Phe Lys Lys Gln Phe Phe Asn Asn Lys Lys Ser Val Ser His Arg
20 25 30

Cys Tyr Val Leu Phe Glu Leu Lys Arg Arg Gly Glu Arg Arg Ala Cys
35 40 45

Phe Trp Gly Tyr Ala Val Asn Lys Pro Gln Ser Gly Thr Glu Arg Gly
50 55 60

Ile His Ala Glu Ile Phe Ser Ile Arg Lys Val Glu Glu Tyr Leu Arg
65 70 75 80

```
Asp Asn Pro Gly Gln Phe Thr Ile Asn Trp Tyr Ser Ser Trp Ser Pro
                85                  90                  95

Cys Ala Asp Cys Ala Glu Lys Ile Leu Glu Trp Tyr Asn Gln Glu Leu
            100                 105                 110

Arg Gly Asn Gly His Thr Leu Lys Ile Trp Ala Cys Lys Leu Tyr Tyr
        115                 120                 125

Glu Lys Asn Ala Arg Asn Gln Ile Gly Leu Trp Asn Leu Arg Asp Asn
    130                 135                 140

Gly Val Gly Leu Asn Val Met Val Ser Glu His Tyr Gln Cys Cys Arg
145                 150                 155                 160

Lys Ile Phe Ile Gln Ser Ser His Asn Gln Leu Asn Glu Asn Arg Trp
                165                 170                 175

Leu Glu Lys Thr Leu Lys Arg Ala Glu Lys Arg Arg Ser Glu Leu Ser
            180                 185                 190

Ile Met Ile Gln Val Lys Ile Leu His Thr Thr Lys Ser Pro Ala Val
        195                 200                 205
```

<210> 296
<211> 384
<212> PRT
<213> Homo sapiens

<400> 296

```
Met Lys Pro His Phe Arg Asn Thr Val Glu Arg Met Tyr Arg Asp Thr
1               5                   10                  15

Phe Ser Tyr Asn Phe Tyr Asn Arg Pro Ile Leu Ser Arg Arg Asn Thr
            20                  25                  30

Val Trp Leu Cys Tyr Glu Val Lys Thr Lys Gly Pro Ser Arg Pro Pro
        35                  40                  45
```

```
Leu Asp Ala Lys Ile Phe Arg Gly Gln Val Tyr Ser Glu Leu Lys Tyr
    50                  55                  60

His Pro Glu Met Arg Phe Phe His Trp Phe Ser Lys Trp Arg Lys Leu
65                  70                  75                  80

His Arg Asp Gln Glu Tyr Glu Val Thr Trp Tyr Ile Ser Trp Ser Pro
                85                  90                  95

Cys Thr Lys Cys Thr Arg Asp Met Ala Thr Phe Leu Ala Glu Asp Pro
            100                 105                 110

Lys Val Thr Leu Thr Ile Phe Val Ala Arg Leu Tyr Tyr Phe Trp Asp
        115                 120                 125

Pro Asp Tyr Gln Glu Ala Leu Arg Ser Leu Cys Gln Lys Arg Asp Gly
    130                 135                 140

Pro Arg Ala Thr Met Lys Ile Met Asn Tyr Asp Glu Phe Gln His Cys
145                 150                 155                 160

Trp Ser Lys Phe Val Tyr Ser Gln Arg Glu Leu Phe Glu Pro Trp Asn
                165                 170                 175

Asn Leu Pro Lys Tyr Tyr Ile Leu Leu His Ile Met Leu Gly Glu Ile
            180                 185                 190

Leu Arg His Ser Met Asp Pro Pro Thr Phe Thr Phe Asn Phe Asn Asn
        195                 200                 205

Glu Pro Trp Val Arg Gly Arg His Glu Thr Tyr Leu Cys Tyr Glu Val
    210                 215                 220

Glu Arg Met His Asn Asp Thr Trp Val Leu Leu Asn Gln Arg Arg Gly
225                 230                 235                 240

Phe Leu Cys Asn Gln Ala Pro His Lys His Gly Phe Leu Glu Gly Arg
                245                 250                 255
```

```
His Ala Glu Leu Cys Phe Leu Asp Val Ile Pro Phe Trp Lys Leu Asp
            260                 265                 270


Leu Asp Gln Asp Tyr Arg Val Thr Cys Phe Thr Ser Trp Ser Pro Cys
        275                 280                 285


Phe Ser Cys Ala Gln Glu Met Ala Lys Phe Ile Ser Lys Asn Lys His
    290                 295                 300


Val Ser Leu Cys Ile Phe Thr Ala Arg Ile Tyr Arg Arg Gln Gly Arg
305                 310                 315                 320


Cys Gln Glu Gly Leu Arg Thr Leu Ala Glu Ala Gly Ala Lys Ile Ser
                325                 330                 335


Ile Met Thr Tyr Ser Glu Phe Lys His Cys Trp Asp Thr Phe Val Asp
            340                 345                 350


His Gln Gly Cys Pro Phe Gln Pro Trp Asp Gly Leu Asp Glu His Ser
        355                 360                 365


Gln Asp Leu Ser Gly Arg Leu Arg Ala Ile Leu Gln Asn Gln Glu Asn
    370                 375                 380


<210>  297
<211>  184
<212>  PRT
<213>  Homo sapiens

<400>  297

Met Asp Pro Pro Thr Phe Thr Phe Asn Phe Asn Asn Glu Pro Trp Val
1               5                   10                  15


Arg Gly Arg His Glu Thr Tyr Leu Cys Tyr Glu Val Glu Arg Met His
            20                  25                  30


Asn Asp Thr Trp Val Leu Leu Asn Gln Arg Arg Gly Phe Leu Cys Asn
        35                  40                  45
```

```
Gln Ala Pro His Lys His Gly Phe Leu Glu Gly Arg His Ala Glu Leu
    50                  55                  60

Cys Phe Leu Asp Val Ile Pro Phe Trp Lys Leu Asp Leu Asp Gln Asp
65                  70                  75                  80

Tyr Arg Val Thr Cys Phe Thr Ser Trp Ser Pro Cys Phe Ser Cys Ala
                85                  90                  95

Gln Glu Met Ala Lys Phe Ile Ser Lys Asn Lys His Val Ser Leu Cys
            100                 105                 110

Ile Phe Thr Ala Arg Ile Tyr Asp Asp Gln Gly Arg Cys Gln Glu Gly
        115                 120                 125

Leu Arg Thr Leu Ala Glu Ala Gly Ala Lys Ile Ser Ile Met Thr Tyr
    130                 135                 140

Ser Glu Phe Lys His Cys Trp Asp Thr Phe Val Asp His Gln Gly Cys
145                 150                 155                 160

Pro Phe Gln Pro Trp Asp Gly Leu Asp Glu His Ser Gln Asp Leu Ser
                165                 170                 175

Gly Arg Leu Arg Ala Ile Leu Gln
            180
```

<210> 298
<211> 184
<212> PRT
<213> Homo sapiens

<400> 298

```
Met Asp Pro Pro Thr Phe Thr Phe Asn Phe Asn Asn Glu Pro Trp Val
1               5                   10                  15

Arg Gly Arg His Glu Thr Tyr Leu Cys Tyr Glu Val Glu Arg Met His
            20                  25                  30

Asn Asp Thr Trp Val Leu Leu Asn Gln Arg Arg Gly Phe Leu Cys Asn
```

35 40 45

Gln Ala Pro His Lys His Gly Phe Leu Glu Gly Arg His Ala Glu Leu
50 55 60

Cys Phe Leu Asp Val Ile Pro Phe Trp Lys Leu Asp Leu Asp Gln Asp
65 70 75 80

Tyr Arg Val Thr Cys Phe Thr Ser Trp Ser Pro Cys Phe Ser Cys Ala
85 90 95

Gln Glu Met Ala Lys Phe Ile Ser Lys Asn Lys His Val Ser Leu Cys
100 105 110

Ile Phe Thr Ala Arg Ile Tyr Arg Arg Gln Gly Arg Cys Gln Glu Gly
115 120 125

Leu Arg Thr Leu Ala Glu Ala Gly Ala Lys Ile Ser Ile Met Thr Tyr
130 135 140

Ser Glu Phe Lys His Cys Trp Asp Thr Phe Val Asp His Gln Gly Cys
145 150 155 160

Pro Phe Gln Pro Trp Asp Gly Leu Asp Glu His Ser Gln Asp Leu Ser
165 170 175

Gly Arg Leu Arg Ala Ile Leu Gln
180

<210> 299
<211> 84
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 299

Met Thr Asn Leu Ser Asp Ile Ile Glu Lys Glu Thr Gly Lys Gln Leu
1 5 10 15

```
Val Ile Gln Glu Ser Ile Leu Met Leu Pro Glu Glu Val Glu Glu Val
            20                  25                  30


Ile Gly Asn Lys Pro Glu Ser Asp Ile Leu Val His Thr Ala Tyr Asp
        35                  40                  45


Glu Ser Thr Asp Glu Asn Val Met Leu Leu Thr Ser Asp Ala Pro Glu
    50                  55                  60


Tyr Lys Pro Trp Ala Leu Val Ile Gln Asp Ser Asn Gly Glu Asn Lys
65                  70                  75                  80


Ile Lys Met Leu
```

<210> 300
<211> 181
<212> PRT
<213> Erwinia tasmaniensis

<400> 300

```
Met Ala Ser Arg Gly Val Asn Lys Val Ile Leu Val Gly Asn Leu Gly
1               5                   10                  15


Gln Asp Pro Glu Val Arg Tyr Met Pro Asn Gly Gly Ala Val Ala Asn
            20                  25                  30


Ile Thr Leu Ala Thr Ser Glu Ser Trp Arg Asp Lys Gln Thr Gly Glu
        35                  40                  45


Thr Lys Glu Lys Thr Glu Trp His Arg Val Val Leu Phe Gly Lys Leu
    50                  55                  60


Ala Glu Val Ala Gly Glu Tyr Leu Arg Lys Gly Ser Gln Val Tyr Ile
65                  70                  75                  80


Glu Gly Ala Leu Gln Thr Arg Lys Trp Thr Asp Gln Ala Gly Val Glu
                85                  90                  95
```

```
Lys Tyr Thr Thr Glu Val Val Val Asn Val Gly Gly Thr Met Gln Met
            100                 105                 110


Leu Gly Gly Arg Ser Gln Gly Gly Gly Ala Ser Ala Gly Gly Gln Asn
        115                 120                 125


Gly Gly Ser Asn Asn Gly Trp Gly Gln Pro Gln Gln Pro Gln Gly Gly
    130                 135                 140


Asn Gln Phe Ser Gly Gly Ala Gln Gln Gln Ala Arg Pro Gln Gln Gln
145                 150                 155                 160


Pro Gln Gln Asn Asn Ala Pro Ala Asn Asn Glu Pro Pro Ile Asp Phe
                165                 170                 175


Asp Asp Asp Ile Pro
            180
```

<210> 301
<211> 209
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 301

```
Met Ala Gly Ala Gln Asp Phe Val Pro His Thr Ala Asp Leu Ala Glu
1               5                   10                  15


Leu Ala Ala Ala Ala Gly Glu Cys Arg Gly Cys Gly Leu Tyr Arg Asp
            20                  25                  30


Ala Thr Gln Ala Val Phe Gly Ala Gly Gly Arg Ser Ala Arg Ile Met
        35                  40                  45


Met Ile Gly Glu Gln Pro Gly Asp Lys Glu Asp Leu Ala Gly Leu Pro
    50                  55                  60


Phe Val Gly Pro Ala Gly Arg Leu Leu Asp Arg Ala Leu Glu Ala Ala
65                  70                  75                  80
```

```
Asp Ile Asp Arg Asp Ala Leu Tyr Val Thr Asn Ala Val Lys His Phe
                85                  90                  95

Lys Phe Thr Arg Ala Ala Gly Gly Lys Arg Arg Ile His Lys Thr Pro
            100                 105                 110

Ser Arg Thr Glu Val Val Ala Cys Arg Pro Trp Leu Ile Ala Glu Met
        115                 120                 125

Thr Ser Val Glu Pro Asp Val Val Val Leu Leu Gly Ala Thr Ala Ala
    130                 135                 140

Lys Ala Leu Leu Gly Asn Asp Phe Arg Val Thr Gln His Arg Gly Glu
145                 150                 155                 160

Val Leu His Val Asp Asp Val Pro Gly Asp Pro Ala Leu Val Ala Thr
                165                 170                 175

Val His Pro Ser Ser Leu Leu Arg Gly Pro Lys Glu Glu Arg Glu Ser
            180                 185                 190

Ala Phe Ala Gly Leu Val Asp Asp Leu Arg Val Ala Ala Asp Val Arg
        195                 200                 205

Pro
```

<210> 302
<211> 313
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 302

```
Met Ile Gly Gln Lys Thr Leu Tyr Ser Phe Phe Ser Pro Ser Pro Ala
1               5                   10                  15
```

```
Arg Lys Arg His Ala Pro Ser Pro Glu Pro Ala Val Gln Gly Thr Gly
            20                  25                  30

Val Ala Gly Val Pro Glu Glu Ser Gly Asp Ala Ala Ala Ile Pro Ala
        35                  40                  45

Lys Lys Ala Pro Ala Gly Gln Glu Glu Pro Gly Thr Pro Pro Ser Ser
    50                  55                  60

Pro Leu Ser Ala Glu Gln Leu Asp Arg Ile Gln Arg Asn Lys Ala Ala
65                  70                  75                  80

Ala Leu Leu Arg Leu Ala Ala Arg Asn Val Pro Val Gly Phe Gly Glu
                85                  90                  95

Ser Trp Lys Lys His Leu Ser Gly Glu Phe Gly Lys Pro Tyr Phe Ile
            100                 105                 110

Lys Leu Met Gly Phe Val Ala Glu Glu Arg Lys His Tyr Thr Val Tyr
        115                 120                 125

Pro Pro Pro His Gln Val Phe Thr Trp Thr Gln Met Cys Asp Ile Lys
    130                 135                 140

Asp Val Lys Val Val Ile Leu Gly Gln Glu Pro Tyr His Gly Pro Asn
145                 150                 155                 160

Gln Ala His Gly Leu Cys Phe Ser Val Gln Arg Pro Val Pro Pro Pro
                165                 170                 175

Pro Ser Leu Glu Asn Ile Tyr Lys Glu Leu Ser Thr Asp Ile Glu Asp
            180                 185                 190

Phe Val His Pro Gly His Gly Asp Leu Ser Gly Trp Ala Lys Gln Gly
        195                 200                 205

Val Leu Leu Leu Asn Ala Val Leu Thr Val Arg Ala His Gln Ala Asn
    210                 215                 220
```

```
Ser His Lys Glu Arg Gly Trp Glu Gln Phe Thr Asp Ala Val Val Ser
225                 230                 235                 240


Trp Leu Asn Gln Asn Ser Asn Gly Leu Val Phe Leu Leu Trp Gly Ser
                245                 250                 255


Tyr Ala Gln Lys Lys Gly Ser Ala Ile Asp Arg Lys Arg His His Val
            260                 265                 270


Leu Gln Thr Ala His Pro Ser Pro Leu Ser Val Tyr Arg Gly Phe Phe
        275                 280                 285


Gly Cys Arg His Phe Ser Lys Thr Asn Glu Leu Leu Gln Lys Ser Gly
    290                 295                 300


Lys Lys Pro Ile Asp Trp Lys Glu Leu
305                 310


<210>  303
<211>  1633
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  303

Met Gly Ser Ser His His His His His His Met Ser Ser Glu Thr Gly
1               5                   10                  15


Pro Val Ala Val Asp Pro Thr Leu Arg Arg Arg Ile Glu Pro His Glu
            20                  25                  30


Phe Glu Val Phe Phe Asp Pro Arg Glu Leu Arg Lys Glu Thr Cys Leu
        35                  40                  45


Leu Tyr Glu Ile Asn Trp Gly Gly Arg His Ser Ile Trp Arg His Thr
    50                  55                  60


Ser Gln Asn Thr Asn Lys His Val Glu Val Asn Phe Ile Glu Lys Phe
65                  70                  75                  80
```

```
Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr Arg Cys Ser Ile Thr Trp
                85                  90                  95

Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys Ser Arg Ala Ile Thr Glu
            100                 105                 110

Phe Leu Ser Arg Tyr Pro His Val Thr Leu Phe Ile Tyr Ile Ala Arg
        115                 120                 125

Leu Tyr His His Ala Asp Pro Arg Asn Arg Gln Gly Leu Arg Asp Leu
    130                 135                 140

Ile Ser Ser Gly Val Thr Ile Gln Ile Met Thr Glu Gln Glu Ser Gly
145                 150                 155                 160

Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser Pro Ser Asn Glu Ala His
                165                 170                 175

Trp Pro Arg Tyr Pro His Leu Trp Val Arg Leu Tyr Val Leu Glu Leu
            180                 185                 190

Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys Leu Asn Ile Leu Arg Arg
        195                 200                 205

Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile Ala Leu Gln Ser Cys His
    210                 215                 220

Tyr Gln Arg Leu Pro Pro His Ile Leu Trp Ala Thr Gly Leu Lys Ser
225                 230                 235                 240

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Asp
                245                 250                 255

Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp
            260                 265                 270

Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val
        275                 280                 285
```

```
Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala
    290                 295                 300

Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg
305                 310                 315                 320

Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu
                325                 330                 335

Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe
            340                 345                 350

His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu
        355                 360                 365

Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu
    370                 375                 380

Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr
385                 390                 395                 400

Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile
                405                 410                 415

Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn
            420                 425                 430

Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln
        435                 440                 445

Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala
    450                 455                 460

Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile
465                 470                 475                 480

Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile
                485                 490                 495
```

```
Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu
            500                 505                 510

Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp
        515                 520                 525

Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe
    530                 535                 540

Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu
545                 550                 555                 560

Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile
                565                 570                 575

Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu
            580                 585                 590

Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln
        595                 600                 605

Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu
    610                 615                 620

Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr
625                 630                 635                 640

Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln
                645                 650                 655

Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu
            660                 665                 670

Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys
        675                 680                 685

Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr
    690                 695                 700
```

```
Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr
705                 710                 715                 720

Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val
                725                 730                 735

Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe
            740                 745                 750

Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu
        755                 760                 765

Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val
    770                 775                 780

Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys
785                 790                 795                 800

Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys
                805                 810                 815

Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val
            820                 825                 830

Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr
        835                 840                 845

His Asp Leu Leu Lys Leu Leu Lys Asp Lys Asp Phe Leu Asp Asn Glu
    850                 855                 860

Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu Phe
865                 870                 875                 880

Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His Leu
                885                 890                 895

Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr Gly
            900                 905                 910
```

```
Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys Gln
        915                 920                 925

Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe Ala Asn
    930                 935                 940

Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu
945                 950                 955                 960

Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu
                965                 970                 975

His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu
            980                 985                 990

Gln Thr Val Lys Val Val Asp Glu  Leu Val Lys Val Met  Gly Arg His
        995                 1000                1005

Lys Pro  Glu Asn Ile Val Ile  Glu Met Ala Arg Glu  Asn Gln Thr
    1010                1015                1020

Thr Gln  Lys Gly Gln Lys Asn  Ser Arg Glu Arg Met  Lys Arg Ile
    1025                1030                1035

Glu Glu  Gly Ile Lys Glu Leu  Gly Ser Gln Ile Leu  Lys Glu His
    1040                1045                1050

Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu Lys Leu  Tyr Leu Tyr
    1055                1060                1065

Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val Asp Gln  Glu Leu Asp
    1070                1075                1080

Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp Ala Ile  Val Pro Gln
    1085                1090                1095

Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn Lys Val  Leu Thr Arg
    1100                1105                1110
```

```
Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn Val Pro  Ser Glu Glu
    1115                1120                1125

Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg Gln Leu  Leu Asn Ala
    1130                1135                1140

Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn Leu Thr  Lys Ala Glu
    1145                1150                1155

Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala Gly Phe  Ile Lys Arg
    1160                1165                1170

Gln Leu  Val Glu Thr Arg Gln  Ile Thr Lys His Val  Ala Gln Ile
    1175                1180                1185

Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp Glu Asn  Asp Lys Leu
    1190                1195                1200

Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys Ser Lys  Leu Val Ser
    1205                1210                1215

Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys Val Arg  Glu Ile Asn
    1220                1225                1230

Asn Tyr  His His Ala His Asp  Ala Tyr Leu Asn Ala  Val Val Gly
    1235                1240                1245

Thr Ala  Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
    1250                1255                1260

Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1265                1270                1275

Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Tyr  Phe Phe Tyr
    1280                1285                1290

Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1295                1300                1305
```

```
Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Gly Glu Thr
    1310                1315                1320

Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1325                1330                1335

Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1340                1345                1350

Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Arg
    1355                1360                1365

Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys Asp Trp  Asp Pro Lys
    1370                1375                1380

Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val Ala Tyr  Ser Val Leu
    1385                1390                1395

Val Val  Ala Lys Val Glu Lys  Gly Lys Ser Lys Lys  Leu Lys Ser
    1400                1405                1410

Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met Glu Arg  Ser Ser Phe
    1415                1420                1425

Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala Lys Gly  Tyr Lys Glu
    1430                1435                1440

Val Lys  Lys Asp Leu Leu Leu  Lys Leu Pro Lys Tyr  Ser Leu Phe
    1445                1450                1455

Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu Ala Ser  Ala Gly Glu
    1460                1465                1470

Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro Ser Lys  Tyr Val Asn
    1475                1480                1485

Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys Leu Lys  Gly Ser Pro
    1490                1495                1500
```

```
Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val Glu Gln  His Lys His
    1505                1510                1515


Tyr Leu  Asp Glu Leu Leu Glu  Gln Ile Ser Glu Phe  Ser Lys Arg
    1520                1525                1530


Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys Val Leu  Ser Ala Tyr
    1535                1540                1545


Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu Gln Ala  Glu Asn Leu
    1550                1555                1560


Leu His  Leu Phe Thr Leu Thr  Asn Leu Gly Ala Pro  Ala Ala Phe
    1565                1570                1575


Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys Arg Tyr  Thr Ser Thr
    1580                1585                1590


Lys Glu  Val Leu Asp Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly
    1595                1600                1605


Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln Leu Gly  Gly Asp Ser
    1610                1615                1620


Gly Gly  Ser Pro Lys Lys Lys  Arg Lys Val
    1625                1630


<210>  304
<211>  1623
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  304

Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1               5                  10                  15
```

```
Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
            20                  25                  30

Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
        35                  40                  45

Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
    50                  55                  60

Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65                  70                  75                  80

Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
                85                  90                  95

Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
            100                 105                 110

Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
        115                 120                 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
    130                 135                 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145                 150                 155                 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
                165                 170                 175

Leu Tyr Val Leu Glu Leu Tyr Cys Leu Leu Leu Gly Leu Pro Pro Cys
            180                 185                 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
        195                 200                 205

Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
    210                 215                 220
```

```
Ala Thr Gly Leu Lys Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
225                 230                 235                 240


Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
                245                 250                 255


Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
            260                 265                 270


Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
        275                 280                 285


Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
    290                 295                 300


Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
305                 310                 315                 320


Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
                325                 330                 335


Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
            340                 345                 350


Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
        355                 360                 365


Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
    370                 375                 380


Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
385                 390                 395                 400


Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
                405                 410                 415


Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
            420                 425                 430
```

```
Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
        435                 440                 445

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
    450                 455                 460

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
465                 470                 475                 480

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
                485                 490                 495

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
            500                 505                 510

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
        515                 520                 525

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
    530                 535                 540

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
545                 550                 555                 560

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
                565                 570                 575

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
            580                 585                 590

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
        595                 600                 605

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
    610                 615                 620

Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
625                 630                 635                 640
```

```
Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
                645                 650                 655

Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
            660                 665                 670

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
        675                 680                 685

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
    690                 695                 700

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
705                 710                 715                 720

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
                725                 730                 735

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
            740                 745                 750

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
        755                 760                 765

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
    770                 775                 780

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
785                 790                 795                 800

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
                805                 810                 815

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
            820                 825                 830

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Leu Leu Lys Asp Lys
        835                 840                 845
```

```
Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
    850                 855                 860

Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
865                 870                 875                 880

Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
                885                 890                 895

Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn
            900                 905                 910

Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
        915                 920                 925

Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp
    930                 935                 940

Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln
945                 950                 955                 960

Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala
                965                 970                 975

Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val
            980                 985                 990

Lys Val Met Gly Arg His Lys Pro  Glu Asn Ile Val Ile  Glu Met Ala
        995                 1000                1005

Arg Glu  Asn Gln Thr Thr Gln  Lys Gly Gln Lys Asn  Ser Arg Glu
    1010                1015                1020

Arg Met  Lys Arg Ile Glu Glu  Gly Ile Lys Glu Leu  Gly Ser Gln
    1025                1030                1035

Ile Leu  Lys Glu His Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu
    1040                1045                1050
```

```
Lys Leu  Tyr Leu Tyr Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val
    1055                1060                1065

Asp Gln  Glu Leu Asp Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp
    1070                1075                1080

Ala Ile  Val Pro Gln Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn
    1085                1090                1095

Lys Val  Leu Thr Arg Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn
    1100                1105                1110

Val Pro  Ser Glu Glu Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg
    1115                1120                1125

Gln Leu  Leu Asn Ala Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn
    1130                1135                1140

Leu Thr  Lys Ala Glu Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala
    1145                1150                1155

Gly Phe  Ile Lys Arg Gln Leu  Val Glu Thr Arg Gln  Ile Thr Lys
    1160                1165                1170

His Val  Ala Gln Ile Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp
    1175                1180                1185

Glu Asn  Asp Lys Leu Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys
    1190                1195                1200

Ser Lys  Leu Val Ser Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys
    1205                1210                1215

Val Arg  Glu Ile Asn Asn Tyr  His His Ala His Asp  Ala Tyr Leu
    1220                1225                1230

Asn Ala  Val Val Gly Thr Ala  Leu Ile Lys Lys Tyr  Pro Lys Leu
    1235                1240                1245
```

```
Glu Ser  Glu Phe Val Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg
    1250                1255                1260

Lys Met  Ile Ala Lys Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala
    1265                1270                1275

Lys Tyr  Phe Phe Tyr Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu
    1280                1285                1290

Ile Thr  Leu Ala Asn Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu
    1295                1300                1305

Thr Asn  Gly Glu Thr Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp
    1310                1315                1320

Phe Ala  Thr Val Arg Lys Val  Leu Ser Met Pro Gln  Val Asn Ile
    1325                1330                1335

Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1340                1345                1350

Ile Leu  Pro Lys Arg Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys
    1355                1360                1365

Asp Trp  Asp Pro Lys Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val
    1370                1375                1380

Ala Tyr  Ser Val Leu Val Val  Ala Lys Val Glu Lys  Gly Lys Ser
    1385                1390                1395

Lys Lys  Leu Lys Ser Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met
    1400                1405                1410

Glu Arg  Ser Ser Phe Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala
    1415                1420                1425

Lys Gly  Tyr Lys Glu Val Lys  Lys Asp Leu Leu Leu  Lys Leu Pro
    1430                1435                1440
```

```
Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu
    1445                1450                1455


Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro
    1460                1465                1470


Ser Lys  Tyr Val Asn Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys
    1475                1480                1485


Leu Lys  Gly Ser Pro Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val
    1490                1495                1500


Glu Gln  His Lys His Tyr Leu  Asp Glu Leu Leu Glu  Gln Ile Ser
    1505                1510                1515


Glu Phe  Ser Lys Arg Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys
    1520                1525                1530


Val Leu  Ser Ala Tyr Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu
    1535                1540                1545


Gln Ala  Glu Asn Leu Leu His  Leu Phe Thr Leu Thr  Asn Leu Gly
    1550                1555                1560


Ala Pro  Ala Ala Phe Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys
    1565                1570                1575


Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asp Ala Thr  Leu Ile His
    1580                1585                1590


Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln
    1595                1600                1605


Leu Gly  Gly Asp Ser Gly Gly  Ser Pro Lys Lys Lys  Arg Lys Val
    1610                1615                1620
```

<210> 305
<211> 1630
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 305

```
Met Thr Ser Glu Lys Gly Pro Ser Thr Gly Asp Pro Thr Leu Arg Arg
1               5                  10                  15


Arg Ile Glu Pro Trp Glu Phe Asp Val Phe Tyr Asp Pro Arg Glu Leu
            20                  25                  30


Arg Lys Glu Ala Cys Leu Leu Tyr Glu Ile Lys Trp Gly Met Ser Arg
        35                  40                  45


Lys Ile Trp Arg Ser Ser Gly Lys Asn Thr Thr Asn His Val Glu Val
    50                  55                  60


Asn Phe Ile Lys Lys Phe Thr Ser Glu Arg Asp Phe His Pro Ser Met
65                  70                  75                  80


Ser Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Trp Glu Cys
                85                  90                  95


Ser Gln Ala Ile Arg Glu Phe Leu Ser Arg His Pro Gly Val Thr Leu
            100                 105                 110


Val Ile Tyr Val Ala Arg Leu Phe Trp His Met Asp Gln Gln Asn Arg
        115                 120                 125


Gln Gly Leu Arg Asp Leu Val Asn Ser Gly Val Thr Ile Gln Ile Met
    130                 135                 140


Arg Ala Ser Glu Tyr Tyr His Cys Trp Arg Asn Phe Val Asn Tyr Pro
145                 150                 155                 160


Pro Gly Asp Glu Ala His Trp Pro Gln Tyr Pro Pro Leu Trp Met Met
                165                 170                 175


Leu Tyr Ala Leu Glu Leu His Cys Ile Ile Leu Ser Leu Pro Pro Cys
            180                 185                 190
```

```
Leu Lys Ile Ser Arg Arg Trp Gln Asn His Leu Thr Phe Phe Arg Leu
        195                 200                 205

His Leu Gln Asn Cys His Tyr Gln Thr Ile Pro Pro His Ile Leu Leu
    210                 215                 220

Ala Thr Gly Leu Ile His Pro Ser Val Ala Trp Arg Ser Gly Ser Glu
225                 230                 235                 240

Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr
                245                 250                 255

Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile
            260                 265                 270

Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn
        275                 280                 285

Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe
    290                 295                 300

Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg
305                 310                 315                 320

Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile
                325                 330                 335

Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu
            340                 345                 350

Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His Pro
        355                 360                 365

Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro
    370                 375                 380

Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala
385                 390                 395                 400
```

```
Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg
                405                 410                 415

Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val
            420                 425                 430

Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu
        435                 440                 445

Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser
    450                 455                 460

Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu
465                 470                 475                 480

Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser
                485                 490                 495

Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp
            500                 505                 510

Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn
        515                 520                 525

Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala
    530                 535                 540

Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn
545                 550                 555                 560

Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr
                565                 570                 575

Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln
            580                 585                 590

Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn
        595                 600                 605
```

```
Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr
    610                 615                 620

Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu
625                 630                 635                 640

Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe
                645                 650                 655

Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His Ala
            660                 665                 670

Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg
        675                 680                 685

Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly
    690                 695                 700

Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser
705                 710                 715                 720

Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly
                725                 730                 735

Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn
            740                 745                 750

Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr
        755                 760                 765

Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly
    770                 775                 780

Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val
785                 790                 795                 800

Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys
                805                 810                 815
```

```
Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser
            820                 825                 830

Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu
        835                 840                 845

Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu
    850                 855                 860

Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg
865                 870                 875                 880

Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp
                885                 890                 895

Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg
            900                 905                 910

Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys
        915                 920                 925

Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe
    930                 935                 940

Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln
945                 950                 955                 960

Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His Glu His Ile Ala
                965                 970                 975

Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val
            980                 985                 990

Lys Val Val Asp Glu Leu Val Lys  Val Met Gly Arg His  Lys Pro Glu
        995                 1000                1005

Asn Ile  Val Ile Glu Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys
    1010                1015                1020
```

```
Gly Gln  Lys Asn Ser Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly
    1025                1030                1035

Ile Lys  Glu Leu Gly Ser Gln  Ile Leu Lys Glu His  Pro Val Glu
    1040                1045                1050

Asn Thr  Gln Leu Gln Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln
    1055                1060                1065

Asn Gly  Arg Asp Met Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg
    1070                1075                1080

Leu Ser  Asp Tyr Asp Val Asp  Ala Ile Val Pro Gln  Ser Phe Leu
    1085                1090                1095

Lys Asp  Asp Ser Ile Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys
    1100                1105                1110

Asn Arg  Gly Lys Ser Asp Asn  Val Pro Ser Glu Glu  Val Val Lys
    1115                1120                1125

Lys Met  Lys Asn Tyr Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile
    1130                1135                1140

Thr Gln  Arg Lys Phe Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly
    1145                1150                1155

Leu Ser  Glu Leu Asp Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val
    1160                1165                1170

Glu Thr  Arg Gln Ile Thr Lys  His Val Ala Gln Ile  Leu Asp Ser
    1175                1180                1185

Arg Met  Asn Thr Lys Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu
    1190                1195                1200

Val Lys  Val Ile Thr Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg
    1205                1210                1215
```

```
Lys Asp  Phe Gln Phe Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His
    1220                1225                1230

His Ala  His Asp Ala Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu
    1235                1240                1245

Ile Lys  Lys Tyr Pro Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp
    1250                1255                1260

Tyr Lys  Val Tyr Asp Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln
    1265                1270                1275

Glu Ile  Gly Lys Ala Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile
    1280                1285                1290

Met Asn  Phe Phe Lys Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile
    1295                1300                1305

Arg Lys  Arg Pro Leu Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile
    1310                1315                1320

Val Trp  Asp Lys Gly Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu
    1325                1330                1335

Ser Met  Pro Gln Val Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr
    1340                1345                1350

Gly Gly  Phe Ser Lys Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp
    1355                1360                1365

Lys Leu  Ile Ala Arg Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly
    1370                1375                1380

Gly Phe  Asp Ser Pro Thr Val  Ala Tyr Ser Val Leu  Val Val Ala
    1385                1390                1395

Lys Val  Glu Lys Gly Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu
    1400                1405                1410
```

```
Leu Leu  Gly Ile Thr Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn
    1415                1420                1425

Pro Ile  Asp Phe Leu Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys
    1430                1435                1440

Asp Leu  Ile Ile Lys Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu
    1445                1450                1455

Asn Gly  Arg Lys Arg Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys
    1460                1465                1470

Gly Asn  Glu Leu Ala Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr
    1475                1480                1485

Leu Ala  Ser His Tyr Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn
    1490                1495                1500

Glu Gln  Lys Gln Leu Phe Val  Glu Gln His Lys His  Tyr Leu Asp
    1505                1510                1515

Glu Ile  Ile Glu Gln Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu
    1520                1525                1530

Ala Asp  Ala Asn Leu Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His
    1535                1540                1545

Arg Asp  Lys Pro Ile Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu
    1550                1555                1560

Phe Thr  Leu Thr Asn Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe
    1565                1570                1575

Asp Thr  Thr Ile Asp Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val
    1580                1585                1590

Leu Asp  Ala Thr Leu Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu
    1595                1600                1605
```

```
Thr Arg  Ile Asp Leu Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser
    1610                1615                1620


Pro Lys  Lys Lys Arg Lys Val
    1625                1630


<210>  306
<211>  1710
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  306

Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1               5                   10                  15


Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
            20                  25                  30


Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
        35                  40                  45


Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
    50                  55                  60


Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65                  70                  75                  80


Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
                85                  90                  95


Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
            100                 105                 110


Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
        115                 120                 125
```

```
Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
    130                 135                 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145                 150                 155                 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
                165                 170                 175

Leu Tyr Val Leu Glu Leu Tyr Cys Leu Leu Leu Gly Leu Pro Pro Cys
            180                 185                 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
        195                 200                 205

Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
    210                 215                 220

Ala Thr Gly Leu Lys Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
225                 230                 235                 240

Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
                245                 250                 255

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
            260                 265                 270

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
        275                 280                 285

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
    290                 295                 300

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
305                 310                 315                 320

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
                325                 330                 335
```

```
Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
            340                 345                 350

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
        355                 360                 365

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
    370                 375                 380

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
385                 390                 395                 400

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
                405                 410                 415

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
            420                 425                 430

Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
        435                 440                 445

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
    450                 455                 460

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
465                 470                 475                 480

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
                485                 490                 495

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
            500                 505                 510

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
        515                 520                 525

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
    530                 535                 540
```

```
Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
545                 550                 555                 560


Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
                565                 570                 575


Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
            580                 585                 590


Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
        595                 600                 605


Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
    610                 615                 620


Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
625                 630                 635                 640


Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
                645                 650                 655


Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
            660                 665                 670


Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
        675                 680                 685


Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
    690                 695                 700


Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
705                 710                 715                 720


Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
                725                 730                 735


Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
            740                 745                 750
```

```
Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
        755                 760                 765

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
    770                 775                 780

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
785                 790                 795                 800

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
                805                 810                 815

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
            820                 825                 830

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Leu Leu Lys Asp Lys
        835                 840                 845

Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
    850                 855                 860

Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
865                 870                 875                 880

Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
                885                 890                 895

Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn
            900                 905                 910

Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
        915                 920                 925

Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp
    930                 935                 940

Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln
945                 950                 955                 960
```

```
Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala
               965                 970                 975


Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val
           980                 985                 990


Lys Val Met Gly Arg His Lys Pro  Glu Asn Ile Val Ile  Glu Met Ala
        995                1000                1005


Arg Glu  Asn Gln Thr Thr Gln  Lys Gly Gln Lys Asn  Ser Arg Glu
    1010                1015                1020


Arg Met  Lys Arg Ile Glu Glu  Gly Ile Lys Glu Leu  Gly Ser Gln
    1025                1030                1035


Ile Leu  Lys Glu His Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu
    1040                1045                1050


Lys Leu  Tyr Leu Tyr Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val
    1055                1060                1065


Asp Gln  Glu Leu Asp Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp
    1070                1075                1080


Ala Ile  Val Pro Gln Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn
    1085                1090                1095


Lys Val  Leu Thr Arg Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn
    1100                1105                1110


Val Pro  Ser Glu Glu Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg
    1115                1120                1125


Gln Leu  Leu Asn Ala Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn
    1130                1135                1140


Leu Thr  Lys Ala Glu Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala
    1145                1150                1155
```

```
Gly Phe  Ile Lys Arg Gln Leu  Val Glu Thr Arg Gln  Ile Thr Lys
    1160                1165                1170

His Val  Ala Gln Ile Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp
    1175                1180                1185

Glu Asn  Asp Lys Leu Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys
    1190                1195                1200

Ser Lys  Leu Val Ser Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys
    1205                1210                1215

Val Arg  Glu Ile Asn Asn Tyr  His His Ala His Asp  Ala Tyr Leu
    1220                1225                1230

Asn Ala  Val Val Gly Thr Ala  Leu Ile Lys Lys Tyr  Pro Lys Leu
    1235                1240                1245

Glu Ser  Glu Phe Val Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg
    1250                1255                1260

Lys Met  Ile Ala Lys Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala
    1265                1270                1275

Lys Tyr  Phe Phe Tyr Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu
    1280                1285                1290

Ile Thr  Leu Ala Asn Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu
    1295                1300                1305

Thr Asn  Gly Glu Thr Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp
    1310                1315                1320

Phe Ala  Thr Val Arg Lys Val  Leu Ser Met Pro Gln  Val Asn Ile
    1325                1330                1335

Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1340                1345                1350
```

```
Ile Leu  Pro Lys Arg Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys
    1355                1360                1365


Asp Trp  Asp Pro Lys Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val
    1370                1375                1380


Ala Tyr  Ser Val Leu Val Val  Ala Lys Val Glu Lys  Gly Lys Ser
    1385                1390                1395


Lys Lys  Leu Lys Ser Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met
    1400                1405                1410


Glu Arg  Ser Ser Phe Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala
    1415                1420                1425


Lys Gly  Tyr Lys Glu Val Lys  Lys Asp Leu Leu Leu  Lys Leu Pro
    1430                1435                1440


Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu
    1445                1450                1455


Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro
    1460                1465                1470


Ser Lys  Tyr Val Asn Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys
    1475                1480                1485


Leu Lys  Gly Ser Pro Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val
    1490                1495                1500


Glu Gln  His Lys His Tyr Leu  Asp Glu Leu Leu Glu  Gln Ile Ser
    1505                1510                1515


Glu Phe  Ser Lys Arg Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys
    1520                1525                1530


Val Leu  Ser Ala Tyr Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu
    1535                1540                1545
```

```
Gln Ala  Glu Asn Leu Leu His  Leu Phe Thr Leu Thr  Asn Leu Gly
    1550                1555                1560


Ala Pro  Ala Ala Phe Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys
    1565                1570                1575


Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asp Ala Thr  Leu Ile His
    1580                1585                1590


Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln
    1595                1600                1605


Leu Gly  Gly Asp Ser Gly Gly  Ser Thr Asn Leu Ser  Asp Leu Leu
    1610                1615                1620


Glu Lys  Glu Thr Gly Lys Gln  Leu Val Ile Gln Glu  Ser Ile Leu
    1625                1630                1635


Met Leu  Pro Glu Glu Val Glu  Glu Val Ile Gly Asn  Lys Pro Glu
    1640                1645                1650


Ser Asp  Ile Leu Val His Thr  Ala Tyr Asp Glu Ser  Thr Asp Glu
    1655                1660                1665


Asn Val  Met Leu Leu Thr Ser  Asp Ala Pro Glu Tyr  Lys Pro Trp
    1670                1675                1680


Ala Leu  Val Ile Gln Asp Ser  Asn Gly Glu Asn Lys  Ile Lys Met
    1685                1690                1695


Leu Ser  Gly Gly Ser Pro Lys  Lys Lys Arg Lys Val
    1700                1705                1710


<210>  307
<211>  1710
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide
```

<400> 307

```
Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1               5                  10                  15

Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
            20                  25                  30

Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
        35                  40                  45

Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
    50                  55                  60

Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65                  70                  75                  80

Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
                85                  90                  95

Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
            100                 105                 110

Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
        115                 120                 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
    130                 135                 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145                 150                 155                 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
                165                 170                 175

Leu Tyr Val Leu Glu Leu Tyr Cys Leu Leu Leu Gly Leu Pro Pro Cys
            180                 185                 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
        195                 200                 205
```

```
Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
    210                 215                 220

Ala Thr Gly Leu Lys Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
225                 230                 235                 240

Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
                245                 250                 255

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
            260                 265                 270

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
        275                 280                 285

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
    290                 295                 300

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
305                 310                 315                 320

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
                325                 330                 335

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
            340                 345                 350

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
        355                 360                 365

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
    370                 375                 380

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
385                 390                 395                 400

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
                405                 410                 415
```

```
Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
            420                 425                 430

Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
        435                 440                 445

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
    450                 455                 460

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
465                 470                 475                 480

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
                485                 490                 495

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
            500                 505                 510

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
        515                 520                 525

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
    530                 535                 540

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
545                 550                 555                 560

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
                565                 570                 575

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
            580                 585                 590

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
        595                 600                 605

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
    610                 615                 620
```

```
Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
625                 630                 635                 640

Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
                645                 650                 655

Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
            660                 665                 670

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
        675                 680                 685

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
    690                 695                 700

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
705                 710                 715                 720

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
                725                 730                 735

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
            740                 745                 750

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
        755                 760                 765

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
    770                 775                 780

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
785                 790                 795                 800

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
                805                 810                 815

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
            820                 825                 830
```

```
Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Leu Leu Lys Asp Lys
        835                 840                 845

Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
    850                 855                 860

Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
865                 870                 875                 880

Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
                885                 890                 895

Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn
            900                 905                 910

Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
        915                 920                 925

Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp
    930                 935                 940

Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln
945                 950                 955                 960

Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala
                965                 970                 975

Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val
            980                 985                 990

Lys Val Met Gly Arg His Lys Pro  Glu Asn Ile Val Ile  Glu Met Ala
        995                 1000                1005

Arg Glu  Asn Gln Thr Thr Gln  Lys Gly Gln Lys Asn  Ser Arg Glu
    1010                1015                1020

Arg Met  Lys Arg Ile Glu Glu  Gly Ile Lys Glu Leu  Gly Ser Gln
    1025                1030                1035
```

```
Ile Leu  Lys Glu His Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu
    1040                1045                1050

Lys Leu  Tyr Leu Tyr Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val
    1055                1060                1065

Asp Gln  Glu Leu Asp Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp
    1070                1075                1080

His Ile  Val Pro Gln Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn
    1085                1090                1095

Lys Val  Leu Thr Arg Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn
    1100                1105                1110

Val Pro  Ser Glu Glu Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg
    1115                1120                1125

Gln Leu  Leu Asn Ala Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn
    1130                1135                1140

Leu Thr  Lys Ala Glu Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala
    1145                1150                1155

Gly Phe  Ile Lys Arg Gln Leu  Val Glu Thr Arg Gln  Ile Thr Lys
    1160                1165                1170

His Val  Ala Gln Ile Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp
    1175                1180                1185

Glu Asn  Asp Lys Leu Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys
    1190                1195                1200

Ser Lys  Leu Val Ser Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys
    1205                1210                1215

Val Arg  Glu Ile Asn Asn Tyr  His His Ala His Asp  Ala Tyr Leu
    1220                1225                1230
```

```
Asn Ala  Val Val Gly Thr Ala  Leu Ile Lys Lys Tyr  Pro Lys Leu
    1235                 1240                 1245

Glu Ser  Glu Phe Val Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg
    1250                 1255                 1260

Lys Met  Ile Ala Lys Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala
    1265                 1270                 1275

Lys Tyr  Phe Phe Tyr Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu
    1280                 1285                 1290

Ile Thr  Leu Ala Asn Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu
    1295                 1300                 1305

Thr Asn  Gly Glu Thr Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp
    1310                 1315                 1320

Phe Ala  Thr Val Arg Lys Val  Leu Ser Met Pro Gln  Val Asn Ile
    1325                 1330                 1335

Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1340                 1345                 1350

Ile Leu  Pro Lys Arg Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys
    1355                 1360                 1365

Asp Trp  Asp Pro Lys Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val
    1370                 1375                 1380

Ala Tyr  Ser Val Leu Val Val  Ala Lys Val Glu Lys  Gly Lys Ser
    1385                 1390                 1395

Lys Lys  Leu Lys Ser Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met
    1400                 1405                 1410

Glu Arg  Ser Ser Phe Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala
    1415                 1420                 1425
```

```
Lys Gly  Tyr Lys Glu Val Lys  Lys Asp Leu Leu Leu  Lys Leu Pro
    1430                 1435                 1440

Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu
    1445                 1450                 1455

Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro
    1460                 1465                 1470

Ser Lys  Tyr Val Asn Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys
    1475                 1480                 1485

Leu Lys  Gly Ser Pro Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val
    1490                 1495                 1500

Glu Gln  His Lys His Tyr Leu  Asp Glu Leu Leu Glu  Gln Ile Ser
    1505                 1510                 1515

Glu Phe  Ser Lys Arg Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys
    1520                 1525                 1530

Val Leu  Ser Ala Tyr Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu
    1535                 1540                 1545

Gln Ala  Glu Asn Leu Leu His  Leu Phe Thr Leu Thr  Asn Leu Gly
    1550                 1555                 1560

Ala Pro  Ala Ala Phe Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys
    1565                 1570                 1575

Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asp Ala Thr  Leu Ile His
    1580                 1585                 1590

Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln
    1595                 1600                 1605

Leu Gly  Gly Asp Ser Gly Gly  Ser Thr Asn Leu Ser  Asp Leu Leu
    1610                 1615                 1620
```

```
Glu Lys  Glu Thr Gly Lys Gln  Leu Val Ile Gln Glu  Ser Ile Leu
    1625                 1630                 1635


Met Leu  Pro Glu Glu Val Glu  Glu Val Ile Gly Asn  Lys Pro Glu
    1640                 1645                 1650


Ser Asp  Ile Leu Val His Thr  Ala Tyr Asp Glu Ser  Thr Asp Glu
    1655                 1660                 1665


Asn Val  Met Leu Leu Thr Ser  Asp Ala Pro Glu Tyr  Lys Pro Trp
    1670                 1675                 1680


Ala Leu  Val Ile Gln Asp Ser  Asn Gly Glu Asn Lys  Ile Lys Met
    1685                 1690                 1695


Leu Ser  Gly Gly Ser Pro Lys  Lys Lys Arg Lys Val
    1700                 1705                 1710


<210>  308
<211>  1679
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  308

Met Thr Asp Ala Glu Tyr Val Arg Ile His Glu Lys Leu Asp Ile Tyr
1               5                  10                  15


Thr Phe Lys Lys Gln Phe Phe Asn Asn Lys Lys Ser Val Ser His Arg
            20                  25                  30


Cys Tyr Val Leu Phe Glu Leu Lys Arg Arg Gly Glu Arg Arg Ala Cys
        35                  40                  45


Phe Trp Gly Tyr Ala Val Asn Lys Pro Gln Ser Gly Thr Glu Arg Gly
    50                  55                  60
```

```
Ile His Ala Glu Ile Phe Ser Ile Arg Lys Val Glu Glu Tyr Leu Arg
65                  70                  75                  80


Asp Asn Pro Gly Gln Phe Thr Ile Asn Trp Tyr Ser Ser Trp Ser Pro
                85                  90                  95


Cys Ala Asp Cys Ala Glu Lys Ile Leu Glu Trp Tyr Asn Gln Glu Leu
            100                 105                 110


Arg Gly Asn Gly His Thr Leu Lys Ile Trp Ala Cys Lys Leu Tyr Tyr
        115                 120                 125


Glu Lys Asn Ala Arg Asn Gln Ile Gly Leu Trp Asn Leu Arg Asp Asn
    130                 135                 140


Gly Val Gly Leu Asn Val Met Val Ser Glu His Tyr Gln Cys Cys Arg
145                 150                 155                 160


Lys Ile Phe Ile Gln Ser Ser His Asn Gln Leu Asn Glu Asn Arg Trp
                165                 170                 175


Leu Glu Lys Thr Leu Lys Arg Ala Glu Lys Arg Arg Ser Glu Leu Ser
            180                 185                 190


Ile Met Ile Gln Val Lys Ile Leu His Thr Thr Lys Ser Pro Ala Val
        195                 200                 205


Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser
    210                 215                 220


Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly
225                 230                 235                 240


Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys
                245                 250                 255


Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly
            260                 265                 270
```

```
Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys
        275                 280                 285

Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr
    290                 295                 300

Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe
305                 310                 315                 320

Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His
                325                 330                 335

Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His
            340                 345                 350

Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser
        355                 360                 365

Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met
    370                 375                 380

Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp
385                 390                 395                 400

Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn
                405                 410                 415

Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys
            420                 425                 430

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
        435                 440                 445

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
    450                 455                 460

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
465                 470                 475                 480
```

```
Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
                485                 490                 495

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
            500                 505                 510

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
        515                 520                 525

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
    530                 535                 540

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
545                 550                 555                 560

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
                565                 570                 575

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
            580                 585                 590

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
        595                 600                 605

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
    610                 615                 620

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
625                 630                 635                 640

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
                645                 650                 655

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
            660                 665                 670

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
        675                 680                 685
```

```
Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
    690                 695                 700

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
705                 710                 715                 720

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
                725                 730                 735

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
            740                 745                 750

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
        755                 760                 765

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
    770                 775                 780

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
785                 790                 795                 800

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
                805                 810                 815

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
            820                 825                 830

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
        835                 840                 845

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
    850                 855                 860

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
865                 870                 875                 880

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
                885                 890                 895
```

```
Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe Ala
            900                 905                 910

Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys
        915                 920                 925

Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His
    930                 935                 940

Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
945                 950                 955                 960

Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg
                965                 970                 975

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
            980                 985                 990

Thr Gln Lys Gly Gln Lys Asn Ser  Arg Glu Arg Met Lys  Arg Ile Glu
        995                 1000                1005

Glu Gly  Ile Lys Glu Leu Gly  Ser Gln Ile Leu Lys  Glu His Pro
    1010                1015                1020

Val Glu  Asn Thr Gln Leu Gln  Asn Glu Lys Leu Tyr  Leu Tyr Tyr
    1025                1030                1035

Leu Gln  Asn Gly Arg Asp Met  Tyr Val Asp Gln Glu  Leu Asp Ile
    1040                1045                1050

Asn Arg  Leu Ser Asp Tyr Asp  Val Asp Ala Ile Val  Pro Gln Ser
    1055                1060                1065

Phe Leu  Lys Asp Asp Ser Ile  Asp Asn Lys Val Leu  Thr Arg Ser
    1070                1075                1080

Asp Lys  Asn Arg Gly Lys Ser  Asp Asn Val Pro Ser  Glu Glu Val
    1085                1090                1095
```

```
Val Lys  Lys Met Lys Asn Tyr  Trp Arg Gln Leu Leu  Asn Ala Lys
    1100                1105                1110

Leu Ile  Thr Gln Arg Lys Phe  Asp Asn Leu Thr Lys  Ala Glu Arg
    1115                1120                1125

Gly Gly  Leu Ser Glu Leu Asp  Lys Ala Gly Phe Ile  Lys Arg Gln
    1130                1135                1140

Leu Val  Glu Thr Arg Gln Ile  Thr Lys His Val Ala  Gln Ile Leu
    1145                1150                1155

Asp Ser  Arg Met Asn Thr Lys  Tyr Asp Glu Asn Asp  Lys Leu Ile
    1160                1165                1170

Arg Glu  Val Lys Val Ile Thr  Leu Lys Ser Lys Leu  Val Ser Asp
    1175                1180                1185

Phe Arg  Lys Asp Phe Gln Phe  Tyr Lys Val Arg Glu  Ile Asn Asn
    1190                1195                1200

Tyr His  His Ala His Asp Ala  Tyr Leu Asn Ala Val  Val Gly Thr
    1205                1210                1215

Ala Leu  Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
    1220                1225                1230

Gly Asp  Tyr Lys Val Tyr Asp  Val Arg Lys Met Ile  Ala Lys Ser
    1235                1240                1245

Glu Gln  Glu Ile Gly Lys Ala  Thr Ala Lys Tyr Phe  Phe Tyr Ser
    1250                1255                1260

Asn Ile  Met Asn Phe Phe Lys  Thr Glu Ile Thr Leu  Ala Asn Gly
    1265                1270                1275

Glu Ile  Arg Lys Arg Pro Leu  Ile Glu Thr Asn Gly  Glu Thr Gly
    1280                1285                1290
```

```
Glu Ile  Val Trp Asp Lys Gly  Arg Asp Phe Ala Thr  Val Arg Lys
    1295                1300                1305

Val Leu  Ser Met Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Val
    1310                1315                1320

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Pro  Lys Arg Asn
    1325                1330                1335

Ser Asp  Lys Leu Ile Ala Arg  Lys Lys Asp Trp Asp  Pro Lys Lys
    1340                1345                1350

Tyr Gly  Gly Phe Asp Ser Pro  Thr Val Ala Tyr Ser  Val Leu Val
    1355                1360                1365

Val Ala  Lys Val Glu Lys Gly  Lys Ser Lys Lys Leu  Lys Ser Val
    1370                1375                1380

Lys Glu  Leu Leu Gly Ile Thr  Ile Met Glu Arg Ser  Ser Phe Glu
    1385                1390                1395

Lys Asn  Pro Ile Asp Phe Leu  Glu Ala Lys Gly Tyr  Lys Glu Val
    1400                1405                1410

Lys Lys  Asp Leu Ile Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu
    1415                1420                1425

Leu Glu  Asn Gly Arg Lys Arg  Met Leu Ala Ser Ala  Gly Glu Leu
    1430                1435                1440

Gln Lys  Gly Asn Glu Leu Ala  Leu Pro Ser Lys Tyr  Val Asn Phe
    1445                1450                1455

Leu Tyr  Leu Ala Ser His Tyr  Glu Lys Leu Lys Gly  Ser Pro Glu
    1460                1465                1470

Asp Asn  Glu Gln Lys Gln Leu  Phe Val Glu Gln His  Lys His Tyr
    1475                1480                1485
```

```
Leu Asp  Glu Ile Ile Glu Gln  Ile Ser Glu Phe Ser  Lys Arg Val
    1490                 1495                 1500

Ile Leu  Ala Asp Ala Asn Leu  Asp Lys Val Leu Ser  Ala Tyr Asn
    1505                 1510                 1515

Lys His  Arg Asp Lys Pro Ile  Arg Glu Gln Ala Glu  Asn Ile Ile
    1520                 1525                 1530

His Leu  Phe Thr Leu Thr Asn  Leu Gly Ala Pro Ala  Ala Phe Lys
    1535                 1540                 1545

Tyr Phe  Asp Thr Thr Ile Asp  Arg Lys Arg Tyr Thr  Ser Thr Lys
    1550                 1555                 1560

Glu Val  Leu Asp Ala Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1565                 1570                 1575

Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu Gly Gly  Asp Ser Gly
    1580                 1585                 1590

Gly Ser  Met Thr Asn Leu Ser  Asp Ile Ile Glu Lys  Glu Thr Gly
    1595                 1600                 1605

Lys Gln  Leu Val Ile Gln Glu  Ser Ile Leu Met Leu  Pro Glu Glu
    1610                 1615                 1620

Val Glu  Glu Val Ile Gly Asn  Lys Pro Glu Ser Asp  Ile Leu Val
    1625                 1630                 1635

His Thr  Ala Tyr Asp Glu Ser  Thr Asp Glu Asn Val  Met Leu Leu
    1640                 1645                 1650

Thr Ser  Asp Ala Pro Glu Tyr  Lys Pro Trp Ala Leu  Val Ile Gln
    1655                 1660                 1665

Asp Ser  Asn Gly Glu Asn Lys  Ile Lys Met Leu
    1670                 1675
```

<210> 309
<211> 1689
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 309

Met Thr Asp Ala Glu Tyr Val Arg Ile His Glu Lys Leu Asp Ile Tyr
1 5 10 15

Thr Phe Lys Lys Gln Phe Phe Asn Asn Lys Lys Ser Val Ser His Arg
20 25 30

Cys Tyr Val Leu Phe Glu Leu Lys Arg Arg Gly Glu Arg Arg Ala Cys
35 40 45

Phe Trp Gly Tyr Ala Val Asn Lys Pro Gln Ser Gly Thr Glu Arg Gly
50 55 60

Ile His Ala Glu Ile Phe Ser Ile Arg Lys Val Glu Glu Tyr Leu Arg
65 70 75 80

Asp Asn Pro Gly Gln Phe Thr Ile Asn Trp Tyr Ser Ser Trp Ser Pro
85 90 95

Cys Ala Asp Cys Ala Glu Lys Ile Leu Glu Trp Tyr Asn Gln Glu Leu
100 105 110

Arg Gly Asn Gly His Thr Leu Lys Ile Trp Ala Cys Lys Leu Tyr Tyr
115 120 125

Glu Lys Asn Ala Arg Asn Gln Ile Gly Leu Trp Asn Leu Arg Asp Asn
130 135 140

Gly Val Gly Leu Asn Val Met Val Ser Glu His Tyr Gln Cys Cys Arg
145 150 155 160

Lys Ile Phe Ile Gln Ser Ser His Asn Gln Leu Asn Glu Asn Arg Trp
165 170 175

```
Leu Glu Lys Thr Leu Lys Arg Ala Glu Lys Arg Arg Ser Glu Leu Ser
            180                 185                 190

Ile Met Ile Gln Val Lys Ile Leu His Thr Thr Lys Ser Pro Ala Val
        195                 200                 205

Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser
    210                 215                 220

Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly
225                 230                 235                 240

Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys
                245                 250                 255

Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly
            260                 265                 270

Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys
        275                 280                 285

Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr
    290                 295                 300

Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe
305                 310                 315                 320

Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His
                325                 330                 335

Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His
            340                 345                 350

Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser
        355                 360                 365

Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met
    370                 375                 380
```

```
Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp
385                 390                 395                 400

Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn
                405                 410                 415

Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys
            420                 425                 430

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
        435                 440                 445

Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
    450                 455                 460

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
465                 470                 475                 480

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
                485                 490                 495

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
            500                 505                 510

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
        515                 520                 525

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
    530                 535                 540

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
545                 550                 555                 560

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
                565                 570                 575

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
            580                 585                 590
```

```
Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
        595                 600                 605

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
    610                 615                 620

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
625                 630                 635                 640

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
                645                 650                 655

Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
            660                 665                 670

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
        675                 680                 685

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
    690                 695                 700

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn
705                 710                 715                 720

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
                725                 730                 735

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
            740                 745                 750

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
        755                 760                 765

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
    770                 775                 780

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
785                 790                 795                 800
```

```
Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
                805                 810                 815

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
            820                 825                 830

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
        835                 840                 845

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
    850                 855                 860

Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
865                 870                 875                 880

Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
                885                 890                 895

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe Ala
            900                 905                 910

Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp Ser Leu Thr Phe Lys
        915                 920                 925

Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His
    930                 935                 940

Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
945                 950                 955                 960

Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg
                965                 970                 975

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
            980                 985                 990

Thr Gln Lys Gly Gln Lys Asn Ser  Arg Glu Arg Met Lys  Arg Ile Glu
        995                 1000                1005
```

```
Glu Gly  Ile Lys Glu Leu Gly  Ser Gln Ile Leu Lys  Glu His Pro
    1010                1015                1020

Val Glu  Asn Thr Gln Leu Gln  Asn Glu Lys Leu Tyr  Leu Tyr Tyr
    1025                1030                1035

Leu Gln  Asn Gly Arg Asp Met  Tyr Val Asp Gln Glu  Leu Asp Ile
    1040                1045                1050

Asn Arg  Leu Ser Asp Tyr Asp  Val Asp His Ile Val  Pro Gln Ser
    1055                1060                1065

Phe Leu  Lys Asp Asp Ser Ile  Asp Asn Lys Val Leu  Thr Arg Ser
    1070                1075                1080

Asp Lys  Asn Arg Gly Lys Ser  Asp Asn Val Pro Ser  Glu Glu Val
    1085                1090                1095

Val Lys  Lys Met Lys Asn Tyr  Trp Arg Gln Leu Leu  Asn Ala Lys
    1100                1105                1110

Leu Ile  Thr Gln Arg Lys Phe  Asp Asn Leu Thr Lys  Ala Glu Arg
    1115                1120                1125

Gly Gly  Leu Ser Glu Leu Asp  Lys Ala Gly Phe Ile  Lys Arg Gln
    1130                1135                1140

Leu Val  Glu Thr Arg Gln Ile  Thr Lys His Val Ala  Gln Ile Leu
    1145                1150                1155

Asp Ser  Arg Met Asn Thr Lys  Tyr Asp Glu Asn Asp  Lys Leu Ile
    1160                1165                1170

Arg Glu  Val Lys Val Ile Thr  Leu Lys Ser Lys Leu  Val Ser Asp
    1175                1180                1185

Phe Arg  Lys Asp Phe Gln Phe  Tyr Lys Val Arg Glu  Ile Asn Asn
    1190                1195                1200
```

```
Tyr His  His Ala His Asp Ala  Tyr Leu Asn Ala Val  Val Gly Thr
    1205                1210                1215

Ala Leu  Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
    1220                1225                1230

Gly Asp  Tyr Lys Val Tyr Asp  Val Arg Lys Met Ile  Ala Lys Ser
    1235                1240                1245

Glu Gln  Glu Ile Gly Lys Ala  Thr Ala Lys Tyr Phe  Phe Tyr Ser
    1250                1255                1260

Asn Ile  Met Asn Phe Phe Lys  Thr Glu Ile Thr Leu  Ala Asn Gly
    1265                1270                1275

Glu Ile  Arg Lys Arg Pro Leu  Ile Glu Thr Asn Gly  Glu Thr Gly
    1280                1285                1290

Glu Ile  Val Trp Asp Lys Gly  Arg Asp Phe Ala Thr  Val Arg Lys
    1295                1300                1305

Val Leu  Ser Met Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Val
    1310                1315                1320

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Pro  Lys Arg Asn
    1325                1330                1335

Ser Asp  Lys Leu Ile Ala Arg  Lys Lys Asp Trp Asp  Pro Lys Lys
    1340                1345                1350

Tyr Gly  Gly Phe Asp Ser Pro  Thr Val Ala Tyr Ser  Val Leu Val
    1355                1360                1365

Val Ala  Lys Val Glu Lys Gly  Lys Ser Lys Lys Leu  Lys Ser Val
    1370                1375                1380

Lys Glu  Leu Leu Gly Ile Thr  Ile Met Glu Arg Ser  Ser Phe Glu
    1385                1390                1395
```

```
Lys Asn  Pro Ile Asp Phe Leu  Glu Ala Lys Gly Tyr  Lys Glu Val
    1400                1405                1410

Lys Lys  Asp Leu Ile Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu
    1415                1420                1425

Leu Glu  Asn Gly Arg Lys Arg  Met Leu Ala Ser Ala  Gly Glu Leu
    1430                1435                1440

Gln Lys  Gly Asn Glu Leu Ala  Leu Pro Ser Lys Tyr  Val Asn Phe
    1445                1450                1455

Leu Tyr  Leu Ala Ser His Tyr  Glu Lys Leu Lys Gly  Ser Pro Glu
    1460                1465                1470

Asp Asn  Glu Gln Lys Gln Leu  Phe Val Glu Gln His  Lys His Tyr
    1475                1480                1485

Leu Asp  Glu Ile Ile Glu Gln  Ile Ser Glu Phe Ser  Lys Arg Val
    1490                1495                1500

Ile Leu  Ala Asp Ala Asn Leu  Asp Lys Val Leu Ser  Ala Tyr Asn
    1505                1510                1515

Lys His  Arg Asp Lys Pro Ile  Arg Glu Gln Ala Glu  Asn Ile Ile
    1520                1525                1530

His Leu  Phe Thr Leu Thr Asn  Leu Gly Ala Pro Ala  Ala Phe Lys
    1535                1540                1545

Tyr Phe  Asp Thr Thr Ile Asp  Arg Lys Arg Tyr Thr  Ser Thr Lys
    1550                1555                1560

Glu Val  Leu Asp Ala Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1565                1570                1575

Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu Gly Gly  Asp Ser Gly
    1580                1585                1590
```

```
Gly Ser  Thr Asn Leu Ser Asp  Ile Ile Glu Lys Glu  Thr Gly Lys
    1595                 1600                 1605


Gln Leu  Val Ile Gln Glu Ser  Ile Leu Met Leu Pro  Glu Glu Val
    1610                 1615                 1620


Glu Glu  Val Ile Gly Asn Lys  Pro Glu Ser Asp Ile  Leu Val His
    1625                 1630                 1635


Thr Ala  Tyr Asp Glu Ser Thr  Asp Glu Asn Val Met  Leu Leu Thr
    1640                 1645                 1650


Ser Asp  Ala Pro Glu Tyr Lys  Pro Trp Ala Leu Val  Ile Gln Asp
    1655                 1660                 1665


Ser Asn  Gly Glu Asn Lys Ile  Lys Met Leu Ser Gly  Gly Ser Pro
    1670                 1675                 1680


Lys Lys  Lys Arg Lys Val
    1685
```

<210> 310
<211> 1655
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 310

```
Met Asp Pro Pro Thr Phe Thr Phe Asn Phe Asn Asn Glu Pro Trp Val
1               5                  10                  15


Arg Gly Arg His Glu Thr Tyr Leu Cys Tyr Glu Val Glu Arg Met His
            20                  25                  30


Asn Asp Thr Trp Val Leu Leu Asn Gln Arg Arg Gly Phe Leu Cys Asn
        35                  40                  45
```

```
Gln Ala Pro His Lys His Gly Phe Leu Glu Gly Arg His Ala Glu Leu
    50                  55                  60

Cys Phe Leu Asp Val Ile Pro Phe Trp Lys Leu Asp Leu Asp Gln Asp
65                  70                  75                  80

Tyr Arg Val Thr Cys Phe Thr Ser Trp Ser Pro Cys Phe Ser Cys Ala
                85                  90                  95

Gln Glu Met Ala Lys Phe Ile Ser Lys Asn Lys His Val Ser Leu Cys
            100                 105                 110

Ile Phe Thr Ala Arg Ile Tyr Asp Asp Gln Gly Arg Cys Gln Glu Gly
        115                 120                 125

Leu Arg Thr Leu Ala Glu Ala Gly Ala Lys Ile Ser Ile Met Thr Tyr
    130                 135                 140

Ser Glu Phe Lys His Cys Trp Asp Thr Phe Val Asp His Gln Gly Cys
145                 150                 155                 160

Pro Phe Gln Pro Trp Asp Gly Leu Asp Glu His Ser Gln Asp Leu Ser
                165                 170                 175

Gly Arg Leu Arg Ala Ile Leu Gln Ser Gly Ser Glu Thr Pro Gly Thr
            180                 185                 190

Ser Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu
        195                 200                 205

Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr
    210                 215                 220

Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His
225                 230                 235                 240

Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu
                245                 250                 255
```

```
Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr
            260                 265                 270

Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu
        275                 280                 285

Met Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe
    290                 295                 300

Leu Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn
305                 310                 315                 320

Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His
                325                 330                 335

Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu
            340                 345                 350

Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu
        355                 360                 365

Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe
    370                 375                 380

Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile
385                 390                 395                 400

Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser
                405                 410                 415

Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys
            420                 425                 430

Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr
        435                 440                 445

Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln
    450                 455                 460
```

```
Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln
465                 470                 475                 480


Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser
                485                 490                 495


Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr
            500                 505                 510


Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His
        515                 520                 525


Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu
    530                 535                 540


Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly
545                 550                 555                 560


Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys
                565                 570                 575


Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu
            580                 585                 590


Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser
        595                 600                 605


Ile Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg
    610                 615                 620


Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu
625                 630                 635                 640


Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg
                645                 650                 655


Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile
            660                 665                 670
```

```
Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln
        675                 680                 685

Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu
    690                 695                 700

Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr
705                 710                 715                 720

Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro
                725                 730                 735

Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe
            740                 745                 750

Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe
        755                 760                 765

Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp
    770                 775                 780

Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile
785                 790                 795                 800

Lys Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu
                805                 810                 815

Asp Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu
            820                 825                 830

Glu Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys
        835                 840                 845

Gln Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys
    850                 855                 860

Leu Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp
865                 870                 875                 880
```

```
Phe Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile
                885                 890                 895


His Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val
            900                 905                 910


Ser Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly
        915                 920                 925


Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp
    930                 935                 940


Glu Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile
945                 950                 955                 960


Glu Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser
                965                 970                 975


Arg Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser
            980                 985                 990


Gln Ile Leu Lys Glu His Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu
        995                 1000                1005


Lys Leu  Tyr Leu Tyr Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val
    1010                1015                1020


Asp Gln  Glu Leu Asp Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp
    1025                1030                1035


Ala Ile  Val Pro Gln Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn
    1040                1045                1050


Lys Val  Leu Thr Arg Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn
    1055                1060                1065


Val Pro  Ser Glu Glu Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg
    1070                1075                1080
```

```
Gln Leu  Leu Asn Ala Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn
    1085                1090                1095

Leu Thr  Lys Ala Glu Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala
    1100                1105                1110

Gly Phe  Ile Lys Arg Gln Leu  Val Glu Thr Arg Gln  Ile Thr Lys
    1115                1120                1125

His Val  Ala Gln Ile Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp
    1130                1135                1140

Glu Asn  Asp Lys Leu Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys
    1145                1150                1155

Ser Lys  Leu Val Ser Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys
    1160                1165                1170

Val Arg  Glu Ile Asn Asn Tyr  His His Ala His Asp  Ala Tyr Leu
    1175                1180                1185

Asn Ala  Val Val Gly Thr Ala  Leu Ile Lys Lys Tyr  Pro Lys Leu
    1190                1195                1200

Glu Ser  Glu Phe Val Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg
    1205                1210                1215

Lys Met  Ile Ala Lys Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala
    1220                1225                1230

Lys Tyr  Phe Phe Tyr Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu
    1235                1240                1245

Ile Thr  Leu Ala Asn Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu
    1250                1255                1260

Thr Asn  Gly Glu Thr Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp
    1265                1270                1275
```

```
Phe Ala  Thr Val Arg Lys Val  Leu Ser Met Pro Gln  Val Asn Ile
    1280                1285                1290


Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1295                1300                1305


Ile Leu  Pro Lys Arg Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys
    1310                1315                1320


Asp Trp  Asp Pro Lys Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val
    1325                1330                1335


Ala Tyr  Ser Val Leu Val Val  Ala Lys Val Glu Lys  Gly Lys Ser
    1340                1345                1350


Lys Lys  Leu Lys Ser Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met
    1355                1360                1365


Glu Arg  Ser Ser Phe Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala
    1370                1375                1380


Lys Gly  Tyr Lys Glu Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro
    1385                1390                1395


Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu
    1400                1405                1410


Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro
    1415                1420                1425


Ser Lys  Tyr Val Asn Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys
    1430                1435                1440


Leu Lys  Gly Ser Pro Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val
    1445                1450                1455


Glu Gln  His Lys His Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser
    1460                1465                1470
```

```
Glu Phe  Ser Lys Arg Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys
    1475                 1480                 1485

Val Leu  Ser Ala Tyr Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu
    1490                 1495                 1500

Gln Ala  Glu Asn Ile Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly
    1505                 1510                 1515

Ala Pro  Ala Ala Phe Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys
    1520                 1525                 1530

Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asp Ala Thr  Leu Ile His
    1535                 1540                 1545

Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln
    1550                 1555                 1560

Leu Gly  Gly Asp Ser Gly Gly  Ser Met Thr Asn Leu  Ser Asp Ile
    1565                 1570                 1575

Ile Glu  Lys Glu Thr Gly Lys  Gln Leu Val Ile Gln  Glu Ser Ile
    1580                 1585                 1590

Leu Met  Leu Pro Glu Glu Val  Glu Glu Val Ile Gly  Asn Lys Pro
    1595                 1600                 1605

Glu Ser  Asp Ile Leu Val His  Thr Ala Tyr Asp Glu  Ser Thr Asp
    1610                 1615                 1620

Glu Asn  Val Met Leu Leu Thr  Ser Asp Ala Pro Glu  Tyr Lys Pro
    1625                 1630                 1635

Trp Ala  Leu Val Ile Gln Asp  Ser Asn Gly Glu Asn  Lys Ile Lys
    1640                 1645                 1650

Met Leu
    1655
```

<210> 311
<211> 1665
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 311

```
Met Asp Pro Pro Thr Phe Thr Phe Asn Phe Asn Asn Glu Pro Trp Val
1               5                  10                  15


Arg Gly Arg His Glu Thr Tyr Leu Cys Tyr Glu Val Glu Arg Met His
            20                  25                  30


Asn Asp Thr Trp Val Leu Leu Asn Gln Arg Arg Gly Phe Leu Cys Asn
        35                  40                  45


Gln Ala Pro His Lys His Gly Phe Leu Glu Gly Arg His Ala Glu Leu
    50                  55                  60


Cys Phe Leu Asp Val Ile Pro Phe Trp Lys Leu Asp Leu Asp Gln Asp
65                  70                  75                  80


Tyr Arg Val Thr Cys Phe Thr Ser Trp Ser Pro Cys Phe Ser Cys Ala
                85                  90                  95


Gln Glu Met Ala Lys Phe Ile Ser Lys Asn Lys His Val Ser Leu Cys
            100                 105                 110


Ile Phe Thr Ala Arg Ile Tyr Asp Asp Gln Gly Arg Cys Gln Glu Gly
        115                 120                 125


Leu Arg Thr Leu Ala Glu Ala Gly Ala Lys Ile Ser Ile Met Thr Tyr
    130                 135                 140


Ser Glu Phe Lys His Cys Trp Asp Thr Phe Val Asp His Gln Gly Cys
145                 150                 155                 160


Pro Phe Gln Pro Trp Asp Gly Leu Asp Glu His Ser Gln Asp Leu Ser
                165                 170                 175
```

```
Gly Arg Leu Arg Ala Ile Leu Gln Ser Gly Ser Glu Thr Pro Gly Thr
            180                 185                 190

Ser Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu
        195                 200                 205

Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr
    210                 215                 220

Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His
225                 230                 235                 240

Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu
                245                 250                 255

Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr
            260                 265                 270

Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu
        275                 280                 285

Met Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe
    290                 295                 300

Leu Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn
305                 310                 315                 320

Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His
                325                 330                 335

Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu
            340                 345                 350

Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu
        355                 360                 365

Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe
    370                 375                 380
```

```
Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile
385                 390                 395                 400

Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser
                405                 410                 415

Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys
            420                 425                 430

Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr
        435                 440                 445

Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln
    450                 455                 460

Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln
465                 470                 475                 480

Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser
                485                 490                 495

Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr
            500                 505                 510

Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His
        515                 520                 525

Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu
    530                 535                 540

Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly
545                 550                 555                 560

Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys
                565                 570                 575

Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu
            580                 585                 590
```

```
Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser
        595                 600                 605

Ile Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg
    610                 615                 620

Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu
625                 630                 635                 640

Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg
                645                 650                 655

Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile
            660                 665                 670

Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln
        675                 680                 685

Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu
    690                 695                 700

Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr
705                 710                 715                 720

Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro
                725                 730                 735

Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe
            740                 745                 750

Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe
        755                 760                 765

Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp
    770                 775                 780

Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile
785                 790                 795                 800
```

```
Lys Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu
                805                 810                 815

Asp Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu
            820                 825                 830

Glu Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys
        835                 840                 845

Gln Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys
    850                 855                 860

Leu Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp
865                 870                 875                 880

Phe Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile
                885                 890                 895

His Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val
            900                 905                 910

Ser Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly
        915                 920                 925

Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp
    930                 935                 940

Glu Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile
945                 950                 955                 960

Glu Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser
                965                 970                 975

Arg Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser
            980                 985                 990

Gln Ile Leu Lys Glu His Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu
        995                 1000                1005
```

```
Lys Leu  Tyr Leu Tyr Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val
    1010                1015                1020

Asp Gln  Glu Leu Asp Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp
    1025                1030                1035

His Ile  Val Pro Gln Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn
    1040                1045                1050

Lys Val  Leu Thr Arg Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn
    1055                1060                1065

Val Pro  Ser Glu Glu Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg
    1070                1075                1080

Gln Leu  Leu Asn Ala Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn
    1085                1090                1095

Leu Thr  Lys Ala Glu Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala
    1100                1105                1110

Gly Phe  Ile Lys Arg Gln Leu  Val Glu Thr Arg Gln  Ile Thr Lys
    1115                1120                1125

His Val  Ala Gln Ile Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp
    1130                1135                1140

Glu Asn  Asp Lys Leu Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys
    1145                1150                1155

Ser Lys  Leu Val Ser Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys
    1160                1165                1170

Val Arg  Glu Ile Asn Asn Tyr  His His Ala His Asp  Ala Tyr Leu
    1175                1180                1185

Asn Ala  Val Val Gly Thr Ala  Leu Ile Lys Lys Tyr  Pro Lys Leu
    1190                1195                1200
```

```
Glu Ser  Glu Phe Val Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg
    1205                 1210                 1215

Lys Met  Ile Ala Lys Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala
    1220                 1225                 1230

Lys Tyr  Phe Phe Tyr Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu
    1235                 1240                 1245

Ile Thr  Leu Ala Asn Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu
    1250                 1255                 1260

Thr Asn  Gly Glu Thr Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp
    1265                 1270                 1275

Phe Ala  Thr Val Arg Lys Val  Leu Ser Met Pro Gln  Val Asn Ile
    1280                 1285                 1290

Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1295                 1300                 1305

Ile Leu  Pro Lys Arg Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys
    1310                 1315                 1320

Asp Trp  Asp Pro Lys Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val
    1325                 1330                 1335

Ala Tyr  Ser Val Leu Val Val  Ala Lys Val Glu Lys  Gly Lys Ser
    1340                 1345                 1350

Lys Lys  Leu Lys Ser Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met
    1355                 1360                 1365

Glu Arg  Ser Ser Phe Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala
    1370                 1375                 1380

Lys Gly  Tyr Lys Glu Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro
    1385                 1390                 1395
```

```
Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu
    1400                1405                1410

Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro
    1415                1420                1425

Ser Lys  Tyr Val Asn Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys
    1430                1435                1440

Leu Lys  Gly Ser Pro Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val
    1445                1450                1455

Glu Gln  His Lys His Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser
    1460                1465                1470

Glu Phe  Ser Lys Arg Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys
    1475                1480                1485

Val Leu  Ser Ala Tyr Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu
    1490                1495                1500

Gln Ala  Glu Asn Ile Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly
    1505                1510                1515

Ala Pro  Ala Ala Phe Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys
    1520                1525                1530

Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asp Ala Thr  Leu Ile His
    1535                1540                1545

Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln
    1550                1555                1560

Leu Gly  Gly Asp Ser Gly Gly  Ser Thr Asn Leu Ser  Asp Ile Ile
    1565                1570                1575

Glu Lys  Glu Thr Gly Lys Gln  Leu Val Ile Gln Glu  Ser Ile Leu
    1580                1585                1590
```

```
Met Leu  Pro Glu Glu Val Glu  Glu Val Ile Gly Asn  Lys Pro Glu
    1595                 1600                 1605


Ser Asp  Ile Leu Val His Thr  Ala Tyr Asp Glu Ser  Thr Asp Glu
    1610                 1615                 1620


Asn Val  Met Leu Leu Thr Ser  Asp Ala Pro Glu Tyr  Lys Pro Trp
    1625                 1630                 1635


Ala Leu  Val Ile Gln Asp Ser  Asn Gly Glu Asn Lys  Ile Lys Met
    1640                 1645                 1650


Leu Ser  Gly Gly Ser Pro Lys  Lys Lys Arg Lys Val
    1655                 1660                 1665
```

<210> 312
<211> 1665
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 312

```
Met Asp Pro Pro Thr Phe Thr Phe Asn Phe Asn Asn Glu Pro Trp Val
1               5                   10                  15


Arg Gly Arg His Glu Thr Tyr Leu Cys Tyr Glu Val Glu Arg Met His
            20                  25                  30


Asn Asp Thr Trp Val Leu Leu Asn Gln Arg Arg Gly Phe Leu Cys Asn
        35                  40                  45


Gln Ala Pro His Lys His Gly Phe Leu Glu Gly Arg His Ala Glu Leu
    50                  55                  60


Cys Phe Leu Asp Val Ile Pro Phe Trp Lys Leu Asp Leu Asp Gln Asp
65                  70                  75                  80
```

```
Tyr Arg Val Thr Cys Phe Thr Ser Trp Ser Pro Cys Phe Ser Cys Ala
                85                  90                  95

Gln Glu Met Ala Lys Phe Ile Ser Lys Asn Lys His Val Ser Leu Cys
            100                 105                 110

Ile Phe Thr Ala Arg Ile Tyr Arg Arg Gln Gly Arg Cys Gln Glu Gly
        115                 120                 125

Leu Arg Thr Leu Ala Glu Ala Gly Ala Lys Ile Ser Ile Met Thr Tyr
    130                 135                 140

Ser Glu Phe Lys His Cys Trp Asp Thr Phe Val Asp His Gln Gly Cys
145                 150                 155                 160

Pro Phe Gln Pro Trp Asp Gly Leu Asp Glu His Ser Gln Asp Leu Ser
                165                 170                 175

Gly Arg Leu Arg Ala Ile Leu Gln Ser Gly Ser Glu Thr Pro Gly Thr
            180                 185                 190

Ser Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu
        195                 200                 205

Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr
    210                 215                 220

Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His
225                 230                 235                 240

Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu
                245                 250                 255

Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr
            260                 265                 270

Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu
        275                 280                 285
```

```
Met Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe
    290                 295                 300

Leu Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn
305                 310                 315                 320

Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His
                325                 330                 335

Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu
            340                 345                 350

Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu
        355                 360                 365

Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe
    370                 375                 380

Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile
385                 390                 395                 400

Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser
                405                 410                 415

Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys
            420                 425                 430

Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr
        435                 440                 445

Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln
    450                 455                 460

Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln
465                 470                 475                 480

Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser
                485                 490                 495
```

```
Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr
            500                 505                 510

Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His
        515                 520                 525

Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu
    530                 535                 540

Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly
545                 550                 555                 560

Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys
                565                 570                 575

Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu
            580                 585                 590

Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser
        595                 600                 605

Ile Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg
    610                 615                 620

Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu
625                 630                 635                 640

Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg
                645                 650                 655

Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile
            660                 665                 670

Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln
        675                 680                 685

Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu
    690                 695                 700
```

```
Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr
705                 710                 715                 720


Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro
                725                 730                 735


Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe
            740                 745                 750


Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe
        755                 760                 765


Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp
    770                 775                 780


Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile
785                 790                 795                 800


Lys Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu
                805                 810                 815


Asp Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu
            820                 825                 830


Glu Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys
        835                 840                 845


Gln Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys
    850                 855                 860


Leu Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp
865                 870                 875                 880


Phe Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile
                885                 890                 895


His Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val
            900                 905                 910
```

```
Ser Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly
        915                 920                 925


Ser Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp
    930                 935                 940


Glu Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile
945                 950                 955                 960


Glu Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser
                965                 970                 975


Arg Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser
            980                 985                 990


Gln Ile Leu Lys Glu His Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu
        995                 1000                1005


Lys Leu  Tyr Leu Tyr Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val
    1010                1015                1020


Asp Gln  Glu Leu Asp Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp
    1025                1030                1035


His Ile  Val Pro Gln Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn
    1040                1045                1050


Lys Val  Leu Thr Arg Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn
    1055                1060                1065


Val Pro  Ser Glu Glu Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg
    1070                1075                1080


Gln Leu  Leu Asn Ala Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn
    1085                1090                1095


Leu Thr  Lys Ala Glu Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala
    1100                1105                1110
```

```
Gly Phe  Ile Lys Arg Gln Leu  Val Glu Thr Arg Gln  Ile Thr Lys
    1115                1120                1125


His Val  Ala Gln Ile Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp
    1130                1135                1140


Glu Asn  Asp Lys Leu Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys
    1145                1150                1155


Ser Lys  Leu Val Ser Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys
    1160                1165                1170


Val Arg  Glu Ile Asn Asn Tyr  His His Ala His Asp  Ala Tyr Leu
    1175                1180                1185


Asn Ala  Val Val Gly Thr Ala  Leu Ile Lys Lys Tyr  Pro Lys Leu
    1190                1195                1200


Glu Ser  Glu Phe Val Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg
    1205                1210                1215


Lys Met  Ile Ala Lys Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala
    1220                1225                1230


Lys Tyr  Phe Phe Tyr Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu
    1235                1240                1245


Ile Thr  Leu Ala Asn Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu
    1250                1255                1260


Thr Asn  Gly Glu Thr Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp
    1265                1270                1275


Phe Ala  Thr Val Arg Lys Val  Leu Ser Met Pro Gln  Val Asn Ile
    1280                1285                1290


Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1295                1300                1305
```

```
Ile Leu  Pro Lys Arg Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys
    1310                1315                1320

Asp Trp  Asp Pro Lys Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val
    1325                1330                1335

Ala Tyr  Ser Val Leu Val Val  Ala Lys Val Glu Lys  Gly Lys Ser
    1340                1345                1350

Lys Lys  Leu Lys Ser Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met
    1355                1360                1365

Glu Arg  Ser Ser Phe Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala
    1370                1375                1380

Lys Gly  Tyr Lys Glu Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro
    1385                1390                1395

Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu
    1400                1405                1410

Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro
    1415                1420                1425

Ser Lys  Tyr Val Asn Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys
    1430                1435                1440

Leu Lys  Gly Ser Pro Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val
    1445                1450                1455

Glu Gln  His Lys His Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser
    1460                1465                1470

Glu Phe  Ser Lys Arg Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys
    1475                1480                1485

Val Leu  Ser Ala Tyr Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu
    1490                1495                1500
```

```
Gln Ala  Glu Asn Ile Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly
    1505                1510                1515


Ala Pro  Ala Ala Phe Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys
    1520                1525                1530


Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asp Ala Thr  Leu Ile His
    1535                1540                1545


Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln
    1550                1555                1560


Leu Gly  Gly Asp Ser Gly Gly  Ser Thr Asn Leu Ser  Asp Ile Ile
    1565                1570                1575


Glu Lys  Glu Thr Gly Lys Gln  Leu Val Ile Gln Glu  Ser Ile Leu
    1580                1585                1590


Met Leu  Pro Glu Glu Val Glu  Glu Val Ile Gly Asn  Lys Pro Glu
    1595                1600                1605


Ser Asp  Ile Leu Val His Thr  Ala Tyr Asp Glu Ser  Thr Asp Glu
    1610                1615                1620


Asn Val  Met Leu Leu Thr Ser  Asp Ala Pro Glu Tyr  Lys Pro Trp
    1625                1630                1635


Ala Leu  Val Ile Gln Asp Ser  Asn Gly Glu Asn Lys  Ile Lys Met
    1640                1645                1650


Leu Ser  Gly Gly Ser Pro Lys  Lys Lys Arg Lys Val
    1655                1660                1665


<210>  313
<211>  1612
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide
```

<400> 313

```
Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1               5                  10                  15

Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
            20                  25                  30

Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
        35                  40                  45

Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
    50                  55                  60

Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65                  70                  75                  80

Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
                85                  90                  95

Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
            100                 105                 110

Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
        115                 120                 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
    130                 135                 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145                 150                 155                 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
                165                 170                 175

Leu Tyr Val Leu Glu Leu Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys
            180                 185                 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
        195                 200                 205
```

```
Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
    210                 215                 220

Ala Thr Gly Leu Lys Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
225                 230                 235                 240

Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
                245                 250                 255

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
            260                 265                 270

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
        275                 280                 285

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
    290                 295                 300

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
305                 310                 315                 320

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
                325                 330                 335

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
            340                 345                 350

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
        355                 360                 365

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
    370                 375                 380

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
385                 390                 395                 400

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
                405                 410                 415
```

```
Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
            420                 425                 430

Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
        435                 440                 445

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
    450                 455                 460

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
465                 470                 475                 480

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
                485                 490                 495

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
            500                 505                 510

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
        515                 520                 525

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
    530                 535                 540

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
545                 550                 555                 560

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
                565                 570                 575

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
            580                 585                 590

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
        595                 600                 605

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
    610                 615                 620
```

```
Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
625                 630                 635                 640

Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
                645                 650                 655

Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
            660                 665                 670

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
        675                 680                 685

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
    690                 695                 700

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
705                 710                 715                 720

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
                725                 730                 735

Glu Arg Met Thr Ala Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
            740                 745                 750

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
        755                 760                 765

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
    770                 775                 780

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
785                 790                 795                 800

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
                805                 810                 815

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
            820                 825                 830
```

```
Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
        835                 840                 845

Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
    850                 855                 860

Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
865                 870                 875                 880

Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
                885                 890                 895

Arg Arg Arg Tyr Thr Gly Trp Gly Ala Leu Ser Arg Lys Leu Ile Asn
            900                 905                 910

Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
        915                 920                 925

Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Ala Leu Ile His Asp Asp
    930                 935                 940

Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln
945                 950                 955                 960

Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala
                965                 970                 975

Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val
            980                 985                 990

Lys Val Met Gly Arg His Lys Pro  Glu Asn Ile Val Ile  Glu Met Ala
        995                 1000                1005

Arg Glu  Asn Gln Thr Thr Gln  Lys Gly Gln Lys Asn  Ser Arg Glu
    1010                1015                1020

Arg Met  Lys Arg Ile Glu Glu  Gly Ile Lys Glu Leu  Gly Ser Gln
    1025                1030                1035
```

```
Ile Leu  Lys Glu His Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu
    1040                1045                1050

Lys Leu  Tyr Leu Tyr Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val
    1055                1060                1065

Asp Gln  Glu Leu Asp Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp
    1070                1075                1080

His Ile  Val Pro Gln Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn
    1085                1090                1095

Lys Val  Leu Thr Arg Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn
    1100                1105                1110

Val Pro  Ser Glu Glu Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg
    1115                1120                1125

Gln Leu  Leu Asn Ala Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn
    1130                1135                1140

Leu Thr  Lys Ala Glu Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala
    1145                1150                1155

Gly Phe  Ile Lys Arg Gln Leu  Val Glu Thr Arg Ala  Ile Thr Lys
    1160                1165                1170

His Val  Ala Gln Ile Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp
    1175                1180                1185

Glu Asn  Asp Lys Leu Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys
    1190                1195                1200

Ser Lys  Leu Val Ser Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys
    1205                1210                1215

Val Arg  Glu Ile Asn Asn Tyr  His His Ala His Asp  Ala Tyr Leu
    1220                1225                1230
```

```
Asn Ala  Val Val Gly Thr Ala  Leu Ile Lys Lys Tyr  Pro Lys Leu
    1235                 1240                 1245

Glu Ser  Glu Phe Val Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg
    1250                 1255                 1260

Lys Met  Ile Ala Lys Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala
    1265                 1270                 1275

Lys Tyr  Phe Phe Tyr Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu
    1280                 1285                 1290

Ile Thr  Leu Ala Asn Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu
    1295                 1300                 1305

Thr Asn  Gly Glu Thr Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp
    1310                 1315                 1320

Phe Ala  Thr Val Arg Lys Val  Leu Ser Met Pro Gln  Val Asn Ile
    1325                 1330                 1335

Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1340                 1345                 1350

Ile Leu  Pro Lys Arg Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys
    1355                 1360                 1365

Asp Trp  Asp Pro Lys Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val
    1370                 1375                 1380

Ala Tyr  Ser Val Leu Val Val  Ala Lys Val Glu Lys  Gly Lys Ser
    1385                 1390                 1395

Lys Lys  Leu Lys Ser Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met
    1400                 1405                 1410

Glu Arg  Ser Ser Phe Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala
    1415                 1420                 1425
```

```
Lys Gly  Tyr Lys Glu Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro
    1430                1435                1440

Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu
    1445                1450                1455

Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro
    1460                1465                1470

Ser Lys  Tyr Val Asn Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys
    1475                1480                1485

Leu Lys  Gly Ser Pro Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val
    1490                1495                1500

Glu Gln  His Lys His Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser
    1505                1510                1515

Glu Phe  Ser Lys Arg Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys
    1520                1525                1530

Val Leu  Ser Ala Tyr Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu
    1535                1540                1545

Gln Ala  Glu Asn Ile Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly
    1550                1555                1560

Ala Pro  Ala Ala Phe Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys
    1565                1570                1575

Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asp Ala Thr  Leu Ile His
    1580                1585                1590

Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln
    1595                1600                1605

Leu Gly  Gly Asp
    1610
```

<210> 314
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 314

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 315
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 315

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 316
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 316

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Ala Arg Gly Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 317
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 317

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Ala Arg Val Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

```
Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165


<210>  318
<211>  166
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  318

Ser Glu Val Glu Phe Ser Tyr Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60


Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Ser His Arg
        115                 120                 125
```

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 319
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 319

Ser Glu Val Glu Phe Ser Tyr Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Ser His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Asp Phe Phe Arg Met Arg Arg Gln Asp Ile Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 320
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 320

Ser Glu Val Glu Phe Ser Tyr Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Ser His Arg
        115   120   125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130   135   140

Ser Asp Phe Phe Arg Met Arg Arg Gln Gly Ile Lys Ala Gln Lys Lys
145   150   155   160

Ala Gln Ser Ser Thr Asp
                165

<210> 321
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 321

Ser Glu Val Glu Phe Ser Tyr Glu Tyr Trp Met Arg His Ala Leu Thr
1   5   10   15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20   25   30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35   40   45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50   55   60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65   70   75   80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85   90   95

Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly Ala
            100   105   110

```
Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Ser His Arg
        115                 120                 125


Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140


Ser Asp Phe Phe Arg Met Arg Arg Gln Val Ile Lys Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165


<210>  322
<211>  166
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  322

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60


Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95
```

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Ile Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 323
<211> 1561
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 323

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1 5 10 15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
20 25 30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
35 40 45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
50 55 60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65 70 75 80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
85 90 95

```
Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300
```

```
Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510
```

```
Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720
```

```
Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925
```

```
Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975

Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990

Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005

Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020

Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035

Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050

Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065

Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080

Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095

Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110

Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125
```

```
Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140

Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320
```

```
Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335

Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515
```

```
Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545


Gly Asp  Ser Gly Gly Ser Pro  Lys Lys Lys Arg Lys  Val
    1550                1555                1560


<210>  324
<211>  1561
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  324

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                   10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly
            100                 105                 110
```

```
Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320
```

```
Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525
```

```
Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735
```

```
Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940
```

```
Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960


Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975


Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990


Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005


Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020


Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035


Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050


Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065


Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080


Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095


Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110


Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125


Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140
```

```
Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155


Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170


Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185


Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200


Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215


Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230


Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245


Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260


Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275


Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290


Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305


Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320


Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335
```

```
Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530
```

Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ser Gln Leu Gly
1535 1540 1545

Gly Asp Ser Gly Gly Ser Pro Lys Lys Lys Arg Lys Val
1550 1555 1560

<210> 325
<211> 1561
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 325

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1 5 10 15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
20 25 30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
35 40 45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
50 55 60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65 70 75 80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
85 90 95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Gly Ala Lys Thr Gly
100 105 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
115 120 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
130 135 140

```
Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350
```

```
Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560
```

```
Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765
```

```
Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975
```

```
Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990

Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005

Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020

Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035

Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050

Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065

Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080

Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095

Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110

Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125

Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140

Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170
```

```
Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335

Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365
```

```
Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545

Gly Asp  Ser Gly Gly Ser Pro  Lys Lys Lys Arg Lys  Val
    1550                1555                1560
```

<210> 326
<211> 1561
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 326

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Val Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160
```

```
Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365
```

```
Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575
```

```
Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780
```

```
Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800


Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815


Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830


Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845


Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860


Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880


Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895


Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910


Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925


Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940


Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960


Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975


Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990
```

```
Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005


Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020


Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035


Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050


Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065


Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080


Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095


Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110


Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125


Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140


Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155


Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170


Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185
```

```
Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335

Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380
```

```
Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395


Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410


Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425


Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440


His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455


Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470


Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485


Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500


Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515


Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545


Gly Asp  Ser Gly Gly Ser Pro  Lys Lys Lys Arg Lys  Val
    1550                1555                1560
```

<210> 327
<211> 1648
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 327

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                   10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175


Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190
```

```
Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400
```

```
Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605
```

```
Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815
```

```
Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975

Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990

Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005

Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020
```

```
Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035

Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050

Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065

Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080

Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095

Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110

Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125

Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140

Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215
```

```
Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335

Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410
```

```
Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545

Gly Asp  Ser Gly Gly Ser Thr  Asn Leu Ser Asp Ile  Ile Glu Lys
    1550                1555                1560

Glu Thr  Gly Lys Gln Leu Val  Ile Gln Glu Ser Ile  Leu Met Leu
    1565                1570                1575

Pro Glu  Glu Val Glu Glu Val  Ile Gly Asn Lys Pro  Glu Ser Asp
    1580                1585                1590

Ile Leu  Val His Thr Ala Tyr  Asp Glu Ser Thr Asp  Glu Asn Val
    1595                1600                1605
```

```
Met Leu  Leu Thr Ser Asp Ala  Pro Glu Tyr Lys Pro  Trp Ala Leu
    1610                 1615                 1620


Val Ile  Gln Asp Ser Asn Gly  Glu Asn Lys Ile Lys  Met Leu Ser
    1625                 1630                 1635


Gly Gly  Ser Pro Lys Lys Lys  Arg Lys Val
    1640                 1645


<210>  328
<211>  1648
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  328

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                   10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Gly Ala Lys Thr Gly
            100                 105                 110
```

```
Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320
```

```
Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525
```

```
Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735
```

```
Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940
```

```
Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960


Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975


Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990


Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005


Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020


Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035


Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050


Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065


Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080


Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095


Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110


Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125


Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140
```

```
Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155


Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170


Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185


Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200


Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215


Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230


Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245


Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260


Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275


Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290


Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305


Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320


Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335
```

```
Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530
```

```
Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545


Gly Asp  Ser Gly Gly Ser Thr  Asn Leu Ser Asp Ile  Ile Glu Lys
    1550                1555                1560


Glu Thr  Gly Lys Gln Leu Val  Ile Gln Glu Ser Ile  Leu Met Leu
    1565                1570                1575


Pro Glu  Glu Val Glu Glu Val  Ile Gly Asn Lys Pro  Glu Ser Asp
    1580                1585                1590


Ile Leu  Val His Thr Ala Tyr  Asp Glu Ser Thr Asp  Glu Asn Val
    1595                1600                1605


Met Leu  Leu Thr Ser Asp Ala  Pro Glu Tyr Lys Pro  Trp Ala Leu
    1610                1615                1620


Val Ile  Gln Asp Ser Asn Gly  Glu Asn Lys Ile Lys  Met Leu Ser
    1625                1630                1635


Gly Gly  Ser Pro Lys Lys Lys  Arg Lys Val
    1640                1645


<210>  329
<211>  1648
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  329

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                   10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45
```

```
Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Val Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255
```

```
Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460
```

```
Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670
```

```
Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880
```

```
Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975

Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990

Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005

Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020

Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035

Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050

Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065

Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080
```

```
Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095

Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110

Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125

Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140

Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275
```

```
Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335

Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470
```

```
Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545

Gly Asp  Ser Gly Gly Ser Thr  Asn Leu Ser Asp Ile  Ile Glu Lys
    1550                1555                1560

Glu Thr  Gly Lys Gln Leu Val  Ile Gln Glu Ser Ile  Leu Met Leu
    1565                1570                1575

Pro Glu  Glu Val Glu Glu Val  Ile Gly Asn Lys Pro  Glu Ser Asp
    1580                1585                1590

Ile Leu  Val His Thr Ala Tyr  Asp Glu Ser Thr Asp  Glu Asn Val
    1595                1600                1605

Met Leu  Leu Thr Ser Asp Ala  Pro Glu Tyr Lys Pro  Trp Ala Leu
    1610                1615                1620

Val Ile  Gln Asp Ser Asn Gly  Glu Asn Lys Ile Lys  Met Leu Ser
    1625                1630                1635

Gly Gly  Ser Pro Lys Lys Lys  Arg Lys Val
    1640                1645
```

<210> 330
<211> 1648

<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 330

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175
```

```
Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380
```

```
Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400


Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415


Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430


Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445


Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460


Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480


Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495


Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510


Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525


Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540


Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560


Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575


Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590
```

```
Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605


Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620


Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640


Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655


Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670


Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685


Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700


Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720


Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735


Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750


Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765


Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780


Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800
```

```
Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975

Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990

Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005
```

```
Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp Ala Ile
    1010                1015                1020

Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035

Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050

Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065

Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080

Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095

Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110

Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125

Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140

Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200
```

```
Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215


Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230


Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245


Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260


Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275


Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290


Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305


Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320


Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335


Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350


Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365


Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380


Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395
```

```
Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410


Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425


Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440


His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455


Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470


Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485


Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500


Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515


Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545


Gly Asp  Ser Gly Gly Ser Thr  Asn Leu Ser Asp Ile  Ile Glu Lys
    1550                1555                1560


Glu Thr  Gly Lys Gln Leu Val  Ile Gln Glu Ser Ile  Leu Met Leu
    1565                1570                1575


Pro Glu  Glu Val Glu Glu Val  Ile Gly Asn Lys Pro  Glu Ser Asp
    1580                1585                1590
```

Ile Leu Val His Thr Ala Tyr Asp Glu Ser Thr Asp Glu Asn Val
1595 1600 1605

Met Leu Leu Thr Ser Asp Ala Pro Glu Tyr Lys Pro Trp Ala Leu
1610 1615 1620

Val Ile Gln Asp Ser Asn Gly Glu Asn Lys Ile Lys Met Leu Ser
1625 1630 1635

Gly Gly Ser Pro Lys Lys Lys Arg Lys Val
1640 1645

<210> 331
<211> 1648
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 331

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1 5 10 15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
20 25 30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
35 40 45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
50 55 60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65 70 75 80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
85 90 95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Gly Ala Lys Thr Gly
100 105 110

```
Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320
```

```
Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525
```

```
Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735
```

```
Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940
```

```
Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960


Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975


Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990


Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005


Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp Ala Ile
    1010                1015                1020


Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035


Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050


Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065


Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080


Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095


Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110


Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125


Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140
```

```
Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335
```

```
Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530
```

```
Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545


Gly Asp  Ser Gly Gly Ser Thr  Asn Leu Ser Asp Ile  Ile Glu Lys
    1550                1555                1560


Glu Thr  Gly Lys Gln Leu Val  Ile Gln Glu Ser Ile  Leu Met Leu
    1565                1570                1575


Pro Glu  Glu Val Glu Glu Val  Ile Gly Asn Lys Pro  Glu Ser Asp
    1580                1585                1590


Ile Leu  Val His Thr Ala Tyr  Asp Glu Ser Thr Asp  Glu Asn Val
    1595                1600                1605


Met Leu  Leu Thr Ser Asp Ala  Pro Glu Tyr Lys Pro  Trp Ala Leu
    1610                1615                1620


Val Ile  Gln Asp Ser Asn Gly  Glu Asn Lys Ile Lys  Met Leu Ser
    1625                1630                1635


Gly Gly  Ser Pro Lys Lys Lys  Arg Lys Val
    1640                1645


<210>  332
<211>  1648
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  332

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                   10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30
```

```
Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Val Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240
```

```
Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445
```

```
Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655
```

```
Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860
```

```
Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880


Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895


Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910


Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925


Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940


Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960


Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975


Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990


Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005


Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp Ala Ile
    1010                1015                1020


Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035


Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050


Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065
```

```
Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080

Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095

Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110

Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125

Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140

Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260
```

```
Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275


Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290


Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305


Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320


Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335


Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350


Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365


Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380


Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395


Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410


Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425


Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440


His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455
```

```
Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470


Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485


Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500


Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515


Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545


Gly Asp  Ser Gly Gly Ser Thr  Asn Leu Ser Asp Ile  Ile Glu Lys
    1550                1555                1560


Glu Thr  Gly Lys Gln Leu Val  Ile Gln Glu Ser Ile  Leu Met Leu
    1565                1570                1575


Pro Glu  Glu Val Glu Glu Val  Ile Gly Asn Lys Pro  Glu Ser Asp
    1580                1585                1590


Ile Leu  Val His Thr Ala Tyr  Asp Glu Ser Thr Asp  Glu Asn Val
    1595                1600                1605


Met Leu  Leu Thr Ser Asp Ala  Pro Glu Tyr Lys Pro  Trp Ala Leu
    1610                1615                1620


Val Ile  Gln Asp Ser Asn Gly  Glu Asn Lys Ile Lys  Met Leu Ser
    1625                1630                1635


Gly Gly  Ser Pro Lys Lys Lys  Arg Lys Val
    1640                1645
```

<210> 333
<211> 1784
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 333

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175
```

```
Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380
```

```
Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590
```

```
Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800
```

```
Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975

Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990

Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005
```

```
Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020

Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035

Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050

Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065

Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080

Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095

Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110

Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125

Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140

Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200
```

```
Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335

Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395
```

```
Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                 1405                 1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                 1420                 1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                 1435                 1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                 1450                 1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                 1465                 1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                 1480                 1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                 1495                 1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                 1510                 1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                 1525                 1530

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                 1540                 1545

Gly Asp  Ser Gly Gly Ser Lys  Gly His Leu Thr Arg  Leu Gly Leu
    1550                 1555                 1560

Glu Phe  Phe Asp Gln Pro Ala  Val Pro Leu Ala Arg  Ala Phe Leu
    1565                 1570                 1575

Gly Gln  Val Leu Val Arg Arg  Leu Pro Asn Gly Thr  Glu Leu Arg
    1580                 1585                 1590
```

```
Gly Arg  Ile Val Glu Thr Gln  Ala Tyr Leu Gly Pro  Glu Asp Glu
    1595                 1600                 1605

Ala Ala  His Ser Arg Gly Gly  Arg Gln Thr Pro Arg  Asn Arg Gly
    1610                 1615                 1620

Met Phe  Met Lys Pro Gly Thr  Leu Tyr Val Tyr Ile  Ile Tyr Gly
    1625                 1630                 1635

Met Tyr  Phe Cys Met Asn Ile  Ser Ser Gln Gly Asp  Gly Ala Cys
    1640                 1645                 1650

Val Leu  Leu Arg Ala Leu Glu  Pro Leu Glu Gly Leu  Glu Thr Met
    1655                 1660                 1665

Arg Gln  Leu Arg Ser Thr Leu  Arg Lys Gly Thr Ala  Ser Arg Val
    1670                 1675                 1680

Leu Lys  Asp Arg Glu Leu Cys  Ser Gly Pro Ser Lys  Leu Cys Gln
    1685                 1690                 1695

Ala Leu  Ala Ile Asn Lys Ser  Phe Asp Gln Arg Asp  Leu Ala Gln
    1700                 1705                 1710

Asp Glu  Ala Val Trp Leu Glu  Arg Gly Pro Leu Glu  Pro Ser Glu
    1715                 1720                 1725

Pro Ala  Val Val Ala Ala Ala  Arg Val Gly Val Gly  His Ala Gly
    1730                 1735                 1740

Glu Trp  Ala Arg Lys Pro Leu  Arg Phe Tyr Val Arg  Gly Ser Pro
    1745                 1750                 1755

Trp Val  Ser Val Val Asp Arg  Val Ala Glu Gln Asp  Thr Gln Ala
    1760                 1765                 1770

Ser Gly  Gly Ser Pro Lys Lys  Lys Arg Lys Val
    1775                 1780
```

<210> 334
<211> 1784
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 334

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Gly Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160
```

```
Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365
```

```
Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575
```

```
Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780
```

```
Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800


Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815


Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830


Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845


Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860


Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880


Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895


Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910


Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925


Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940


Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960


Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975


Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990
```

```
Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005


Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020


Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035


Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050


Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065


Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080


Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095


Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110


Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125


Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140


Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155


Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170


Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185
```

```
Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200


Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215


Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230


Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245


Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260


Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275


Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290


Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305


Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320


Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335


Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350


Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365


Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380
```

```
Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395


Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410


Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425


Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440


His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455


Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470


Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485


Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500


Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515


Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545


Gly Asp  Ser Gly Gly Ser Lys  Gly His Leu Thr Arg  Leu Gly Leu
    1550                1555                1560


Glu Phe  Phe Asp Gln Pro Ala  Val Pro Leu Ala Arg  Ala Phe Leu
    1565                1570                1575
```

```
Gly Gln  Val Leu Val Arg Arg  Leu Pro Asn Gly Thr  Glu Leu Arg
    1580                1585                1590

Gly Arg  Ile Val Glu Thr Gln  Ala Tyr Leu Gly Pro  Glu Asp Glu
    1595                1600                1605

Ala Ala  His Ser Arg Gly Gly  Arg Gln Thr Pro Arg  Asn Arg Gly
    1610                1615                1620

Met Phe  Met Lys Pro Gly Thr  Leu Tyr Val Tyr Ile  Ile Tyr Gly
    1625                1630                1635

Met Tyr  Phe Cys Met Asn Ile  Ser Ser Gln Gly Asp  Gly Ala Cys
    1640                1645                1650

Val Leu  Leu Arg Ala Leu Glu  Pro Leu Glu Gly Leu  Glu Thr Met
    1655                1660                1665

Arg Gln  Leu Arg Ser Thr Leu  Arg Lys Gly Thr Ala  Ser Arg Val
    1670                1675                1680

Leu Lys  Asp Arg Glu Leu Cys  Ser Gly Pro Ser Lys  Leu Cys Gln
    1685                1690                1695

Ala Leu  Ala Ile Asn Lys Ser  Phe Asp Gln Arg Asp  Leu Ala Gln
    1700                1705                1710

Asp Glu  Ala Val Trp Leu Glu  Arg Gly Pro Leu Glu  Pro Ser Glu
    1715                1720                1725

Pro Ala  Val Val Ala Ala Ala  Arg Val Gly Val Gly  His Ala Gly
    1730                1735                1740

Glu Trp  Ala Arg Lys Pro Leu  Arg Phe Tyr Val Arg  Gly Ser Pro
    1745                1750                1755

Trp Val  Ser Val Val Asp Arg  Val Ala Glu Gln Asp  Thr Gln Ala
    1760                1765                1770
```

Ser Gly Gly Ser Pro Lys Lys Lys Arg Lys Val
1775 1780

<210> 335
<211> 1784
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 335

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1 5 10 15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
20 25 30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
35 40 45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
50 55 60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65 70 75 80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
85 90 95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Val Ala Lys Thr Gly
100 105 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
115 120 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
130 135 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145 150 155 160

```
Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365
```

```
Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575
```

```
Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780
```

```
Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975

Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990
```

```
Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005


Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020


Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035


Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050


Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065


Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080


Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095


Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110


Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125


Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140


Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155


Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170


Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185
```

```
Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335

Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380
```

```
Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545

Gly Asp  Ser Gly Gly Ser Lys  Gly His Leu Thr Arg  Leu Gly Leu
    1550                1555                1560

Glu Phe  Phe Asp Gln Pro Ala  Val Pro Leu Ala Arg  Ala Phe Leu
    1565                1570                1575
```

```
Gly Gln  Val Leu Val Arg Arg  Leu Pro Asn Gly Thr  Glu Leu Arg
    1580                1585                1590

Gly Arg  Ile Val Glu Thr Gln  Ala Tyr Leu Gly Pro  Glu Asp Glu
    1595                1600                1605

Ala Ala  His Ser Arg Gly Gly  Arg Gln Thr Pro Arg  Asn Arg Gly
    1610                1615                1620

Met Phe  Met Lys Pro Gly Thr  Leu Tyr Val Tyr Ile  Ile Tyr Gly
    1625                1630                1635

Met Tyr  Phe Cys Met Asn Ile  Ser Ser Gln Gly Asp  Gly Ala Cys
    1640                1645                1650

Val Leu  Leu Arg Ala Leu Glu  Pro Leu Glu Gly Leu  Glu Thr Met
    1655                1660                1665

Arg Gln  Leu Arg Ser Thr Leu  Arg Lys Gly Thr Ala  Ser Arg Val
    1670                1675                1680

Leu Lys  Asp Arg Glu Leu Cys  Ser Gly Pro Ser Lys  Leu Cys Gln
    1685                1690                1695

Ala Leu  Ala Ile Asn Lys Ser  Phe Asp Gln Arg Asp  Leu Ala Gln
    1700                1705                1710

Asp Glu  Ala Val Trp Leu Glu  Arg Gly Pro Leu Glu  Pro Ser Glu
    1715                1720                1725

Pro Ala  Val Val Ala Ala Ala  Arg Val Gly Val Gly  His Ala Gly
    1730                1735                1740

Glu Trp  Ala Arg Lys Pro Leu  Arg Phe Tyr Val Arg  Gly Ser Pro
    1745                1750                1755

Trp Val  Ser Val Val Asp Arg  Val Ala Glu Gln Asp  Thr Gln Ala
    1760                1765                1770
```

Ser Gly Gly Ser Pro Lys Lys Lys Arg Lys Val
    1775   1780

<210> 336
<211> 1787
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 336

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1   5   10   15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20   25   30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35   40   45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50   55   60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65   70   75   80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85   90   95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly
            100   105   110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115   120   125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130   135   140

```
Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175


Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190


Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205


Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220


Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240


Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255


Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270


Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285


Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300


Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320


Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335


Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350
```

```
Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560
```

```
Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765
```

```
Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975
```

```
Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990


Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005


Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020


Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035


Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050


Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065


Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080


Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095


Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110


Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125


Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140


Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155


Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170
```

```
Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185


Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200


Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215


Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230


Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245


Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260


Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275


Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290


Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305


Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320


Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335


Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350


Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365
```

```
Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545

Gly Asp  Ser Gly Gly Ser Asp  Leu Ala Ser Leu Arg  Ala Gln Gln
    1550                1555                1560
```

```
Ile Glu  Leu Ala Ser Ser Val  Ile Arg Glu Asp Arg  Leu Asp Lys
    1565                1570                1575

Asp Pro  Pro Asp Leu Ile Ala  Gly Ala Ala Val Gly  Phe Glu Gln
    1580                1585                1590

Gly Gly  Glu Val Thr Arg Ala  Ala Met Val Leu Leu  Lys Tyr Pro
    1595                1600                1605

Ser Leu  Glu Leu Val Glu Tyr  Lys Val Ala Arg Ile  Ala Thr Thr
    1610                1615                1620

Met Pro  Tyr Ile Pro Gly Phe  Leu Ser Phe Arg Glu  Tyr Pro Ala
    1625                1630                1635

Leu Leu  Ala Ala Trp Glu Met  Leu Ser Gln Lys Pro  Asp Leu Val
    1640                1645                1650

Phe Val  Asp Gly His Gly Ile  Ser His Pro Arg Arg  Leu Gly Val
    1655                1660                1665

Ala Ser  His Phe Gly Leu Leu  Val Asp Val Pro Thr  Ile Gly Val
    1670                1675                1680

Ala Lys  Lys Arg Leu Cys Gly  Lys Phe Glu Pro Leu  Ser Ser Glu
    1685                1690                1695

Pro Gly  Ala Leu Ala Pro Leu  Met Asp Lys Gly Glu  Gln Leu Ala
    1700                1705                1710

Trp Val  Trp Arg Ser Lys Ala  Arg Cys Asn Pro Leu  Phe Ile Ala
    1715                1720                1725

Thr Gly  His Arg Val Ser Val  Asp Ser Ala Leu Ala  Trp Val Gln
    1730                1735                1740

Arg Cys  Met Lys Gly Tyr Arg  Leu Pro Glu Pro Thr  Arg Trp Ala
    1745                1750                1755
```

Asp Ala Val Ala Ser Glu Arg Pro Ala Phe Val Arg Tyr Thr Ala
1760 1765 1770

Asn Gln Pro Ser Gly Gly Ser Pro Lys Lys Lys Arg Lys Val
1775 1780 1785

<210> 337
<211> 1787
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 337

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1 5 10 15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
20 25 30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
35 40 45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
50 55 60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65 70 75 80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
85 90 95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Gly Ala Lys Thr Gly
100 105 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
115 120 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
130 135 140

```
Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350
```

```
Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560
```

```
Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765
```

```
Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975
```

```
Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990

Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005

Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020

Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035

Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050

Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065

Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080

Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095

Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110

Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125

Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140

Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170
```

```
Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335

Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365
```

```
Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545

Gly Asp  Ser Gly Gly Ser Asp  Leu Ala Ser Leu Arg  Ala Gln Gln
    1550                1555                1560
```

```
Ile Glu  Leu Ala Ser Ser Val  Ile Arg Glu Asp Arg  Leu Asp Lys
    1565                1570                1575

Asp Pro  Pro Asp Leu Ile Ala  Gly Ala Ala Val Gly  Phe Glu Gln
    1580                1585                1590

Gly Gly  Glu Val Thr Arg Ala  Ala Met Val Leu Leu  Lys Tyr Pro
    1595                1600                1605

Ser Leu  Glu Leu Val Glu Tyr  Lys Val Ala Arg Ile  Ala Thr Thr
    1610                1615                1620

Met Pro  Tyr Ile Pro Gly Phe  Leu Ser Phe Arg Glu  Tyr Pro Ala
    1625                1630                1635

Leu Leu  Ala Ala Trp Glu Met  Leu Ser Gln Lys Pro  Asp Leu Val
    1640                1645                1650

Phe Val  Asp Gly His Gly Ile  Ser His Pro Arg Arg  Leu Gly Val
    1655                1660                1665

Ala Ser  His Phe Gly Leu Leu  Val Asp Val Pro Thr  Ile Gly Val
    1670                1675                1680

Ala Lys  Lys Arg Leu Cys Gly  Lys Phe Glu Pro Leu  Ser Ser Glu
    1685                1690                1695

Pro Gly  Ala Leu Ala Pro Leu  Met Asp Lys Gly Glu  Gln Leu Ala
    1700                1705                1710

Trp Val  Trp Arg Ser Lys Ala  Arg Cys Asn Pro Leu  Phe Ile Ala
    1715                1720                1725

Thr Gly  His Arg Val Ser Val  Asp Ser Ala Leu Ala  Trp Val Gln
    1730                1735                1740

Arg Cys  Met Lys Gly Tyr Arg  Leu Pro Glu Pro Thr  Arg Trp Ala
    1745                1750                1755
```

```
Asp Ala  Val Ala Ser Glu Arg  Pro Ala Phe Val Arg  Tyr Thr Ala
    1760                1765                1770


Asn Gln  Pro Ser Gly Gly Ser  Pro Lys Lys Lys Arg  Lys Val
    1775                1780                1785


<210>  338
<211>  1787
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  338

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                   10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Val Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125
```

```
Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335
```

```
Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540
```

```
Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560


Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575


Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590


Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605


Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620


Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640


Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655


Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670


Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685


Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700


Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720


Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735


Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750
```

```
Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960
```

```
Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
               965                 970                 975


Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990


Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005


Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020


Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035


Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050


Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065


Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080


Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095


Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110


Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125


Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140


Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155
```

```
Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335

Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350
```

```
Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545
```

```
Gly Asp  Ser Gly Gly Ser Asp  Leu Ala Ser Leu Arg  Ala Gln Gln
    1550                 1555                 1560


Ile Glu  Leu Ala Ser Ser Val  Ile Arg Glu Asp Arg  Leu Asp Lys
    1565                 1570                 1575


Asp Pro  Pro Asp Leu Ile Ala  Gly Ala Ala Val Gly  Phe Glu Gln
    1580                 1585                 1590


Gly Gly  Glu Val Thr Arg Ala  Ala Met Val Leu Leu  Lys Tyr Pro
    1595                 1600                 1605


Ser Leu  Glu Leu Val Glu Tyr  Lys Val Ala Arg Ile  Ala Thr Thr
    1610                 1615                 1620


Met Pro  Tyr Ile Pro Gly Phe  Leu Ser Phe Arg Glu  Tyr Pro Ala
    1625                 1630                 1635


Leu Leu  Ala Ala Trp Glu Met  Leu Ser Gln Lys Pro  Asp Leu Val
    1640                 1645                 1650


Phe Val  Asp Gly His Gly Ile  Ser His Pro Arg Arg  Leu Gly Val
    1655                 1660                 1665


Ala Ser  His Phe Gly Leu Leu  Val Asp Val Pro Thr  Ile Gly Val
    1670                 1675                 1680


Ala Lys  Lys Arg Leu Cys Gly  Lys Phe Glu Pro Leu  Ser Ser Glu
    1685                 1690                 1695


Pro Gly  Ala Leu Ala Pro Leu  Met Asp Lys Gly Glu  Gln Leu Ala
    1700                 1705                 1710


Trp Val  Trp Arg Ser Lys Ala  Arg Cys Asn Pro Leu  Phe Ile Ala
    1715                 1720                 1725


Thr Gly  His Arg Val Ser Val  Asp Ser Ala Leu Ala  Trp Val Gln
    1730                 1735                 1740
```

Arg Cys Met Lys Gly Tyr Arg Leu Pro Glu Pro Thr Arg Trp Ala
1745 1750 1755

Asp Ala Val Ala Ser Glu Arg Pro Ala Phe Val Arg Tyr Thr Ala
1760 1765 1770

Asn Gln Pro Ser Gly Gly Ser Pro Lys Lys Lys Arg Lys Val
1775 1780 1785

<210> 339
<211> 1787
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 339

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1 5 10 15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
20 25 30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
35 40 45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
50 55 60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65 70 75 80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
85 90 95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Val Ala Lys Thr Gly
100 105 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
115 120 125

```
Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335
```

```
Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540
```

```
Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750
```

```
Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960
```

```
Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
               965                 970                 975

Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
           980                 985                 990

Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005

Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020

Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035

Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050

Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065

Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080

Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095

Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110

Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125

Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140

Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155
```

```
Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335

Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350
```

```
Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530

Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545
```

```
Gly Asp  Ser Gly Gly Ser Asp  Leu Ala Ser Leu Arg  Ala Gln Gln
    1550                 1555                 1560

Ile Glu  Leu Ala Ser Ser Val  Ile Arg Glu Asp Arg  Leu Asp Lys
    1565                 1570                 1575

Asp Pro  Pro Asp Leu Ile Ala  Gly Ala Ala Val Gly  Phe Glu Gln
    1580                 1585                 1590

Gly Gly  Glu Val Thr Arg Ala  Ala Met Val Leu Leu  Lys Tyr Pro
    1595                 1600                 1605

Ser Leu  Glu Leu Val Glu Tyr  Lys Val Ala Arg Ile  Ala Thr Thr
    1610                 1615                 1620

Met Pro  Tyr Ile Pro Gly Phe  Leu Ser Phe Arg Glu  Tyr Pro Ala
    1625                 1630                 1635

Leu Leu  Ala Ala Trp Glu Met  Leu Ser Gln Lys Pro  Asp Leu Val
    1640                 1645                 1650

Phe Val  Asp Gly His Gly Ile  Ser His Pro Arg Arg  Leu Gly Val
    1655                 1660                 1665

Ala Ser  His Phe Gly Leu Leu  Val Asp Val Pro Thr  Ile Gly Val
    1670                 1675                 1680

Ala Lys  Lys Arg Leu Cys Gly  Lys Phe Glu Pro Leu  Ser Ser Glu
    1685                 1690                 1695

Pro Gly  Ala Leu Ala Pro Leu  Met Asp Lys Gly Glu  Gln Leu Ala
    1700                 1705                 1710

Trp Val  Trp Arg Ser Lys Ala  Arg Cys Asn Pro Leu  Phe Ile Ala
    1715                 1720                 1725

Thr Gly  His Arg Val Ser Val  Asp Ser Ala Leu Ala  Trp Val Gln
    1730                 1735                 1740
```

```
Arg Cys  Met Lys Gly Tyr Arg  Leu Pro Glu Pro Thr  Arg Trp Ala
    1745                1750                1755


Asp Ala  Val Ala Ser Glu Arg  Pro Ala Phe Val Arg  Tyr Thr Ala
    1760                1765                1770


Asn Gln  Pro Ser Gly Gly Ser  Pro Lys Lys Lys Arg  Lys Val
    1775                1780                1785


<210>  340
<211>  1550
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide


<220>
<221>  misc_feature
<222>  (155)..(155)
<223>  Xaa can be any naturally occurring amino acid

<400>  340

Met Ser Glu Val Glu Phe Ser Tyr Glu Tyr Trp Met Arg His Ala Leu
1               5                   10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95
```

```
Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Ser His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Xaa Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300
```

```
Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320

Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510
```

```
Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525

Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720
```

```
Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735

Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925
```

```
Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940

Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975

Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990

Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005

Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp Ala Ile
    1010                1015                1020

Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035

Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050

Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065

Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080

Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095

Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110

Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125
```

```
Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140

Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320
```

```
Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335

Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515
```

```
Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530


Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545


Gly Asp
    1550
```

<210> 341
<211> 1782
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 341

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                   10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly
            100                 105                 110
```

```
Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320
```

```
Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525
```

```
Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735
```

```
Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940
```

```
Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960


Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975


Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990


Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005


Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020


Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035


Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050


Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065


Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080


Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095


Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110


Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125


Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140
```

```
Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335
```

```
Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530
```

```
Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545

Gly Asp  Gly Gly Ser Lys Gly  His Leu Thr Arg Leu  Gly Leu Glu
    1550                1555                1560

Phe Phe  Asp Gln Pro Ala Val  Pro Leu Ala Arg Ala  Phe Leu Gly
    1565                1570                1575

Gln Val  Leu Val Arg Arg Leu  Pro Asn Gly Thr Glu  Leu Arg Gly
    1580                1585                1590

Arg Ile  Val Glu Thr Gln Ala  Tyr Leu Gly Pro Glu  Asp Glu Ala
    1595                1600                1605

Ala His  Ser Arg Gly Gly Arg  Gln Thr Pro Arg Asn  Arg Gly Met
    1610                1615                1620

Phe Met  Lys Pro Gly Thr Leu  Tyr Val Tyr Ile Ile  Tyr Gly Met
    1625                1630                1635

Tyr Phe  Cys Met Asn Ile Ser  Ser Gln Gly Asp Gly  Ala Cys Val
    1640                1645                1650

Leu Leu  Arg Ala Leu Glu Pro  Leu Glu Gly Leu Glu  Thr Met Arg
    1655                1660                1665

Gln Leu  Arg Ser Thr Leu Arg  Lys Gly Thr Ala Ser  Arg Val Leu
    1670                1675                1680

Lys Asp  Arg Glu Leu Cys Ser  Gly Pro Ser Lys Leu  Cys Gln Ala
    1685                1690                1695

Leu Ala  Ile Asn Lys Ser Phe  Asp Gln Arg Asp Leu  Ala Gln Asp
    1700                1705                1710

Glu Ala  Val Trp Leu Glu Arg  Gly Pro Leu Glu Pro  Ser Glu Pro
    1715                1720                1725
```

```
Ala Val  Val Ala Ala Ala Arg  Val Gly Val Gly His  Ala Gly Glu
    1730                1735                1740


Trp Ala  Arg Lys Pro Leu Arg  Phe Tyr Val Arg Gly  Ser Pro Trp
    1745                1750                1755


Val Ser  Val Val Asp Arg Val  Ala Glu Gln Asp Thr  Gln Ala Gly
    1760                1765                1770


Gly Ser  Pro Lys Lys Lys Arg  Lys Val
    1775                1780
```

<210> 342
<211> 1785
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 342

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                   10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asn Ala Lys Thr Gly
            100                 105                 110
```

```
Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Ser Glu Thr Pro Gly Thr Ser
                165                 170                 175

Glu Ser Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala
            180                 185                 190

Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys
        195                 200                 205

Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser
    210                 215                 220

Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr
225                 230                 235                 240

Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg
                245                 250                 255

Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met
            260                 265                 270

Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu
        275                 280                 285

Val Glu Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile
    290                 295                 300

Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu
305                 310                 315                 320
```

```
Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile
                325                 330                 335

Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile
            340                 345                 350

Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile
        355                 360                 365

Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn
    370                 375                 380

Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys
385                 390                 395                 400

Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys
                405                 410                 415

Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro
            420                 425                 430

Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu
        435                 440                 445

Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile
    450                 455                 460

Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp
465                 470                 475                 480

Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys
                485                 490                 495

Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln
            500                 505                 510

Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys
        515                 520                 525
```

```
Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr
    530                 535                 540

Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro
545                 550                 555                 560

Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn
                565                 570                 575

Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile
            580                 585                 590

Pro His Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln
        595                 600                 605

Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys
    610                 615                 620

Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly
625                 630                 635                 640

Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr
                645                 650                 655

Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser
            660                 665                 670

Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys
        675                 680                 685

Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn
    690                 695                 700

Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala
705                 710                 715                 720

Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys
                725                 730                 735
```

```
Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys
            740                 745                 750

Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg
        755                 760                 765

Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys
    770                 775                 780

Asp Lys Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp
785                 790                 795                 800

Ile Val Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu
                805                 810                 815

Arg Leu Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln
            820                 825                 830

Leu Lys Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu
        835                 840                 845

Ile Asn Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe
    850                 855                 860

Leu Lys Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His
865                 870                 875                 880

Asp Asp Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser
                885                 890                 895

Gly Gln Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser
            900                 905                 910

Pro Ala Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu
        915                 920                 925

Leu Val Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu
    930                 935                 940
```

```
Met Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
945                 950                 955                 960

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser Gln
                965                 970                 975

Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn Glu Lys
            980                 985                 990

Leu Tyr Leu Tyr Tyr Leu Gln Asn  Gly Arg Asp Met Tyr  Val Asp Gln
        995                 1000                1005

Glu Leu  Asp Ile Asn Arg Leu  Ser Asp Tyr Asp Val  Asp His Ile
    1010                1015                1020

Val Pro  Gln Ser Phe Leu Lys  Asp Asp Ser Ile Asp  Asn Lys Val
    1025                1030                1035

Leu Thr  Arg Ser Asp Lys Asn  Arg Gly Lys Ser Asp  Asn Val Pro
    1040                1045                1050

Ser Glu  Glu Val Val Lys Lys  Met Lys Asn Tyr Trp  Arg Gln Leu
    1055                1060                1065

Leu Asn  Ala Lys Leu Ile Thr  Gln Arg Lys Phe Asp  Asn Leu Thr
    1070                1075                1080

Lys Ala  Glu Arg Gly Gly Leu  Ser Glu Leu Asp Lys  Ala Gly Phe
    1085                1090                1095

Ile Lys  Arg Gln Leu Val Glu  Thr Arg Gln Ile Thr  Lys His Val
    1100                1105                1110

Ala Gln  Ile Leu Asp Ser Arg  Met Asn Thr Lys Tyr  Asp Glu Asn
    1115                1120                1125

Asp Lys  Leu Ile Arg Glu Val  Lys Val Ile Thr Leu  Lys Ser Lys
    1130                1135                1140
```

```
Leu Val  Ser Asp Phe Arg Lys  Asp Phe Gln Phe Tyr  Lys Val Arg
    1145                1150                1155

Glu Ile  Asn Asn Tyr His His  Ala His Asp Ala Tyr  Leu Asn Ala
    1160                1165                1170

Val Val  Gly Thr Ala Leu Ile  Lys Lys Tyr Pro Lys  Leu Glu Ser
    1175                1180                1185

Glu Phe  Val Tyr Gly Asp Tyr  Lys Val Tyr Asp Val  Arg Lys Met
    1190                1195                1200

Ile Ala  Lys Ser Glu Gln Glu  Ile Gly Lys Ala Thr  Ala Lys Tyr
    1205                1210                1215

Phe Phe  Tyr Ser Asn Ile Met  Asn Phe Phe Lys Thr  Glu Ile Thr
    1220                1225                1230

Leu Ala  Asn Gly Glu Ile Arg  Lys Arg Pro Leu Ile  Glu Thr Asn
    1235                1240                1245

Gly Glu  Thr Gly Glu Ile Val  Trp Asp Lys Gly Arg  Asp Phe Ala
    1250                1255                1260

Thr Val  Arg Lys Val Leu Ser  Met Pro Gln Val Asn  Ile Val Lys
    1265                1270                1275

Lys Thr  Glu Val Gln Thr Gly  Gly Phe Ser Lys Glu  Ser Ile Leu
    1280                1285                1290

Pro Lys  Arg Asn Ser Asp Lys  Leu Ile Ala Arg Lys  Lys Asp Trp
    1295                1300                1305

Asp Pro  Lys Lys Tyr Gly Gly  Phe Asp Ser Pro Thr  Val Ala Tyr
    1310                1315                1320

Ser Val  Leu Val Val Ala Lys  Val Glu Lys Gly Lys  Ser Lys Lys
    1325                1330                1335
```

```
Leu Lys  Ser Val Lys Glu Leu  Leu Gly Ile Thr Ile  Met Glu Arg
    1340                1345                1350

Ser Ser  Phe Glu Lys Asn Pro  Ile Asp Phe Leu Glu  Ala Lys Gly
    1355                1360                1365

Tyr Lys  Glu Val Lys Lys Asp  Leu Ile Ile Lys Leu  Pro Lys Tyr
    1370                1375                1380

Ser Leu  Phe Glu Leu Glu Asn  Gly Arg Lys Arg Met  Leu Ala Ser
    1385                1390                1395

Ala Gly  Glu Leu Gln Lys Gly  Asn Glu Leu Ala Leu  Pro Ser Lys
    1400                1405                1410

Tyr Val  Asn Phe Leu Tyr Leu  Ala Ser His Tyr Glu  Lys Leu Lys
    1415                1420                1425

Gly Ser  Pro Glu Asp Asn Glu  Gln Lys Gln Leu Phe  Val Glu Gln
    1430                1435                1440

His Lys  His Tyr Leu Asp Glu  Ile Ile Glu Gln Ile  Ser Glu Phe
    1445                1450                1455

Ser Lys  Arg Val Ile Leu Ala  Asp Ala Asn Leu Asp  Lys Val Leu
    1460                1465                1470

Ser Ala  Tyr Asn Lys His Arg  Asp Lys Pro Ile Arg  Glu Gln Ala
    1475                1480                1485

Glu Asn  Ile Ile His Leu Phe  Thr Leu Thr Asn Leu  Gly Ala Pro
    1490                1495                1500

Ala Ala  Phe Lys Tyr Phe Asp  Thr Thr Ile Asp Arg  Lys Arg Tyr
    1505                1510                1515

Thr Ser  Thr Lys Glu Val Leu  Asp Ala Thr Leu Ile  His Gln Ser
    1520                1525                1530
```

```
Ile Thr  Gly Leu Tyr Glu Thr  Arg Ile Asp Leu Ser  Gln Leu Gly
    1535                1540                1545

Gly Asp  Gly Gly Ser Asp Leu  Ala Ser Leu Arg Ala  Gln Gln Ile
    1550                1555                1560

Glu Leu  Ala Ser Ser Val Ile  Arg Glu Asp Arg Leu  Asp Lys Asp
    1565                1570                1575

Pro Pro  Asp Leu Ile Ala Gly  Ala Ala Val Gly Phe  Glu Gln Gly
    1580                1585                1590

Gly Glu  Val Thr Arg Ala Ala  Met Val Leu Leu Lys  Tyr Pro Ser
    1595                1600                1605

Leu Glu  Leu Val Glu Tyr Lys  Val Ala Arg Ile Ala  Thr Thr Met
    1610                1615                1620

Pro Tyr  Ile Pro Gly Phe Leu  Ser Phe Arg Glu Tyr  Pro Ala Leu
    1625                1630                1635

Leu Ala  Ala Trp Glu Met Leu  Ser Gln Lys Pro Asp  Leu Val Phe
    1640                1645                1650

Val Asp  Gly His Gly Ile Ser  His Pro Arg Arg Leu  Gly Val Ala
    1655                1660                1665

Ser His  Phe Gly Leu Leu Val  Asp Val Pro Thr Ile  Gly Val Ala
    1670                1675                1680

Lys Lys  Arg Leu Cys Gly Lys  Phe Glu Pro Leu Ser  Ser Glu Pro
    1685                1690                1695

Gly Ala  Leu Ala Pro Leu Met  Asp Lys Gly Glu Gln  Leu Ala Trp
    1700                1705                1710

Val Trp  Arg Ser Lys Ala Arg  Cys Asn Pro Leu Phe  Ile Ala Thr
    1715                1720                1725
```

```
Gly His  Arg Val Ser Val Asp  Ser Ala Leu Ala Trp  Val Gln Arg
    1730                1735                1740


Cys Met  Lys Gly Tyr Arg Leu  Pro Glu Pro Thr Arg  Trp Ala Asp
    1745                1750                1755


Ala Val  Ala Ser Glu Arg Pro  Ala Phe Val Arg Tyr  Thr Ala Asn
    1760                1765                1770


Gln Pro  Gly Gly Ser Pro Lys  Lys Lys Arg Lys Val
    1775                1780                1785


<210>  343
<211>  24
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  343

Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr
1               5                   10                  15


Ser Glu Ser Ala Thr Pro Glu Ser
            20


<210>  344
<211>  16
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  344

Lys Arg Pro Ala Ala Thr Lys Lys Ala Gly Gln Ala Lys Lys Lys Lys
1               5                   10                  15


<210>  345
<211>  17
```

<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 345

Lys Lys Thr Glu Leu Gln Thr Thr Asn Ala Glu Asn Lys Thr Lys Lys
1 5 10 15

Leu

<210> 346
<211> 19
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 346

Lys Arg Gly Ile Asn Asp Arg Asn Phe Trp Arg Gly Glu Asn Gly Arg
1 5 10 15

Lys Thr Arg

<210> 347
<211> 16
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 347

Arg Lys Ser Gly Lys Ile Ala Ala Ile Val Val Lys Arg Pro Arg Lys
1 5 10 15

<210> 348
<211> 20
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic Polynucleotide

<400> 348
gaagcgcctg gcagtgtacc 20

<210> 349
<211> 21
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic Polynucleotide

<400> 349
gacgtgcgcg gccgcctggt g 21

<210> 350
<211> 306
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic Polynucleotide

<400> 350
tgcctgtcat acgaaaccga gatactgaca gtagaatatg gccttctgcc aatcgggaag 60

attgtggaga aacggataga atgcacagtt tactctgtcg ataacaatgg taacatttat 120

actcagccag ttgcccagtg gcacgaccgg ggagagcagg aagtattcga atactgtctg 180

gaggatggaa gtctcattag ggccactaag gaccacaaat ttatgacagt cgatggccag 240

atgctgccta tagacgaaat ctttgagcga gagttggacc tcatgcgagt tgacaacctt 300

cctaat 306

<210> 351
<211> 102
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 351

Cys Leu Ser Tyr Glu Thr Glu Ile Leu Thr Val Glu Tyr Gly Leu Leu
1 5 10 15

Pro Ile Gly Lys Ile Val Glu Lys Arg Ile Glu Cys Thr Val Tyr Ser
20 25 30

Val Asp Asn Asn Gly Asn Ile Tyr Thr Gln Pro Val Ala Gln Trp His
35 40 45

Asp Arg Gly Glu Gln Glu Val Phe Glu Tyr Cys Leu Glu Asp Gly Ser
50 55 60

Leu Ile Arg Ala Thr Lys Asp His Lys Phe Met Thr Val Asp Gly Gln
65 70 75 80

Met Leu Pro Ile Asp Glu Ile Phe Glu Arg Glu Leu Asp Leu Met Arg
85 90 95

Val Asp Asn Leu Pro Asn
100

<210> 352
<211> 108
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic Polynucleotide

<400> 352
atgatcaaga tagctacaag gaagtatctt ggcaaacaaa acgtttatga tattggagtc 60

gaaagagatc acaactttgc tctgaagaac ggattcatag cttctaat 108

<210> 353
<211> 36
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 353

Met Ile Lys Ile Ala Thr Arg Lys Tyr Leu Gly Lys Gln Asn Val Tyr
1 5 10 15

Asp Ile Gly Val Glu Arg Asp His Asn Phe Ala Leu Lys Asn Gly Phe
20 25 30

Ile Ala Ser Asn
35

<210> 354
<211> 303
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic Polynucleotide

<400> 354
tgcctgtctt atgataccga gatacttacc gttgaatatg gcttcttgcc tattggaaag 60

attgtcgaag agagaattga atgcacagta tatactgtag acaagaatgg tttcgtttac 120

acacagccca ttgctcaatg gcacaatcgc ggcgaacaag aagtatttga gtactgtctc 180

gaggatggaa gcatcatacg agcaactaaa gatcataaat tcatgaccac tgacgggcag 240

atgttgccaa tagatgagat attcgagcgg ggcttggatc tcaaacaagt ggatggattg 300

cca 303

<210> 355
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 355

Cys Leu Ser Tyr Asp Thr Glu Ile Leu Thr Val Glu Tyr Gly Phe Leu
1 5 10 15

Pro Ile Gly Lys Ile Val Glu Glu Arg Ile Glu Cys Thr Val Tyr Thr
20 25 30

Val Asp Lys Asn Gly Phe Val Tyr Thr Gln Pro Ile Ala Gln Trp His
35 40 45

Asn Arg Gly Glu Gln Glu Val Phe Glu Tyr Cys Leu Glu Asp Gly Ser
50 55 60

Ile Ile Arg Ala Thr Lys Asp His Lys Phe Met Thr Thr Asp Gly Gln
65 70 75 80

Met Leu Pro Ile Asp Glu Ile Phe Glu Arg Gly Leu Asp Leu Lys Gln
85 90 95

Val Asp Gly Leu Pro
100

<210> 356
<211> 159
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic Polynucleotide

<400> 356
atgaagagga ctgccgatgg atcagagttt gaatctccca agaagaagag gaaagtaaag 60

ataatatctc gaaaaagtct tggtacccaa aatgtctatg atattggagt ggagaaagat 120

cacaacttcc ttctcaagaa cggtctcgta gccagcaac 159

<210> 357
<211> 53
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 357

Met Lys Arg Thr Ala Asp Gly Ser Glu Phe Glu Ser Pro Lys Lys Lys
1 5 10 15

Arg Lys Val Lys Ile Ile Ser Arg Lys Ser Leu Gly Thr Gln Asn Val
20 25 30

Tyr Asp Ile Gly Val Glu Lys Asp His Asn Phe Leu Leu Lys Asn Gly
        35   40   45

Leu Val Ala Ser Asn
    50

<210> 358
<211> 82
<212> RNA
<213> Artificial Sequence

<220>
<223> Synthetic Polynucleotide

<400> 358
guuuuagagc uagaaauagc aaguuaaaau aaaggcuagu ccguuaucaa cuugaaaaag 60

uggcaccgag ucggugcuuu uu   82

<210> 359
<211> 93
<212> RNA
<213> Streptococcus pyogenes

<400> 359
guuuaagagc uaugcuggaa agccacggug aaaaaguuca acuauugccu gaucggaaua 60

aauuugaacg auacgacagu cggugcuuuu uuu   93

<210> 360
<211> 82
<212> RNA
<213> Streptococcus pyogenes

<400> 360
guuuaagagc uagaaauagc aaguuuaaau aaggcuaguc cguuaucaac uugaaaaagu 60

ggcaccgagu cggugcuuuu uu   82

<210> 361
<211> 97
<212> RNA
<213> Streptococcus thermophilus

<400> 361

guuuuuguac ucucaagauu caauaaucuu gcagaagcua caaagauaag gcuucaugcc 60

gaaaucaaca cccugucauu uuauggcagg guguuuu 97

<210> 362
<211> 97
<212> RNA
<213> Streptococcus thermophilus

<400> 362
guuuuagagc uguguuguuu guuaaaacaa cacagcgagu uaaaauaagg cuuaguccgu 60

acucaacuug aaaagguggc accgauucgg uguuuuu 97

<210> 363
<211> 74
<212> RNA
<213> C. jejuni

<400> 363
aagaaauuua aaaagggacu aaaauaaaga guuugcggga cucugcgggg uuacaauccc 60

cuaaaaccgc uuuu 74

<210> 364
<211> 95
<212> RNA
<213> Francisella novicida

<400> 364
aucuaaaauu auaaauguac caaauaauua augcucugua aucauuuaaa aguauuuuga 60

acggaccucu guuugacacg ucugaauaac uaaaa 95

<210> 365
<211> 109
<212> RNA
<213> Streptococcus thermophilus2

<400> 365
uguaagggac gccuuacaca guuacuuaaa ucuugcagaa gcuacaaaga uaaggcuuca 60

ugccgaaauc aacacccugu cauuuuaugg caggguguuu ucguuauuu 109

<210> 366
<211> 110
<212> RNA

<213> M. mobile

<400> 366
uguauuucga aauacagaug uacaguuaag aauacauaag aaugauacau cacuaaaaaa 60

aggcuuuaug ccguaacuac uacuuauuuu caaaauaagu aguuuuuuuu 110

<210> 367
<211> 92
<212> RNA
<213> Listeria innocua

<400> 367
auuguuagua uucaaaauaa cauagcaagu uaaaauaagg cuuuguccgu uaucaacuuu 60

uaauuaagua gcgcuguuuc ggcgcuuuuu uu 92

<210> 368
<211> 89
<212> RNA
<213> Streptococcus pyogenes

<400> 368
guuggaacca uucaaaacag cauagcaagu uaaaauaagg cuaguccguu aucaacuuga 60

aaaaguggca ccgagucggu gcuuuuuuu 89

<210> 369
<211> 107
<212> RNA
<213> Streptococcus mutans

<400> 369
guuggaauca uucgaaacaa cacagcaagu uaaaauaagg cagugauuuu uaauccaguc 60

cguacacaac uugaaaaagu gcgcaccgau ucggugcuuu uuuauuu 107

<210> 370
<211> 96
<212> RNA
<213> Streptococcus thermophilus

<400> 370
uugugguuug aaaccauucg aaacaacaca gcgaguuaaa auaaggcuua guccguacuc 60

aacuugaaaa gguggcaccg auucgguguu uuuuuu 96

<210> 371
<211> 102
<212> RNA
<213> Neisseria meningitidis

<400> 371
acauauuguc gcacugcgaa augagaaccg uugcuacaau aaggccgucu gaaaagaugu 60

gccgcaacgc ucugccccuu aaagcuucug cuuuaagggg ca 102

<210> 372
<211> 110
<212> RNA
<213> P. multocida

<400> 372
gcauauuguu gcacugcgaa augagagacg uugcuacaau aaggcuucug aaaagaauga 60

ccguaacgcu cugccccuug ugauucuuaa uugcaagggg caucguuuuu 110

<210> 373
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 373

Pro Lys Lys Lys Arg Lys Val
1 5

<210> 374
<211> 30
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 374

Met Asp Ser Leu Leu Met Asn Arg Arg Lys Phe Leu Tyr Gln Phe Lys
1 5 10 15

Asn Val Arg Trp Ala Lys Gly Arg Arg Glu Thr Tyr Leu Cys
20 25 30

<210> 375
<211> 18
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 375

Lys Arg Thr Ala Asp Gly Ser Glu Phe Glu Ser Pro Lys Lys Lys Arg
1 5 10 15

Lys Val

<210> 376
<211> 609
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic Polynucleotide

<400> 376
gcttatcgat aatcaacctc tggattacaa aatttgtgaa agattgactg gtattcttaa 60

ctatgttgct ccttttacgc tatgtggata cgctgcttta atgcctttgt atcatgctat 120

tgcttcccgt atggctttca ttttctcctc cttgtataaa tcctggttgc tgtctcttta 180

tgaggagttg tggcccgttg tcaggcaacg tggcgtggtg tgcactgtgt ttgctgacgc 240

aacccccact ggttggggca ttgccaccac ctgtcagctc ctttccggga ctttcgcttt 300

ccccctccct attgccacgg cggaactcat cgccgcctgc cttgcccgct gctggacagg 360

ggctcggctg ttgggcactg acaattccgt ggtgttgtcg gggaaatcat cgtcctttcc 420

ttggctgctc gcctatgttg ccacctggat tctgcgcggg acgtccttct gctacgtccc 480

ttcggccctc aatccagcgg accttccttc ccgcggcctg ctgccggctc tgcggcctct 540

tccgcgtctt cgccttcgcc ctcagacgag tcggatctcc ctttgggccg cctccccgca 600

tcgataccg 609

<210> 377
<211> 16
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 377

Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser
1 5 10 15

<210> 378
<211> 4
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 378

Ser Gly Gly Ser
1

<210> 379
<211> 60
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<220>
<221> MISC_FEATURE
<222> (5)..(60)
<223> May be absent

<400> 379

Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Gly Ser
1 5 10 15

Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Gly Ser
20 25 30

Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Gly Ser
35 40 45

Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Gly Ser
50 55 60

<210> 380
<211> 60
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<220>
<221> MISC_FEATURE
<222> (5)..(60)
<223> May be absent

<400> 380

Gly Gly Gly Ser Gly Gly Gly Ser Gly Gly Gly Ser Gly Gly Gly Ser
1 5 10 15

Gly Gly Gly Ser Gly Gly Gly Ser Gly Gly Gly Ser Gly Gly Gly Ser
20 25 30

Gly Gly Gly Ser Gly Gly Gly Ser Gly Gly Gly Ser Gly Gly Gly Ser
35 40 45

Gly Gly Gly Ser Gly Gly Gly Ser Gly Gly Gly Ser
50 55 60

<210> 381
<211> 75
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<220>
<221> MISC_FEATURE
<222> (6)..(75)

<223> May be absent

<400> 381

```
Gly Gly Gly Gly Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly Ser Gly
1               5                   10                  15


Gly Gly Gly Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly Ser Gly Gly
            20                  25                  30


Gly Gly Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly Ser Gly Gly Gly
        35                  40                  45


Gly Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly
    50                  55                  60


Ser Gly Gly Gly Gly Ser Gly Gly Gly Gly Ser
65                  70                  75
```

<210> 382
<211> 75
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<220>
<221> MISC_FEATURE
<222> (6)..(75)
<223> May be absent

<400> 382

```
Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Glu
1               5                   10                  15


Ala Ala Ala Lys Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Glu Ala
            20                  25                  30


Ala Ala Lys Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Glu Ala Ala
        35                  40                  45
```

Ala Lys Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys Glu Ala Ala Ala
50 55 60

Lys Glu Ala Ala Ala Lys Glu Ala Ala Ala Lys
65 70 75

<210> 383
<211> 24
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 383

Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala
1 5 10 15

Thr Pro Glu Ser Ser Gly Gly Ser
20

<210> 384
<211> 32
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 384

Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr
1 5 10 15

Ser Glu Ser Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser
20 25 30

<210> 385
<211> 104
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 385

Gly Gly Ser Gly Gly Ser Pro Gly Ser Pro Ala Gly Ser Pro Thr Ser
1 5 10 15

Thr Glu Glu Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Gly Pro Gly
20 25 30

Thr Ser Thr Glu Pro Ser Glu Gly Ser Ala Pro Gly Ser Pro Ala Gly
35 40 45

Ser Pro Thr Ser Thr Glu Glu Gly Thr Ser Thr Glu Pro Ser Glu Gly
50 55 60

Ser Ala Pro Gly Thr Ser Thr Glu Pro Ser Glu Gly Ser Ala Pro Gly
65 70 75 80

Thr Ser Glu Ser Ala Thr Pro Glu Ser Gly Pro Gly Ser Glu Pro Ala
85 90 95

Thr Ser Gly Gly Ser Gly Gly Ser
100

<210> 386
<211> 145
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic Polynucleotide

<400> 386
ttggccactc cctctctgcg cgctcgctcg ctcactgagg ccgggcgacc aaaggtcgcc 60

cgacgcccgg gctttgcccg ggcggcctca gtgagcgagc gagcgcgcag agagggagtg 120

gccaactcca tcactagggg ttcct 145

<210> 387
<211> 146
<212> DNA
<213> Artificial Sequence

<220>

<223> Synthetic Polynucleotide

<400> 387
ttggccactc cctctatgcg cactcgctcg ctcggtgggg cctggcgacc aaaggtcgcc 60

agacggacgt gctttgcacg tccggcccca ccgagcgagc gagtgcgcat agagggagtg 120

gccaactcca tcactagagg tatggc 146

<210> 388
<211> 167
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic Polynucleotide

<400> 388
ctctcccccc tgtcgcgttc gctcgctcgc tggctcgttt gggggggtgg cagctcaaag 60

agctgccaga cgacggccct ctggccgtcg ccccccccaaa cgagccagcg agcgagcgaa 120

cgcgacaggg gggagagtgc cacactctca agcaaggggg ttttgta 167

<210> 389
<211> 142
<212> DNA
<213> Artificial Sequence

<220>
<223> Synthetic Polynucleotide

<400> 389
ttgcccactc cctctatgcg cgctcgctcg ctcggtgggg cctgcggacc aaaggtccgc 60

agacggcaga gctctgctct gccggcccca ccgagcgagc gagcgcgcat agagggagtg 120

ggcaactcca tcactagggg ta 142

<210> 390
<211> 15
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<220>

<221> MISC_FEATURE
<222> (2)..(15)
<223> May be absent

<400> 390

Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly Gly
1 5 10 15

<210> 391
<211> 40
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 391

Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr
1 5 10 15

Ser Glu Ser Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser
20 25 30

Ser Gly Gly Ser Ser Gly Gly Ser
35 40

<210> 392
<211> 64
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 392

Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr
1 5 10 15

Ser Glu Ser Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser
20 25 30

Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr
35 40 45

```
Ser Glu Ser Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser
    50                  55                  60


<210>  393
<211>  92
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  393

Pro Gly Ser Pro Ala Gly Ser Pro Thr Ser Thr Glu Glu Gly Thr Ser
1               5                   10                  15


Glu Ser Ala Thr Pro Glu Ser Gly Pro Gly Thr Ser Thr Glu Pro Ser
            20                  25                  30


Glu Gly Ser Ala Pro Gly Ser Pro Ala Gly Ser Pro Thr Ser Thr Glu
        35                  40                  45


Glu Gly Thr Ser Thr Glu Pro Ser Glu Gly Ser Ala Pro Gly Thr Ser
    50                  55                  60


Thr Glu Pro Ser Glu Gly Ser Ala Pro Gly Thr Ser Glu Ser Ala Thr
65                  70                  75                  80


Pro Glu Ser Gly Pro Gly Ser Glu Pro Ala Thr Ser
                85                  90


<210>  394
<211>  1367
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  394

Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly
1               5                   10                  15
```

```
Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys
            20                  25                  30

Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly
        35                  40                  45

Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys
    50                  55                  60

Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr
65                  70                  75                  80

Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe
                85                  90                  95

Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His
            100                 105                 110

Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His
        115                 120                 125

Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser
    130                 135                 140

Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met
145                 150                 155                 160

Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp
                165                 170                 175

Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn
            180                 185                 190

Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys
        195                 200                 205

Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu
    210                 215                 220
```

```
Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu
225                 230                 235                 240

Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp
                245                 250                 255

Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp
            260                 265                 270

Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu
        275                 280                 285

Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile
    290                 295                 300

Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met
305                 310                 315                 320

Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala
                325                 330                 335

Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp
            340                 345                 350

Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln
        355                 360                 365

Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly
    370                 375                 380

Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys
385                 390                 395                 400

Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly
                405                 410                 415

Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu
            420                 425                 430
```

```
Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro
        435                 440                 445

Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met
    450                 455                 460

Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val
465                 470                 475                 480

Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Ala
                485                 490                 495

Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu
            500                 505                 510

Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr
        515                 520                 525

Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys
    530                 535                 540

Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val
545                 550                 555                 560

Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser
                565                 570                 575

Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr
            580                 585                 590

Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys Asp Phe Leu Asp Asn
        595                 600                 605

Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val Leu Thr Leu Thr Leu
    610                 615                 620

Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu Lys Thr Tyr Ala His
625                 630                 635                 640
```

```
Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys Arg Arg Arg Tyr Thr
                645                 650                 655

Gly Trp Gly Ala Leu Ser Arg Lys Leu Ile Asn Gly Ile Arg Asp Lys
            660                 665                 670

Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys Ser Asp Gly Phe Ala
        675                 680                 685

Asn Arg Asn Phe Met Ala Leu Ile His Asp Asp Ser Leu Thr Phe Lys
    690                 695                 700

Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln Gly Asp Ser Leu His
705                 710                 715                 720

Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala Ile Lys Lys Gly Ile
                725                 730                 735

Leu Gln Thr Val Lys Val Val Asp Glu Leu Val Lys Val Met Gly Arg
            740                 745                 750

His Lys Pro Glu Asn Ile Val Ile Glu Met Ala Arg Glu Asn Gln Thr
        755                 760                 765

Thr Gln Lys Gly Gln Lys Asn Ser Arg Glu Arg Met Lys Arg Ile Glu
    770                 775                 780

Glu Gly Ile Lys Glu Leu Gly Ser Gln Ile Leu Lys Glu His Pro Val
785                 790                 795                 800

Glu Asn Thr Gln Leu Gln Asn Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln
                805                 810                 815

Asn Gly Arg Asp Met Tyr Val Asp Gln Glu Leu Asp Ile Asn Arg Leu
            820                 825                 830

Ser Asp Tyr Asp Val Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp
        835                 840                 845
```

```
Asp Ser Ile Asp Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly
    850                 855                 860

Lys Ser Asp Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn
865                 870                 875                 880

Tyr Trp Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe
                885                 890                 895

Asp Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
            900                 905                 910

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Ala Ile Thr Lys
        915                 920                 925

His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr Asp Glu
    930                 935                 940

Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu Lys Ser Lys
945                 950                 955                 960

Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr Lys Val Arg Glu
                965                 970                 975

Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu Asn Ala Val Val
            980                 985                 990

Gly Thr Ala Leu Ile Lys Lys Tyr  Pro Lys Leu Glu Ser  Glu Phe Val
        995                 1000                1005

Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg Lys Met  Ile Ala Lys
    1010                1015                1020

Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala Lys Tyr  Phe Phe Tyr
    1025                1030                1035

Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu Ile Thr  Leu Ala Asn
    1040                1045                1050
```

```
Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu Thr Asn  Gly Glu Thr
    1055                1060                1065

Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp Phe Ala  Thr Val Arg
    1070                1075                1080

Lys Val  Leu Ser Met Pro Gln  Val Asn Ile Val Lys  Lys Thr Glu
    1085                1090                1095

Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser Ile Leu  Pro Lys Arg
    1100                1105                1110

Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys Asp Trp  Asp Pro Lys
    1115                1120                1125

Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val Ala Tyr  Ser Val Leu
    1130                1135                1140

Val Val  Ala Lys Val Glu Lys  Gly Lys Ser Lys Lys  Leu Lys Ser
    1145                1150                1155

Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met Glu Arg  Ser Ser Phe
    1160                1165                1170

Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala Lys Gly  Tyr Lys Glu
    1175                1180                1185

Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro Lys Tyr  Ser Leu Phe
    1190                1195                1200

Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu Ala Ser  Ala Gly Glu
    1205                1210                1215

Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro Ser Lys  Tyr Val Asn
    1220                1225                1230

Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys Leu Lys  Gly Ser Pro
    1235                1240                1245
```

```
Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val Glu Gln  His Lys His
    1250                1255                1260


Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser Glu Phe  Ser Lys Arg
    1265                1270                1275


Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys Val Leu  Ser Ala Tyr
    1280                1285                1290


Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu Gln Ala  Glu Asn Ile
    1295                1300                1305


Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly Ala Pro  Ala Ala Phe
    1310                1315                1320


Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys Arg Tyr  Thr Ser Thr
    1325                1330                1335


Lys Glu  Val Leu Asp Ala Thr  Leu Ile His Gln Ser  Ile Thr Gly
    1340                1345                1350


Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln Leu Gly  Gly Asp
    1355                1360                1365


<210>  395
<211>  1129
<212>  PRT
<213>  Alicyclobacillus acidoterrestris

<400>  395

Met Ala Val Lys Ser Ile Lys Val Lys Leu Arg Leu Asp Asp Met Pro
1               5                   10                  15


Glu Ile Arg Ala Gly Leu Trp Lys Leu His Lys Glu Val Asn Ala Gly
            20                  25                  30


Val Arg Tyr Tyr Thr Glu Trp Leu Ser Leu Leu Arg Gln Glu Asn Leu
        35                  40                  45
```

```
Tyr Arg Arg Ser Pro Asn Gly Asp Gly Glu Gln Glu Cys Asp Lys Thr
    50                  55                  60

Ala Glu Glu Cys Lys Ala Glu Leu Leu Glu Arg Leu Arg Ala Arg Gln
65                  70                  75                  80

Val Glu Asn Gly His Arg Gly Pro Ala Gly Ser Asp Asp Glu Leu Leu
                85                  90                  95

Gln Leu Ala Arg Gln Leu Tyr Glu Leu Leu Val Pro Gln Ala Ile Gly
            100                 105                 110

Ala Lys Gly Asp Ala Gln Gln Ile Ala Arg Lys Phe Leu Ser Pro Leu
        115                 120                 125

Ala Asp Lys Asp Ala Val Gly Gly Leu Gly Ile Ala Lys Ala Gly Asn
    130                 135                 140

Lys Pro Arg Trp Val Arg Met Arg Glu Ala Gly Glu Pro Gly Trp Glu
145                 150                 155                 160

Glu Glu Lys Glu Lys Ala Glu Thr Arg Lys Ser Ala Asp Arg Thr Ala
                165                 170                 175

Asp Val Leu Arg Ala Leu Ala Asp Phe Gly Leu Lys Pro Leu Met Arg
            180                 185                 190

Val Tyr Thr Asp Ser Glu Met Ser Ser Val Glu Trp Lys Pro Leu Arg
        195                 200                 205

Lys Gly Gln Ala Val Arg Thr Trp Asp Arg Asp Met Phe Gln Gln Ala
    210                 215                 220

Ile Glu Arg Met Met Ser Trp Glu Ser Trp Asn Gln Arg Val Gly Gln
225                 230                 235                 240

Glu Tyr Ala Lys Leu Val Glu Gln Lys Asn Arg Phe Glu Gln Lys Asn
                245                 250                 255
```

```
Phe Val Gly Gln Glu His Leu Val His Leu Val Asn Gln Leu Gln Gln
            260                 265                 270

Asp Met Lys Glu Ala Ser Pro Gly Leu Glu Ser Lys Glu Gln Thr Ala
        275                 280                 285

His Tyr Val Thr Gly Arg Ala Leu Arg Gly Ser Asp Lys Val Phe Glu
    290                 295                 300

Lys Trp Gly Lys Leu Ala Pro Asp Ala Pro Phe Asp Leu Tyr Asp Ala
305                 310                 315                 320

Glu Ile Lys Asn Val Gln Arg Arg Asn Thr Arg Arg Phe Gly Ser His
                325                 330                 335

Asp Leu Phe Ala Lys Leu Ala Glu Pro Glu Tyr Gln Ala Leu Trp Arg
            340                 345                 350

Glu Asp Ala Ser Phe Leu Thr Arg Tyr Ala Val Tyr Asn Ser Ile Leu
        355                 360                 365

Arg Lys Leu Asn His Ala Lys Met Phe Ala Thr Phe Thr Leu Pro Asp
    370                 375                 380

Ala Thr Ala His Pro Ile Trp Thr Arg Phe Asp Lys Leu Gly Gly Asn
385                 390                 395                 400

Leu His Gln Tyr Thr Phe Leu Phe Asn Glu Phe Gly Glu Arg Arg His
                405                 410                 415

Ala Ile Arg Phe His Lys Leu Leu Lys Val Glu Asn Gly Val Ala Arg
            420                 425                 430

Glu Val Asp Asp Val Thr Val Pro Ile Ser Met Ser Glu Gln Leu Asp
        435                 440                 445

Asn Leu Leu Pro Arg Asp Pro Asn Glu Pro Ile Ala Leu Tyr Phe Arg
    450                 455                 460
```

```
Asp Tyr Gly Ala Glu Gln His Phe Thr Gly Glu Phe Gly Gly Ala Lys
465                 470                 475                 480

Ile Gln Cys Arg Arg Asp Gln Leu Ala His Met His Arg Arg Arg Gly
                485                 490                 495

Ala Arg Asp Val Tyr Leu Asn Val Ser Val Arg Val Gln Ser Gln Ser
            500                 505                 510

Glu Ala Arg Gly Glu Arg Arg Pro Pro Tyr Ala Ala Val Phe Arg Leu
        515                 520                 525

Val Gly Asp Asn His Arg Ala Phe Val His Phe Asp Lys Leu Ser Asp
    530                 535                 540

Tyr Leu Ala Glu His Pro Asp Asp Gly Lys Leu Gly Ser Glu Gly Leu
545                 550                 555                 560

Leu Ser Gly Leu Arg Val Met Ser Val Asp Leu Gly Leu Arg Thr Ser
                565                 570                 575

Ala Ser Ile Ser Val Phe Arg Val Ala Arg Lys Asp Glu Leu Lys Pro
            580                 585                 590

Asn Ser Lys Gly Arg Val Pro Phe Phe Phe Pro Ile Lys Gly Asn Asp
        595                 600                 605

Asn Leu Val Ala Val His Glu Arg Ser Gln Leu Leu Lys Leu Pro Gly
    610                 615                 620

Glu Thr Glu Ser Lys Asp Leu Arg Ala Ile Arg Glu Glu Arg Gln Arg
625                 630                 635                 640

Thr Leu Arg Gln Leu Arg Thr Gln Leu Ala Tyr Leu Arg Leu Leu Val
                645                 650                 655

Arg Cys Gly Ser Glu Asp Val Gly Arg Arg Glu Arg Ser Trp Ala Lys
            660                 665                 670
```

```
Leu Ile Glu Gln Pro Val Asp Ala Ala Asn His Met Thr Pro Asp Trp
        675                 680                 685

Arg Glu Ala Phe Glu Asn Glu Leu Gln Lys Leu Lys Ser Leu His Gly
    690                 695                 700

Ile Cys Ser Asp Lys Glu Trp Met Asp Ala Val Tyr Glu Ser Val Arg
705                 710                 715                 720

Arg Val Trp Arg His Met Gly Lys Gln Val Arg Asp Trp Arg Lys Asp
                725                 730                 735

Val Arg Ser Gly Glu Arg Pro Lys Ile Arg Gly Tyr Ala Lys Asp Val
            740                 745                 750

Val Gly Gly Asn Ser Ile Glu Gln Ile Glu Tyr Leu Glu Arg Gln Tyr
        755                 760                 765

Lys Phe Leu Lys Ser Trp Ser Phe Phe Gly Lys Val Ser Gly Gln Val
    770                 775                 780

Ile Arg Ala Glu Lys Gly Ser Arg Phe Ala Ile Thr Leu Arg Glu His
785                 790                 795                 800

Ile Asp His Ala Lys Glu Asp Arg Leu Lys Lys Leu Ala Asp Arg Ile
                805                 810                 815

Ile Met Glu Ala Leu Gly Tyr Val Tyr Ala Leu Asp Glu Arg Gly Lys
            820                 825                 830

Gly Lys Trp Val Ala Lys Tyr Pro Pro Cys Gln Leu Ile Leu Leu Glu
        835                 840                 845

Glu Leu Ser Glu Tyr Gln Phe Asn Asn Asp Arg Pro Pro Ser Glu Asn
    850                 855                 860

Asn Gln Leu Met Gln Trp Ser His Arg Gly Val Phe Gln Glu Leu Ile
865                 870                 875                 880
```

```
Asn Gln Ala Gln Val His Asp Leu Leu Val Gly Thr Met Tyr Ala Ala
                885                 890                 895


Phe Ser Ser Arg Phe Asp Ala Arg Thr Gly Ala Pro Gly Ile Arg Cys
            900                 905                 910


Arg Arg Val Pro Ala Arg Cys Thr Gln Glu His Asn Pro Glu Pro Phe
        915                 920                 925


Pro Trp Trp Leu Asn Lys Phe Val Val Glu His Thr Leu Asp Ala Cys
    930                 935                 940


Pro Leu Arg Ala Asp Asp Leu Ile Pro Thr Gly Glu Gly Glu Ile Phe
945                 950                 955                 960


Val Ser Pro Phe Ser Ala Glu Glu Gly Asp Phe His Gln Ile His Ala
                965                 970                 975


Asp Leu Asn Ala Ala Gln Asn Leu Gln Gln Arg Leu Trp Ser Asp Phe
            980                 985                 990


Asp Ile Ser Gln Ile Arg Leu Arg  Cys Asp Trp Gly Glu  Val Asp Gly
        995                 1000                1005


Glu Leu  Val Leu Ile Pro Arg  Leu Thr Gly Lys Arg  Thr Ala Asp
    1010                1015                1020


Ser Tyr  Ser Asn Lys Val Phe  Tyr Thr Asn Thr Gly  Val Thr Tyr
    1025                1030                1035


Tyr Glu  Arg Glu Arg Gly Lys  Lys Arg Arg Lys Val  Phe Ala Gln
    1040                1045                1050


Glu Lys  Leu Ser Glu Glu Glu  Ala Glu Leu Leu Val  Glu Ala Asp
    1055                1060                1065


Glu Ala  Arg Glu Lys Ser Val  Val Leu Met Arg Asp  Pro Ser Gly
    1070                1075                1080
```

```
Ile Ile  Asn Arg Gly Asn Trp  Thr Arg Gln Lys Glu  Phe Trp Ser
    1085                1090                1095


Met Val  Asn Gln Arg Ile Glu  Gly Tyr Leu Val Lys  Gln Ile Arg
    1100                1105                1110


Ser Arg  Val Pro Leu Gln Asp  Ser Ala Cys Glu Asn  Thr Gly Asp
    1115                1120                1125


Ile
```

<210> 396
<211> 1389
<212> PRT
<213> Leptotrichia shahii

<400> 396

```
Met Gly Asn Leu Phe Gly His Lys Arg Trp Tyr Glu Val Arg Asp Lys
1               5                   10                  15


Lys Asp Phe Lys Ile Lys Arg Lys Val Lys Val Lys Arg Asn Tyr Asp
            20                  25                  30


Gly Asn Lys Tyr Ile Leu Asn Ile Asn Glu Asn Asn Asn Lys Glu Lys
        35                  40                  45


Ile Asp Asn Asn Lys Phe Ile Arg Lys Tyr Ile Asn Tyr Lys Lys Asn
    50                  55                  60


Asp Asn Ile Leu Lys Glu Phe Thr Arg Lys Phe His Ala Gly Asn Ile
65                  70                  75                  80


Leu Phe Lys Leu Lys Gly Lys Glu Gly Ile Ile Arg Ile Glu Asn Asn
                85                  90                  95


Asp Asp Phe Leu Glu Thr Glu Glu Val Val Leu Tyr Ile Glu Ala Tyr
            100                 105                 110
```

```
Gly Lys Ser Glu Lys Leu Lys Ala Leu Gly Ile Thr Lys Lys Lys Ile
        115                 120                 125


Ile Asp Glu Ala Ile Arg Gln Gly Ile Thr Lys Asp Asp Lys Lys Ile
    130                 135                 140


Glu Ile Lys Arg Gln Glu Asn Glu Glu Glu Ile Glu Ile Asp Ile Arg
145                 150                 155                 160


Asp Glu Tyr Thr Asn Lys Thr Leu Asn Asp Cys Ser Ile Ile Leu Arg
                165                 170                 175


Ile Ile Glu Asn Asp Glu Leu Glu Thr Lys Lys Ser Ile Tyr Glu Ile
            180                 185                 190


Phe Lys Asn Ile Asn Met Ser Leu Tyr Lys Ile Ile Glu Lys Ile Ile
        195                 200                 205


Glu Asn Glu Thr Glu Lys Val Phe Glu Asn Arg Tyr Tyr Glu Glu His
    210                 215                 220


Leu Arg Glu Lys Leu Leu Lys Asp Asp Lys Ile Asp Val Ile Leu Thr
225                 230                 235                 240


Asn Phe Met Glu Ile Arg Glu Lys Ile Lys Ser Asn Leu Glu Ile Leu
                245                 250                 255


Gly Phe Val Lys Phe Tyr Leu Asn Val Gly Gly Asp Lys Lys Lys Ser
            260                 265                 270


Lys Asn Lys Lys Met Leu Val Glu Lys Ile Leu Asn Ile Asn Val Asp
        275                 280                 285


Leu Thr Val Glu Asp Ile Ala Asp Phe Val Ile Lys Glu Leu Glu Phe
    290                 295                 300


Trp Asn Ile Thr Lys Arg Ile Glu Lys Val Lys Lys Val Asn Asn Glu
305                 310                 315                 320
```

```
Phe Leu Glu Lys Arg Arg Asn Arg Thr Tyr Ile Lys Ser Tyr Val Leu
                325                 330                 335

Leu Asp Lys His Glu Lys Phe Lys Ile Glu Arg Glu Asn Lys Lys Asp
            340                 345                 350

Lys Ile Val Lys Phe Phe Val Glu Asn Ile Lys Asn Asn Ser Ile Lys
        355                 360                 365

Glu Lys Ile Glu Lys Ile Leu Ala Glu Phe Lys Ile Asp Glu Leu Ile
    370                 375                 380

Lys Lys Leu Glu Lys Glu Leu Lys Lys Gly Asn Cys Asp Thr Glu Ile
385                 390                 395                 400

Phe Gly Ile Phe Lys Lys His Tyr Lys Val Asn Phe Asp Ser Lys Lys
                405                 410                 415

Phe Ser Lys Lys Ser Asp Glu Glu Lys Glu Leu Tyr Lys Ile Ile Tyr
            420                 425                 430

Arg Tyr Leu Lys Gly Arg Ile Glu Lys Ile Leu Val Asn Glu Gln Lys
        435                 440                 445

Val Arg Leu Lys Lys Met Glu Lys Ile Glu Ile Glu Lys Ile Leu Asn
    450                 455                 460

Glu Ser Ile Leu Ser Glu Lys Ile Leu Lys Arg Val Lys Gln Tyr Thr
465                 470                 475                 480

Leu Glu His Ile Met Tyr Leu Gly Lys Leu Arg His Asn Asp Ile Asp
                485                 490                 495

Met Thr Thr Val Asn Thr Asp Asp Phe Ser Arg Leu His Ala Lys Glu
            500                 505                 510

Glu Leu Asp Leu Glu Leu Ile Thr Phe Phe Ala Ser Thr Asn Met Glu
        515                 520                 525
```

```
Leu Asn Lys Ile Phe Ser Arg Glu Asn Ile Asn Asn Asp Glu Asn Ile
    530                 535                 540

Asp Phe Phe Gly Gly Asp Arg Glu Lys Asn Tyr Val Leu Asp Lys Lys
545                 550                 555                 560

Ile Leu Asn Ser Lys Ile Lys Ile Ile Arg Asp Leu Asp Phe Ile Asp
                565                 570                 575

Asn Lys Asn Asn Ile Thr Asn Asn Phe Ile Arg Lys Phe Thr Lys Ile
            580                 585                 590

Gly Thr Asn Glu Arg Asn Arg Ile Leu His Ala Ile Ser Lys Glu Arg
        595                 600                 605

Asp Leu Gln Gly Thr Gln Asp Asp Tyr Asn Lys Val Ile Asn Ile Ile
    610                 615                 620

Gln Asn Leu Lys Ile Ser Asp Glu Glu Val Ser Lys Ala Leu Asn Leu
625                 630                 635                 640

Asp Val Val Phe Lys Asp Lys Lys Asn Ile Ile Thr Lys Ile Asn Asp
                645                 650                 655

Ile Lys Ile Ser Glu Glu Asn Asn Asn Asp Ile Lys Tyr Leu Pro Ser
            660                 665                 670

Phe Ser Lys Val Leu Pro Glu Ile Leu Asn Leu Tyr Arg Asn Asn Pro
        675                 680                 685

Lys Asn Glu Pro Phe Asp Thr Ile Glu Thr Glu Lys Ile Val Leu Asn
    690                 695                 700

Ala Leu Ile Tyr Val Asn Lys Glu Leu Tyr Lys Lys Leu Ile Leu Glu
705                 710                 715                 720

Asp Asp Leu Glu Glu Asn Glu Ser Lys Asn Ile Phe Leu Gln Glu Leu
                725                 730                 735
```

```
Lys Lys Thr Leu Gly Asn Ile Asp Glu Ile Asp Glu Asn Ile Ile Glu
            740                 745                 750

Asn Tyr Tyr Lys Asn Ala Gln Ile Ser Ala Ser Lys Gly Asn Asn Lys
        755                 760                 765

Ala Ile Lys Lys Tyr Gln Lys Lys Val Ile Glu Cys Tyr Ile Gly Tyr
    770                 775                 780

Leu Arg Lys Asn Tyr Glu Glu Leu Phe Asp Phe Ser Asp Phe Lys Met
785                 790                 795                 800

Asn Ile Gln Glu Ile Lys Lys Gln Ile Lys Asp Ile Asn Asp Asn Lys
                805                 810                 815

Thr Tyr Glu Arg Ile Thr Val Lys Thr Ser Asp Lys Thr Ile Val Ile
            820                 825                 830

Asn Asp Asp Phe Glu Tyr Ile Ile Ser Ile Phe Ala Leu Leu Asn Ser
        835                 840                 845

Asn Ala Val Ile Asn Lys Ile Arg Asn Arg Phe Phe Ala Thr Ser Val
    850                 855                 860

Trp Leu Asn Thr Ser Glu Tyr Gln Asn Ile Ile Asp Ile Leu Asp Glu
865                 870                 875                 880

Ile Met Gln Leu Asn Thr Leu Arg Asn Glu Cys Ile Thr Glu Asn Trp
                885                 890                 895

Asn Leu Asn Leu Glu Glu Phe Ile Gln Lys Met Lys Glu Ile Glu Lys
            900                 905                 910

Asp Phe Asp Asp Phe Lys Ile Gln Thr Lys Lys Glu Ile Phe Asn Asn
        915                 920                 925

Tyr Tyr Glu Asp Ile Lys Asn Asn Ile Leu Thr Glu Phe Lys Asp Asp
    930                 935                 940
```

```
Ile Asn Gly Cys Asp Val Leu Glu Lys Lys Leu Glu Lys Ile Val Ile
945                 950                 955                 960


Phe Asp Asp Glu Thr Lys Phe Glu Ile Asp Lys Lys Ser Asn Ile Leu
                965                 970                 975


Gln Asp Glu Gln Arg Lys Leu Ser Asn Ile Asn Lys Lys Asp Leu Lys
            980                 985                 990


Lys Lys Val Asp Gln Tyr Ile Lys  Asp Lys Asp Gln Glu  Ile Lys Ser
        995                 1000                1005


Lys Ile  Leu Cys Arg Ile Ile  Phe Asn Ser Asp Phe  Leu Lys Lys
    1010                1015                1020


Tyr Lys  Lys Glu Ile Asp Asn  Leu Ile Glu Asp Met  Glu Ser Glu
    1025                1030                1035


Asn Glu  Asn Lys Phe Gln Glu  Ile Tyr Tyr Pro Lys  Glu Arg Lys
    1040                1045                1050


Asn Glu  Leu Tyr Ile Tyr Lys  Lys Asn Leu Phe Leu  Asn Ile Gly
    1055                1060                1065


Asn Pro  Asn Phe Asp Lys Ile  Tyr Gly Leu Ile Ser  Asn Asp Ile
    1070                1075                1080


Lys Met  Ala Asp Ala Lys Phe  Leu Phe Asn Ile Asp  Gly Lys Asn
    1085                1090                1095


Ile Arg  Lys Asn Lys Ile Ser  Glu Ile Asp Ala Ile  Leu Lys Asn
    1100                1105                1110


Leu Asn  Asp Lys Leu Asn Gly  Tyr Ser Lys Glu Tyr  Lys Glu Lys
    1115                1120                1125


Tyr Ile  Lys Lys Leu Lys Glu  Asn Asp Asp Phe Phe  Ala Lys Asn
    1130                1135                1140
```

```
Ile Gln  Asn Lys Asn Tyr Lys  Ser Phe Glu Lys Asp  Tyr Asn Arg
    1145                1150                1155

Val Ser  Glu Tyr Lys Lys Ile  Arg Asp Leu Val Glu  Phe Asn Tyr
    1160                1165                1170

Leu Asn  Lys Ile Glu Ser Tyr  Leu Ile Asp Ile Asn  Trp Lys Leu
    1175                1180                1185

Ala Ile  Gln Met Ala Arg Phe  Glu Arg Asp Met His  Tyr Ile Val
    1190                1195                1200

Asn Gly  Leu Arg Glu Leu Gly  Ile Ile Lys Leu Ser  Gly Tyr Asn
    1205                1210                1215

Thr Gly  Ile Ser Arg Ala Tyr  Pro Lys Arg Asn Gly  Ser Asp Gly
    1220                1225                1230

Phe Tyr  Thr Thr Thr Ala Tyr  Tyr Lys Phe Phe Asp  Glu Glu Ser
    1235                1240                1245

Tyr Lys  Lys Phe Glu Lys Ile  Cys Tyr Gly Phe Gly  Ile Asp Leu
    1250                1255                1260

Ser Glu  Asn Ser Glu Ile Asn  Lys Pro Glu Asn Glu  Ser Ile Arg
    1265                1270                1275

Asn Tyr  Ile Ser His Phe Tyr  Ile Val Arg Asn Pro  Phe Ala Asp
    1280                1285                1290

Tyr Ser  Ile Ala Glu Gln Ile  Asp Arg Val Ser Asn  Leu Leu Ser
    1295                1300                1305

Tyr Ser  Thr Arg Tyr Asn Asn  Ser Thr Tyr Ala Ser  Val Phe Glu
    1310                1315                1320

Val Phe  Lys Lys Asp Val Asn  Leu Asp Tyr Asp Glu  Leu Lys Lys
    1325                1330                1335
```

```
Lys Phe  Lys Leu Ile Gly Asn  Asn Asp Ile Leu Glu  Arg Leu Met
    1340                1345                1350


Lys Pro  Lys Lys Val Ser Val  Leu Glu Leu Glu Ser  Tyr Asn Ser
    1355                1360                1365


Asp Tyr  Ile Lys Asn Leu Ile  Ile Glu Leu Leu Thr  Lys Ile Glu
    1370                1375                1380


Asn Thr  Asn Asp Thr Leu
    1385
```

<210> 397
<211> 1050
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 397

```
Met Arg Ser Asn Tyr His Gly Gly Arg Asn Ala Arg Gln Trp Arg Lys
1               5                   10                  15


Gln Ile Ser Gly Leu Ala Arg Arg Thr Lys Glu Thr Val Phe Thr Tyr
            20                  25                  30


Lys Phe Pro Leu Glu Thr Asp Ala Ala Glu Ile Asp Phe Asp Lys Ala
        35                  40                  45


Val Gln Thr Tyr Gly Ile Ala Glu Gly Val Gly His Gly Ser Leu Ile
    50                  55                  60


Gly Leu Val Cys Ala Phe His Leu Ser Gly Phe Arg Leu Phe Ser Lys
65                  70                  75                  80


Ala Gly Glu Ala Met Ala Phe Arg Asn Arg Ser Arg Tyr Pro Thr Asp
                85                  90                  95


Ala Phe Ala Glu Lys Leu Ser Ala Ile Met Gly Ile Gln Leu Pro Thr
            100                 105                 110
```

```
Leu Ser Pro Glu Gly Leu Asp Leu Ile Phe Gln Ser Pro Pro Arg Ser
        115                 120                 125

Arg Asp Gly Ile Ala Pro Val Trp Ser Glu Asn Glu Val Arg Asn Arg
    130                 135                 140

Leu Tyr Thr Asn Trp Thr Gly Arg Gly Pro Ala Asn Lys Pro Asp Glu
145                 150                 155                 160

His Leu Leu Glu Ile Ala Gly Glu Ile Ala Lys Gln Val Phe Pro Lys
                165                 170                 175

Phe Gly Gly Trp Asp Asp Leu Ala Ser Asp Pro Asp Lys Ala Leu Ala
            180                 185                 190

Ala Ala Asp Lys Tyr Phe Gln Ser Gln Gly Asp Phe Pro Ser Ile Ala
        195                 200                 205

Ser Leu Pro Ala Ala Ile Met Leu Ser Pro Ala Asn Ser Thr Val Asp
    210                 215                 220

Phe Glu Gly Asp Tyr Ile Ala Ile Asp Pro Ala Ala Glu Thr Leu Leu
225                 230                 235                 240

His Gln Ala Val Ser Arg Cys Ala Ala Arg Leu Gly Arg Glu Arg Pro
                245                 250                 255

Asp Leu Asp Gln Asn Lys Gly Pro Phe Val Ser Ser Leu Gln Asp Ala
            260                 265                 270

Leu Val Ser Ser Gln Asn Asn Gly Leu Ser Trp Leu Phe Gly Val Gly
        275                 280                 285

Phe Gln His Trp Lys Glu Lys Ser Pro Lys Glu Leu Ile Asp Glu Tyr
    290                 295                 300

Lys Val Pro Ala Asp Gln His Gly Ala Val Thr Gln Val Lys Ser Phe
305                 310                 315                 320
```

```
Val Asp Ala Ile Pro Leu Asn Pro Leu Phe Asp Thr Thr His Tyr Gly
                325                 330                 335

Glu Phe Arg Ala Ser Val Ala Gly Lys Val Arg Ser Trp Val Ala Asn
            340                 345                 350

Tyr Trp Lys Arg Leu Leu Asp Leu Lys Ser Leu Leu Ala Thr Thr Glu
        355                 360                 365

Phe Thr Leu Pro Glu Ser Ile Ser Asp Pro Lys Ala Val Ser Leu Phe
    370                 375                 380

Ser Gly Leu Leu Val Asp Pro Gln Gly Leu Lys Lys Val Ala Asp Ser
385                 390                 395                 400

Leu Pro Ala Arg Leu Val Ser Ala Glu Glu Ala Ile Asp Arg Leu Met
                405                 410                 415

Gly Val Gly Ile Pro Thr Ala Ala Asp Ile Ala Gln Val Glu Arg Val
            420                 425                 430

Ala Asp Glu Ile Gly Ala Phe Ile Gly Gln Val Gln Gln Phe Asn Asn
        435                 440                 445

Gln Val Lys Gln Lys Leu Glu Asn Leu Gln Asp Ala Asp Asp Glu Glu
    450                 455                 460

Phe Leu Lys Gly Leu Lys Ile Glu Leu Pro Ser Gly Asp Lys Glu Pro
465                 470                 475                 480

Pro Ala Ile Asn Arg Ile Ser Gly Gly Ala Pro Asp Ala Ala Ala Glu
                485                 490                 495

Ile Ser Glu Leu Glu Glu Lys Leu Gln Arg Leu Leu Asp Ala Arg Ser
            500                 505                 510

Glu His Phe Gln Thr Ile Ser Glu Trp Ala Glu Glu Asn Ala Val Thr
        515                 520                 525
```

```
Leu Asp Pro Ile Ala Ala Met Val Glu Leu Glu Arg Leu Arg Leu Ala
    530                 535                 540

Glu Arg Gly Ala Thr Gly Asp Pro Glu Glu Tyr Ala Leu Arg Leu Leu
545                 550                 555                 560

Leu Gln Arg Ile Gly Arg Leu Ala Asn Arg Val Ser Pro Val Ser Ala
                565                 570                 575

Gly Ser Ile Arg Glu Leu Leu Lys Pro Val Phe Met Glu Glu Arg Glu
            580                 585                 590

Phe Asn Leu Phe Phe His Asn Arg Leu Gly Ser Leu Tyr Arg Ser Pro
        595                 600                 605

Tyr Ser Thr Ser Arg His Gln Pro Phe Ser Ile Asp Val Gly Lys Ala
    610                 615                 620

Lys Ala Ile Asp Trp Ile Ala Gly Leu Asp Gln Ile Ser Ser Asp Ile
625                 630                 635                 640

Glu Lys Ala Leu Ser Gly Ala Gly Glu Ala Leu Gly Asp Gln Leu Arg
                645                 650                 655

Asp Trp Ile Asn Leu Ala Gly Phe Ala Ile Ser Gln Arg Leu Arg Gly
            660                 665                 670

Leu Pro Asp Thr Val Pro Asn Ala Leu Ala Gln Val Arg Cys Pro Asp
        675                 680                 685

Asp Val Arg Ile Pro Pro Leu Leu Ala Met Leu Leu Glu Glu Asp Asp
    690                 695                 700

Ile Ala Arg Asp Val Cys Leu Lys Ala Phe Asn Leu Tyr Val Ser Ala
705                 710                 715                 720

Ile Asn Gly Cys Leu Phe Gly Ala Leu Arg Glu Gly Phe Ile Val Arg
                725                 730                 735
```

```
Thr Arg Phe Gln Arg Ile Gly Thr Asp Gln Ile His Tyr Val Pro Lys
            740                 745                 750

Asp Lys Ala Trp Glu Tyr Pro Asp Arg Leu Asn Thr Ala Lys Gly Pro
        755                 760                 765

Ile Asn Ala Ala Val Ser Ser Asp Trp Ile Glu Lys Asp Gly Ala Val
    770                 775                 780

Ile Lys Pro Val Glu Thr Val Arg Asn Leu Ser Ser Thr Gly Phe Ala
785                 790                 795                 800

Gly Ala Gly Val Ser Glu Tyr Leu Val Gln Ala Pro His Asp Trp Tyr
                805                 810                 815

Thr Pro Leu Asp Leu Arg Asp Val Ala His Leu Val Thr Gly Leu Pro
            820                 825                 830

Val Glu Lys Asn Ile Thr Lys Leu Lys Arg Leu Thr Asn Arg Thr Ala
        835                 840                 845

Phe Arg Met Val Gly Ala Ser Ser Phe Lys Thr His Leu Asp Ser Val
    850                 855                 860

Leu Leu Ser Asp Lys Ile Lys Leu Gly Asp Phe Thr Ile Ile Ile Asp
865                 870                 875                 880

Gln His Tyr Arg Gln Ser Val Thr Tyr Gly Gly Lys Val Lys Ile Ser
                885                 890                 895

Tyr Glu Pro Glu Arg Leu Gln Val Glu Ala Ala Val Pro Val Val Asp
            900                 905                 910

Thr Arg Asp Arg Thr Val Pro Glu Pro Asp Thr Leu Phe Asp His Ile
        915                 920                 925

Val Ala Ile Asp Leu Gly Glu Arg Ser Val Gly Phe Ala Val Phe Asp
    930                 935                 940
```

```
Ile Lys Ser Cys Leu Arg Thr Gly Glu Val Lys Pro Ile His Asp Asn
945                 950                 955                 960


Asn Gly Asn Pro Val Val Gly Thr Val Ala Val Pro Ser Ile Arg Arg
                965                 970                 975


Leu Met Lys Ala Val Arg Ser His Arg Arg Arg Arg Gln Pro Asn Gln
            980                 985                 990


Lys Val Asn Gln Thr Tyr Ser Thr  Ala Leu Gln Asn Tyr  Arg Glu Asn
        995                 1000                1005


Val Ile  Gly Asp Val Cys Asn  Arg Ile Asp Thr Leu  Met Glu Arg
    1010                1015                1020


Tyr Asn  Ala Phe Pro Val Leu  Glu Phe Gln Ile Lys  Asn Phe Gln
    1025                1030                1035


Ala Gly  Ala Lys Gln Leu Glu  Ile Val Tyr Gly Ser
    1040                1045                1050


<210>  398

<400>  398
000

<210>  399
<211>  1395
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  399

Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1               5                   10                  15


Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
            20                  25                  30
```

```
Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
        35                  40                  45

Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
    50                  55                  60

Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65                  70                  75                  80

Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
                85                  90                  95

Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
            100                 105                 110

Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
        115                 120                 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
    130                 135                 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145                 150                 155                 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
                165                 170                 175

Leu Tyr Val Leu Glu Leu Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys
            180                 185                 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
        195                 200                 205

Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
    210                 215                 220

Ala Thr Gly Leu Lys Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
225                 230                 235                 240
```

```
Ala Thr Pro Glu Ser Lys Arg Asn Tyr Ile Leu Gly Leu Asp Ile Gly
                245                 250                 255

Ile Thr Ser Val Gly Tyr Gly Ile Ile Asp Tyr Glu Thr Arg Asp Val
            260                 265                 270

Ile Asp Ala Gly Val Arg Leu Phe Lys Glu Ala Asn Val Glu Asn Asn
        275                 280                 285

Glu Gly Arg Arg Ser Lys Arg Gly Ala Arg Arg Leu Lys Arg Arg Arg
    290                 295                 300

Arg His Arg Ile Gln Arg Val Lys Lys Leu Leu Phe Asp Tyr Asn Leu
305                 310                 315                 320

Leu Thr Asp His Ser Glu Leu Ser Gly Ile Asn Pro Tyr Glu Ala Arg
                325                 330                 335

Val Lys Gly Leu Ser Gln Lys Leu Ser Glu Glu Glu Phe Ser Ala Ala
            340                 345                 350

Leu Leu His Leu Ala Lys Arg Arg Gly Val His Asn Val Asn Glu Val
        355                 360                 365

Glu Glu Asp Thr Gly Asn Glu Leu Ser Thr Lys Glu Gln Ile Ser Arg
    370                 375                 380

Asn Ser Lys Ala Leu Glu Glu Lys Tyr Val Ala Glu Leu Gln Leu Glu
385                 390                 395                 400

Arg Leu Lys Lys Asp Gly Glu Val Arg Gly Ser Ile Asn Arg Phe Lys
                405                 410                 415

Thr Ser Asp Tyr Val Lys Glu Ala Lys Gln Leu Leu Lys Val Gln Lys
            420                 425                 430

Ala Tyr His Gln Leu Asp Gln Ser Phe Ile Asp Thr Tyr Ile Asp Leu
        435                 440                 445
```

```
Leu Glu Thr Arg Arg Thr Tyr Tyr Glu Gly Pro Gly Glu Gly Ser Pro
    450                 455                 460

Phe Gly Trp Lys Asp Ile Lys Glu Trp Tyr Glu Met Leu Met Gly His
465                 470                 475                 480

Cys Thr Tyr Phe Pro Glu Glu Leu Arg Ser Val Lys Tyr Ala Tyr Asn
                485                 490                 495

Ala Asp Leu Tyr Asn Ala Leu Asn Asp Leu Asn Asn Leu Val Ile Thr
            500                 505                 510

Arg Asp Glu Asn Glu Lys Leu Glu Tyr Tyr Glu Lys Phe Gln Ile Ile
        515                 520                 525

Glu Asn Val Phe Lys Gln Lys Lys Lys Pro Thr Leu Lys Gln Ile Ala
    530                 535                 540

Lys Glu Ile Leu Val Asn Glu Glu Asp Ile Lys Gly Tyr Arg Val Thr
545                 550                 555                 560

Ser Thr Gly Lys Pro Glu Phe Thr Asn Leu Lys Val Tyr His Asp Ile
                565                 570                 575

Lys Asp Ile Thr Ala Arg Lys Glu Ile Ile Glu Asn Ala Glu Leu Leu
            580                 585                 590

Asp Gln Ile Ala Lys Ile Leu Thr Ile Tyr Gln Ser Ser Glu Asp Ile
        595                 600                 605

Gln Glu Glu Leu Thr Asn Leu Asn Ser Glu Leu Thr Gln Glu Glu Ile
    610                 615                 620

Glu Gln Ile Ser Asn Leu Lys Gly Tyr Thr Gly Thr His Asn Leu Ser
625                 630                 635                 640

Leu Lys Ala Ile Asn Leu Ile Leu Asp Glu Leu Trp His Thr Asn Asp
                645                 650                 655
```

```
Asn Gln Ile Ala Ile Phe Asn Arg Leu Lys Leu Val Pro Lys Lys Val
            660                 665                 670

Asp Leu Ser Gln Gln Lys Glu Ile Pro Thr Thr Leu Val Asp Asp Phe
        675                 680                 685

Ile Leu Ser Pro Val Val Lys Arg Ser Phe Ile Gln Ser Ile Lys Val
    690                 695                 700

Ile Asn Ala Ile Ile Lys Lys Tyr Gly Leu Pro Asn Asp Ile Ile Ile
705                 710                 715                 720

Glu Leu Ala Arg Glu Lys Asn Ser Lys Asp Ala Gln Lys Met Ile Asn
                725                 730                 735

Glu Met Gln Lys Arg Asn Arg Gln Thr Asn Glu Arg Ile Glu Glu Ile
            740                 745                 750

Ile Arg Thr Thr Gly Lys Glu Asn Ala Lys Tyr Leu Ile Glu Lys Ile
        755                 760                 765

Lys Leu His Asp Met Gln Glu Gly Lys Cys Leu Tyr Ser Leu Glu Ala
    770                 775                 780

Ile Pro Leu Glu Asp Leu Leu Asn Asn Pro Phe Asn Tyr Glu Val Asp
785                 790                 795                 800

His Ile Ile Pro Arg Ser Val Ser Phe Asp Asn Ser Phe Asn Asn Lys
                805                 810                 815

Val Leu Val Lys Gln Glu Glu Ala Ser Lys Lys Gly Asn Arg Thr Pro
            820                 825                 830

Phe Gln Tyr Leu Ser Ser Ser Asp Ser Lys Ile Ser Tyr Glu Thr Phe
        835                 840                 845

Lys Lys His Ile Leu Asn Leu Ala Lys Gly Lys Gly Arg Ile Ser Lys
    850                 855                 860
```

```
Thr Lys Lys Glu Tyr Leu Leu Glu Glu Arg Asp Ile Asn Arg Phe Ser
865                 870                 875                 880


Val Gln Lys Asp Phe Ile Asn Arg Asn Leu Val Asp Thr Arg Tyr Ala
                885                 890                 895


Thr Arg Gly Leu Met Asn Leu Leu Arg Ser Tyr Phe Arg Val Asn Asn
            900                 905                 910


Leu Asp Val Lys Val Lys Ser Ile Asn Gly Gly Phe Thr Ser Phe Leu
        915                 920                 925


Arg Arg Lys Trp Lys Phe Lys Lys Glu Arg Asn Lys Gly Tyr Lys His
    930                 935                 940


His Ala Glu Asp Ala Leu Ile Ile Ala Asn Ala Asp Phe Ile Phe Lys
945                 950                 955                 960


Glu Trp Lys Lys Leu Asp Lys Ala Lys Lys Val Met Glu Asn Gln Met
                965                 970                 975


Phe Glu Glu Lys Gln Ala Glu Ser Met Pro Glu Ile Glu Thr Glu Gln
            980                 985                 990


Glu Tyr Lys Glu Ile Phe Ile Thr  Pro His Gln Ile Lys  His Ile Lys
        995                 1000                1005


Asp Phe  Lys Asp Tyr Lys Tyr  Ser His Arg Val Asp  Lys Lys Pro
    1010                1015                1020


Asn Arg  Glu Leu Ile Asn Asp  Thr Leu Tyr Ser Thr  Arg Lys Asp
    1025                1030                1035


Asp Lys  Gly Asn Thr Leu Ile  Val Asn Asn Leu Asn  Gly Leu Tyr
    1040                1045                1050


Asp Lys  Asp Asn Asp Lys Leu  Lys Lys Leu Ile Asn  Lys Ser Pro
    1055                1060                1065
```

```
Glu Lys  Leu Leu Met Tyr His  His Asp Pro Gln Thr  Tyr Gln Lys
    1070                1075                1080

Leu Lys  Leu Ile Met Glu Gln  Tyr Gly Asp Glu Lys  Asn Pro Leu
    1085                1090                1095

Tyr Lys  Tyr Tyr Glu Glu Thr  Gly Asn Tyr Leu Thr  Lys Tyr Ser
    1100                1105                1110

Lys Lys  Asp Asn Gly Pro Val  Ile Lys Lys Ile Lys  Tyr Tyr Gly
    1115                1120                1125

Asn Lys  Leu Asn Ala His Leu  Asp Ile Thr Asp Asp  Tyr Pro Asn
    1130                1135                1140

Ser Arg  Asn Lys Val Val Lys  Leu Ser Leu Lys Pro  Tyr Arg Phe
    1145                1150                1155

Asp Val  Tyr Leu Asp Asn Gly  Val Tyr Lys Phe Val  Thr Val Lys
    1160                1165                1170

Asn Leu  Asp Val Ile Lys Lys  Glu Asn Tyr Tyr Glu  Val Asn Ser
    1175                1180                1185

Lys Cys  Tyr Glu Glu Ala Lys  Lys Leu Lys Lys Ile  Ser Asn Gln
    1190                1195                1200

Ala Glu  Phe Ile Ala Ser Phe  Tyr Asn Asn Asp Leu  Ile Lys Ile
    1205                1210                1215

Asn Gly  Glu Leu Tyr Arg Val  Ile Gly Val Asn Asn  Asp Leu Leu
    1220                1225                1230

Asn Arg  Ile Glu Val Asn Met  Ile Asp Ile Thr Tyr  Arg Glu Tyr
    1235                1240                1245

Leu Glu  Asn Met Asn Asp Lys  Arg Pro Pro Arg Ile  Ile Lys Thr
    1250                1255                1260
```

```
Ile Ala  Ser Lys Thr Gln Ser  Ile Lys Lys Tyr Ser  Thr Asp Ile
    1265                1270                1275


Leu Gly  Asn Leu Tyr Glu Val  Lys Ser Lys Lys His  Pro Gln Ile
    1280                1285                1290


Ile Lys  Lys Gly Ser Gly Gly  Ser Thr Asn Leu Ser  Asp Ile Ile
    1295                1300                1305


Glu Lys  Glu Thr Gly Lys Gln  Leu Val Ile Gln Glu  Ser Ile Leu
    1310                1315                1320


Met Leu  Pro Glu Glu Val Glu  Glu Val Ile Gly Asn  Lys Pro Glu
    1325                1330                1335


Ser Asp  Ile Leu Val His Thr  Ala Tyr Asp Glu Ser  Thr Asp Glu
    1340                1345                1350


Asn Val  Met Leu Leu Thr Ser  Asp Ala Pro Glu Tyr  Lys Pro Trp
    1355                1360                1365


Ala Leu  Val Ile Gln Asp Ser  Asn Gly Glu Asn Lys  Ile Lys Met
    1370                1375                1380


Leu Ser  Gly Gly Ser Pro Lys  Lys Lys Arg Lys Val
    1385                1390                1395


<210>  400
<211>  1395
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  400

Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1               5                  10                  15


Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
```

20 25 30

Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
35 40 45

Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
50 55 60

Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65 70 75 80

Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
85 90 95

Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
100 105 110

Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
115 120 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
130 135 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145 150 155 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
165 170 175

Leu Tyr Val Leu Glu Leu Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys
180 185 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
195 200 205

Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
210 215 220

Ala Thr Gly Leu Lys Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser

225 230 235 240

Ala Thr Pro Glu Ser Lys Arg Asn Tyr Ile Leu Gly Leu Asp Ile Gly
245 250 255

Ile Thr Ser Val Gly Tyr Gly Ile Ile Asp Tyr Glu Thr Arg Asp Val
260 265 270

Ile Asp Ala Gly Val Arg Leu Phe Lys Glu Ala Asn Val Glu Asn Asn
275 280 285

Glu Gly Arg Arg Ser Lys Arg Gly Ala Arg Arg Leu Lys Arg Arg Arg
290 295 300

Arg His Arg Ile Gln Arg Val Lys Lys Leu Leu Phe Asp Tyr Asn Leu
305 310 315 320

Leu Thr Asp His Ser Glu Leu Ser Gly Ile Asn Pro Tyr Glu Ala Arg
325 330 335

Val Lys Gly Leu Ser Gln Lys Leu Ser Glu Glu Glu Phe Ser Ala Ala
340 345 350

Leu Leu His Leu Ala Lys Arg Arg Gly Val His Asn Val Asn Glu Val
355 360 365

Glu Glu Asp Thr Gly Asn Glu Leu Ser Thr Lys Glu Gln Ile Ser Arg
370 375 380

Asn Ser Lys Ala Leu Glu Glu Lys Tyr Val Ala Glu Leu Gln Leu Glu
385 390 395 400

Arg Leu Lys Lys Asp Gly Glu Val Arg Gly Ser Ile Asn Arg Phe Lys
405 410 415

Thr Ser Asp Tyr Val Lys Glu Ala Lys Gln Leu Leu Lys Val Gln Lys
420 425 430

Ala Tyr His Gln Leu Asp Gln Ser Phe Ile Asp Thr Tyr Ile Asp Leu

435 440 445

Leu Glu Thr Arg Arg Thr Tyr Tyr Glu Gly Pro Gly Glu Gly Ser Pro
450 455 460

Phe Gly Trp Lys Asp Ile Lys Glu Trp Tyr Glu Met Leu Met Gly His
465 470 475 480

Cys Thr Tyr Phe Pro Glu Glu Leu Arg Ser Val Lys Tyr Ala Tyr Asn
485 490 495

Ala Asp Leu Tyr Asn Ala Leu Asn Asp Leu Asn Asn Leu Val Ile Thr
500 505 510

Arg Asp Glu Asn Glu Lys Leu Glu Tyr Tyr Glu Lys Phe Gln Ile Ile
515 520 525

Glu Asn Val Phe Lys Gln Lys Lys Lys Pro Thr Leu Lys Gln Ile Ala
530 535 540

Lys Glu Ile Leu Val Asn Glu Glu Asp Ile Lys Gly Tyr Arg Val Thr
545 550 555 560

Ser Thr Gly Lys Pro Glu Phe Thr Asn Leu Lys Val Tyr His Asp Ile
565 570 575

Lys Asp Ile Thr Ala Arg Lys Glu Ile Ile Glu Asn Ala Glu Leu Leu
580 585 590

Asp Gln Ile Ala Lys Ile Leu Thr Ile Tyr Gln Ser Ser Glu Asp Ile
595 600 605

Gln Glu Glu Leu Thr Asn Leu Asn Ser Glu Leu Thr Gln Glu Glu Ile
610 615 620

Glu Gln Ile Ser Asn Leu Lys Gly Tyr Thr Gly Thr His Asn Leu Ser
625 630 635 640

Leu Lys Ala Ile Asn Leu Ile Leu Asp Glu Leu Trp His Thr Asn Asp

645 650 655

Asn Gln Ile Ala Ile Phe Asn Arg Leu Lys Leu Val Pro Lys Lys Val
660 665 670

Asp Leu Ser Gln Gln Lys Glu Ile Pro Thr Thr Leu Val Asp Asp Phe
675 680 685

Ile Leu Ser Pro Val Val Lys Arg Ser Phe Ile Gln Ser Ile Lys Val
690 695 700

Ile Asn Ala Ile Ile Lys Lys Tyr Gly Leu Pro Asn Asp Ile Ile Ile
705 710 715 720

Glu Leu Ala Arg Glu Lys Asn Ser Lys Asp Ala Gln Lys Met Ile Asn
725 730 735

Glu Met Gln Lys Arg Asn Arg Gln Thr Asn Glu Arg Ile Glu Glu Ile
740 745 750

Ile Arg Thr Thr Gly Lys Glu Asn Ala Lys Tyr Leu Ile Glu Lys Ile
755 760 765

Lys Leu His Asp Met Gln Glu Gly Lys Cys Leu Tyr Ser Leu Glu Ala
770 775 780

Ile Pro Leu Glu Asp Leu Leu Asn Asn Pro Phe Asn Tyr Glu Val Asp
785 790 795 800

His Ile Ile Pro Arg Ser Val Ser Phe Asp Asn Ser Phe Asn Asn Lys
805 810 815

Val Leu Val Lys Gln Glu Glu Ala Ser Lys Lys Gly Asn Arg Thr Pro
820 825 830

Phe Gln Tyr Leu Ser Ser Ser Asp Ser Lys Ile Ser Tyr Glu Thr Phe
835 840 845

Lys Lys His Ile Leu Asn Leu Ala Lys Gly Lys Gly Arg Ile Ser Lys

```
    850                 855                 860

Thr Lys Lys Glu Tyr Leu Leu Glu Glu Arg Asp Ile Asn Arg Phe Ser
865                 870                 875                 880

Val Gln Lys Asp Phe Ile Asn Arg Asn Leu Val Asp Thr Arg Tyr Ala
                885                 890                 895

Thr Arg Gly Leu Met Asn Leu Leu Arg Ser Tyr Phe Arg Val Asn Asn
            900                 905                 910

Leu Asp Val Lys Val Lys Ser Ile Asn Gly Gly Phe Thr Ser Phe Leu
        915                 920                 925

Arg Arg Lys Trp Lys Phe Lys Lys Glu Arg Asn Lys Gly Tyr Lys His
    930                 935                 940

His Ala Glu Asp Ala Leu Ile Ile Ala Asn Ala Asp Phe Ile Phe Lys
945                 950                 955                 960

Glu Trp Lys Lys Leu Asp Lys Ala Lys Lys Val Met Glu Asn Gln Met
                965                 970                 975

Phe Glu Glu Lys Gln Ala Glu Ser Met Pro Glu Ile Glu Thr Glu Gln
            980                 985                 990

Glu Tyr Lys Glu Ile Phe Ile Thr  Pro His Gln Ile Lys  His Ile Lys
        995                 1000                1005

Asp Phe  Lys Asp Tyr Lys Tyr  Ser His Arg Val Asp  Lys Lys Pro
    1010                1015                1020

Asn Arg  Lys Leu Ile Asn Asp  Thr Leu Tyr Ser Thr  Arg Lys Asp
    1025                1030                1035

Asp Lys  Gly Asn Thr Leu Ile  Val Asn Asn Leu Asn  Gly Leu Tyr
    1040                1045                1050

Asp Lys  Asp Asn Asp Lys Leu  Lys Lys Leu Ile Asn  Lys Ser Pro
```

1055 1060 1065

Glu Lys Leu Leu Met Tyr His His Asp Pro Gln Thr Tyr Gln Lys
1070 1075 1080

Leu Lys Leu Ile Met Glu Gln Tyr Gly Asp Glu Lys Asn Pro Leu
1085 1090 1095

Tyr Lys Tyr Tyr Glu Glu Thr Gly Asn Tyr Leu Thr Lys Tyr Ser
1100 1105 1110

Lys Lys Asp Asn Gly Pro Val Ile Lys Lys Ile Lys Tyr Tyr Gly
1115 1120 1125

Asn Lys Leu Asn Ala His Leu Asp Ile Thr Asp Asp Tyr Pro Asn
1130 1135 1140

Ser Arg Asn Lys Val Val Lys Leu Ser Leu Lys Pro Tyr Arg Phe
1145 1150 1155

Asp Val Tyr Leu Asp Asn Gly Val Tyr Lys Phe Val Thr Val Lys
1160 1165 1170

Asn Leu Asp Val Ile Lys Lys Glu Asn Tyr Tyr Glu Val Asn Ser
1175 1180 1185

Lys Cys Tyr Glu Glu Ala Lys Lys Leu Lys Lys Ile Ser Asn Gln
1190 1195 1200

Ala Glu Phe Ile Ala Ser Phe Tyr Lys Asn Asp Leu Ile Lys Ile
1205 1210 1215

Asn Gly Glu Leu Tyr Arg Val Ile Gly Val Asn Asn Asp Leu Leu
1220 1225 1230

Asn Arg Ile Glu Val Asn Met Ile Asp Ile Thr Tyr Arg Glu Tyr
1235 1240 1245

Leu Glu Asn Met Asn Asp Lys Arg Pro Pro His Ile Ile Lys Thr

1250 1255 1260

Ile Ala Ser Lys Thr Gln Ser Ile Lys Lys Tyr Ser Thr Asp Ile
1265 1270 1275

Leu Gly Asn Leu Tyr Glu Val Lys Ser Lys Lys His Pro Gln Ile
1280 1285 1290

Ile Lys Lys Gly Ser Gly Gly Ser Thr Asn Leu Ser Asp Ile Ile
1295 1300 1305

Glu Lys Glu Thr Gly Lys Gln Leu Val Ile Gln Glu Ser Ile Leu
1310 1315 1320

Met Leu Pro Glu Glu Val Glu Glu Val Ile Gly Asn Lys Pro Glu
1325 1330 1335

Ser Asp Ile Leu Val His Thr Ala Tyr Asp Glu Ser Thr Asp Glu
1340 1345 1350

Asn Val Met Leu Leu Thr Ser Asp Ala Pro Glu Tyr Lys Pro Trp
1355 1360 1365

Ala Leu Val Ile Gln Asp Ser Asn Gly Glu Asn Lys Ile Lys Met
1370 1375 1380

Leu Ser Gly Gly Ser Pro Lys Lys Lys Arg Lys Val
1385 1390 1395

<210> 401
<211> 1810
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 401

Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1 5 10 15

```
Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
            20                  25                  30

Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
        35                  40                  45

Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
    50                  55                  60

Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65                  70                  75                  80

Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
                85                  90                  95

Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
            100                 105                 110

Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
        115                 120                 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
    130                 135                 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145                 150                 155                 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
                165                 170                 175

Leu Tyr Val Leu Glu Leu Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys
            180                 185                 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
        195                 200                 205

Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
    210                 215                 220
```

```
Ala Thr Gly Leu Lys Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
225                 230                 235                 240

Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
                245                 250                 255

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
            260                 265                 270

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
        275                 280                 285

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
    290                 295                 300

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
305                 310                 315                 320

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
                325                 330                 335

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
            340                 345                 350

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
        355                 360                 365

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
    370                 375                 380

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
385                 390                 395                 400

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
                405                 410                 415

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
            420                 425                 430
```

```
Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
        435                 440                 445

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
    450                 455                 460

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
465                 470                 475                 480

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
                485                 490                 495

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
            500                 505                 510

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
        515                 520                 525

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
    530                 535                 540

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
545                 550                 555                 560

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
                565                 570                 575

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
            580                 585                 590

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
        595                 600                 605

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
    610                 615                 620

Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
625                 630                 635                 640
```

```
Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
                645                 650                 655

Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
            660                 665                 670

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
        675                 680                 685

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
    690                 695                 700

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
705                 710                 715                 720

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
                725                 730                 735

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
            740                 745                 750

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
        755                 760                 765

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
    770                 775                 780

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
785                 790                 795                 800

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
                805                 810                 815

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
            820                 825                 830

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
        835                 840                 845
```

```
Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
    850                 855                 860

Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
865                 870                 875                 880

Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
                885                 890                 895

Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn
            900                 905                 910

Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
        915                 920                 925

Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp
    930                 935                 940

Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln
945                 950                 955                 960

Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala
                965                 970                 975

Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val
            980                 985                 990

Lys Val Met Gly Arg His Lys Pro  Glu Asn Ile Val Ile  Glu Met Ala
        995                 1000                1005

Arg Glu  Asn Gln Thr Thr Gln  Lys Gly Gln Lys Asn  Ser Arg Glu
    1010                1015                1020

Arg Met  Lys Arg Ile Glu Glu  Gly Ile Lys Glu Leu  Gly Ser Gln
    1025                1030                1035

Ile Leu  Lys Glu His Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu
    1040                1045                1050
```

```
Lys Leu  Tyr Leu Tyr Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val
    1055                1060                1065

Asp Gln  Glu Leu Asp Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp
    1070                1075                1080

His Ile  Val Pro Gln Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn
    1085                1090                1095

Lys Val  Leu Thr Arg Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn
    1100                1105                1110

Val Pro  Ser Glu Glu Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg
    1115                1120                1125

Gln Leu  Leu Asn Ala Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn
    1130                1135                1140

Leu Thr  Lys Ala Glu Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala
    1145                1150                1155

Gly Phe  Ile Lys Arg Gln Leu  Val Glu Thr Arg Gln  Ile Thr Lys
    1160                1165                1170

His Val  Ala Gln Ile Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp
    1175                1180                1185

Glu Asn  Asp Lys Leu Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys
    1190                1195                1200

Ser Lys  Leu Val Ser Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys
    1205                1210                1215

Val Arg  Glu Ile Asn Asn Tyr  His His Ala His Asp  Ala Tyr Leu
    1220                1225                1230

Asn Ala  Val Val Gly Thr Ala  Leu Ile Lys Lys Tyr  Pro Lys Leu
    1235                1240                1245
```

```
Glu Ser  Glu Phe Val Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg
    1250                1255                1260

Lys Met  Ile Ala Lys Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala
    1265                1270                1275

Lys Tyr  Phe Phe Tyr Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu
    1280                1285                1290

Ile Thr  Leu Ala Asn Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu
    1295                1300                1305

Thr Asn  Gly Glu Thr Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp
    1310                1315                1320

Phe Ala  Thr Val Arg Lys Val  Leu Ser Met Pro Gln  Val Asn Ile
    1325                1330                1335

Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1340                1345                1350

Ile Leu  Pro Lys Arg Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys
    1355                1360                1365

Asp Trp  Asp Pro Lys Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val
    1370                1375                1380

Ala Tyr  Ser Val Leu Val Val  Ala Lys Val Glu Lys  Gly Lys Ser
    1385                1390                1395

Lys Lys  Leu Lys Ser Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met
    1400                1405                1410

Glu Arg  Ser Ser Phe Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala
    1415                1420                1425

Lys Gly  Tyr Lys Glu Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro
    1430                1435                1440
```

```
Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu
    1445                1450                1455

Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro
    1460                1465                1470

Ser Lys  Tyr Val Asn Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys
    1475                1480                1485

Leu Lys  Gly Ser Pro Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val
    1490                1495                1500

Glu Gln  His Lys His Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser
    1505                1510                1515

Glu Phe  Ser Lys Arg Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys
    1520                1525                1530

Val Leu  Ser Ala Tyr Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu
    1535                1540                1545

Gln Ala  Glu Asn Ile Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly
    1550                1555                1560

Ala Pro  Ala Ala Phe Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys
    1565                1570                1575

Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asp Ala Thr  Leu Ile His
    1580                1585                1590

Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln
    1595                1600                1605

Leu Gly  Gly Asp Ser Gly Gly  Ser Gly Gly Ser Gly  Gly Ser Ala
    1610                1615                1620

Ser Arg  Gly Val Asn Lys Val  Ile Leu Val Gly Asn  Leu Gly Gln
    1625                1630                1635
```

```
Asp Pro  Glu Val Arg Tyr Met  Pro Asn Gly Gly Ala  Val Ala Asn
    1640                1645                1650

Ile Thr  Leu Ala Thr Ser Glu  Ser Trp Arg Asp Lys  Ala Thr Gly
    1655                1660                1665

Glu Met  Lys Glu Gln Thr Glu  Trp His Arg Val Val  Leu Phe Gly
    1670                1675                1680

Lys Leu  Ala Glu Val Ala Ser  Glu Tyr Leu Arg Lys  Gly Ser Gln
    1685                1690                1695

Val Tyr  Ile Glu Gly Gln Leu  Arg Thr Arg Lys Trp  Thr Asp Gln
    1700                1705                1710

Ser Gly  Gln Asp Arg Tyr Thr  Thr Glu Val Val Val  Asn Val Gly
    1715                1720                1725

Gly Thr  Met Gln Met Leu Gly  Gly Arg Gln Gly Gly  Gly Ala Pro
    1730                1735                1740

Ala Gly  Gly Asn Ile Gly Gly  Gly Gln Pro Gln Gly  Gly Trp Gly
    1745                1750                1755

Gln Pro  Gln Gln Pro Gln Gly  Gly Asn Gln Phe Ser  Gly Gly Ala
    1760                1765                1770

Gln Ser  Arg Pro Gln Gln Ser  Ala Pro Ala Ala Pro  Ser Asn Glu
    1775                1780                1785

Pro Pro  Met Asp Phe Asp Asp  Asp Ile Pro Phe Ser  Gly Gly Ser
    1790                1795                1800

Pro Lys  Lys Lys Arg Lys Val
    1805                1810
```

<210> 402
<211> 1716
<212> PRT

<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 402

Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1 5 10 15

Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
20 25 30

Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
35 40 45

Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
50 55 60

Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65 70 75 80

Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
85 90 95

Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
100 105 110

Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
115 120 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
130 135 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145 150 155 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
165 170 175

Leu Tyr Val Leu Glu Leu Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys

180 185 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
195 200 205

Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
210 215 220

Ala Thr Gly Leu Lys Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
225 230 235 240

Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
245 250 255

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
260 265 270

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
275 280 285

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
290 295 300

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
305 310 315 320

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
325 330 335

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
340 345 350

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
355 360 365

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
370 375 380

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu

385 390 395 400

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
405 410 415

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
420 425 430

Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
435 440 445

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
450 455 460

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
465 470 475 480

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
485 490 495

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
500 505 510

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
515 520 525

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
530 535 540

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
545 550 555 560

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
565 570 575

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
580 585 590

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp

595 600 605

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
610 615 620

Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
625 630 635 640

Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
645 650 655

Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
660 665 670

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
675 680 685

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
690 695 700

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
705 710 715 720

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
725 730 735

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
740 745 750

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
755 760 765

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
770 775 780

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
785 790 795 800

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile

```
                805                 810                 815

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
            820                 825                 830

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
        835                 840                 845

Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
    850                 855                 860

Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
865                 870                 875                 880

Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
                885                 890                 895

Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn
            900                 905                 910

Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
        915                 920                 925

Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp
    930                 935                 940

Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln
945                 950                 955                 960

Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala
                965                 970                 975

Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val
            980                 985                 990

Lys Val Met Gly Arg His Lys Pro  Glu Asn Ile Val Ile  Glu Met Ala
        995                 1000                1005

Arg Glu  Asn Gln Thr Thr Gln  Lys Gly Gln Lys Asn  Ser Arg Glu
```

```
    1010                1015                1020

Arg Met  Lys Arg Ile Glu Glu  Gly Ile Lys Glu Leu  Gly Ser Gln
    1025                1030                1035

Ile Leu  Lys Glu His Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu
    1040                1045                1050

Lys Leu  Tyr Leu Tyr Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val
    1055                1060                1065

Asp Gln  Glu Leu Asp Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp
    1070                1075                1080

His Ile  Val Pro Gln Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn
    1085                1090                1095

Lys Val  Leu Thr Arg Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn
    1100                1105                1110

Val Pro  Ser Glu Glu Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg
    1115                1120                1125

Gln Leu  Leu Asn Ala Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn
    1130                1135                1140

Leu Thr  Lys Ala Glu Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala
    1145                1150                1155

Gly Phe  Ile Lys Arg Gln Leu  Val Glu Thr Arg Gln  Ile Thr Lys
    1160                1165                1170

His Val  Ala Gln Ile Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp
    1175                1180                1185

Glu Asn  Asp Lys Leu Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys
    1190                1195                1200

Ser Lys  Leu Val Ser Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys
```

1205 1210 1215

Val Arg Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr Leu
1220 1225 1230

Asn Ala Val Val Gly Thr Ala Leu Ile Lys Lys Tyr Pro Lys Leu
1235 1240 1245

Glu Ser Glu Phe Val Tyr Gly Asp Tyr Lys Val Tyr Asp Val Arg
1250 1255 1260

Lys Met Ile Ala Lys Ser Glu Gln Glu Ile Gly Lys Ala Thr Ala
1265 1270 1275

Lys Tyr Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe Lys Thr Glu
1280 1285 1290

Ile Thr Leu Ala Asn Gly Glu Ile Arg Lys Arg Pro Leu Ile Glu
1295 1300 1305

Thr Asn Gly Glu Thr Gly Glu Ile Val Trp Asp Lys Gly Arg Asp
1310 1315 1320

Phe Ala Thr Val Arg Lys Val Leu Ser Met Pro Gln Val Asn Ile
1325 1330 1335

Val Lys Lys Thr Glu Val Gln Thr Gly Gly Phe Ser Lys Glu Ser
1340 1345 1350

Ile Leu Pro Lys Arg Asn Ser Asp Lys Leu Ile Ala Arg Lys Lys
1355 1360 1365

Asp Trp Asp Pro Lys Lys Tyr Gly Gly Phe Asp Ser Pro Thr Val
1370 1375 1380

Ala Tyr Ser Val Leu Val Val Ala Lys Val Glu Lys Gly Lys Ser
1385 1390 1395

Lys Lys Leu Lys Ser Val Lys Glu Leu Leu Gly Ile Thr Ile Met

1400 1405 1410

Glu Arg Ser Ser Phe Glu Lys Asn Pro Ile Asp Phe Leu Glu Ala
1415 1420 1425

Lys Gly Tyr Lys Glu Val Lys Lys Asp Leu Ile Ile Lys Leu Pro
1430 1435 1440

Lys Tyr Ser Leu Phe Glu Leu Glu Asn Gly Arg Lys Arg Met Leu
1445 1450 1455

Ala Ser Ala Gly Glu Leu Gln Lys Gly Asn Glu Leu Ala Leu Pro
1460 1465 1470

Ser Lys Tyr Val Asn Phe Leu Tyr Leu Ala Ser His Tyr Glu Lys
1475 1480 1485

Leu Lys Gly Ser Pro Glu Asp Asn Glu Gln Lys Gln Leu Phe Val
1490 1495 1500

Glu Gln His Lys His Tyr Leu Asp Glu Ile Ile Glu Gln Ile Ser
1505 1510 1515

Glu Phe Ser Lys Arg Val Ile Leu Ala Asp Ala Asn Leu Asp Lys
1520 1525 1530

Val Leu Ser Ala Tyr Asn Lys His Arg Asp Lys Pro Ile Arg Glu
1535 1540 1545

Gln Ala Glu Asn Ile Ile His Leu Phe Thr Leu Thr Asn Leu Gly
1550 1555 1560

Ala Pro Ala Ala Phe Lys Tyr Phe Asp Thr Thr Ile Asp Arg Lys
1565 1570 1575

Arg Tyr Thr Ser Thr Lys Glu Val Leu Asp Ala Thr Leu Ile His
1580 1585 1590

Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ser Gln

1595 1600 1605

Leu Gly Gly Asp Ser Gly Gly Ser Gly Gly Ser Gly Gly Ser Thr
1610 1615 1620

Asn Leu Ser Asp Ile Ile Glu Lys Glu Thr Gly Lys Gln Leu Val
1625 1630 1635

Ile Gln Glu Ser Ile Leu Met Leu Pro Glu Glu Val Glu Glu Val
1640 1645 1650

Ile Gly Asn Lys Pro Glu Ser Asp Ile Leu Val His Thr Ala Tyr
1655 1660 1665

Asp Glu Ser Thr Asp Glu Asn Val Met Leu Leu Thr Ser Asp Ala
1670 1675 1680

Pro Glu Tyr Lys Pro Trp Ala Leu Val Ile Gln Asp Ser Asn Gly
1685 1690 1695

Glu Asn Lys Ile Lys Met Leu Ser Gly Gly Ser Pro Lys Lys Lys
1700 1705 1710

Arg Lys Val
1715

<210> 403
<211> 1722
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 403

Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1 5 10 15

Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
20 25 30

```
Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
        35                  40                  45

Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
    50                  55                  60

Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65                  70                  75                  80

Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
                85                  90                  95

Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
            100                 105                 110

Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
        115                 120                 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
    130                 135                 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145                 150                 155                 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
                165                 170                 175

Leu Tyr Val Leu Glu Leu Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys
            180                 185                 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
        195                 200                 205

Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
    210                 215                 220

Ala Thr Gly Leu Lys Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
225                 230                 235                 240
```

```
Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
                245                 250                 255

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
            260                 265                 270

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
        275                 280                 285

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
    290                 295                 300

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
305                 310                 315                 320

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
                325                 330                 335

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
            340                 345                 350

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
        355                 360                 365

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
    370                 375                 380

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
385                 390                 395                 400

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
                405                 410                 415

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
            420                 425                 430

Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
        435                 440                 445
```

```
Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
    450                 455                 460

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
465                 470                 475                 480

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
                485                 490                 495

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
            500                 505                 510

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
        515                 520                 525

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
    530                 535                 540

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
545                 550                 555                 560

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
                565                 570                 575

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
            580                 585                 590

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
        595                 600                 605

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
    610                 615                 620

Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
625                 630                 635                 640

Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
                645                 650                 655
```

```
Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
            660                 665                 670

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
        675                 680                 685

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
    690                 695                 700

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
705                 710                 715                 720

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
                725                 730                 735

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
            740                 745                 750

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
        755                 760                 765

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
    770                 775                 780

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
785                 790                 795                 800

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
                805                 810                 815

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
            820                 825                 830

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
        835                 840                 845

Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
    850                 855                 860
```

```
Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
865                 870                 875                 880


Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
                885                 890                 895


Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn
            900                 905                 910


Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
        915                 920                 925


Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp
    930                 935                 940


Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln
945                 950                 955                 960


Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala
                965                 970                 975


Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val
            980                 985                 990


Lys Val Met Gly Arg His Lys Pro  Glu Asn Ile Val Ile  Glu Met Ala
        995                 1000                1005


Arg Glu  Asn Gln Thr Thr Gln  Lys Gly Gln Lys Asn  Ser Arg Glu
    1010                1015                1020


Arg Met  Lys Arg Ile Glu Glu  Gly Ile Lys Glu Leu  Gly Ser Gln
    1025                1030                1035


Ile Leu  Lys Glu His Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu
    1040                1045                1050


Lys Leu  Tyr Leu Tyr Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val
    1055                1060                1065
```

```
Asp Gln  Glu Leu Asp Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp
    1070                1075                1080

His Ile  Val Pro Gln Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn
    1085                1090                1095

Lys Val  Leu Thr Arg Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn
    1100                1105                1110

Val Pro  Ser Glu Glu Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg
    1115                1120                1125

Gln Leu  Leu Asn Ala Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn
    1130                1135                1140

Leu Thr  Lys Ala Glu Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala
    1145                1150                1155

Gly Phe  Ile Lys Arg Gln Leu  Val Glu Thr Arg Gln  Ile Thr Lys
    1160                1165                1170

His Val  Ala Gln Ile Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp
    1175                1180                1185

Glu Asn  Asp Lys Leu Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys
    1190                1195                1200

Ser Lys  Leu Val Ser Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys
    1205                1210                1215

Val Arg  Glu Ile Asn Asn Tyr  His His Ala His Asp  Ala Tyr Leu
    1220                1225                1230

Asn Ala  Val Val Gly Thr Ala  Leu Ile Lys Lys Tyr  Pro Lys Leu
    1235                1240                1245

Glu Ser  Glu Phe Val Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg
    1250                1255                1260
```

```
Lys Met  Ile Ala Lys Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala
    1265                1270                1275

Lys Tyr  Phe Phe Tyr Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu
    1280                1285                1290

Ile Thr  Leu Ala Asn Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu
    1295                1300                1305

Thr Asn  Gly Glu Thr Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp
    1310                1315                1320

Phe Ala  Thr Val Arg Lys Val  Leu Ser Met Pro Gln  Val Asn Ile
    1325                1330                1335

Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1340                1345                1350

Ile Leu  Pro Lys Arg Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys
    1355                1360                1365

Asp Trp  Asp Pro Lys Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val
    1370                1375                1380

Ala Tyr  Ser Val Leu Val Val  Ala Lys Val Glu Lys  Gly Lys Ser
    1385                1390                1395

Lys Lys  Leu Lys Ser Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met
    1400                1405                1410

Glu Arg  Ser Ser Phe Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala
    1415                1420                1425

Lys Gly  Tyr Lys Glu Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro
    1430                1435                1440

Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu
    1445                1450                1455
```

```
Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro
    1460                1465                1470

Ser Lys  Tyr Val Asn Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys
    1475                1480                1485

Leu Lys  Gly Ser Pro Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val
    1490                1495                1500

Glu Gln  His Lys His Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser
    1505                1510                1515

Glu Phe  Ser Lys Arg Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys
    1520                1525                1530

Val Leu  Ser Ala Tyr Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu
    1535                1540                1545

Gln Ala  Glu Asn Ile Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly
    1550                1555                1560

Ala Pro  Ala Ala Phe Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys
    1565                1570                1575

Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asp Ala Thr  Leu Ile His
    1580                1585                1590

Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln
    1595                1600                1605

Leu Gly  Gly Asp Ser Gly Ser  Glu Thr Pro Gly Thr  Ser Glu Ser
    1610                1615                1620

Ala Thr  Pro Glu Ser Thr Asn  Leu Ser Asp Ile Ile  Glu Lys Glu
    1625                1630                1635

Thr Gly  Lys Gln Leu Val Ile  Gln Glu Ser Ile Leu  Met Leu Pro
    1640                1645                1650
```

```
Glu Glu  Val Glu Glu Val Ile  Gly Asn Lys Pro Glu  Ser Asp Ile
    1655                1660                1665


Leu Val  His Thr Ala Tyr Asp  Glu Ser Thr Asp Glu  Asn Val Met
    1670                1675                1680


Leu Leu  Thr Ser Asp Ala Pro  Glu Tyr Lys Pro Trp  Ala Leu Val
    1685                1690                1695


Ile Gln  Asp Ser Asn Gly Glu  Asn Lys Ile Lys Met  Leu Ser Gly
    1700                1705                1710


Gly Ser  Pro Lys Lys Lys Arg  Lys Val
    1715                1720


<210>  404
<211>  1726
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  404

Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1               5                   10                  15


Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
            20                  25                  30


Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
        35                  40                  45


Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
    50                  55                  60


Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65                  70                  75                  80


Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
```

```
                85                  90                  95

Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
            100                 105                 110

Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
        115                 120                 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
    130                 135                 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145                 150                 155                 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
                165                 170                 175

Leu Tyr Val Leu Glu Leu Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys
            180                 185                 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
        195                 200                 205

Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
    210                 215                 220

Ala Thr Gly Leu Lys Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Ser
225                 230                 235                 240

Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser Gly Gly
                245                 250                 255

Ser Ser Gly Gly Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
            260                 265                 270

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
        275                 280                 285

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
```

```
    290                 295                 300

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
305                 310                 315                 320

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
                325                 330                 335

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
            340                 345                 350

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
        355                 360                 365

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
    370                 375                 380

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
385                 390                 395                 400

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
                405                 410                 415

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
            420                 425                 430

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
        435                 440                 445

Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
    450                 455                 460

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
465                 470                 475                 480

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
                485                 490                 495

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
```

```
            500                 505                 510

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
        515                 520                 525

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
    530                 535                 540

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
545                 550                 555                 560

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
                565                 570                 575

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
            580                 585                 590

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
        595                 600                 605

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
    610                 615                 620

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
625                 630                 635                 640

Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
                645                 650                 655

Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
            660                 665                 670

Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
        675                 680                 685

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
    690                 695                 700

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
```

```
705                 710                 715                 720

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
                725                 730                 735

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
            740                 745                 750

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
        755                 760                 765

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
    770                 775                 780

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
785                 790                 795                 800

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
                805                 810                 815

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
            820                 825                 830

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
        835                 840                 845

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
    850                 855                 860

Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
865                 870                 875                 880

Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
                885                 890                 895

Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
            900                 905                 910

Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn
```

915 920 925

Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
930 935 940

Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp
945 950 955 960

Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln
965 970 975

Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala
980 985 990

Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val
995 1000 1005

Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu Met
1010 1015 1020

Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
1025 1030 1035

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser
1040 1045 1050

Gln Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn
1055 1060 1065

Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr
1070 1075 1080

Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp Tyr Asp Val
1085 1090 1095

Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp Ser Ile Asp
1100 1105 1110

Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser Asp

1115 1120 1125

Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
1130 1135 1140

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp
1145 1150 1155

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
1160 1165 1170

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
1175 1180 1185

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr
1190 1195 1200

Asp Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu
1205 1210 1215

Lys Ser Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr
1220 1225 1230

Lys Val Arg Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr
1235 1240 1245

Leu Asn Ala Val Val Gly Thr Ala Leu Ile Lys Lys Tyr Pro Lys
1250 1255 1260

Leu Glu Ser Glu Phe Val Tyr Gly Asp Tyr Lys Val Tyr Asp Val
1265 1270 1275

Arg Lys Met Ile Ala Lys Ser Glu Gln Glu Ile Gly Lys Ala Thr
1280 1285 1290

Ala Lys Tyr Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe Lys Thr
1295 1300 1305

Glu Ile Thr Leu Ala Asn Gly Glu Ile Arg Lys Arg Pro Leu Ile

```
    1310                1315                1320

Glu Thr  Asn Gly Glu Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg
    1325                1330                1335

Asp Phe  Ala Thr Val Arg Lys  Val Leu Ser Met Pro  Gln Val Asn
    1340                1345                1350

Ile Val  Lys Lys Thr Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu
    1355                1360                1365

Ser Ile  Leu Pro Lys Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys
    1370                1375                1380

Lys Asp  Trp Asp Pro Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr
    1385                1390                1395

Val Ala  Tyr Ser Val Leu Val  Val Ala Lys Val Glu  Lys Gly Lys
    1400                1405                1410

Ser Lys  Lys Leu Lys Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile
    1415                1420                1425

Met Glu  Arg Ser Ser Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu
    1430                1435                1440

Ala Lys  Gly Tyr Lys Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu
    1445                1450                1455

Pro Lys  Tyr Ser Leu Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met
    1460                1465                1470

Leu Ala  Ser Ala Gly Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu
    1475                1480                1485

Pro Ser  Lys Tyr Val Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu
    1490                1495                1500

Lys Leu  Lys Gly Ser Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe
```

1505 1510 1515

Val Glu Gln His Lys His Tyr Leu Asp Glu Ile Ile Glu Gln Ile
1520 1525 1530

Ser Glu Phe Ser Lys Arg Val Ile Leu Ala Asp Ala Asn Leu Asp
1535 1540 1545

Lys Val Leu Ser Ala Tyr Asn Lys His Arg Asp Lys Pro Ile Arg
1550 1555 1560

Glu Gln Ala Glu Asn Ile Ile His Leu Phe Thr Leu Thr Asn Leu
1565 1570 1575

Gly Ala Pro Ala Ala Phe Lys Tyr Phe Asp Thr Thr Ile Asp Arg
1580 1585 1590

Lys Arg Tyr Thr Ser Thr Lys Glu Val Leu Asp Ala Thr Leu Ile
1595 1600 1605

His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ser
1610 1615 1620

Gln Leu Gly Gly Asp Ser Gly Gly Ser Thr Asn Leu Ser Asp Ile
1625 1630 1635

Ile Glu Lys Glu Thr Gly Lys Gln Leu Val Ile Gln Glu Ser Ile
1640 1645 1650

Leu Met Leu Pro Glu Glu Val Glu Glu Val Ile Gly Asn Lys Pro
1655 1660 1665

Glu Ser Asp Ile Leu Val His Thr Ala Tyr Asp Glu Ser Thr Asp
1670 1675 1680

Glu Asn Val Met Leu Leu Thr Ser Asp Ala Pro Glu Tyr Lys Pro
1685 1690 1695

Trp Ala Leu Val Ile Gln Asp Ser Asn Gly Glu Asn Lys Ile Lys

1700 1705 1710

Met Leu Ser Gly Gly Ser Pro Lys Lys Lys Arg Lys Val
1715 1720 1725

<210> 405
<211> 1797
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 405

Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1 5 10 15

Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
20 25 30

Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
35 40 45

Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
50 55 60

Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65 70 75 80

Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
85 90 95

Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
100 105 110

Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
115 120 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
130 135 140

```
Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145                 150                 155                 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
                165                 170                 175

Leu Tyr Val Leu Glu Leu Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys
            180                 185                 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
        195                 200                 205

Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
    210                 215                 220

Ala Thr Gly Leu Lys Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
225                 230                 235                 240

Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
                245                 250                 255

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
            260                 265                 270

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
        275                 280                 285

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
    290                 295                 300

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
305                 310                 315                 320

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
                325                 330                 335

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
            340                 345                 350
```

```
Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
        355                 360                 365

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
    370                 375                 380

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
385                 390                 395                 400

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
                405                 410                 415

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
            420                 425                 430

Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
        435                 440                 445

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
    450                 455                 460

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
465                 470                 475                 480

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
                485                 490                 495

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
            500                 505                 510

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
        515                 520                 525

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
    530                 535                 540

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
545                 550                 555                 560
```

```
Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
                565                 570                 575

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
            580                 585                 590

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
        595                 600                 605

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
    610                 615                 620

Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
625                 630                 635                 640

Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
                645                 650                 655

Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
            660                 665                 670

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
        675                 680                 685

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
    690                 695                 700

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
705                 710                 715                 720

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
                725                 730                 735

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
            740                 745                 750

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
        755                 760                 765
```

```
Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
    770                 775                 780

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
785                 790                 795                 800

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
                805                 810                 815

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
            820                 825                 830

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
        835                 840                 845

Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
    850                 855                 860

Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
865                 870                 875                 880

Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
                885                 890                 895

Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn
            900                 905                 910

Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
        915                 920                 925

Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp
    930                 935                 940

Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln
945                 950                 955                 960

Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala
                965                 970                 975
```

```
Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val
            980                 985                 990


Lys Val Met Gly Arg His Lys Pro  Glu Asn Ile Val Ile  Glu Met Ala
        995                 1000                1005


Arg Glu  Asn Gln Thr Thr Gln  Lys Gly Gln Lys Asn  Ser Arg Glu
    1010                1015                1020


Arg Met  Lys Arg Ile Glu Glu  Gly Ile Lys Glu Leu  Gly Ser Gln
    1025                1030                1035


Ile Leu  Lys Glu His Pro Val  Glu Asn Thr Gln Leu  Gln Asn Glu
    1040                1045                1050


Lys Leu  Tyr Leu Tyr Tyr Leu  Gln Asn Gly Arg Asp  Met Tyr Val
    1055                1060                1065


Asp Gln  Glu Leu Asp Ile Asn  Arg Leu Ser Asp Tyr  Asp Val Asp
    1070                1075                1080


His Ile  Val Pro Gln Ser Phe  Leu Lys Asp Asp Ser  Ile Asp Asn
    1085                1090                1095


Lys Val  Leu Thr Arg Ser Asp  Lys Asn Arg Gly Lys  Ser Asp Asn
    1100                1105                1110


Val Pro  Ser Glu Glu Val Val  Lys Lys Met Lys Asn  Tyr Trp Arg
    1115                1120                1125


Gln Leu  Leu Asn Ala Lys Leu  Ile Thr Gln Arg Lys  Phe Asp Asn
    1130                1135                1140


Leu Thr  Lys Ala Glu Arg Gly  Gly Leu Ser Glu Leu  Asp Lys Ala
    1145                1150                1155


Gly Phe  Ile Lys Arg Gln Leu  Val Glu Thr Arg Gln  Ile Thr Lys
    1160                1165                1170
```

```
His Val  Ala Gln Ile Leu Asp  Ser Arg Met Asn Thr  Lys Tyr Asp
    1175                1180                1185

Glu Asn  Asp Lys Leu Ile Arg  Glu Val Lys Val Ile  Thr Leu Lys
    1190                1195                1200

Ser Lys  Leu Val Ser Asp Phe  Arg Lys Asp Phe Gln  Phe Tyr Lys
    1205                1210                1215

Val Arg  Glu Ile Asn Asn Tyr  His His Ala His Asp  Ala Tyr Leu
    1220                1225                1230

Asn Ala  Val Val Gly Thr Ala  Leu Ile Lys Lys Tyr  Pro Lys Leu
    1235                1240                1245

Glu Ser  Glu Phe Val Tyr Gly  Asp Tyr Lys Val Tyr  Asp Val Arg
    1250                1255                1260

Lys Met  Ile Ala Lys Ser Glu  Gln Glu Ile Gly Lys  Ala Thr Ala
    1265                1270                1275

Lys Tyr  Phe Phe Tyr Ser Asn  Ile Met Asn Phe Phe  Lys Thr Glu
    1280                1285                1290

Ile Thr  Leu Ala Asn Gly Glu  Ile Arg Lys Arg Pro  Leu Ile Glu
    1295                1300                1305

Thr Asn  Gly Glu Thr Gly Glu  Ile Val Trp Asp Lys  Gly Arg Asp
    1310                1315                1320

Phe Ala  Thr Val Arg Lys Val  Leu Ser Met Pro Gln  Val Asn Ile
    1325                1330                1335

Val Lys  Lys Thr Glu Val Gln  Thr Gly Gly Phe Ser  Lys Glu Ser
    1340                1345                1350

Ile Leu  Pro Lys Arg Asn Ser  Asp Lys Leu Ile Ala  Arg Lys Lys
    1355                1360                1365
```

```
Asp Trp  Asp Pro Lys Lys Tyr  Gly Gly Phe Asp Ser  Pro Thr Val
    1370                1375                1380

Ala Tyr  Ser Val Leu Val Val  Ala Lys Val Glu Lys  Gly Lys Ser
    1385                1390                1395

Lys Lys  Leu Lys Ser Val Lys  Glu Leu Leu Gly Ile  Thr Ile Met
    1400                1405                1410

Glu Arg  Ser Ser Phe Glu Lys  Asn Pro Ile Asp Phe  Leu Glu Ala
    1415                1420                1425

Lys Gly  Tyr Lys Glu Val Lys  Lys Asp Leu Ile Ile  Lys Leu Pro
    1430                1435                1440

Lys Tyr  Ser Leu Phe Glu Leu  Glu Asn Gly Arg Lys  Arg Met Leu
    1445                1450                1455

Ala Ser  Ala Gly Glu Leu Gln  Lys Gly Asn Glu Leu  Ala Leu Pro
    1460                1465                1470

Ser Lys  Tyr Val Asn Phe Leu  Tyr Leu Ala Ser His  Tyr Glu Lys
    1475                1480                1485

Leu Lys  Gly Ser Pro Glu Asp  Asn Glu Gln Lys Gln  Leu Phe Val
    1490                1495                1500

Glu Gln  His Lys His Tyr Leu  Asp Glu Ile Ile Glu  Gln Ile Ser
    1505                1510                1515

Glu Phe  Ser Lys Arg Val Ile  Leu Ala Asp Ala Asn  Leu Asp Lys
    1520                1525                1530

Val Leu  Ser Ala Tyr Asn Lys  His Arg Asp Lys Pro  Ile Arg Glu
    1535                1540                1545

Gln Ala  Glu Asn Ile Ile His  Leu Phe Thr Leu Thr  Asn Leu Gly
    1550                1555                1560
```

```
Ala Pro  Ala Ala Phe Lys Tyr  Phe Asp Thr Thr Ile  Asp Arg Lys
    1565                1570                1575

Arg Tyr  Thr Ser Thr Lys Glu  Val Leu Asp Ala Thr  Leu Ile His
    1580                1585                1590

Gln Ser  Ile Thr Gly Leu Tyr  Glu Thr Arg Ile Asp  Leu Ser Gln
    1595                1600                1605

Leu Gly  Gly Asp Ser Gly Gly  Ser Thr Asn Leu Ser  Asp Ile Ile
    1610                1615                1620

Glu Lys  Glu Thr Gly Lys Gln  Leu Val Ile Gln Glu  Ser Ile Leu
    1625                1630                1635

Met Leu  Pro Glu Glu Val Glu  Glu Val Ile Gly Asn  Lys Pro Glu
    1640                1645                1650

Ser Asp  Ile Leu Val His Thr  Ala Tyr Asp Glu Ser  Thr Asp Glu
    1655                1660                1665

Asn Val  Met Leu Leu Thr Ser  Asp Ala Pro Glu Tyr  Lys Pro Trp
    1670                1675                1680

Ala Leu  Val Ile Gln Asp Ser  Asn Gly Glu Asn Lys  Ile Lys Met
    1685                1690                1695

Leu Ser  Gly Gly Ser Thr Asn  Leu Ser Asp Ile Ile  Glu Lys Glu
    1700                1705                1710

Thr Gly  Lys Gln Leu Val Ile  Gln Glu Ser Ile Leu  Met Leu Pro
    1715                1720                1725

Glu Glu  Val Glu Glu Val Ile  Gly Asn Lys Pro Glu  Ser Asp Ile
    1730                1735                1740

Leu Val  His Thr Ala Tyr Asp  Glu Ser Thr Asp Glu  Asn Val Met
    1745                1750                1755
```

```
Leu Leu  Thr Ser Asp Ala Pro  Glu Tyr Lys Pro Trp  Ala Leu Val
    1760                1765                1770


Ile Gln  Asp Ser Asn Gly Glu  Asn Lys Ile Lys Met  Leu Ser Gly
    1775                1780                1785


Gly Ser  Pro Lys Lys Lys Arg  Lys Val
    1790                1795


<210>  406
<211>  1825
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  406

Met Ser Ser Glu Thr Gly Pro Val Ala Val Asp Pro Thr Leu Arg Arg
1               5                   10                  15


Arg Ile Glu Pro His Glu Phe Glu Val Phe Phe Asp Pro Arg Glu Leu
            20                  25                  30


Arg Lys Glu Thr Cys Leu Leu Tyr Glu Ile Asn Trp Gly Gly Arg His
        35                  40                  45


Ser Ile Trp Arg His Thr Ser Gln Asn Thr Asn Lys His Val Glu Val
    50                  55                  60


Asn Phe Ile Glu Lys Phe Thr Thr Glu Arg Tyr Phe Cys Pro Asn Thr
65                  70                  75                  80


Arg Cys Ser Ile Thr Trp Phe Leu Ser Trp Ser Pro Cys Gly Glu Cys
                85                  90                  95


Ser Arg Ala Ile Thr Glu Phe Leu Ser Arg Tyr Pro His Val Thr Leu
            100                 105                 110


Phe Ile Tyr Ile Ala Arg Leu Tyr His His Ala Asp Pro Arg Asn Arg
```

115 120 125

Gln Gly Leu Arg Asp Leu Ile Ser Ser Gly Val Thr Ile Gln Ile Met
130 135 140

Thr Glu Gln Glu Ser Gly Tyr Cys Trp Arg Asn Phe Val Asn Tyr Ser
145 150 155 160

Pro Ser Asn Glu Ala His Trp Pro Arg Tyr Pro His Leu Trp Val Arg
165 170 175

Leu Tyr Val Leu Glu Leu Tyr Cys Ile Ile Leu Gly Leu Pro Pro Cys
180 185 190

Leu Asn Ile Leu Arg Arg Lys Gln Pro Gln Leu Thr Phe Phe Thr Ile
195 200 205

Ala Leu Gln Ser Cys His Tyr Gln Arg Leu Pro Pro His Ile Leu Trp
210 215 220

Ala Thr Gly Leu Lys Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly Ser
225 230 235 240

Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser Gly Gly
245 250 255

Ser Ser Gly Gly Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
260 265 270

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
275 280 285

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
290 295 300

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
305 310 315 320

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys

325 330 335

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
340 345 350

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
355 360 365

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
370 375 380

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
385 390 395 400

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
405 410 415

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
420 425 430

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
435 440 445

Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
450 455 460

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
465 470 475 480

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
485 490 495

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
500 505 510

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
515 520 525

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp

```
    530                 535                 540

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
545                 550                 555                 560

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
                565                 570                 575

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
            580                 585                 590

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
        595                 600                 605

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
    610                 615                 620

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
625                 630                 635                 640

Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
                645                 650                 655

Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
            660                 665                 670

Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
        675                 680                 685

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
    690                 695                 700

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
705                 710                 715                 720

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
                725                 730                 735

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
```

```
            740                 745                 750

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
        755                 760                 765

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
    770                 775                 780

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
785                 790                 795                 800

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
                805                 810                 815

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
            820                 825                 830

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
        835                 840                 845

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
    850                 855                 860

Asp Phe Leu Asp Asn Glu Glu Asn Glu Asp Ile Leu Glu Asp Ile Val
865                 870                 875                 880

Leu Thr Leu Thr Leu Phe Glu Asp Arg Glu Met Ile Glu Glu Arg Leu
                885                 890                 895

Lys Thr Tyr Ala His Leu Phe Asp Asp Lys Val Met Lys Gln Leu Lys
            900                 905                 910

Arg Arg Arg Tyr Thr Gly Trp Gly Arg Leu Ser Arg Lys Leu Ile Asn
        915                 920                 925

Gly Ile Arg Asp Lys Gln Ser Gly Lys Thr Ile Leu Asp Phe Leu Lys
    930                 935                 940

Ser Asp Gly Phe Ala Asn Arg Asn Phe Met Gln Leu Ile His Asp Asp
```

945 950 955 960

Ser Leu Thr Phe Lys Glu Asp Ile Gln Lys Ala Gln Val Ser Gly Gln
965 970 975

Gly Asp Ser Leu His Glu His Ile Ala Asn Leu Ala Gly Ser Pro Ala
980 985 990

Ile Lys Lys Gly Ile Leu Gln Thr Val Lys Val Val Asp Glu Leu Val
995 1000 1005

Lys Val Met Gly Arg His Lys Pro Glu Asn Ile Val Ile Glu Met
1010 1015 1020

Ala Arg Glu Asn Gln Thr Thr Gln Lys Gly Gln Lys Asn Ser Arg
1025 1030 1035

Glu Arg Met Lys Arg Ile Glu Glu Gly Ile Lys Glu Leu Gly Ser
1040 1045 1050

Gln Ile Leu Lys Glu His Pro Val Glu Asn Thr Gln Leu Gln Asn
1055 1060 1065

Glu Lys Leu Tyr Leu Tyr Tyr Leu Gln Asn Gly Arg Asp Met Tyr
1070 1075 1080

Val Asp Gln Glu Leu Asp Ile Asn Arg Leu Ser Asp Tyr Asp Val
1085 1090 1095

Asp His Ile Val Pro Gln Ser Phe Leu Lys Asp Asp Ser Ile Asp
1100 1105 1110

Asn Lys Val Leu Thr Arg Ser Asp Lys Asn Arg Gly Lys Ser Asp
1115 1120 1125

Asn Val Pro Ser Glu Glu Val Val Lys Lys Met Lys Asn Tyr Trp
1130 1135 1140

Arg Gln Leu Leu Asn Ala Lys Leu Ile Thr Gln Arg Lys Phe Asp

1145 1150 1155

Asn Leu Thr Lys Ala Glu Arg Gly Gly Leu Ser Glu Leu Asp Lys
1160 1165 1170

Ala Gly Phe Ile Lys Arg Gln Leu Val Glu Thr Arg Gln Ile Thr
1175 1180 1185

Lys His Val Ala Gln Ile Leu Asp Ser Arg Met Asn Thr Lys Tyr
1190 1195 1200

Asp Glu Asn Asp Lys Leu Ile Arg Glu Val Lys Val Ile Thr Leu
1205 1210 1215

Lys Ser Lys Leu Val Ser Asp Phe Arg Lys Asp Phe Gln Phe Tyr
1220 1225 1230

Lys Val Arg Glu Ile Asn Asn Tyr His His Ala His Asp Ala Tyr
1235 1240 1245

Leu Asn Ala Val Val Gly Thr Ala Leu Ile Lys Lys Tyr Pro Lys
1250 1255 1260

Leu Glu Ser Glu Phe Val Tyr Gly Asp Tyr Lys Val Tyr Asp Val
1265 1270 1275

Arg Lys Met Ile Ala Lys Ser Glu Gln Glu Ile Gly Lys Ala Thr
1280 1285 1290

Ala Lys Tyr Phe Phe Tyr Ser Asn Ile Met Asn Phe Phe Lys Thr
1295 1300 1305

Glu Ile Thr Leu Ala Asn Gly Glu Ile Arg Lys Arg Pro Leu Ile
1310 1315 1320

Glu Thr Asn Gly Glu Thr Gly Glu Ile Val Trp Asp Lys Gly Arg
1325 1330 1335

Asp Phe Ala Thr Val Arg Lys Val Leu Ser Met Pro Gln Val Asn

1340 1345 1350

Ile Val Lys Lys Thr Glu Val Gln Thr Gly Gly Phe Ser Lys Glu
1355 1360 1365

Ser Ile Leu Pro Lys Arg Asn Ser Asp Lys Leu Ile Ala Arg Lys
1370 1375 1380

Lys Asp Trp Asp Pro Lys Lys Tyr Gly Gly Phe Asp Ser Pro Thr
1385 1390 1395

Val Ala Tyr Ser Val Leu Val Val Ala Lys Val Glu Lys Gly Lys
1400 1405 1410

Ser Lys Lys Leu Lys Ser Val Lys Glu Leu Leu Gly Ile Thr Ile
1415 1420 1425

Met Glu Arg Ser Ser Phe Glu Lys Asn Pro Ile Asp Phe Leu Glu
1430 1435 1440

Ala Lys Gly Tyr Lys Glu Val Lys Lys Asp Leu Ile Ile Lys Leu
1445 1450 1455

Pro Lys Tyr Ser Leu Phe Glu Leu Glu Asn Gly Arg Lys Arg Met
1460 1465 1470

Leu Ala Ser Ala Gly Glu Leu Gln Lys Gly Asn Glu Leu Ala Leu
1475 1480 1485

Pro Ser Lys Tyr Val Asn Phe Leu Tyr Leu Ala Ser His Tyr Glu
1490 1495 1500

Lys Leu Lys Gly Ser Pro Glu Asp Asn Glu Gln Lys Gln Leu Phe
1505 1510 1515

Val Glu Gln His Lys His Tyr Leu Asp Glu Ile Ile Glu Gln Ile
1520 1525 1530

Ser Glu Phe Ser Lys Arg Val Ile Leu Ala Asp Ala Asn Leu Asp

1535 1540 1545

Lys Val Leu Ser Ala Tyr Asn Lys His Arg Asp Lys Pro Ile Arg
1550 1555 1560

Glu Gln Ala Glu Asn Ile Ile His Leu Phe Thr Leu Thr Asn Leu
1565 1570 1575

Gly Ala Pro Ala Ala Phe Lys Tyr Phe Asp Thr Thr Ile Asp Arg
1580 1585 1590

Lys Arg Tyr Thr Ser Thr Lys Glu Val Leu Asp Ala Thr Leu Ile
1595 1600 1605

His Gln Ser Ile Thr Gly Leu Tyr Glu Thr Arg Ile Asp Leu Ser
1610 1615 1620

Gln Leu Gly Gly Asp Ser Gly Gly Ser Gly Gly Ser Gly Gly Ser
1625 1630 1635

Thr Asn Leu Ser Asp Ile Ile Glu Lys Glu Thr Gly Lys Gln Leu
1640 1645 1650

Val Ile Gln Glu Ser Ile Leu Met Leu Pro Glu Glu Val Glu Glu
1655 1660 1665

Val Ile Gly Asn Lys Pro Glu Ser Asp Ile Leu Val His Thr Ala
1670 1675 1680

Tyr Asp Glu Ser Thr Asp Glu Asn Val Met Leu Leu Thr Ser Asp
1685 1690 1695

Ala Pro Glu Tyr Lys Pro Trp Ala Leu Val Ile Gln Asp Ser Asn
1700 1705 1710

Gly Glu Asn Lys Ile Lys Met Leu Ser Gly Gly Ser Gly Gly Ser
1715 1720 1725

Gly Gly Ser Thr Asn Leu Ser Asp Ile Ile Glu Lys Glu Thr Gly

1730 1735 1740

Lys Gln Leu Val Ile Gln Glu Ser Ile Leu Met Leu Pro Glu Glu
1745 1750 1755

Val Glu Glu Val Ile Gly Asn Lys Pro Glu Ser Asp Ile Leu Val
1760 1765 1770

His Thr Ala Tyr Asp Glu Ser Thr Asp Glu Asn Val Met Leu Leu
1775 1780 1785

Thr Ser Asp Ala Pro Glu Tyr Lys Pro Trp Ala Leu Val Ile Gln
1790 1795 1800

Asp Ser Asn Gly Glu Asn Lys Ile Lys Met Leu Ser Gly Gly Ser
1805 1810 1815

Pro Lys Lys Lys Arg Lys Val
1820 1825

<210> 407
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 407

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

```
Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
        115                 120                 125


Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140


Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Ile Lys Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165


<210>  408
<211>  166
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  408

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
```

```
    50                  55                  60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
            100                 105                 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115                 120                 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145                 150                 155                 160

Ala Gln Ser Ser Thr Asp
                165
```

<210> 409
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 409

```
Ala Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Phe
        35                  40                  45
```

```
Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
            100                 105                 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
        115                 120                 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Ile Lys Ala Gln Lys Lys
145                 150                 155                 160

Ala Gln Ser Ser Thr Asp
                165
```

<210> 410
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 410

```
Ser Glu Val Glu Phe Ser Tyr Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
```

35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Thr Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Ser His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Ser Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 411
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 411

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Gly Glu Val Pro Val Gly Ala Val
20 25 30

```
Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95

Arg Ile Gly Arg Val Val Phe Gly Val His Asn Ala Lys Thr Gly Ala
            100                 105                 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115                 120                 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Asn Asp Leu Leu
    130                 135                 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145                 150                 155                 160

Ala Gln Ser Ser Thr Asp
                165
```

<210> 412
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 412

```
Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15

Leu Ala Lys Arg Ala Trp Asp Gly Gly Glu Val Pro Val Gly Ala Val
```

20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val His Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Asn Asp Leu Leu
130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 413
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 413

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

```
Leu Ala Lys Arg Ala Trp Asp Asp Gly Glu Val Pro Val Gly Ala Val
            20                  25                  30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95

Arg Ile Gly Arg Val Val Phe Gly Val Lys Asn Ala Lys Thr Gly Ala
            100                 105                 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115                 120                 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Asn Gly Leu Leu
    130                 135                 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145                 150                 155                 160

Ala Gln Ser Ser Thr Asp
                165
```

<210> 414
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 414

```
Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
```

1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Gln Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Asn Ala Leu Leu
130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 415
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 415

```
Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15

Leu Ala Lys Arg Ala Trp Asp Met Gly Glu Val Pro Val Gly Ala Val
            20                  25                  30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95

Arg Ile Gly Arg Val Val Phe Gly Val Pro Asn Ala Lys Thr Gly Ala
            100                 105                 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115                 120                 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Asn Asp Leu Leu
    130                 135                 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145                 150                 155                 160

Ala Gln Ser Ser Thr Asp
                165
```

<210> 416
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 416

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Cys Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val His Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Asn Ala Leu Leu
130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 417
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 417

```
Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60


Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115                 120                 125


Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Asn Leu Leu Leu
    130                 135                 140


Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165
```

<210> 418
<211> 166
<212> PRT

<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 418

```
Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Glu Gly Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60


Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115                 120                 125


Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Asn Ala Leu Leu
    130                 135                 140


Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165
```

<210> 419

<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 419

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly His His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Asn Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 420
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 420

```
Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Ala Gly Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60


Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Val Asn Asn Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115                 120                 125


Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Asn Glu Leu Leu
    130                 135                 140


Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
```

165

<210> 421
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 421

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 422
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 422

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Thr Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Thr Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys

145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 423
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 423

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Ser Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 424
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 424

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val Leu Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu

130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 425
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 425

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

```
Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140


Arg Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165


<210>  426
<211>  166
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  426

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val Leu Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Leu Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60


Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
```

115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 427
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 427

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val Leu Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115   120   125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130   135   140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Asn Ala Gln Lys Lys
145   150   155   160

Ala Gln Ser Ser Thr Asp
                165

<210> 428
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 428

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1   5   10   15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20   25   30

Leu Val Leu Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35   40   45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50   55   60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65   70   75   80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85   90   95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala

100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Cys Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 429
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 429

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Arg Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 430
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 430

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Ser Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly His His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser

85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 431
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 431

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Leu His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

```
Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115                 120                 125


Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140


Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Asn Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165


<210>  432
<211>  160
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  432

Met Gly Ser His Met Thr Asn Asp Ile Tyr Phe Met Thr Leu Ala Ile
1               5                   10                  15


Glu Glu Ala Lys Lys Ala Ala Gln Leu Gly Glu Val Pro Ile Gly Ala
            20                  25                  30


Ile Ile Thr Lys Asp Asp Glu Val Ile Ala Arg Ala His Asn Leu Arg
        35                  40                  45


Glu Thr Leu Gln Gln Pro Thr Ala His Ala Glu His Ile Ala Ile Glu
    50                  55                  60


Arg Ala Ala Lys Val Leu Gly Ser Trp Arg Leu Glu Gly Cys Thr Leu
```

65 70 75 80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Thr Ile Val Met
85 90 95

Ser Arg Ile Pro Arg Val Val Tyr Gly Ala Asp Asp Pro Lys Gly Gly
100 105 110

Cys Ser Gly Ser Leu Met Asn Leu Leu Gln Gln Ser Asn Phe Asn His
115 120 125

Arg Ala Ile Val Asp Lys Gly Val Leu Lys Glu Ala Cys Ser Thr Leu
130 135 140

Leu Thr Thr Phe Phe Lys Asn Leu Arg Ala Asn Lys Lys Ser Thr Asn
145 150 155 160

<210> 433
<211> 159
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 433

Gly Ser His Met Thr Asn Asp Ile Tyr Phe Met Thr Leu Ala Ile Glu
1 5 10 15

Glu Ala Lys Lys Ala Ala Gln Leu Gly Glu Val Pro Ile Gly Ala Ile
20 25 30

Ile Thr Lys Asp Asp Glu Val Ile Ala Arg Ala His Asn Leu Arg Glu
35 40 45

Thr Leu Gln Gln Pro Thr Ala His Ala Glu His Ile Ala Ile Glu Arg
50 55 60

Ala Ala Lys Val Leu Gly Ser Trp Arg Leu Glu Gly Cys Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Thr Ile Val Met Ser
85 90 95

Arg Ile Pro Arg Val Val Tyr Gly Ala Asp Asn Pro Lys Gly Gly Cys
100 105 110

Ser Gly Ser Leu Met Asn Leu Leu Gln Gln Ser Asn Phe Asn His Arg
115 120 125

Ala Ile Val Asp Lys Gly Val Leu Lys Glu Ala Cys Ser Thr Leu Leu
130 135 140

Thr Thr Phe Phe Lys Asn Leu Arg Ala Asn Lys Lys Ser Thr Asn
145 150 155

<210> 434
<211> 159
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 434

Gly Ser His Met Thr Asn Asp Ile Tyr Phe Met Thr Leu Ala Ile Glu
1 5 10 15

Glu Ala Lys Lys Ala Ala Gln Leu Gly Glu Val Pro Ile Gly Ala Ile
20 25 30

Ile Thr Lys Asp Asp Glu Val Ile Ala Arg Ala His Asn Leu Arg Glu
35 40 45

Thr Leu Gln Gln Pro Thr Ala His Ala Glu His Ile Ala Ile Glu Arg
50 55 60

Ala Ala Lys Val Leu Gly Ser Trp Arg Leu Glu Gly Cys Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Thr Ile Val Met Ser

85 90 95

Arg Ile Pro Arg Val Val Tyr Gly Ala Ala Asn Pro Lys Gly Gly Cys
100 105 110

Ser Gly Ser Leu Met Asn Leu Leu Gln Gln Ser Asn Phe Asn His Arg
115 120 125

Ala Ile Val Asp Lys Gly Val Leu Lys Glu Ala Cys Ser Thr Leu Leu
130 135 140

Thr Thr Phe Phe Lys Asn Leu Arg Ala Asn Lys Lys Ser Thr Asn
145 150 155

<210> 435
<211> 159
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 435

Gly Ser His Met Thr Asn Asp Ile Tyr Phe Met Thr Leu Ala Ile Glu
1 5 10 15

Glu Ala Lys Lys Ala Ala Gln Leu Pro Glu Val Pro Ile Gly Ala Ile
20 25 30

Ile Thr Lys Asp Asp Glu Val Ile Ala Arg Ala His Asn Leu Arg Glu
35 40 45

Thr Leu Gln Gln Pro Thr Ala His Ala Glu His Ile Ala Ile Glu Arg
50 55 60

Ala Ala Lys Val Leu Gly Ser Trp Arg Leu Glu Gly Cys Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Thr Ile Val Met Ser
85 90 95

```
Arg Ile Pro Arg Val Val Tyr Gly Ala Ala Asn Pro Lys Gly Gly Cys
            100                 105                 110


Ser Gly Ser Leu Met Asn Leu Leu Gln Gln Ser Asn Phe Asn His Arg
        115                 120                 125


Ala Ile Val Asp Lys Gly Val Leu Lys Glu Ala Cys Ser Thr Leu Leu
    130                 135                 140


Thr Thr Phe Phe Lys Asn Leu Arg Ala Asn Lys Lys Ser Thr Asn
145                 150                 155


<210>  436
<211>  159
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  436

Gly Ser His Met Thr Asn Asp Ile Tyr Phe Met Thr Leu Ala Ile Glu
1               5                   10                  15


Glu Ala Lys Lys Ala Ala Gln Leu Pro Glu Val Pro Ile Gly Ala Ile
            20                  25                  30


Ile Thr Lys Asp Asp Glu Val Ile Ala Arg Ala His Asn Leu Arg Glu
        35                  40                  45


Thr Leu Gln Gln Pro Thr Ala His Ala Glu His Ile Ala Ile Glu Arg
    50                  55                  60


Ala Ala Lys Val Leu Gly Ser Trp Arg Leu Glu Gly Cys Thr Leu Tyr
65                  70                  75                  80


Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Thr Ile Val Met Ser
                85                  90                  95


Arg Ile Pro Arg Val Val Tyr Gly Ala Ala Asn Pro Lys Gly Gly Cys
```

100 105 110

Ser Gly Ser Leu Met Asn Leu Leu Gln Gln Ser Asn Phe Asn His Arg
115 120 125

Ala Ile Val Asp Lys Gly Val Leu Lys Glu Ala Cys Ala Thr Leu Leu
130 135 140

Thr Thr Phe Phe Lys Asn Leu Arg Ala Asn Lys Lys Ser Thr Asn
145 150 155

<210> 437
<211> 159
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 437

Gly Ser His Met Thr Asn Asp Ile Tyr Phe Met Thr Leu Ala Ile Glu
1 5 10 15

Glu Ala Lys Lys Ala Ala Gln Leu Gly Glu Val Pro Ile Gly Ala Ile
20 25 30

Ile Thr Lys Asp Asp Glu Val Ile Ala Arg Ala His Asn Leu Arg Glu
35 40 45

Thr Leu Gln Gln Pro Thr Ala His Ala Glu His Ile Ala Ile Glu Arg
50 55 60

Ala Ala Lys Val Leu Gly Ser Trp Arg Leu Glu Gly Cys Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Thr Ile Val Met Ser
85 90 95

Arg Ile Pro Arg Val Val Tyr Gly Ala Ala Asn Pro Lys Gly Gly Cys
100 105 110

```
Ser Gly Ser Leu Met Asn Leu Leu Gln Gln Ser Asn Phe Asn His Arg
        115                 120                 125


Ala Ile Val Asp Lys Gly Val Leu Lys Glu Ala Cys Ala Thr Leu Leu
    130                 135                 140


Thr Thr Phe Phe Lys Asn Leu Arg Ala Asn Lys Lys Ser Thr Asn
145                 150                 155


<210>  438
<211>  166
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  438

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Ser Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60


Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
```

115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 439
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 439

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Thr Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala
100 105 110

```
Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
        115                 120                 125


Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140


Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165


<210>  440
<211>  166
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  440

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Ala Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60


Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala
```

100 105 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 441
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 441

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

```
Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
        115                 120                 125


Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Asn Ala Leu Leu
    130                 135                 140


Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165


<210>  442
<211>  166
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  442

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60


Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
```

85 90 95

Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Asn Ala Leu Leu
130 135 140

Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 443
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 443

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Leu Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

```
Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
        115                 120                 125


Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140


Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165


<210>  444
<211>  166
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  444

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60


Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
```

65 70 75 80

Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Asp Phe Phe Arg Met Pro Arg Gln Glu Ile Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 445
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 445

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

```
Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His Arg
        115                 120                 125


Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140


Ser Asp Phe Phe Arg Met His Arg Gln Glu Ile Lys Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165


<210>  446
<211>  166
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  446

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30


Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45


Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
```

50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 447
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 447

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val Leu Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
35 40 45

```
Gly Leu His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
            100                 105                 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115                 120                 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140

Cys Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Asn Ala Gln Lys Lys
145                 150                 155                 160

Ala Gln Ser Ser Thr Asp
                165
```

<210> 448
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 448

```
Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
            20                  25                  30

Leu Val Leu Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Ser Ile
```

35 40 45

Gly Leu His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Cys Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Asn Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 449
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 449

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

```
Leu Val Leu Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Ala Ile
        35                  40                  45


Gly Leu His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60


Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80


Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95


Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
            100                 105                 110


Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115                 120                 125


Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140


Cys Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Asn Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165


<210>  450
<211>  166
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  450

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1               5                   10                  15


Leu Ala Lys Arg Ala Leu Asp Glu Arg Glu Val Pro Val Gly Ala Val
```

20 25 30

Leu Val Leu Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Ala Ile
35 40 45

Gly Leu His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

Cys Tyr Phe Phe Arg Met Pro Arg Gln Val Phe Asn Ala Gln Lys Lys
145 150 155 160

Ala Gln Ser Ser Thr Asp
165

<210> 451
<211> 160
<212> PRT
<213> Staphylococcus aureus

<400> 451

Met Gly Ser His Met Thr Asn Asp Ile Tyr Phe Met Thr Leu Ala Ile
1 5 10 15

Glu Glu Ala Lys Lys Ala Ala Gln Leu Gly Glu Val Pro Ile Gly Ala
20 25 30

```
Ile Ile Thr Lys Asp Asp Glu Val Ile Ala Arg Ala His Asn Leu Arg
        35                  40                  45

Glu Thr Leu Gln Gln Pro Thr Ala His Ala Glu His Ile Ala Ile Glu
    50                  55                  60

Arg Ala Ala Lys Val Leu Gly Ser Trp Arg Leu Glu Gly Cys Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Thr Ile Val Met
                85                  90                  95

Ser Arg Ile Pro Arg Val Val Tyr Gly Ala Asp Asp Pro Lys Gly Gly
            100                 105                 110

Cys Ser Gly Ser Leu Met Asn Leu Leu Gln Gln Ser Asn Phe Asn His
        115                 120                 125

Arg Ala Ile Val Asp Lys Gly Val Leu Lys Glu Ala Cys Ser Thr Leu
    130                 135                 140

Leu Thr Thr Phe Phe Lys Asn Leu Arg Ala Asn Lys Lys Ser Thr Asn
145                 150                 155                 160
```

<210> 452
<211> 161
<212> PRT
<213> Bacillus subtilis

<400> 452

```
Met Thr Gln Asp Glu Leu Tyr Met Lys Glu Ala Ile Lys Glu Ala Lys
1               5                   10                  15

Lys Ala Glu Glu Lys Gly Glu Val Pro Ile Gly Ala Val Leu Val Ile
            20                  25                  30

Asn Gly Glu Ile Ile Ala Arg Ala His Asn Leu Arg Glu Thr Glu Gln
        35                  40                  45
```

```
Arg Ser Ile Ala His Ala Glu Met Leu Val Ile Asp Glu Ala Cys Lys
    50                  55                  60

Ala Leu Gly Thr Trp Arg Leu Glu Gly Ala Thr Leu Tyr Val Thr Leu
65                  70                  75                  80

Glu Pro Cys Pro Met Cys Ala Gly Ala Val Val Leu Ser Arg Val Glu
                85                  90                  95

Lys Val Val Phe Gly Ala Phe Asp Pro Lys Gly Gly Cys Ser Gly Thr
            100                 105                 110

Leu Met Asn Leu Leu Gln Glu Glu Arg Phe Asn His Gln Ala Glu Val
        115                 120                 125

Val Ser Gly Val Leu Glu Glu Glu Cys Gly Gly Met Leu Ser Ala Phe
    130                 135                 140

Phe Arg Glu Leu Arg Lys Lys Lys Lys Ala Ala Arg Lys Asn Leu Ser
145                 150                 155                 160

Glu
```

<210> 453
<211> 183
<212> PRT
<213> Salmonella typhimurium

<400> 453

```
Met Pro Pro Ala Phe Ile Thr Gly Val Thr Ser Leu Ser Asp Val Glu
1               5                   10                  15

Leu Asp His Glu Tyr Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg
            20                  25                  30

Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val Leu Val His Asn
        35                  40                  45
```

His Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile Gly Arg His Asp
50 55 60

Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val
65 70 75 80

Leu Gln Asn Tyr Arg Leu Leu Asp Thr Thr Leu Tyr Val Thr Leu Glu
85 90 95

Pro Cys Val Met Cys Ala Gly Ala Met Val His Ser Arg Ile Gly Arg
100 105 110

Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly Ala Ala Gly Ser Leu
115 120 125

Ile Asp Val Leu His His Pro Gly Met Asn His Arg Val Glu Ile Ile
130 135 140

Glu Gly Val Leu Arg Asp Glu Cys Ala Thr Leu Leu Ser Asp Phe Phe
145 150 155 160

Arg Met Arg Arg Gln Glu Ile Lys Ala Leu Lys Lys Ala Asp Arg Ala
165 170 175

Glu Gly Ala Gly Pro Ala Val
180

<210> 454
<211> 164
<212> PRT
<213> Shewanella putrefaciens

<400> 454

Met Asp Glu Tyr Trp Met Gln Val Ala Met Gln Met Ala Glu Lys Ala
1 5 10 15

Glu Ala Ala Gly Glu Val Pro Val Gly Ala Val Leu Val Lys Asp Gly
20 25 30

Gln Gln Ile Ala Thr Gly Tyr Asn Leu Ser Ile Ser Gln His Asp Pro

35 40 45

Thr Ala His Ala Glu Ile Leu Cys Leu Arg Ser Ala Gly Lys Lys Leu
50 55 60

Glu Asn Tyr Arg Leu Leu Asp Ala Thr Leu Tyr Ile Thr Leu Glu Pro
65 70 75 80

Cys Ala Met Cys Ala Gly Ala Met Val His Ser Arg Ile Ala Arg Val
85 90 95

Val Tyr Gly Ala Arg Asp Glu Lys Thr Gly Ala Ala Gly Thr Val Val
100 105 110

Asn Leu Leu Gln His Pro Ala Phe Asn His Gln Val Glu Val Thr Ser
115 120 125

Gly Val Leu Ala Glu Ala Cys Ser Ala Gln Leu Ser Arg Phe Phe Lys
130 135 140

Arg Arg Arg Asp Glu Lys Lys Ala Leu Lys Leu Ala Gln Arg Ala Gln
145 150 155 160

Gln Gly Ile Glu

<210> 455
<211> 173
<212> PRT
<213> Haemophilus influenzae

<400> 455

Met Asp Ala Ala Lys Val Arg Ser Glu Phe Asp Glu Lys Met Met Arg
1 5 10 15

Tyr Ala Leu Glu Leu Ala Asp Lys Ala Glu Ala Leu Gly Glu Ile Pro
20 25 30

Val Gly Ala Val Leu Val Asp Asp Ala Arg Asn Ile Ile Gly Glu Gly
35 40 45

```
Trp Asn Leu Ser Ile Val Gln Ser Asp Pro Thr Ala His Ala Glu Ile
    50                  55                  60

Ile Ala Leu Arg Asn Gly Ala Lys Asn Ile Gln Asn Tyr Arg Leu Leu
65                  70                  75                  80

Asn Ser Thr Leu Tyr Val Thr Leu Glu Pro Cys Thr Met Cys Ala Gly
                85                  90                  95

Ala Ile Leu His Ser Arg Ile Lys Arg Leu Val Phe Gly Ala Ser Asp
            100                 105                 110

Tyr Lys Thr Gly Ala Ile Gly Ser Arg Phe His Phe Phe Asp Asp Tyr
        115                 120                 125

Lys Met Asn His Thr Leu Glu Ile Thr Ser Gly Val Leu Ala Glu Glu
    130                 135                 140

Cys Ser Gln Lys Leu Ser Thr Phe Phe Gln Lys Arg Arg Glu Glu Lys
145                 150                 155                 160

Lys Ile Glu Lys Ala Leu Leu Lys Ser Leu Ser Asp Lys
                165                 170
```

<210> 456
<211> 161
<212> PRT
<213> Caulobacter crescentus

<400> 456

```
Met Arg Thr Asp Glu Ser Glu Asp Gln Asp His Arg Met Met Arg Leu
1               5                   10                  15

Ala Leu Asp Ala Ala Arg Ala Ala Ala Glu Ala Gly Glu Thr Pro Val
            20                  25                  30

Gly Ala Val Ile Leu Asp Pro Ser Thr Gly Glu Val Ile Ala Thr Ala
        35                  40                  45
```

```
Gly Asn Gly Pro Ile Ala Ala His Asp Pro Thr Ala His Ala Glu Ile
    50                  55                  60


Ala Ala Met Arg Ala Ala Ala Ala Lys Leu Gly Asn Tyr Arg Leu Thr
65                  70                  75                  80


Asp Leu Thr Leu Val Val Thr Leu Glu Pro Cys Ala Met Cys Ala Gly
                85                  90                  95


Ala Ile Ser His Ala Arg Ile Gly Arg Val Val Phe Gly Ala Asp Asp
            100                 105                 110


Pro Lys Gly Gly Ala Val Val His Gly Pro Lys Phe Phe Ala Gln Pro
        115                 120                 125


Thr Cys His Trp Arg Pro Glu Val Thr Gly Gly Val Leu Ala Asp Glu
    130                 135                 140


Ser Ala Asp Leu Leu Arg Gly Phe Phe Arg Ala Arg Arg Lys Ala Lys
145                 150                 155                 160


Ile
```

<210> 457
<211> 179
<212> PRT
<213> Geobacter sulfurreducens

<400> 457

```
Met Ser Ser Leu Lys Lys Thr Pro Ile Arg Asp Asp Ala Tyr Trp Met
1               5                   10                  15


Gly Lys Ala Ile Arg Glu Ala Ala Lys Ala Ala Ala Arg Asp Glu Val
            20                  25                  30


Pro Ile Gly Ala Val Ile Val Arg Asp Gly Ala Val Ile Gly Arg Gly
        35                  40                  45
```

His Asn Leu Arg Glu Gly Ser Asn Asp Pro Ser Ala His Ala Glu Met
50 55 60

Ile Ala Ile Arg Gln Ala Ala Arg Arg Ser Ala Asn Trp Arg Leu Thr
65 70 75 80

Gly Ala Thr Leu Tyr Val Thr Leu Glu Pro Cys Leu Met Cys Met Gly
85 90 95

Ala Ile Ile Leu Ala Arg Leu Glu Arg Val Val Phe Gly Cys Tyr Asp
100 105 110

Pro Lys Gly Gly Ala Ala Gly Ser Leu Tyr Asp Leu Ser Ala Asp Pro
115 120 125

Arg Leu Asn His Gln Val Arg Leu Ser Pro Gly Val Cys Gln Glu Glu
130 135 140

Cys Gly Thr Met Leu Ser Asp Phe Phe Arg Asp Leu Arg Arg Arg Lys
145 150 155 160

Lys Ala Lys Ala Thr Pro Ala Leu Phe Ile Asp Glu Arg Lys Val Pro
165 170 175

Pro Glu Pro

<210> 458
<211> 1774
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 458

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

```
Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro Ile
        35                  40                  45

Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
    50                  55                  60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65                  70                  75                  80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
                85                  90                  95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
            100                 105                 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
        115                 120                 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
    130                 135                 140

Ser Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Lys Ala Gln Lys Lys
145                 150                 155                 160

Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser Gly
                165                 170                 175

Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser Gly
            180                 185                 190

Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr Trp
        195                 200                 205

Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu
    210                 215                 220

Val Pro Val Gly Ala Val Leu Val His Asn Asn Arg Val Ile Gly Glu
225                 230                 235                 240
```

```
Gly Trp Asn Arg Pro Ile Gly Arg His Asp Pro Thr Ala His Ala Glu
                245                 250                 255

Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu
            260                 265                 270

Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys Ala
        275                 280                 285

Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val Arg
    290                 295                 300

Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His Tyr
305                 310                 315                 320

Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp
                325                 330                 335

Glu Cys Ala Ala Leu Leu Ser Tyr Phe Phe Arg Met Arg Arg Gln Val
            340                 345                 350

Phe Lys Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser
        355                 360                 365

Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala
    370                 375                 380

Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys Tyr
385                 390                 395                 400

Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val Ile
                405                 410                 415

Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly Asn
            420                 425                 430

Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu Phe
        435                 440                 445
```

```
Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala Arg
    450                 455                 460

Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu Ile
465                 470                 475                 480

Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg Leu
                485                 490                 495

Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His Pro
            500                 505                 510

Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr Pro
        515                 520                 525

Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys Ala
    530                 535                 540

Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe Arg
545                 550                 555                 560

Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp Val
                565                 570                 575

Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe Glu
            580                 585                 590

Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu Ser
        595                 600                 605

Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln Leu
    610                 615                 620

Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu Ser
625                 630                 635                 640

Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu Asp
                645                 650                 655
```

```
Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp Asn
            660                 665                 670

Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala Ala
        675                 680                 685

Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val Asn
    690                 695                 700

Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg Tyr
705                 710                 715                 720

Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg Gln
                725                 730                 735

Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys Asn
            740                 745                 750

Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe Tyr
        755                 760                 765

Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu Leu
    770                 775                 780

Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr Phe
785                 790                 795                 800

Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His Ala
                805                 810                 815

Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn Arg
            820                 825                 830

Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val Gly
        835                 840                 845

Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys Ser
    850                 855                 860
```

```
Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys Gly
865                 870                 875                 880


Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys Asn
                885                 890                 895


Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu Tyr
            900                 905                 910


Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu Gly
        915                 920                 925


Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile Val
    930                 935                 940


Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu Lys
945                 950                 955                 960


Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile Ser
                965                 970                 975


Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp Leu
            980                 985                 990


Leu Lys Ile Ile Lys Asp Lys Asp  Phe Leu Asp Asn Glu  Glu Asn Glu
        995                 1000                1005


Asp Ile  Leu Glu Asp Ile Val  Leu Thr Leu Thr Leu  Phe Glu Asp
    1010                1015                1020


Arg Glu  Met Ile Glu Glu Arg  Leu Lys Thr Tyr Ala  His Leu Phe
    1025                1030                1035


Asp Asp  Lys Val Met Lys Gln  Leu Lys Arg Arg Arg  Tyr Thr Gly
    1040                1045                1050


Trp Gly  Arg Leu Ser Arg Lys  Leu Ile Asn Gly Ile  Arg Asp Lys
    1055                1060                1065
```

```
Gln Ser  Gly Lys Thr Ile Leu  Asp Phe Leu Lys Ser  Asp Gly Phe
    1070                1075                1080

Ala Asn  Arg Asn Phe Met Gln  Leu Ile His Asp Asp  Ser Leu Thr
    1085                1090                1095

Phe Lys  Glu Asp Ile Gln Lys  Ala Gln Val Ser Gly  Gln Gly Asp
    1100                1105                1110

Ser Leu  His Glu His Ile Ala  Asn Leu Ala Gly Ser  Pro Ala Ile
    1115                1120                1125

Lys Lys  Gly Ile Leu Gln Thr  Val Lys Val Val Asp  Glu Leu Val
    1130                1135                1140

Lys Val  Met Gly Arg His Lys  Pro Glu Asn Ile Val  Ile Glu Met
    1145                1150                1155

Ala Arg  Glu Asn Gln Thr Thr  Gln Lys Gly Gln Lys  Asn Ser Arg
    1160                1165                1170

Glu Arg  Met Lys Arg Ile Glu  Glu Gly Ile Lys Glu  Leu Gly Ser
    1175                1180                1185

Gln Ile  Leu Lys Glu His Pro  Val Glu Asn Thr Gln  Leu Gln Asn
    1190                1195                1200

Glu Lys  Leu Tyr Leu Tyr Tyr  Leu Gln Asn Gly Arg  Asp Met Tyr
    1205                1210                1215

Val Asp  Gln Glu Leu Asp Ile  Asn Arg Leu Ser Asp  Tyr Asp Val
    1220                1225                1230

Asp His  Ile Val Pro Gln Ser  Phe Leu Lys Asp Asp  Ser Ile Asp
    1235                1240                1245

Asn Lys  Val Leu Thr Arg Ser  Asp Lys Asn Arg Gly  Lys Ser Asp
    1250                1255                1260
```

```
Asn Val  Pro Ser Glu Glu Val  Val Lys Lys Met Lys  Asn Tyr Trp
    1265                1270                1275

Arg Gln  Leu Leu Asn Ala Lys  Leu Ile Thr Gln Arg  Lys Phe Asp
    1280                1285                1290

Asn Leu  Thr Lys Ala Glu Arg  Gly Gly Leu Ser Glu  Leu Asp Lys
    1295                1300                1305

Ala Gly  Phe Ile Lys Arg Gln  Leu Val Glu Thr Arg  Gln Ile Thr
    1310                1315                1320

Lys His  Val Ala Gln Ile Leu  Asp Ser Arg Met Asn  Thr Lys Tyr
    1325                1330                1335

Asp Glu  Asn Asp Lys Leu Ile  Arg Glu Val Lys Val  Ile Thr Leu
    1340                1345                1350

Lys Ser  Lys Leu Val Ser Asp  Phe Arg Lys Asp Phe  Gln Phe Tyr
    1355                1360                1365

Lys Val  Arg Glu Ile Asn Asn  Tyr His His Ala His  Asp Ala Tyr
    1370                1375                1380

Leu Asn  Ala Val Val Gly Thr  Ala Leu Ile Lys Lys  Tyr Pro Lys
    1385                1390                1395

Leu Glu  Ser Glu Phe Val Tyr  Gly Asp Tyr Lys Val  Tyr Asp Val
    1400                1405                1410

Arg Lys  Met Ile Ala Lys Ser  Glu Gln Glu Ile Gly  Lys Ala Thr
    1415                1420                1425

Ala Lys  Tyr Phe Phe Tyr Ser  Asn Ile Met Asn Phe  Phe Lys Thr
    1430                1435                1440

Glu Ile  Thr Leu Ala Asn Gly  Glu Ile Arg Lys Arg  Pro Leu Ile
    1445                1450                1455
```

```
Glu Thr  Asn Gly Glu Thr Gly  Glu Ile Val Trp Asp  Lys Gly Arg
    1460                1465                1470

Asp Phe  Ala Thr Val Arg Lys  Val Leu Ser Met Pro  Gln Val Asn
    1475                1480                1485

Ile Val  Lys Lys Thr Glu Val  Gln Thr Gly Gly Phe  Ser Lys Glu
    1490                1495                1500

Ser Ile  Leu Pro Lys Arg Asn  Ser Asp Lys Leu Ile  Ala Arg Lys
    1505                1510                1515

Lys Asp  Trp Asp Pro Lys Lys  Tyr Gly Gly Phe Asp  Ser Pro Thr
    1520                1525                1530

Val Ala  Tyr Ser Val Leu Val  Val Ala Lys Val Glu  Lys Gly Lys
    1535                1540                1545

Ser Lys  Lys Leu Lys Ser Val  Lys Glu Leu Leu Gly  Ile Thr Ile
    1550                1555                1560

Met Glu  Arg Ser Ser Phe Glu  Lys Asn Pro Ile Asp  Phe Leu Glu
    1565                1570                1575

Ala Lys  Gly Tyr Lys Glu Val  Lys Lys Asp Leu Ile  Ile Lys Leu
    1580                1585                1590

Pro Lys  Tyr Ser Leu Phe Glu  Leu Glu Asn Gly Arg  Lys Arg Met
    1595                1600                1605

Leu Ala  Ser Ala Gly Glu Leu  Gln Lys Gly Asn Glu  Leu Ala Leu
    1610                1615                1620

Pro Ser  Lys Tyr Val Asn Phe  Leu Tyr Leu Ala Ser  His Tyr Glu
    1625                1630                1635

Lys Leu  Lys Gly Ser Pro Glu  Asp Asn Glu Gln Lys  Gln Leu Phe
    1640                1645                1650
```

```
Val Glu  Gln His Lys His Tyr  Leu Asp Glu Ile Ile  Glu Gln Ile
    1655                 1660                 1665


Ser Glu  Phe Ser Lys Arg Val  Ile Leu Ala Asp Ala  Asn Leu Asp
    1670                 1675                 1680


Lys Val  Leu Ser Ala Tyr Asn  Lys His Arg Asp Lys  Pro Ile Arg
    1685                 1690                 1695


Glu Gln  Ala Glu Asn Ile Ile  His Leu Phe Thr Leu  Thr Asn Leu
    1700                 1705                 1710


Gly Ala  Pro Ala Ala Phe Lys  Tyr Phe Asp Thr Thr  Ile Asp Arg
    1715                 1720                 1725


Lys Arg  Tyr Thr Ser Thr Lys  Glu Val Leu Asp Ala  Thr Leu Ile
    1730                 1735                 1740


His Gln  Ser Ile Thr Gly Leu  Tyr Glu Thr Arg Ile  Asp Leu Ser
    1745                 1750                 1755


Gln Leu  Gly Gly Asp Ser Gly  Gly Ser Pro Lys Lys  Lys Arg Lys
    1760                 1765                 1770


Val
```

<210> 459
<211> 1775
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 459

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15
```

```
Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Leu Asp Glu Arg
    210                 215                 220
```

```
Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240


Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255


Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270


Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285


Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300


Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320


Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335


Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Pro Arg Gln
            340                 345                 350


Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365


Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380


Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400


Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415


Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430
```

```
Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575

Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590

Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640
```

```
Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780

Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800

Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815

Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830

Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845
```

```
Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005

Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020

Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035

Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050
```

```
Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200

Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215

Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230

Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245
```

```
Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                 1255                 1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                 1270                 1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                 1285                 1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                 1300                 1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                 1315                 1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                 1330                 1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                 1345                 1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                 1360                 1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                 1375                 1380

Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                 1390                 1395

Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                 1405                 1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                 1420                 1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                 1435                 1440
```

```
Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455


Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470


Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485


Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500


Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515


Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530


Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545


Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560


Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575


Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590


Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605


Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620


Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635
```

```
Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755


Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770


Lys Val
    1775


<210>  460
<211>  1767
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  460

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15
```

```
Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Arg Asp Glu Arg
    210                 215                 220
```

```
Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Pro Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
385                 390                 395                 400

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
                405                 410                 415

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
            420                 425                 430
```

```
Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
        435                 440                 445

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
    450                 455                 460

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
465                 470                 475                 480

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
                485                 490                 495

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
            500                 505                 510

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
        515                 520                 525

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
    530                 535                 540

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
545                 550                 555                 560

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
                565                 570                 575

Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
            580                 585                 590

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
        595                 600                 605

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
    610                 615                 620

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
625                 630                 635                 640
```

```
Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
                645                 650                 655

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
            660                 665                 670

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
        675                 680                 685

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
    690                 695                 700

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
705                 710                 715                 720

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
                725                 730                 735

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
            740                 745                 750

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
        755                 760                 765

Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
    770                 775                 780

Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
785                 790                 795                 800

Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
                805                 810                 815

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
            820                 825                 830

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
        835                 840                 845
```

```
Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
    850                 855                 860

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
865                 870                 875                 880

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
                885                 890                 895

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
            900                 905                 910

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
        915                 920                 925

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
    930                 935                 940

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
945                 950                 955                 960

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
                965                 970                 975

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
            980                 985                 990

Asp Phe Leu Asp Asn Glu Glu Asn  Glu Asp Ile Leu Glu  Asp Ile Val
        995                 1000                1005

Leu Thr  Leu Thr Leu Phe Glu  Asp Arg Glu Met Ile  Glu Glu Arg
    1010                1015                1020

Leu Lys  Thr Tyr Ala His Leu  Phe Asp Asp Lys Val  Met Lys Gln
    1025                1030                1035

Leu Lys  Arg Arg Arg Tyr Thr  Gly Trp Gly Arg Leu  Ser Arg Lys
    1040                1045                1050
```

```
Leu Ile  Asn Gly Ile Arg Asp  Lys Gln Ser Gly Lys  Thr Ile Leu
    1055                1060                1065

Asp Phe  Leu Lys Ser Asp Gly  Phe Ala Asn Arg Asn  Phe Met Gln
    1070                1075                1080

Leu Ile  His Asp Asp Ser Leu  Thr Phe Lys Glu Asp  Ile Gln Lys
    1085                1090                1095

Ala Gln  Val Ser Gly Gln Gly  Asp Ser Leu His Glu  His Ile Ala
    1100                1105                1110

Asn Leu  Ala Gly Ser Pro Ala  Ile Lys Lys Gly Ile  Leu Gln Thr
    1115                1120                1125

Val Lys  Val Val Asp Glu Leu  Val Lys Val Met Gly  Arg His Lys
    1130                1135                1140

Pro Glu  Asn Ile Val Ile Glu  Met Ala Arg Glu Asn  Gln Thr Thr
    1145                1150                1155

Gln Lys  Gly Gln Lys Asn Ser  Arg Glu Arg Met Lys  Arg Ile Glu
    1160                1165                1170

Glu Gly  Ile Lys Glu Leu Gly  Ser Gln Ile Leu Lys  Glu His Pro
    1175                1180                1185

Val Glu  Asn Thr Gln Leu Gln  Asn Glu Lys Leu Tyr  Leu Tyr Tyr
    1190                1195                1200

Leu Gln  Asn Gly Arg Asp Met  Tyr Val Asp Gln Glu  Leu Asp Ile
    1205                1210                1215

Asn Arg  Leu Ser Asp Tyr Asp  Val Asp His Ile Val  Pro Gln Ser
    1220                1225                1230

Phe Leu  Lys Asp Asp Ser Ile  Asp Asn Lys Val Leu  Thr Arg Ser
    1235                1240                1245
```

```
Asp Lys  Asn Arg Gly Lys Ser  Asp Asn Val Pro Ser  Glu Glu Val
    1250                 1255                 1260

Val Lys  Lys Met Lys Asn Tyr  Trp Arg Gln Leu Leu  Asn Ala Lys
    1265                 1270                 1275

Leu Ile  Thr Gln Arg Lys Phe  Asp Asn Leu Thr Lys  Ala Glu Arg
    1280                 1285                 1290

Gly Gly  Leu Ser Glu Leu Asp  Lys Ala Gly Phe Ile  Lys Arg Gln
    1295                 1300                 1305

Leu Val  Glu Thr Arg Gln Ile  Thr Lys His Val Ala  Gln Ile Leu
    1310                 1315                 1320

Asp Ser  Arg Met Asn Thr Lys  Tyr Asp Glu Asn Asp  Lys Leu Ile
    1325                 1330                 1335

Arg Glu  Val Lys Val Ile Thr  Leu Lys Ser Lys Leu  Val Ser Asp
    1340                 1345                 1350

Phe Arg  Lys Asp Phe Gln Phe  Tyr Lys Val Arg Glu  Ile Asn Asn
    1355                 1360                 1365

Tyr His  His Ala His Asp Ala  Tyr Leu Asn Ala Val  Val Gly Thr
    1370                 1375                 1380

Ala Leu  Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
    1385                 1390                 1395

Gly Asp  Tyr Lys Val Tyr Asp  Val Arg Lys Met Ile  Ala Lys Ser
    1400                 1405                 1410

Glu Gln  Glu Ile Gly Lys Ala  Thr Ala Lys Tyr Phe  Phe Tyr Ser
    1415                 1420                 1425

Asn Ile  Met Asn Phe Phe Lys  Thr Glu Ile Thr Leu  Ala Asn Gly
    1430                 1435                 1440
```

```
Glu Ile  Arg Lys Arg Pro Leu  Ile Glu Thr Asn Gly  Glu Thr Gly
    1445                1450                1455

Glu Ile  Val Trp Asp Lys Gly  Arg Asp Phe Ala Thr  Val Arg Lys
    1460                1465                1470

Val Leu  Ser Met Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Val
    1475                1480                1485

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Pro  Lys Arg Asn
    1490                1495                1500

Ser Asp  Lys Leu Ile Ala Arg  Lys Lys Asp Trp Asp  Pro Lys Lys
    1505                1510                1515

Tyr Gly  Gly Phe Asp Ser Pro  Thr Val Ala Tyr Ser  Val Leu Val
    1520                1525                1530

Val Ala  Lys Val Glu Lys Gly  Lys Ser Lys Lys Leu  Lys Ser Val
    1535                1540                1545

Lys Glu  Leu Leu Gly Ile Thr  Ile Met Glu Arg Ser  Ser Phe Glu
    1550                1555                1560

Lys Asn  Pro Ile Asp Phe Leu  Glu Ala Lys Gly Tyr  Lys Glu Val
    1565                1570                1575

Lys Lys  Asp Leu Ile Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu
    1580                1585                1590

Leu Glu  Asn Gly Arg Lys Arg  Met Leu Ala Ser Ala  Gly Glu Leu
    1595                1600                1605

Gln Lys  Gly Asn Glu Leu Ala  Leu Pro Ser Lys Tyr  Val Asn Phe
    1610                1615                1620

Leu Tyr  Leu Ala Ser His Tyr  Glu Lys Leu Lys Gly  Ser Pro Glu
    1625                1630                1635
```

```
Asp Asn  Glu Gln Lys Gln Leu  Phe Val Glu Gln His  Lys His Tyr
    1640                1645                1650


Leu Asp  Glu Ile Ile Glu Gln  Ile Ser Glu Phe Ser  Lys Arg Val
    1655                1660                1665


Ile Leu  Ala Asp Ala Asn Leu  Asp Lys Val Leu Ser  Ala Tyr Asn
    1670                1675                1680


Lys His  Arg Asp Lys Pro Ile  Arg Glu Gln Ala Glu  Asn Ile Ile
    1685                1690                1695


His Leu  Phe Thr Leu Thr Asn  Leu Gly Ala Pro Ala  Ala Phe Lys
    1700                1705                1710


Tyr Phe  Asp Thr Thr Ile Asp  Arg Lys Arg Tyr Thr  Ser Thr Lys
    1715                1720                1725


Glu Val  Leu Asp Ala Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1730                1735                1740


Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu Gly Gly  Asp Ser Gly
    1745                1750                1755


Gly Ser  Pro Lys Lys Lys Arg  Lys Val
    1760                1765


<210>  461
<211>  1775
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  461

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15
```

```
Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg
    210                 215                 220
```

```
Glu Val Pro Val Gly Ala Val Leu Val His Asn Asn Arg Val Ile Gly
225                 230                 235                 240


Glu Gly Trp Asn Arg Pro Ile Gly Arg His Asp Pro Thr Ala His Ala
                245                 250                 255


Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270


Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285


Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300


Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320


Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335


Asp Glu Cys Ala Ala Leu Leu Ser Tyr Phe Phe Arg Met Arg Arg Gln
            340                 345                 350


Val Phe Lys Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365


Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380


Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400


Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415


Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430
```

```
Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575

Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590

Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640
```

```
Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780

Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800

Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815

Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830

Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845
```

```
Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005

Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020

Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035

Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050
```

```
Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200

Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215

Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230

Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245
```

```
Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                 1255                 1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                 1270                 1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                 1285                 1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                 1300                 1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                 1315                 1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                 1330                 1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                 1345                 1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                 1360                 1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                 1375                 1380

Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                 1390                 1395

Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                 1405                 1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                 1420                 1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                 1435                 1440
```

```
Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455


Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470


Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485


Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500


Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515


Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530


Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545


Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560


Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575


Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590


Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605


Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620


Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635
```

```
Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755


Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770


Lys Val
    1775


<210>  462
<211>  1775
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  462

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15
```

```
Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg
    210                 215                 220
```

```
Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Pro Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Arg Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400

Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415

Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430
```

```
Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575

Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590

Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640
```

```
Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780

Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800

Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815

Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830

Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845
```

```
Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005

Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020

Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035

Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050
```

```
Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200

Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215

Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230

Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245
```

```
Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380

Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395

Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                1420                1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                1435                1440
```

```
Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575

Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605

Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635
```

```
Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755

Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770

Lys Val
    1775
```

<210> 463
<211> 1767
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 463

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205
```

```
Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Pro Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Arg Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
385                 390                 395                 400

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
                405                 410                 415
```

```
Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
            420                 425                 430

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
        435                 440                 445

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
    450                 455                 460

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
465                 470                 475                 480

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
                485                 490                 495

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
            500                 505                 510

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
        515                 520                 525

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
    530                 535                 540

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
545                 550                 555                 560

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
                565                 570                 575

Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
            580                 585                 590

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
        595                 600                 605

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
    610                 615                 620
```

```
Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
625                 630                 635                 640


Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
                645                 650                 655


Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
            660                 665                 670


Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
        675                 680                 685


Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
    690                 695                 700


Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
705                 710                 715                 720


Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
                725                 730                 735


Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
            740                 745                 750


Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
        755                 760                 765


Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
    770                 775                 780


Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
785                 790                 795                 800


Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
                805                 810                 815


Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
            820                 825                 830
```

```
Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
        835                 840                 845

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
    850                 855                 860

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
865                 870                 875                 880

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
                885                 890                 895

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
            900                 905                 910

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
        915                 920                 925

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
    930                 935                 940

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
945                 950                 955                 960

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
                965                 970                 975

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
            980                 985                 990

Asp Phe Leu Asp Asn Glu Glu Asn  Glu Asp Ile Leu Glu  Asp Ile Val
        995                 1000                1005

Leu Thr  Leu Thr Leu Phe Glu  Asp Arg Glu Met Ile  Glu Glu Arg
    1010                1015                1020

Leu Lys  Thr Tyr Ala His Leu  Phe Asp Asp Lys Val  Met Lys Gln
    1025                1030                1035
```

```
Leu Lys  Arg Arg Arg Tyr Thr  Gly Trp Gly Arg Leu  Ser Arg Lys
    1040                1045                1050

Leu Ile  Asn Gly Ile Arg Asp  Lys Gln Ser Gly Lys  Thr Ile Leu
    1055                1060                1065

Asp Phe  Leu Lys Ser Asp Gly  Phe Ala Asn Arg Asn  Phe Met Gln
    1070                1075                1080

Leu Ile  His Asp Asp Ser Leu  Thr Phe Lys Glu Asp  Ile Gln Lys
    1085                1090                1095

Ala Gln  Val Ser Gly Gln Gly  Asp Ser Leu His Glu  His Ile Ala
    1100                1105                1110

Asn Leu  Ala Gly Ser Pro Ala  Ile Lys Lys Gly Ile  Leu Gln Thr
    1115                1120                1125

Val Lys  Val Val Asp Glu Leu  Val Lys Val Met Gly  Arg His Lys
    1130                1135                1140

Pro Glu  Asn Ile Val Ile Glu  Met Ala Arg Glu Asn  Gln Thr Thr
    1145                1150                1155

Gln Lys  Gly Gln Lys Asn Ser  Arg Glu Arg Met Lys  Arg Ile Glu
    1160                1165                1170

Glu Gly  Ile Lys Glu Leu Gly  Ser Gln Ile Leu Lys  Glu His Pro
    1175                1180                1185

Val Glu  Asn Thr Gln Leu Gln  Asn Glu Lys Leu Tyr  Leu Tyr Tyr
    1190                1195                1200

Leu Gln  Asn Gly Arg Asp Met  Tyr Val Asp Gln Glu  Leu Asp Ile
    1205                1210                1215

Asn Arg  Leu Ser Asp Tyr Asp  Val Asp His Ile Val  Pro Gln Ser
    1220                1225                1230
```

```
Phe Leu  Lys Asp Asp Ser Ile  Asp Asn Lys Val Leu  Thr Arg Ser
    1235                1240                1245

Asp Lys  Asn Arg Gly Lys Ser  Asp Asn Val Pro Ser  Glu Glu Val
    1250                1255                1260

Val Lys  Lys Met Lys Asn Tyr  Trp Arg Gln Leu Leu  Asn Ala Lys
    1265                1270                1275

Leu Ile  Thr Gln Arg Lys Phe  Asp Asn Leu Thr Lys  Ala Glu Arg
    1280                1285                1290

Gly Gly  Leu Ser Glu Leu Asp  Lys Ala Gly Phe Ile  Lys Arg Gln
    1295                1300                1305

Leu Val  Glu Thr Arg Gln Ile  Thr Lys His Val Ala  Gln Ile Leu
    1310                1315                1320

Asp Ser  Arg Met Asn Thr Lys  Tyr Asp Glu Asn Asp  Lys Leu Ile
    1325                1330                1335

Arg Glu  Val Lys Val Ile Thr  Leu Lys Ser Lys Leu  Val Ser Asp
    1340                1345                1350

Phe Arg  Lys Asp Phe Gln Phe  Tyr Lys Val Arg Glu  Ile Asn Asn
    1355                1360                1365

Tyr His  His Ala His Asp Ala  Tyr Leu Asn Ala Val  Val Gly Thr
    1370                1375                1380

Ala Leu  Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
    1385                1390                1395

Gly Asp  Tyr Lys Val Tyr Asp  Val Arg Lys Met Ile  Ala Lys Ser
    1400                1405                1410

Glu Gln  Glu Ile Gly Lys Ala  Thr Ala Lys Tyr Phe  Phe Tyr Ser
    1415                1420                1425
```

```
Asn Ile  Met Asn Phe Phe Lys  Thr Glu Ile Thr Leu  Ala Asn Gly
    1430                1435                1440


Glu Ile  Arg Lys Arg Pro Leu  Ile Glu Thr Asn Gly  Glu Thr Gly
    1445                1450                1455


Glu Ile  Val Trp Asp Lys Gly  Arg Asp Phe Ala Thr  Val Arg Lys
    1460                1465                1470


Val Leu  Ser Met Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Val
    1475                1480                1485


Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Pro  Lys Arg Asn
    1490                1495                1500


Ser Asp  Lys Leu Ile Ala Arg  Lys Lys Asp Trp Asp  Pro Lys Lys
    1505                1510                1515


Tyr Gly  Gly Phe Asp Ser Pro  Thr Val Ala Tyr Ser  Val Leu Val
    1520                1525                1530


Val Ala  Lys Val Glu Lys Gly  Lys Ser Lys Lys Leu  Lys Ser Val
    1535                1540                1545


Lys Glu  Leu Leu Gly Ile Thr  Ile Met Glu Arg Ser  Ser Phe Glu
    1550                1555                1560


Lys Asn  Pro Ile Asp Phe Leu  Glu Ala Lys Gly Tyr  Lys Glu Val
    1565                1570                1575


Lys Lys  Asp Leu Ile Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu
    1580                1585                1590


Leu Glu  Asn Gly Arg Lys Arg  Met Leu Ala Ser Ala  Gly Glu Leu
    1595                1600                1605


Gln Lys  Gly Asn Glu Leu Ala  Leu Pro Ser Lys Tyr  Val Asn Phe
    1610                1615                1620
```

```
Leu Tyr  Leu Ala Ser His Tyr  Glu Lys Leu Lys Gly  Ser Pro Glu
    1625                1630                1635


Asp Asn  Glu Gln Lys Gln Leu  Phe Val Glu Gln His  Lys His Tyr
    1640                1645                1650


Leu Asp  Glu Ile Ile Glu Gln  Ile Ser Glu Phe Ser  Lys Arg Val
    1655                1660                1665


Ile Leu  Ala Asp Ala Asn Leu  Asp Lys Val Leu Ser  Ala Tyr Asn
    1670                1675                1680


Lys His  Arg Asp Lys Pro Ile  Arg Glu Gln Ala Glu  Asn Ile Ile
    1685                1690                1695


His Leu  Phe Thr Leu Thr Asn  Leu Gly Ala Pro Ala  Ala Phe Lys
    1700                1705                1710


Tyr Phe  Asp Thr Thr Ile Asp  Arg Lys Arg Tyr Thr  Ser Thr Lys
    1715                1720                1725


Glu Val  Leu Asp Ala Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1730                1735                1740


Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu Gly Gly  Asp Ser Gly
    1745                1750                1755


Gly Ser  Pro Lys Lys Lys Arg  Lys Val
    1760                1765


<210>  464
<211>  1775
<212>  PRT
<213>  Artificial Sequence

<220>
<223>  Synthetic Polypeptide

<400>  464

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15
```

```
Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg
    210                 215                 220
```

```
Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ser Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Arg Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400

Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415

Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430
```

```
Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575

Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590

Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640
```

```
Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780

Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800

Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815

Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830

Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845
```

```
Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005

Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020

Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035

Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050
```

```
Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200

Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215

Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230

Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245
```

```
Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380

Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395

Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                1420                1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                1435                1440
```

```
Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575

Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605

Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635
```

```
Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755

Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770

Lys Val
    1775
```

<210> 465
<211> 1775
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 465

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205
```

```
Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ser Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Asn Ala Leu Leu Cys Tyr Phe Phe Arg Met Arg Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400

Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415
```

```
Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430

Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575

Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590

Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620
```

```
Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640


Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655


Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670


Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685


Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700


Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720


Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735


Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750


Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765


Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780


Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800


Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815


Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830
```

```
Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845

Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005

Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020

Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035
```

```
Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050

Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200

Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215

Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230
```

```
Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245


Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260


Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275


Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290


Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305


Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320


Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335


Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350


Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365


Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380


Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395


Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410


Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                1420                1425
```

```
Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                1435                1440


Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455


Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470


Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485


Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500


Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515


Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530


Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545


Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560


Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575


Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590


Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605


Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620
```

```
Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635


Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755


Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770


Lys Val
    1775
```

<210> 466
<211> 1775
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 466

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205
```

```
Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Arg Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400

Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415
```

```
Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430

Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575

Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590

Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620
```

```
Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640

Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780

Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800

Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815

Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830
```

```
Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845

Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005

Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020

Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035
```

```
Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050

Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200

Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215

Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230
```

```
Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245

Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380

Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395

Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                1420                1425
```

```
Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                1435                1440

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575

Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605

Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620
```

```
Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635


Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755


Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770


Lys Val
    1775
```

<210> 467
<211> 1775
<212> PRT
<213> Artificial Sequence

<220>

<223> Synthetic Polypeptide

<400> 467

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175


Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190
```

```
Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Asn Ala Leu Leu Cys Tyr Phe Phe Arg Met Arg Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400
```

```
Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415

Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430

Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575

Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590

Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605
```

```
Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640

Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780

Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800

Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815
```

```
Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830

Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845

Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005

Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020
```

```
Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035

Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050

Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200

Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215
```

```
Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230

Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245

Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380

Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395

Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410
```

```
Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                 1420                 1425


Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                 1435                 1440


Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                 1450                 1455


Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                 1465                 1470


Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                 1480                 1485


Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                 1495                 1500


Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                 1510                 1515


Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                 1525                 1530


Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                 1540                 1545


Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                 1555                 1560


Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                 1570                 1575


Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                 1585                 1590


Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                 1600                 1605
```

```
Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620


Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635


Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650


Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665


Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680


Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695


Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710


Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725


Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740


Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755


Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770


Lys Val
    1775
```

<210> 468
<211> 1775
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 468

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175


Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190
```

```
Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Arg Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Pro Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400
```

```
Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415

Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430

Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575

Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590

Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605
```

```
Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640

Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780

Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800

Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815
```

```
Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830

Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845

Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005

Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020
```

```
Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035

Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050

Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200

Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215
```

```
Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230

Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245

Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380

Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395

Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410
```

```
Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                 1420                 1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                 1435                 1440

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                 1450                 1455

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                 1465                 1470

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                 1480                 1485

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                 1495                 1500

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                 1510                 1515

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                 1525                 1530

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                 1540                 1545

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                 1555                 1560

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                 1570                 1575

Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                 1585                 1590

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                 1600                 1605
```

```
Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755

Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770

Lys Val
    1775
```

<210> 469
<211> 1775

<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 469

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175
```

```
Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Leu Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Asn Ala Leu Leu Cys Tyr Phe Phe Arg Met Arg Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380
```

```
Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400


Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415


Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430


Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445


Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460


Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480


Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495


Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510


Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525


Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540


Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560


Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575


Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590
```

```
Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640

Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780

Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800
```

```
Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815

Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830

Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845

Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005
```

```
Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020

Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035

Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050

Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200
```

```
Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215


Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230


Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245


Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260


Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275


Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290


Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305


Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320


Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335


Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350


Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365


Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380


Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395
```

```
Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                1420                1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                1435                1440

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575

Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590
```

```
Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605

Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755

Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770

Lys Val
    1775
```

<210> 470
<211> 1775
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 470

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175
```

```
Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Leu Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Asn Ala Leu Leu Cys Tyr Phe Phe Arg Met Pro Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380
```

```
Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400

Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415

Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430

Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575

Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590
```

```
Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640

Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780

Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800
```

```
Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815

Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830

Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845

Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005
```

```
Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020

Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035

Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050

Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200
```

```
Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215

Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230

Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245

Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380

Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395
```

```
Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                1420                1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                1435                1440

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575

Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590
```

```
Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605

Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755

Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770

Lys Val
    1775
```

<210> 471
<211> 1775
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 471

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160
```

```
Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Arg Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Pro Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365
```

```
Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400

Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415

Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430

Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575
```

```
Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590

Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640

Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780
```

```
Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800


Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815


Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830


Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845


Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860


Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880


Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895


Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910


Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925


Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940


Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960


Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975


Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990
```

```
Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005


Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020


Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035


Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050


Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065


Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080


Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095


Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110


Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125


Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140


Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155


Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170


Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185
```

```
Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200

Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215

Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230

Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245

Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380
```

```
Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395

Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                1420                1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                1435                1440

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575
```

```
Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605

Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755

Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770
```

Lys Val
1775

<210> 472
<211> 1767
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 472

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1 5 10 15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
20 25 30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
35 40 45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
50 55 60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65 70 75 80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
85 90 95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
100 105 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
115 120 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
130 135 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145 150 155 160

```
Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Pro Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365
```

```
Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
385                 390                 395                 400

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
                405                 410                 415

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
            420                 425                 430

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
        435                 440                 445

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
    450                 455                 460

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
465                 470                 475                 480

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
                485                 490                 495

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
            500                 505                 510

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
        515                 520                 525

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
    530                 535                 540

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
545                 550                 555                 560

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
                565                 570                 575
```

```
Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
            580                 585                 590

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
        595                 600                 605

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
    610                 615                 620

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
625                 630                 635                 640

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
                645                 650                 655

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
            660                 665                 670

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
        675                 680                 685

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
    690                 695                 700

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
705                 710                 715                 720

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
                725                 730                 735

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
            740                 745                 750

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
        755                 760                 765

Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
    770                 775                 780
```

```
Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
785                 790                 795                 800

Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
                805                 810                 815

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
            820                 825                 830

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
        835                 840                 845

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
    850                 855                 860

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
865                 870                 875                 880

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
                885                 890                 895

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
            900                 905                 910

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
        915                 920                 925

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
    930                 935                 940

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
945                 950                 955                 960

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
                965                 970                 975

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
            980                 985                 990
```

```
Asp Phe Leu Asp Asn Glu Glu Asn  Glu Asp Ile Leu Glu  Asp Ile Val
        995                 1000                1005


Leu Thr  Leu Thr Leu Phe Glu  Asp Arg Glu Met Ile  Glu Glu Arg
    1010                1015                1020


Leu Lys  Thr Tyr Ala His Leu  Phe Asp Asp Lys Val  Met Lys Gln
    1025                1030                1035


Leu Lys  Arg Arg Arg Tyr Thr  Gly Trp Gly Arg Leu  Ser Arg Lys
    1040                1045                1050


Leu Ile  Asn Gly Ile Arg Asp  Lys Gln Ser Gly Lys  Thr Ile Leu
    1055                1060                1065


Asp Phe  Leu Lys Ser Asp Gly  Phe Ala Asn Arg Asn  Phe Met Gln
    1070                1075                1080


Leu Ile  His Asp Asp Ser Leu  Thr Phe Lys Glu Asp  Ile Gln Lys
    1085                1090                1095


Ala Gln  Val Ser Gly Gln Gly  Asp Ser Leu His Glu  His Ile Ala
    1100                1105                1110


Asn Leu  Ala Gly Ser Pro Ala  Ile Lys Lys Gly Ile  Leu Gln Thr
    1115                1120                1125


Val Lys  Val Val Asp Glu Leu  Val Lys Val Met Gly  Arg His Lys
    1130                1135                1140


Pro Glu  Asn Ile Val Ile Glu  Met Ala Arg Glu Asn  Gln Thr Thr
    1145                1150                1155


Gln Lys  Gly Gln Lys Asn Ser  Arg Glu Arg Met Lys  Arg Ile Glu
    1160                1165                1170


Glu Gly  Ile Lys Glu Leu Gly  Ser Gln Ile Leu Lys  Glu His Pro
    1175                1180                1185
```

```
Val Glu  Asn Thr Gln Leu Gln  Asn Glu Lys Leu Tyr  Leu Tyr Tyr
    1190                1195                1200

Leu Gln  Asn Gly Arg Asp Met  Tyr Val Asp Gln Glu  Leu Asp Ile
    1205                1210                1215

Asn Arg  Leu Ser Asp Tyr Asp  Val Asp His Ile Val  Pro Gln Ser
    1220                1225                1230

Phe Leu  Lys Asp Asp Ser Ile  Asp Asn Lys Val Leu  Thr Arg Ser
    1235                1240                1245

Asp Lys  Asn Arg Gly Lys Ser  Asp Asn Val Pro Ser  Glu Glu Val
    1250                1255                1260

Val Lys  Lys Met Lys Asn Tyr  Trp Arg Gln Leu Leu  Asn Ala Lys
    1265                1270                1275

Leu Ile  Thr Gln Arg Lys Phe  Asp Asn Leu Thr Lys  Ala Glu Arg
    1280                1285                1290

Gly Gly  Leu Ser Glu Leu Asp  Lys Ala Gly Phe Ile  Lys Arg Gln
    1295                1300                1305

Leu Val  Glu Thr Arg Gln Ile  Thr Lys His Val Ala  Gln Ile Leu
    1310                1315                1320

Asp Ser  Arg Met Asn Thr Lys  Tyr Asp Glu Asn Asp  Lys Leu Ile
    1325                1330                1335

Arg Glu  Val Lys Val Ile Thr  Leu Lys Ser Lys Leu  Val Ser Asp
    1340                1345                1350

Phe Arg  Lys Asp Phe Gln Phe  Tyr Lys Val Arg Glu  Ile Asn Asn
    1355                1360                1365

Tyr His  His Ala His Asp Ala  Tyr Leu Asn Ala Val  Val Gly Thr
    1370                1375                1380
```

```
Ala Leu  Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
    1385                1390                1395

Gly Asp  Tyr Lys Val Tyr Asp  Val Arg Lys Met Ile  Ala Lys Ser
    1400                1405                1410

Glu Gln  Glu Ile Gly Lys Ala  Thr Ala Lys Tyr Phe  Phe Tyr Ser
    1415                1420                1425

Asn Ile  Met Asn Phe Phe Lys  Thr Glu Ile Thr Leu  Ala Asn Gly
    1430                1435                1440

Glu Ile  Arg Lys Arg Pro Leu  Ile Glu Thr Asn Gly  Glu Thr Gly
    1445                1450                1455

Glu Ile  Val Trp Asp Lys Gly  Arg Asp Phe Ala Thr  Val Arg Lys
    1460                1465                1470

Val Leu  Ser Met Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Val
    1475                1480                1485

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Pro  Lys Arg Asn
    1490                1495                1500

Ser Asp  Lys Leu Ile Ala Arg  Lys Lys Asp Trp Asp  Pro Lys Lys
    1505                1510                1515

Tyr Gly  Gly Phe Asp Ser Pro  Thr Val Ala Tyr Ser  Val Leu Val
    1520                1525                1530

Val Ala  Lys Val Glu Lys Gly  Lys Ser Lys Lys Leu  Lys Ser Val
    1535                1540                1545

Lys Glu  Leu Leu Gly Ile Thr  Ile Met Glu Arg Ser  Ser Phe Glu
    1550                1555                1560

Lys Asn  Pro Ile Asp Phe Leu  Glu Ala Lys Gly Tyr  Lys Glu Val
    1565                1570                1575
```

```
Lys Lys  Asp Leu Ile Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu
    1580                 1585                 1590

Leu Glu  Asn Gly Arg Lys Arg  Met Leu Ala Ser Ala  Gly Glu Leu
    1595                 1600                 1605

Gln Lys  Gly Asn Glu Leu Ala  Leu Pro Ser Lys Tyr  Val Asn Phe
    1610                 1615                 1620

Leu Tyr  Leu Ala Ser His Tyr  Glu Lys Leu Lys Gly  Ser Pro Glu
    1625                 1630                 1635

Asp Asn  Glu Gln Lys Gln Leu  Phe Val Glu Gln His  Lys His Tyr
    1640                 1645                 1650

Leu Asp  Glu Ile Ile Glu Gln  Ile Ser Glu Phe Ser  Lys Arg Val
    1655                 1660                 1665

Ile Leu  Ala Asp Ala Asn Leu  Asp Lys Val Leu Ser  Ala Tyr Asn
    1670                 1675                 1680

Lys His  Arg Asp Lys Pro Ile  Arg Glu Gln Ala Glu  Asn Ile Ile
    1685                 1690                 1695

His Leu  Phe Thr Leu Thr Asn  Leu Gly Ala Pro Ala  Ala Phe Lys
    1700                 1705                 1710

Tyr Phe  Asp Thr Thr Ile Asp  Arg Lys Arg Tyr Thr  Ser Thr Lys
    1715                 1720                 1725

Glu Val  Leu Asp Ala Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1730                 1735                 1740

Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu Gly Gly  Asp Ser Gly
    1745                 1750                 1755

Gly Ser  Pro Lys Lys Lys Arg  Lys Val
    1760                 1765
```

<210> 473
<211> 1767
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 473

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160
```

```
Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Asn Ala Leu Leu Cys Tyr Phe Phe Arg Met Pro Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365
```

```
Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
385                 390                 395                 400

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
                405                 410                 415

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
            420                 425                 430

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
        435                 440                 445

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
    450                 455                 460

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
465                 470                 475                 480

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
                485                 490                 495

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
            500                 505                 510

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
        515                 520                 525

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
    530                 535                 540

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
545                 550                 555                 560

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
                565                 570                 575
```

```
Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
            580                 585                 590

Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
        595                 600                 605

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
    610                 615                 620

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
625                 630                 635                 640

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
                645                 650                 655

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
            660                 665                 670

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
        675                 680                 685

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
    690                 695                 700

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
705                 710                 715                 720

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
                725                 730                 735

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
            740                 745                 750

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
        755                 760                 765

Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
    770                 775                 780
```

```
Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
785                 790                 795                 800


Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
                805                 810                 815


Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
            820                 825                 830


Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
        835                 840                 845


Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
    850                 855                 860


Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
865                 870                 875                 880


Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
                885                 890                 895


Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
            900                 905                 910


Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
        915                 920                 925


Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
    930                 935                 940


Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
945                 950                 955                 960


Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
                965                 970                 975


Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
            980                 985                 990
```

```
Asp Phe Leu Asp Asn Glu Glu Asn  Glu Asp Ile Leu Glu  Asp Ile Val
        995                 1000                1005


Leu Thr  Leu Thr Leu Phe Glu  Asp Arg Glu Met Ile  Glu Glu Arg
    1010                1015                1020


Leu Lys  Thr Tyr Ala His Leu  Phe Asp Asp Lys Val  Met Lys Gln
    1025                1030                1035


Leu Lys  Arg Arg Arg Tyr Thr  Gly Trp Gly Arg Leu  Ser Arg Lys
    1040                1045                1050


Leu Ile  Asn Gly Ile Arg Asp  Lys Gln Ser Gly Lys  Thr Ile Leu
    1055                1060                1065


Asp Phe  Leu Lys Ser Asp Gly  Phe Ala Asn Arg Asn  Phe Met Gln
    1070                1075                1080


Leu Ile  His Asp Asp Ser Leu  Thr Phe Lys Glu Asp  Ile Gln Lys
    1085                1090                1095


Ala Gln  Val Ser Gly Gln Gly  Asp Ser Leu His Glu  His Ile Ala
    1100                1105                1110


Asn Leu  Ala Gly Ser Pro Ala  Ile Lys Lys Gly Ile  Leu Gln Thr
    1115                1120                1125


Val Lys  Val Val Asp Glu Leu  Val Lys Val Met Gly  Arg His Lys
    1130                1135                1140


Pro Glu  Asn Ile Val Ile Glu  Met Ala Arg Glu Asn  Gln Thr Thr
    1145                1150                1155


Gln Lys  Gly Gln Lys Asn Ser  Arg Glu Arg Met Lys  Arg Ile Glu
    1160                1165                1170


Glu Gly  Ile Lys Glu Leu Gly  Ser Gln Ile Leu Lys  Glu His Pro
    1175                1180                1185
```

```
Val Glu  Asn Thr Gln Leu Gln  Asn Glu Lys Leu Tyr  Leu Tyr Tyr
    1190                1195                1200


Leu Gln  Asn Gly Arg Asp Met  Tyr Val Asp Gln Glu  Leu Asp Ile
    1205                1210                1215


Asn Arg  Leu Ser Asp Tyr Asp  Val Asp His Ile Val  Pro Gln Ser
    1220                1225                1230


Phe Leu  Lys Asp Asp Ser Ile  Asp Asn Lys Val Leu  Thr Arg Ser
    1235                1240                1245


Asp Lys  Asn Arg Gly Lys Ser  Asp Asn Val Pro Ser  Glu Glu Val
    1250                1255                1260


Val Lys  Lys Met Lys Asn Tyr  Trp Arg Gln Leu Leu  Asn Ala Lys
    1265                1270                1275


Leu Ile  Thr Gln Arg Lys Phe  Asp Asn Leu Thr Lys  Ala Glu Arg
    1280                1285                1290


Gly Gly  Leu Ser Glu Leu Asp  Lys Ala Gly Phe Ile  Lys Arg Gln
    1295                1300                1305


Leu Val  Glu Thr Arg Gln Ile  Thr Lys His Val Ala  Gln Ile Leu
    1310                1315                1320


Asp Ser  Arg Met Asn Thr Lys  Tyr Asp Glu Asn Asp  Lys Leu Ile
    1325                1330                1335


Arg Glu  Val Lys Val Ile Thr  Leu Lys Ser Lys Leu  Val Ser Asp
    1340                1345                1350


Phe Arg  Lys Asp Phe Gln Phe  Tyr Lys Val Arg Glu  Ile Asn Asn
    1355                1360                1365


Tyr His  His Ala His Asp Ala  Tyr Leu Asn Ala Val  Val Gly Thr
    1370                1375                1380
```

```
Ala Leu  Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
    1385                1390                1395

Gly Asp  Tyr Lys Val Tyr Asp  Val Arg Lys Met Ile  Ala Lys Ser
    1400                1405                1410

Glu Gln  Glu Ile Gly Lys Ala  Thr Ala Lys Tyr Phe  Phe Tyr Ser
    1415                1420                1425

Asn Ile  Met Asn Phe Phe Lys  Thr Glu Ile Thr Leu  Ala Asn Gly
    1430                1435                1440

Glu Ile  Arg Lys Arg Pro Leu  Ile Glu Thr Asn Gly  Glu Thr Gly
    1445                1450                1455

Glu Ile  Val Trp Asp Lys Gly  Arg Asp Phe Ala Thr  Val Arg Lys
    1460                1465                1470

Val Leu  Ser Met Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Val
    1475                1480                1485

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Pro  Lys Arg Asn
    1490                1495                1500

Ser Asp  Lys Leu Ile Ala Arg  Lys Lys Asp Trp Asp  Pro Lys Lys
    1505                1510                1515

Tyr Gly  Gly Phe Asp Ser Pro  Thr Val Ala Tyr Ser  Val Leu Val
    1520                1525                1530

Val Ala  Lys Val Glu Lys Gly  Lys Ser Lys Lys Leu  Lys Ser Val
    1535                1540                1545

Lys Glu  Leu Leu Gly Ile Thr  Ile Met Glu Arg Ser  Ser Phe Glu
    1550                1555                1560

Lys Asn  Pro Ile Asp Phe Leu  Glu Ala Lys Gly Tyr  Lys Glu Val
    1565                1570                1575
```

```
Lys Lys  Asp Leu Ile Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu
    1580                 1585                 1590

Leu Glu  Asn Gly Arg Lys Arg  Met Leu Ala Ser Ala  Gly Glu Leu
    1595                 1600                 1605

Gln Lys  Gly Asn Glu Leu Ala  Leu Pro Ser Lys Tyr  Val Asn Phe
    1610                 1615                 1620

Leu Tyr  Leu Ala Ser His Tyr  Glu Lys Leu Lys Gly  Ser Pro Glu
    1625                 1630                 1635

Asp Asn  Glu Gln Lys Gln Leu  Phe Val Glu Gln His  Lys His Tyr
    1640                 1645                 1650

Leu Asp  Glu Ile Ile Glu Gln  Ile Ser Glu Phe Ser  Lys Arg Val
    1655                 1660                 1665

Ile Leu  Ala Asp Ala Asn Leu  Asp Lys Val Leu Ser  Ala Tyr Asn
    1670                 1675                 1680

Lys His  Arg Asp Lys Pro Ile  Arg Glu Gln Ala Glu  Asn Ile Ile
    1685                 1690                 1695

His Leu  Phe Thr Leu Thr Asn  Leu Gly Ala Pro Ala  Ala Phe Lys
    1700                 1705                 1710

Tyr Phe  Asp Thr Thr Ile Asp  Arg Lys Arg Tyr Thr  Ser Thr Lys
    1715                 1720                 1725

Glu Val  Leu Asp Ala Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1730                 1735                 1740

Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu Gly Gly  Asp Ser Gly
    1745                 1750                 1755

Gly Ser  Pro Lys Lys Lys Arg  Lys Val
    1760                 1765
```

<210> 474
<211> 1767
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 474

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175
```

```
Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Leu Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Pro Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380
```

```
Ala Thr Pro Glu Ser Asp Lys Lys Tyr Ser Ile Gly Leu Ala Ile Gly
385                 390                 395                 400

Thr Asn Ser Val Gly Trp Ala Val Ile Thr Asp Glu Tyr Lys Val Pro
                405                 410                 415

Ser Lys Lys Phe Lys Val Leu Gly Asn Thr Asp Arg His Ser Ile Lys
            420                 425                 430

Lys Asn Leu Ile Gly Ala Leu Leu Phe Asp Ser Gly Glu Thr Ala Glu
        435                 440                 445

Ala Thr Arg Leu Lys Arg Thr Ala Arg Arg Arg Tyr Thr Arg Arg Lys
    450                 455                 460

Asn Arg Ile Cys Tyr Leu Gln Glu Ile Phe Ser Asn Glu Met Ala Lys
465                 470                 475                 480

Val Asp Asp Ser Phe Phe His Arg Leu Glu Glu Ser Phe Leu Val Glu
                485                 490                 495

Glu Asp Lys Lys His Glu Arg His Pro Ile Phe Gly Asn Ile Val Asp
            500                 505                 510

Glu Val Ala Tyr His Glu Lys Tyr Pro Thr Ile Tyr His Leu Arg Lys
        515                 520                 525

Lys Leu Val Asp Ser Thr Asp Lys Ala Asp Leu Arg Leu Ile Tyr Leu
    530                 535                 540

Ala Leu Ala His Met Ile Lys Phe Arg Gly His Phe Leu Ile Glu Gly
545                 550                 555                 560

Asp Leu Asn Pro Asp Asn Ser Asp Val Asp Lys Leu Phe Ile Gln Leu
                565                 570                 575

Val Gln Thr Tyr Asn Gln Leu Phe Glu Glu Asn Pro Ile Asn Ala Ser
            580                 585                 590
```

```
Gly Val Asp Ala Lys Ala Ile Leu Ser Ala Arg Leu Ser Lys Ser Arg
        595                 600                 605

Arg Leu Glu Asn Leu Ile Ala Gln Leu Pro Gly Glu Lys Lys Asn Gly
    610                 615                 620

Leu Phe Gly Asn Leu Ile Ala Leu Ser Leu Gly Leu Thr Pro Asn Phe
625                 630                 635                 640

Lys Ser Asn Phe Asp Leu Ala Glu Asp Ala Lys Leu Gln Leu Ser Lys
                645                 650                 655

Asp Thr Tyr Asp Asp Asp Leu Asp Asn Leu Leu Ala Gln Ile Gly Asp
            660                 665                 670

Gln Tyr Ala Asp Leu Phe Leu Ala Ala Lys Asn Leu Ser Asp Ala Ile
        675                 680                 685

Leu Leu Ser Asp Ile Leu Arg Val Asn Thr Glu Ile Thr Lys Ala Pro
    690                 695                 700

Leu Ser Ala Ser Met Ile Lys Arg Tyr Asp Glu His His Gln Asp Leu
705                 710                 715                 720

Thr Leu Leu Lys Ala Leu Val Arg Gln Gln Leu Pro Glu Lys Tyr Lys
                725                 730                 735

Glu Ile Phe Phe Asp Gln Ser Lys Asn Gly Tyr Ala Gly Tyr Ile Asp
            740                 745                 750

Gly Gly Ala Ser Gln Glu Glu Phe Tyr Lys Phe Ile Lys Pro Ile Leu
        755                 760                 765

Glu Lys Met Asp Gly Thr Glu Glu Leu Leu Val Lys Leu Asn Arg Glu
    770                 775                 780

Asp Leu Leu Arg Lys Gln Arg Thr Phe Asp Asn Gly Ser Ile Pro His
785                 790                 795                 800
```

```
Gln Ile His Leu Gly Glu Leu His Ala Ile Leu Arg Arg Gln Glu Asp
                805                 810                 815

Phe Tyr Pro Phe Leu Lys Asp Asn Arg Glu Lys Ile Glu Lys Ile Leu
            820                 825                 830

Thr Phe Arg Ile Pro Tyr Tyr Val Gly Pro Leu Ala Arg Gly Asn Ser
        835                 840                 845

Arg Phe Ala Trp Met Thr Arg Lys Ser Glu Glu Thr Ile Thr Pro Trp
    850                 855                 860

Asn Phe Glu Glu Val Val Asp Lys Gly Ala Ser Ala Gln Ser Phe Ile
865                 870                 875                 880

Glu Arg Met Thr Asn Phe Asp Lys Asn Leu Pro Asn Glu Lys Val Leu
                885                 890                 895

Pro Lys His Ser Leu Leu Tyr Glu Tyr Phe Thr Val Tyr Asn Glu Leu
            900                 905                 910

Thr Lys Val Lys Tyr Val Thr Glu Gly Met Arg Lys Pro Ala Phe Leu
        915                 920                 925

Ser Gly Glu Gln Lys Lys Ala Ile Val Asp Leu Leu Phe Lys Thr Asn
    930                 935                 940

Arg Lys Val Thr Val Lys Gln Leu Lys Glu Asp Tyr Phe Lys Lys Ile
945                 950                 955                 960

Glu Cys Phe Asp Ser Val Glu Ile Ser Gly Val Glu Asp Arg Phe Asn
                965                 970                 975

Ala Ser Leu Gly Thr Tyr His Asp Leu Leu Lys Ile Ile Lys Asp Lys
            980                 985                 990

Asp Phe Leu Asp Asn Glu Glu Asn  Glu Asp Ile Leu Glu  Asp Ile Val
        995                 1000                1005
```

```
Leu Thr  Leu Thr Leu Phe Glu  Asp Arg Glu Met Ile  Glu Glu Arg
    1010                1015                1020

Leu Lys  Thr Tyr Ala His Leu  Phe Asp Asp Lys Val  Met Lys Gln
    1025                1030                1035

Leu Lys  Arg Arg Arg Tyr Thr  Gly Trp Gly Arg Leu  Ser Arg Lys
    1040                1045                1050

Leu Ile  Asn Gly Ile Arg Asp  Lys Gln Ser Gly Lys  Thr Ile Leu
    1055                1060                1065

Asp Phe  Leu Lys Ser Asp Gly  Phe Ala Asn Arg Asn  Phe Met Gln
    1070                1075                1080

Leu Ile  His Asp Asp Ser Leu  Thr Phe Lys Glu Asp  Ile Gln Lys
    1085                1090                1095

Ala Gln  Val Ser Gly Gln Gly  Asp Ser Leu His Glu  His Ile Ala
    1100                1105                1110

Asn Leu  Ala Gly Ser Pro Ala  Ile Lys Lys Gly Ile  Leu Gln Thr
    1115                1120                1125

Val Lys  Val Val Asp Glu Leu  Val Lys Val Met Gly  Arg His Lys
    1130                1135                1140

Pro Glu  Asn Ile Val Ile Glu  Met Ala Arg Glu Asn  Gln Thr Thr
    1145                1150                1155

Gln Lys  Gly Gln Lys Asn Ser  Arg Glu Arg Met Lys  Arg Ile Glu
    1160                1165                1170

Glu Gly  Ile Lys Glu Leu Gly  Ser Gln Ile Leu Lys  Glu His Pro
    1175                1180                1185

Val Glu  Asn Thr Gln Leu Gln  Asn Glu Lys Leu Tyr  Leu Tyr Tyr
    1190                1195                1200
```

```
Leu Gln  Asn Gly Arg Asp Met  Tyr Val Asp Gln Glu  Leu Asp Ile
    1205                 1210                 1215

Asn Arg  Leu Ser Asp Tyr Asp  Val Asp His Ile Val  Pro Gln Ser
    1220                 1225                 1230

Phe Leu  Lys Asp Asp Ser Ile  Asp Asn Lys Val Leu  Thr Arg Ser
    1235                 1240                 1245

Asp Lys  Asn Arg Gly Lys Ser  Asp Asn Val Pro Ser  Glu Glu Val
    1250                 1255                 1260

Val Lys  Lys Met Lys Asn Tyr  Trp Arg Gln Leu Leu  Asn Ala Lys
    1265                 1270                 1275

Leu Ile  Thr Gln Arg Lys Phe  Asp Asn Leu Thr Lys  Ala Glu Arg
    1280                 1285                 1290

Gly Gly  Leu Ser Glu Leu Asp  Lys Ala Gly Phe Ile  Lys Arg Gln
    1295                 1300                 1305

Leu Val  Glu Thr Arg Gln Ile  Thr Lys His Val Ala  Gln Ile Leu
    1310                 1315                 1320

Asp Ser  Arg Met Asn Thr Lys  Tyr Asp Glu Asn Asp  Lys Leu Ile
    1325                 1330                 1335

Arg Glu  Val Lys Val Ile Thr  Leu Lys Ser Lys Leu  Val Ser Asp
    1340                 1345                 1350

Phe Arg  Lys Asp Phe Gln Phe  Tyr Lys Val Arg Glu  Ile Asn Asn
    1355                 1360                 1365

Tyr His  His Ala His Asp Ala  Tyr Leu Asn Ala Val  Val Gly Thr
    1370                 1375                 1380

Ala Leu  Ile Lys Lys Tyr Pro  Lys Leu Glu Ser Glu  Phe Val Tyr
    1385                 1390                 1395
```

```
Gly Asp  Tyr Lys Val Tyr Asp  Val Arg Lys Met Ile  Ala Lys Ser
    1400                1405                1410

Glu Gln  Glu Ile Gly Lys Ala  Thr Ala Lys Tyr Phe  Phe Tyr Ser
    1415                1420                1425

Asn Ile  Met Asn Phe Phe Lys  Thr Glu Ile Thr Leu  Ala Asn Gly
    1430                1435                1440

Glu Ile  Arg Lys Arg Pro Leu  Ile Glu Thr Asn Gly  Glu Thr Gly
    1445                1450                1455

Glu Ile  Val Trp Asp Lys Gly  Arg Asp Phe Ala Thr  Val Arg Lys
    1460                1465                1470

Val Leu  Ser Met Pro Gln Val  Asn Ile Val Lys Lys  Thr Glu Val
    1475                1480                1485

Gln Thr  Gly Gly Phe Ser Lys  Glu Ser Ile Leu Pro  Lys Arg Asn
    1490                1495                1500

Ser Asp  Lys Leu Ile Ala Arg  Lys Lys Asp Trp Asp  Pro Lys Lys
    1505                1510                1515

Tyr Gly  Gly Phe Asp Ser Pro  Thr Val Ala Tyr Ser  Val Leu Val
    1520                1525                1530

Val Ala  Lys Val Glu Lys Gly  Lys Ser Lys Lys Leu  Lys Ser Val
    1535                1540                1545

Lys Glu  Leu Leu Gly Ile Thr  Ile Met Glu Arg Ser  Ser Phe Glu
    1550                1555                1560

Lys Asn  Pro Ile Asp Phe Leu  Glu Ala Lys Gly Tyr  Lys Glu Val
    1565                1570                1575

Lys Lys  Asp Leu Ile Ile Lys  Leu Pro Lys Tyr Ser  Leu Phe Glu
    1580                1585                1590
```

```
Leu Glu  Asn Gly Arg Lys Arg  Met Leu Ala Ser Ala  Gly Glu Leu
    1595                1600                1605

Gln Lys  Gly Asn Glu Leu Ala  Leu Pro Ser Lys Tyr  Val Asn Phe
    1610                1615                1620

Leu Tyr  Leu Ala Ser His Tyr  Glu Lys Leu Lys Gly  Ser Pro Glu
    1625                1630                1635

Asp Asn  Glu Gln Lys Gln Leu  Phe Val Glu Gln His  Lys His Tyr
    1640                1645                1650

Leu Asp  Glu Ile Ile Glu Gln  Ile Ser Glu Phe Ser  Lys Arg Val
    1655                1660                1665

Ile Leu  Ala Asp Ala Asn Leu  Asp Lys Val Leu Ser  Ala Tyr Asn
    1670                1675                1680

Lys His  Arg Asp Lys Pro Ile  Arg Glu Gln Ala Glu  Asn Ile Ile
    1685                1690                1695

His Leu  Phe Thr Leu Thr Asn  Leu Gly Ala Pro Ala  Ala Phe Lys
    1700                1705                1710

Tyr Phe  Asp Thr Thr Ile Asp  Arg Lys Arg Tyr Thr  Ser Thr Lys
    1715                1720                1725

Glu Val  Leu Asp Ala Thr Leu  Ile His Gln Ser Ile  Thr Gly Leu
    1730                1735                1740

Tyr Glu  Thr Arg Ile Asp Leu  Ser Gln Leu Gly Gly  Asp Ser Gly
    1745                1750                1755

Gly Ser  Pro Lys Lys Lys Arg  Lys Val
    1760                1765
```

<210> 475
<211> 1775

<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 475

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1 5 10 15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
20 25 30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
35 40 45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
50 55 60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65 70 75 80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
85 90 95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
100 105 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
115 120 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
130 135 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145 150 155 160

Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
165 170 175

```
Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ser Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Arg Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380
```

```
Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400


Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415


Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430


Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445


Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460


Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480


Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495


Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510


Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525


Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540


Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560


Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575


Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590
```

```
Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640

Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780

Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800
```

```
Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815

Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830

Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845

Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005
```

```
Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020

Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035

Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050

Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200
```

```
Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215


Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230


Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245


Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260


Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275


Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290


Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305


Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320


Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335


Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350


Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365


Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380


Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395
```

```
Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                1420                1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                1435                1440

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575

Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590
```

```
Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605

Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755

Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770

Lys Val
    1775
```

<210> 476
<211> 1775
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 476

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160


Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175
```

```
Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Leu Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Asn Ala Leu Leu Cys Tyr Phe Phe Arg Met Arg Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365

Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380
```

```
Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400

Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415

Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430

Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575

Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590
```

```
Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640

Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780

Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800
```

```
Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815

Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830

Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845

Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990

Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005
```

```
Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020

Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035

Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050

Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065

Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080

Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095

Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110

Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125

Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140

Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155

Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170

Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185

Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200
```

```
Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215

Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230

Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245

Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380

Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395
```

```
Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                1420                1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                1435                1440

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575

Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590
```

```
Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605

Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755

Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770

Lys Val
    1775
```

<210> 477
<211> 1775
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 477

```
Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1               5                  10                  15


Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
            20                  25                  30


Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
        35                  40                  45


Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
    50                  55                  60


Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65                  70                  75                  80


Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
                85                  90                  95


Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
            100                 105                 110


Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
        115                 120                 125


Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
    130                 135                 140


Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145                 150                 155                 160
```

```
Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Leu Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Asn Ala Leu Leu Cys Tyr Phe Phe Arg Met Pro Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365
```

```
Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400

Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415

Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430

Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575
```

```
Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590

Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640

Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780
```

```
Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800


Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815


Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830


Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845


Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860


Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880


Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895


Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910


Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925


Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940


Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960


Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975


Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990
```

```
Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005


Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020


Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035


Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050


Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065


Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080


Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095


Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110


Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125


Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140


Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155


Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170


Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185
```

```
Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                1195                1200

Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                1210                1215

Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                1225                1230

Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                1240                1245

Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                1255                1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                1270                1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                1285                1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                1300                1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                1315                1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                1330                1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                1345                1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                1360                1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                1375                1380
```

```
Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395

Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                1420                1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                1435                1440

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575
```

```
Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605

Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755

Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770
```

Lys Val
1775

<210> 478
<211> 1775
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 478

Met Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu
1 5 10 15

Thr Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala
20 25 30

Val Leu Val His Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Pro
35 40 45

Ile Gly Arg His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg
50 55 60

Gln Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu
65 70 75 80

Tyr Val Thr Leu Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His
85 90 95

Ser Arg Ile Gly Arg Val Val Phe Gly Ala Arg Asp Ala Lys Thr Gly
100 105 110

Ala Ala Gly Ser Leu Met Asp Val Leu His His Pro Gly Met Asn His
115 120 125

Arg Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu
130 135 140

Leu Ser Asp Phe Phe Arg Met Arg Arg Gln Glu Ile Lys Ala Gln Lys
145 150 155 160

```
Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly Ser Ser Gly Gly Ser Ser
                165                 170                 175

Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser Ala Thr Pro Glu Ser Ser
            180                 185                 190

Gly Gly Ser Ser Gly Gly Ser Ser Glu Val Glu Phe Ser His Glu Tyr
        195                 200                 205

Trp Met Arg His Ala Leu Thr Leu Ala Lys Arg Ala Arg Asp Glu Arg
    210                 215                 220

Glu Val Pro Val Gly Ala Val Leu Val Leu Asn Asn Arg Val Ile Gly
225                 230                 235                 240

Glu Gly Trp Asn Arg Ala Ile Gly Leu His Asp Pro Thr Ala His Ala
                245                 250                 255

Glu Ile Met Ala Leu Arg Gln Gly Gly Leu Val Met Gln Asn Tyr Arg
            260                 265                 270

Leu Ile Asp Ala Thr Leu Tyr Val Thr Phe Glu Pro Cys Val Met Cys
        275                 280                 285

Ala Gly Ala Met Ile His Ser Arg Ile Gly Arg Val Val Phe Gly Val
    290                 295                 300

Arg Asn Ala Lys Thr Gly Ala Ala Gly Ser Leu Met Asp Val Leu His
305                 310                 315                 320

Tyr Pro Gly Met Asn His Arg Val Glu Ile Thr Glu Gly Ile Leu Ala
                325                 330                 335

Asp Glu Cys Ala Ala Leu Leu Cys Tyr Phe Phe Arg Met Pro Arg Gln
            340                 345                 350

Val Phe Asn Ala Gln Lys Lys Ala Gln Ser Ser Thr Asp Ser Gly Gly
        355                 360                 365
```

```
Ser Ser Gly Gly Ser Ser Gly Ser Glu Thr Pro Gly Thr Ser Glu Ser
    370                 375                 380

Ala Thr Pro Glu Ser Ser Gly Gly Ser Ser Gly Gly Ser Asp Lys Lys
385                 390                 395                 400

Tyr Ser Ile Gly Leu Ala Ile Gly Thr Asn Ser Val Gly Trp Ala Val
                405                 410                 415

Ile Thr Asp Glu Tyr Lys Val Pro Ser Lys Lys Phe Lys Val Leu Gly
            420                 425                 430

Asn Thr Asp Arg His Ser Ile Lys Lys Asn Leu Ile Gly Ala Leu Leu
        435                 440                 445

Phe Asp Ser Gly Glu Thr Ala Glu Ala Thr Arg Leu Lys Arg Thr Ala
    450                 455                 460

Arg Arg Arg Tyr Thr Arg Arg Lys Asn Arg Ile Cys Tyr Leu Gln Glu
465                 470                 475                 480

Ile Phe Ser Asn Glu Met Ala Lys Val Asp Asp Ser Phe Phe His Arg
                485                 490                 495

Leu Glu Glu Ser Phe Leu Val Glu Glu Asp Lys Lys His Glu Arg His
            500                 505                 510

Pro Ile Phe Gly Asn Ile Val Asp Glu Val Ala Tyr His Glu Lys Tyr
        515                 520                 525

Pro Thr Ile Tyr His Leu Arg Lys Lys Leu Val Asp Ser Thr Asp Lys
    530                 535                 540

Ala Asp Leu Arg Leu Ile Tyr Leu Ala Leu Ala His Met Ile Lys Phe
545                 550                 555                 560

Arg Gly His Phe Leu Ile Glu Gly Asp Leu Asn Pro Asp Asn Ser Asp
                565                 570                 575
```

```
Val Asp Lys Leu Phe Ile Gln Leu Val Gln Thr Tyr Asn Gln Leu Phe
            580                 585                 590

Glu Glu Asn Pro Ile Asn Ala Ser Gly Val Asp Ala Lys Ala Ile Leu
        595                 600                 605

Ser Ala Arg Leu Ser Lys Ser Arg Arg Leu Glu Asn Leu Ile Ala Gln
    610                 615                 620

Leu Pro Gly Glu Lys Lys Asn Gly Leu Phe Gly Asn Leu Ile Ala Leu
625                 630                 635                 640

Ser Leu Gly Leu Thr Pro Asn Phe Lys Ser Asn Phe Asp Leu Ala Glu
                645                 650                 655

Asp Ala Lys Leu Gln Leu Ser Lys Asp Thr Tyr Asp Asp Asp Leu Asp
            660                 665                 670

Asn Leu Leu Ala Gln Ile Gly Asp Gln Tyr Ala Asp Leu Phe Leu Ala
        675                 680                 685

Ala Lys Asn Leu Ser Asp Ala Ile Leu Leu Ser Asp Ile Leu Arg Val
    690                 695                 700

Asn Thr Glu Ile Thr Lys Ala Pro Leu Ser Ala Ser Met Ile Lys Arg
705                 710                 715                 720

Tyr Asp Glu His His Gln Asp Leu Thr Leu Leu Lys Ala Leu Val Arg
                725                 730                 735

Gln Gln Leu Pro Glu Lys Tyr Lys Glu Ile Phe Phe Asp Gln Ser Lys
            740                 745                 750

Asn Gly Tyr Ala Gly Tyr Ile Asp Gly Gly Ala Ser Gln Glu Glu Phe
        755                 760                 765

Tyr Lys Phe Ile Lys Pro Ile Leu Glu Lys Met Asp Gly Thr Glu Glu
    770                 775                 780
```

```
Leu Leu Val Lys Leu Asn Arg Glu Asp Leu Leu Arg Lys Gln Arg Thr
785                 790                 795                 800

Phe Asp Asn Gly Ser Ile Pro His Gln Ile His Leu Gly Glu Leu His
                805                 810                 815

Ala Ile Leu Arg Arg Gln Glu Asp Phe Tyr Pro Phe Leu Lys Asp Asn
            820                 825                 830

Arg Glu Lys Ile Glu Lys Ile Leu Thr Phe Arg Ile Pro Tyr Tyr Val
        835                 840                 845

Gly Pro Leu Ala Arg Gly Asn Ser Arg Phe Ala Trp Met Thr Arg Lys
    850                 855                 860

Ser Glu Glu Thr Ile Thr Pro Trp Asn Phe Glu Glu Val Val Asp Lys
865                 870                 875                 880

Gly Ala Ser Ala Gln Ser Phe Ile Glu Arg Met Thr Asn Phe Asp Lys
                885                 890                 895

Asn Leu Pro Asn Glu Lys Val Leu Pro Lys His Ser Leu Leu Tyr Glu
            900                 905                 910

Tyr Phe Thr Val Tyr Asn Glu Leu Thr Lys Val Lys Tyr Val Thr Glu
        915                 920                 925

Gly Met Arg Lys Pro Ala Phe Leu Ser Gly Glu Gln Lys Lys Ala Ile
    930                 935                 940

Val Asp Leu Leu Phe Lys Thr Asn Arg Lys Val Thr Val Lys Gln Leu
945                 950                 955                 960

Lys Glu Asp Tyr Phe Lys Lys Ile Glu Cys Phe Asp Ser Val Glu Ile
                965                 970                 975

Ser Gly Val Glu Asp Arg Phe Asn Ala Ser Leu Gly Thr Tyr His Asp
            980                 985                 990
```

```
Leu Leu Lys Ile Ile Lys Asp Lys  Asp Phe Leu Asp Asn  Glu Glu Asn
        995                 1000                1005


Glu Asp  Ile Leu Glu Asp Ile  Val Leu Thr Leu Thr  Leu Phe Glu
    1010                1015                1020


Asp Arg  Glu Met Ile Glu Glu  Arg Leu Lys Thr Tyr  Ala His Leu
    1025                1030                1035


Phe Asp  Asp Lys Val Met Lys  Gln Leu Lys Arg Arg  Arg Tyr Thr
    1040                1045                1050


Gly Trp  Gly Arg Leu Ser Arg  Lys Leu Ile Asn Gly  Ile Arg Asp
    1055                1060                1065


Lys Gln  Ser Gly Lys Thr Ile  Leu Asp Phe Leu Lys  Ser Asp Gly
    1070                1075                1080


Phe Ala  Asn Arg Asn Phe Met  Gln Leu Ile His Asp  Asp Ser Leu
    1085                1090                1095


Thr Phe  Lys Glu Asp Ile Gln  Lys Ala Gln Val Ser  Gly Gln Gly
    1100                1105                1110


Asp Ser  Leu His Glu His Ile  Ala Asn Leu Ala Gly  Ser Pro Ala
    1115                1120                1125


Ile Lys  Lys Gly Ile Leu Gln  Thr Val Lys Val Val  Asp Glu Leu
    1130                1135                1140


Val Lys  Val Met Gly Arg His  Lys Pro Glu Asn Ile  Val Ile Glu
    1145                1150                1155


Met Ala  Arg Glu Asn Gln Thr  Thr Gln Lys Gly Gln  Lys Asn Ser
    1160                1165                1170


Arg Glu  Arg Met Lys Arg Ile  Glu Glu Gly Ile Lys  Glu Leu Gly
    1175                1180                1185
```

```
Ser Gln  Ile Leu Lys Glu His  Pro Val Glu Asn Thr  Gln Leu Gln
    1190                 1195                 1200

Asn Glu  Lys Leu Tyr Leu Tyr  Tyr Leu Gln Asn Gly  Arg Asp Met
    1205                 1210                 1215

Tyr Val  Asp Gln Glu Leu Asp  Ile Asn Arg Leu Ser  Asp Tyr Asp
    1220                 1225                 1230

Val Asp  His Ile Val Pro Gln  Ser Phe Leu Lys Asp  Asp Ser Ile
    1235                 1240                 1245

Asp Asn  Lys Val Leu Thr Arg  Ser Asp Lys Asn Arg  Gly Lys Ser
    1250                 1255                 1260

Asp Asn  Val Pro Ser Glu Glu  Val Val Lys Lys Met  Lys Asn Tyr
    1265                 1270                 1275

Trp Arg  Gln Leu Leu Asn Ala  Lys Leu Ile Thr Gln  Arg Lys Phe
    1280                 1285                 1290

Asp Asn  Leu Thr Lys Ala Glu  Arg Gly Gly Leu Ser  Glu Leu Asp
    1295                 1300                 1305

Lys Ala  Gly Phe Ile Lys Arg  Gln Leu Val Glu Thr  Arg Gln Ile
    1310                 1315                 1320

Thr Lys  His Val Ala Gln Ile  Leu Asp Ser Arg Met  Asn Thr Lys
    1325                 1330                 1335

Tyr Asp  Glu Asn Asp Lys Leu  Ile Arg Glu Val Lys  Val Ile Thr
    1340                 1345                 1350

Leu Lys  Ser Lys Leu Val Ser  Asp Phe Arg Lys Asp  Phe Gln Phe
    1355                 1360                 1365

Tyr Lys  Val Arg Glu Ile Asn  Asn Tyr His His Ala  His Asp Ala
    1370                 1375                 1380
```

```
Tyr Leu  Asn Ala Val Val Gly  Thr Ala Leu Ile Lys  Lys Tyr Pro
    1385                1390                1395

Lys Leu  Glu Ser Glu Phe Val  Tyr Gly Asp Tyr Lys  Val Tyr Asp
    1400                1405                1410

Val Arg  Lys Met Ile Ala Lys  Ser Glu Gln Glu Ile  Gly Lys Ala
    1415                1420                1425

Thr Ala  Lys Tyr Phe Phe Tyr  Ser Asn Ile Met Asn  Phe Phe Lys
    1430                1435                1440

Thr Glu  Ile Thr Leu Ala Asn  Gly Glu Ile Arg Lys  Arg Pro Leu
    1445                1450                1455

Ile Glu  Thr Asn Gly Glu Thr  Gly Glu Ile Val Trp  Asp Lys Gly
    1460                1465                1470

Arg Asp  Phe Ala Thr Val Arg  Lys Val Leu Ser Met  Pro Gln Val
    1475                1480                1485

Asn Ile  Val Lys Lys Thr Glu  Val Gln Thr Gly Gly  Phe Ser Lys
    1490                1495                1500

Glu Ser  Ile Leu Pro Lys Arg  Asn Ser Asp Lys Leu  Ile Ala Arg
    1505                1510                1515

Lys Lys  Asp Trp Asp Pro Lys  Lys Tyr Gly Gly Phe  Asp Ser Pro
    1520                1525                1530

Thr Val  Ala Tyr Ser Val Leu  Val Val Ala Lys Val  Glu Lys Gly
    1535                1540                1545

Lys Ser  Lys Lys Leu Lys Ser  Val Lys Glu Leu Leu  Gly Ile Thr
    1550                1555                1560

Ile Met  Glu Arg Ser Ser Phe  Glu Lys Asn Pro Ile  Asp Phe Leu
    1565                1570                1575
```

```
Glu Ala  Lys Gly Tyr Lys Glu  Val Lys Lys Asp Leu  Ile Ile Lys
    1580                1585                1590

Leu Pro  Lys Tyr Ser Leu Phe  Glu Leu Glu Asn Gly  Arg Lys Arg
    1595                1600                1605

Met Leu  Ala Ser Ala Gly Glu  Leu Gln Lys Gly Asn  Glu Leu Ala
    1610                1615                1620

Leu Pro  Ser Lys Tyr Val Asn  Phe Leu Tyr Leu Ala  Ser His Tyr
    1625                1630                1635

Glu Lys  Leu Lys Gly Ser Pro  Glu Asp Asn Glu Gln  Lys Gln Leu
    1640                1645                1650

Phe Val  Glu Gln His Lys His  Tyr Leu Asp Glu Ile  Ile Glu Gln
    1655                1660                1665

Ile Ser  Glu Phe Ser Lys Arg  Val Ile Leu Ala Asp  Ala Asn Leu
    1670                1675                1680

Asp Lys  Val Leu Ser Ala Tyr  Asn Lys His Arg Asp  Lys Pro Ile
    1685                1690                1695

Arg Glu  Gln Ala Glu Asn Ile  Ile His Leu Phe Thr  Leu Thr Asn
    1700                1705                1710

Leu Gly  Ala Pro Ala Ala Phe  Lys Tyr Phe Asp Thr  Thr Ile Asp
    1715                1720                1725

Arg Lys  Arg Tyr Thr Ser Thr  Lys Glu Val Leu Asp  Ala Thr Leu
    1730                1735                1740

Ile His  Gln Ser Ile Thr Gly  Leu Tyr Glu Thr Arg  Ile Asp Leu
    1745                1750                1755

Ser Gln  Leu Gly Gly Asp Ser  Gly Gly Ser Pro Lys  Lys Lys Arg
    1760                1765                1770
```

Lys Val
1775

<210> 479
<211> 166
<212> PRT
<213> Artificial Sequence

<220>
<223> Synthetic Polypeptide

<400> 479

Ser Glu Val Glu Phe Ser His Glu Tyr Trp Met Arg His Ala Leu Thr
1 5 10 15

Leu Ala Lys Arg Ala Trp Asp Glu Arg Glu Val Pro Val Gly Ala Val
20 25 30

Leu Val Leu Asn Asn Arg Val Ile Gly Glu Gly Trp Asn Arg Ser Ile
35 40 45

Gly Leu His Asp Pro Thr Ala His Ala Glu Ile Met Ala Leu Arg Gln
50 55 60

Gly Gly Leu Val Met Gln Asn Tyr Arg Leu Ile Asp Ala Thr Leu Tyr
65 70 75 80

Val Thr Phe Glu Pro Cys Val Met Cys Ala Gly Ala Met Ile His Ser
85 90 95

Arg Ile Gly Arg Val Val Phe Gly Val Arg Asn Ala Lys Thr Gly Ala
100 105 110

Ala Gly Ser Leu Met Asp Val Leu His Tyr Pro Gly Met Asn His Arg
115 120 125

Val Glu Ile Thr Glu Gly Ile Leu Ala Asp Glu Cys Ala Ala Leu Leu
130 135 140

```
Cys Tyr Phe Phe Arg Met Arg Arg Gln Val Phe Asn Ala Gln Lys Lys
145                 150                 155                 160


Ala Gln Ser Ser Thr Asp
                165
```