

(12) STANDARD PATENT
(19) AUSTRALIAN PATENT OFFICE

(11) Application No. **AU 2019290127 B2**

(54) Title
Neoantigens and uses thereof

(51) International Patent Classification(s)
A61K 38/17 (2006.01) **C07K 14/47** (2006.01)
A61K 39/00 (2006.01) **C12Q 1/6886** (2018.01)
A61P 35/04 (2006.01)

(21) Application No: **2019290127** (22) Date of Filing: **2019.06.19**

(87) WIPO No: **WO19/246286**

(30) Priority Data

(31) Number	(32) Date	(33) Country
62/800,735	2019.02.04	US
62/687,188	2018.06.19	US

(43) Publication Date: **2019.12.26**

(44) Accepted Journal Date: **2025.03.20**

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(56) Related Art
WO 2017/173321 A1
WO 2016/187508 A2
US 2016/0331820 A1



(51) International Patent Classification:

A61K 38/17 (2006.01) A61P 35/04 (2006.01)
A61K 39/00 (2006.01) C12Q 1/6886 (2018.01)
C07K 14/47 (2006.01)

(21) International Application Number:

PCT/US2019/038019

(22) International Filing Date:

19 June 2019 (19.06.2019)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

62/687,188 19 June 2018 (19.06.2018) US
62/800,735 04 February 2019 (04.02.2019) US

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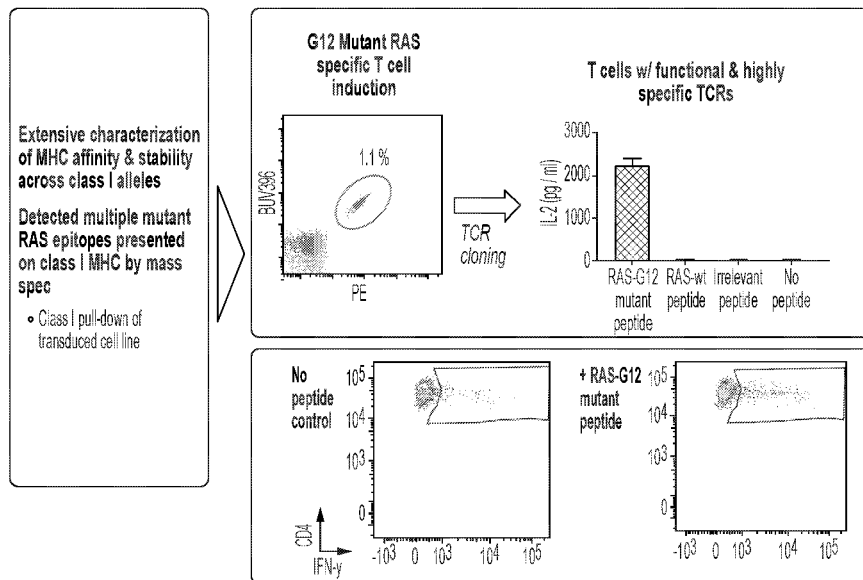
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, 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, 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,

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FIG. 1



(57) Abstract: Disclosed herein relates to immunotherapeutic compositions comprising immunotherapeutic peptides comprising neoepitopes, polynucleotides encoding the immunotherapeutic peptides, antigen presenting cells comprising the immunotherapeutic peptides or polynucleotides, or T cell receptors specific for the neoepitopes. Also disclosed herein is use of the immunotherapeutic compositions.



TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,
KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

- *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*

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))*

NEOANTIGENS AND USES THEREOF

CROSS-REFERENCE

[0001] This application claims benefit of U.S. Provisional Application Nos. 62/687,188, filed on June 19, 2018 and 62/800,735, filed on February 4, 2019; which are incorporated herein by reference in their entirety.

BACKGROUND

[0002] Cancer immunotherapy is the use of the immune system to treat cancer. Immunotherapies exploit the fact that cancer cells often have molecules on their surface that can be detected by the immune system, known as tumor antigens, which are often proteins or other macromolecules (*e.g.* carbohydrates). Active immunotherapy directs the immune system to attack tumor cells by targeting tumor antigens. Passive immunotherapies enhance existing anti-tumor responses and include the use of monoclonal antibodies, lymphocytes and cytokines. Tumor vaccines are typically composed of tumor antigens and immunostimulatory molecules (*e.g.*, adjuvants, cytokines or TLR ligands) that work together to induce antigen-specific cytotoxic T cells (CTLs) that recognize and lyse tumor cells. One of the critical barriers to developing curative and tumor-specific immunotherapy is the identification and selection of highly specific and restricted tumor antigens to avoid autoimmunity.

[0003] Tumor neoantigens, which arise as a result of genetic change (*e.g.*, inversions, translocations, deletions, missense mutations, splice site mutations, etc.) within malignant cells, represent the most tumor-specific class of antigens and can be patient-specific or shared. Tumor neoantigens are unique to the tumor cell as the mutation and its corresponding protein are present only in the tumor. They also avoid central tolerance and are therefore more likely to be immunogenic. Therefore, tumor neoantigens provide an excellent target for immune recognition including by both humoral and cellular immunity. However, tumor neoantigens have rarely been used in cancer vaccine or immunogenic compositions due to technical difficulties in identifying them, selecting optimized antigens, and producing neoantigens for use in a vaccine or immunogenic composition. Accordingly, there is still a need for developing additional cancer therapeutics.

INCORPORATION BY REFERENCE

[0004] All publications, patents, and patent applications mentioned in this specification are herein incorporated by reference to the same extent as if each individual publication, patent, or patent application was specifically and individually indicated to be incorporated by reference.

SUMMARY

[0004a] In a first aspect, the present invention provides composition comprising T cells specific to an HLA-peptide complex comprising a mutant RAS peptide, wherein the HLA-peptide complex comprises:

- (a) a protein encoded by an HLA-C03:04 allele and the mutant RAS peptide consisting of the sequence GAVGVGKSA;
- (b) a protein encoded by an HLA-C01:02 allele and the mutant RAS peptide consisting of the sequence AVGVGKSAL; or (c) a protein encoded by an HLA-C08:02 allele and the mutant RAS peptide consisting of the sequence GADGVGKSAL or GADGVGKSA.

[0004b] In a second aspect, the present invention provides a method of preparing the composition of the first aspect, comprising priming T cells with antigen presenting cells (APCs) comprising the HLA-peptide complex; wherein the APCs comprise (i) a polypeptide comprising the mutant RAS peptide or (ii) a polynucleotide encoding the polypeptide comprising the mutant RAS peptide.

[0004c] In a third aspect, the present invention provides a composition comprising the polypeptide comprising the mutant RAS peptide or the polynucleotide encoding the polypeptide of the second aspect.

[0004d] In a fourth aspect, the present invention provides a pharmaceutical composition comprising:

- (a) the mutant RAS peptide as recited in the first aspect;
- (b) the polypeptide comprising the mutant RAS peptide as recited in the second aspect;
- (c) the polynucleotide encoding the polypeptide as recited in (b);
- (d) an antigen presenting cell comprising (a), (b) or (c); or
- (e) the T cells specific to an HLA-peptide complex comprising the mutant RAS peptide as recited in the first aspect, and a pharmaceutically acceptable excipient.

[0004e] In a fifth aspect, the present invention provides the use of the composition of any one of the first, second or third aspects in the manufacture of a medicament for treating a mutant RAS cancer.

[0004f] In a sixth aspect, the present invention provides method of treating a human subject with a mutant RAS cancer comprising: administering to the subject a therapeutically effective amount of the pharmaceutical composition of the fourth aspect, or the composition of the any one of the first, second or third aspects.

[0004g] In a seventh aspect, the present invention provides a method of treating a subject with a mutant RAS cancer, comprising:

administering to the subject a therapeutically effective amount of the T cells of the first aspect, wherein, the T cells are from the subject with cancer, and wherein, the subject expresses:

- (a) a protein encoded by an HLA-C03:04 allele and the T cells are specific to the mutant RAS peptide consisting of the sequence GAVGVGKSA;
- (b) a protein encoded by an HLA-C01:02 allele and the T cells are specific to the mutant RAS peptide consisting of the sequence AVGVGKSAL; or
- (c) a protein encoded by an HLA-C08:02 allele and the T cells are specific to the mutant RAS peptide consisting of the sequence GADGVGKSAL or GADGVGKSA.

[0004h] In an eighth aspect, the present invention provides a method of preparing T cells specific to an HLA-peptide complex comprising at least one mutant RAS peptide sequence, the method comprising priming T cells with antigen presenting cells (APCs) comprising (i) at least one polypeptide comprising the at least one mutant RAS peptide sequence or (ii) at least one polynucleotide encoding the at least one polypeptide; wherein:

- a) the APCs express a protein encoded by an HLA-A30:01 allele and the at least one mutant RAS peptide consists of the sequence VVVGAVGVGK;
- b) the APCs express a protein encoded by an HLA-A30:01 or HLA-A68:01 allele and the at least one mutant RAS peptide consists of the sequence VVGAVGVGK;
- c) the APCs express a protein encoded by an HLA-C03:03, or HLA-C03:04 allele and the at least one mutant RAS peptide consists of the sequence GAVGVGKSAL;
- d) the APCs express a protein encoded by an HLA-A03:01 or HLA-A68:01 allele and the at least one mutant RAS peptide consists of the sequence VVVGADGVGK;
- e) the APCs express a protein encoded by an HLA-A03:01, HLA-A30:01 or HLA-A68:01 allele and the at least one mutant RAS peptide consists of the sequence VVVGARGVGK; or
- f) the APCs express a protein encoded by an HLA-A68:01 allele and the at least one mutant RAS peptide consists of the sequence VVVGACGVGK.

In some aspects, provided herein is a composition comprising at least one polypeptide comprising two or more mutant RAS peptide sequences selected from the group consisting of KLVVVGADGV, KLVVVGACGV, KLVVVGAVGV, LVVVGADGV, LVVVGACGV, LVVVGAVGV; GADGVGKSAL, GACGVGKSAL, GAVGVGKSAL, GADGVGKSA, GACGVGKSA, GAVGVGKSA; and/or VVGADGVGK, VVGACGVGK, VVGAVGVGK,

VVVGADGVGK, VVVGACGVGK, VVVGAVGVGK; at least one polynucleotide encoding the at least one polypeptide.

[0006] In some embodiments, the composition comprises a mixture of the three or more mutant RAS peptide sequences.

[0007] In some aspects, provided herein is a composition comprising: at least one polypeptide comprising two or more mutant RAS peptide sequences each comprising: at least 8 contiguous amino acids of a mutant RAS protein comprising a mutation at G12, and the mutation at G12; and further wherein three or more amino acid residues that are heterologous to the mutant RAS protein are linked to the N-terminus or C-terminus of the two or more mutant RAS peptide sequences, wherein the three or more amino acid residues enhance processing of the mutant RAS peptide sequences in cell and/or enhance presentation of an epitope of the mutant RAS peptide sequences; or at least one polynucleotide encoding the at least one polypeptide.

[0008] In some embodiments, the three or more amino acid residues that are heterologous to the mutant RAS protein are linked to the N-terminus or C-terminus of the two or more mutant RAS peptide sequences comprises an amino acid sequence of a protein of CMV such as pp65, HIV, or MART-1.

[0009] In some embodiments, the three or more amino acid residues that are heterologous to the mutant RAS protein are linked to the N-terminus or C-terminus of the two or more mutant RAS peptide sequences comprises at least 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, 31, 32, 33, 34, 35, 36, 37, 38, 39, or 40 amino acids.

[0010] In some embodiments, the three or more amino acid residues that are heterologous to the mutant RAS protein are linked to the N-terminus or C-terminus of the two or more mutant RAS peptide sequences comprises at most 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, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 50, 60, 70, 80, 90, or 100 amino acids.

[0011] In some aspects, provided herein is a composition comprising at least one polypeptide of the formula $(Xaa_N)_N-(Xaa_{RAS})_P-(Xaa_C)_C$ wherein P is an integer greater than 7; $(Xaa_{RAS})_P$ is a mutant RAS peptide sequence comprising at least 8 contiguous amino acids of a mutant RAS protein; the at least 8 contiguous amino acids comprising at least 8 contiguous amino acids of the sequence Lys1 Leu2 Val3 Val4 Val5 Gly6 Ala7 Xaa8 Gly9 Val10 Gly11 Lys12 Ser13 Ala14 Leu15 N is (i) 0 or (ii) an integer greater than 2; $(Xaa_N)_N$ is any amino acid sequence heterologous to the mutant RAS protein; C is (i) 0 or (ii) an integer greater than 2; $(Xaa_C)_C$ is any amino acid sequence heterologous to the mutant RAS protein; Xaa8 is selected from the group consisting of Asp, Val, Cys, Ala, Arg and Ser; the polypeptide is not KLVVVGAVGVGKSALTIQL; and both N and C are not 0; or at least one polynucleotide encoding the at least one polypeptide.

[0012] In some embodiments, $(Xaa_N)_N$ and/or $(Xaa_C)_C$ comprises an amino acid sequence of a protein of CMV such as pp65, HIV, or MART-1.

[0013] In some embodiments, N and/or C is an integer greater than 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, 31, 32, 33, 34, 35, 36, 37, 38, 39, or 40.

[0014] In some embodiments, N and/or C is an integer less than 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, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 50, 60, 70, 80, 90, or 100.

[0015] In some embodiments, N is 0.

[0016] In some embodiments, C is 0.

[0017] In some aspects, provided herein is a composition comprising at least one polypeptide comprising of an amino acid sequence of Xaa₁-Xaa₂-Val₃-Val₄-Val₅-Gly₆-Ala₇-Xaa₈-Gly₉-Xaa₁₀ wherein Xaa₁ is not Ala; with the proviso that when Xaa₁ is not Lys, Xaa₂ is Leu and/or Xaa₁₀ is Gly; Xaa₂ is not Glu; with the proviso that when Xaa₂ is not Leu, Xaa₁ is Lys and/or Xaa₁₀ is Gly; Xaa₈ is selected from the group consisting of Asp, Val, Cys, Ala, Arg and Ser; with the proviso that when Xaa₈ is Glu, Xaa₁ is not Tyr and/or Xaa₂ is not Leu, and with the proviso that when Xaa₈ is Val, Xaa₁ is not Lys; Xaa₁₀ is any amino acid; with the proviso that when Xaa₁₀ is not Gly, Xaa₁ is Lys and/or Xaa₂ is Leu; and the polypeptide comprises an HLA-A02:01-restricted T cell epitope, HLA-A03:01-restricted T cell epitope, an HLA-A11:01-restricted T cell epitope, an HLA-A03:02-restricted T cell epitope, an HLA-A30:01-restricted T cell epitope, an HLA-A31:01-restricted T cell epitope, an HLA-A33:01-restricted T cell epitope, an HLA-A33:03-restricted T cell epitope, an HLA-A68:01-restricted T cell epitope, or an HLA-A74:01-restricted T cell epitope that binds to an HLA-A02:01, HLA-A03:01, HLA-A11:01, HLA-A03:02, HLA-A30:01, HLA-A31:01, HLA-A33:01, HLA-A33:03, HLA-A68:01, and/or an HLA-A74:01 molecule; and induces an HLA-A02:01-restricted cytotoxic T cell response, an HLA-A02:01-restricted cytotoxic T cell response, HLA-A03:01-restricted cytotoxic T cell response, an HLA-A11:01-restricted cytotoxic T cell response, an HLA-A03:02-restricted cytotoxic T cell response, an HLA-A30:01-restricted cytotoxic T cell response, an HLA-A31:01-restricted cytotoxic T cell response, an HLA-A33:01-restricted cytotoxic T cell response, an HLA-A33:03-restricted cytotoxic T cell response, an HLA-A68:01-restricted cytotoxic T cell response, or an HLA-A74:01-restricted cytotoxic T cell response; and that binds to an HLA-A02:01, HLA-A03:01, HLA-A11:01, HLA-A03:02, HLA-A30:01, HLA-A31:01, HLA-A33:01, HLA-A33:03, HLA-A68:01, and/or an HLA-A74:01; or at least one polynucleotide encoding the at least one polypeptide.

[0018] In some aspects, provided herein is a composition comprising at least one polypeptide comprising one or more mutant RAS peptide sequences each comprising: at least 8 contiguous amino acids of a mutant RAS protein comprising a G12A, G12C, G12D, G12R, G12S, or G12V mutation, and the G12A, G12C, G12D, G12R, G12S, or G12V mutation; and further wherein the peptide: comprises a mutation not encoded by a genome of a cancer cell and has an affinity or predicted affinity of 150 nM or less for an HLA-A02:01 allele and/or a half-life of 2 hours or more, or has a half-life of 2 hours or more and an affinity or predicted affinity of 150 nM or less for an HLA-A02:01 allele, an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, or an HLA-A74:01 allele and/or an HLA-C08:02 allele; or at least one polynucleotide encoding the at least one polypeptide.

[0019] In some embodiments, the composition further comprises (i) a peptide comprising a peptide sequence in any one of Table 3 to 14, or (ii) a polynucleotide encoding the peptide comprising a sequence in Table 3 to 14.

In some aspects, provided herein is a composition comprising: (a) at least one polypeptide comprising one or more mutant RAS peptide sequences selected from the group consisting of: DTAGHEEY, TAGHEEYSAM, DILDTAGHE, DILDTAGH, ILDTAGHEE, ILDTAGHE, DILDTAGHEEY, DTAGHEEYS, LLDILDTAGH, DILDTAGRE, DILDTAGR, ILDTAGREE, ILDTAGRE, CLLDILDTAGR, TAGREEYSAM, REEYSAMRD, DTAGKEEYSAM, CLLDILDTAGK, DTAGKEEY, LLDILDTAGK, ILDTAGKE, ILDTAGKEE, DTAGLEEY, ILDTAGLE, DILDTAGL, ILDTAGLEE, GLEEYSAMRDQY, LLDILDTAGLE, LDILDTAGL, DILDTAGLE, DILDTAGLEEY, AGVVGKSAL, GAAGVVGKSAL, AAGVVGKSAL, CGVVGKSAL, ACGVVGKSAL, DGVVGKSAL, ADGVVGKSAL, DGVVGKSALTI, GARGVVGKSA, KLVVVGARGV, VVVGARGV, SGVVGKSAL, VVVGASGVGK, GASGVVGKSAL, VGVVGKSAL, VVVGAGCVGK, KLVVVGAGC, GDVVGKSAL, DVGKSALTI, VVVGAGDVGK, TAGKEEYSAM, DTAGHEEYSAM, TAGHEEYSA, DTAGREEYSAM, TAGKEEYSA, AAGVVGKSA, AGCVVGKSAL, AGDVVGKSAL, AGKEEYSAMR, AGVVGKSALTI, ARGVVGKSAL, ASGVVGKSA, ASGVVGKSAL, AVGVVGKSA, CVGKSALTI, DILDTAGK, DILDTAGREEY, DTAGHEEYSAMR, DTAGKEEYS, DTAGKEEYSAMR, DTAGLEEYS, DTAGLEEYSA, DTAGLEEYSAMR, DTAGREEYS, DTAGREEYSAMR, GAAGVVGKSA, GACGVVGKSA, GACGVVGKSAL, GADGVGKS, GAGDVVGKSA, GAGDVVGKSAL, GASGVVGKSA, GCVVGKSAL, GCVVGKSALTI, GHEEYSAM, GKEEYSAM, GLEEYSAMR, GREEYSAM, GREEYSAMR, HEEYSAMRD, KEEYSAMRD, KLVVVGASG, LDILDTAGR, LEEYSAMRD, LVVVGARGV, LVVVGASGV, REEYSAMRDQY, RGVVGKSAL, TAGLEEYSA, TEYKLVVVGAA, VGAAGVVGKSA, VGADGVGK, VGASGVVGKSA, VGVVGKSALTI, VVVGAAAGV, VVVGAVGV, YKLVVVGAC, YKLVVVGAD, YKLVVVGAR, and DILDTAGKE; or (b) at least one polynucleotide encoding the at least one polypeptide.

[0020] In some embodiments, the composition further comprises (i) a peptide comprising a peptide sequence in any one of Table 1 to 14, or (ii) a polynucleotide encoding the peptide comprising a sequence in Table 1 to 14.

[0021] In some embodiments, at least one of the mutant RAS peptide sequences comprises N or C terminal amino acid sequence extension of at least 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, 31, 32, 33, 34, 35, 36, 37, 38, 39, or 40 amino acids, wherein the N or C terminal extension is a wild-type RAS amino acid sequence or a non-heterologous RAS amino acid sequence.

[0022] In some embodiments, the at least one polypeptide comprises at least 3, 4, 5, 6, 7, 8, 9, or 10 mutant RAS peptide sequences.

[0023] In some embodiments, the at least one polypeptide comprises at least two polypeptides, or the at least one polynucleotide comprises at least two polynucleotides.

[0024] In some embodiments, at least one of the mutant RAS peptide sequences comprises at least 9, 10, 11, 12, 13, 14, 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, or 40 contiguous amino acids of a mutant RAS protein.

[0025] In some embodiments, at least 2, 3, 4, 5, 6, 7, 8, 9, or 10 of the mutant RAS peptide sequences comprise at least 9, 10, 11, 12, 13, 14, 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, or 40 contiguous amino acids of a mutant RAS protein.

[0026] In some embodiments, each of the mutant RAS peptide sequences or each of the two or more RAS peptide sequences comprises at least 9, 10, 11, 12, 13, 14, 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, or 40 contiguous amino acids of a mutant RAS protein.

[0027] In some embodiments, the at least one polypeptide comprises at least one mutant RAS peptide sequence that binds to or is predicted to bind to a protein encoded by an HLA-A02:01 allele, an HLA-A03:01 allele, an HLA-A11:01 allele, and/or an HLA-C08:02 allele.

[0028] In some embodiments, the at least one polypeptide comprises at least one mutant RAS peptide sequence that binds to or is predicted to bind to a protein encoded by: an HLA-A02:01 allele and an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, or an HLA-A74:01 allele; an HLA-A02:01 allele and an HLA-C08:02 allele; an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, or an HLA-A74:01 allele and an HLA-C08:02 allele; or an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, or an HLA-A74:01 allele and allele and an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, or an HLA-A74:01 allele.

[0029] In some embodiments, the mutant RAS peptide sequences comprise a first mutant RAS peptide sequence that binds to or is predicted to bind to a protein encoded by an HLA-A02:01 allele, an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, an HLA-A74:01 allele, and/or an HLA-C08:02 allele; and a second RAS peptide sequence that binds to or is predicted to bind to a protein encoded by an HLA-A02:01 allele, an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, an HLA-A74:01 allele, and/or an HLA-C08:02 allele; wherein the first mutant RAS peptide sequence binds to or is predicted to bind to a protein encoded by different HLA allele than the second mutant RAS peptide sequence.

[0030] In some embodiments, the at least one polypeptide comprises at least one mutant RAS peptide sequence that binds to a protein encoded by an HLA allele with an affinity of less than 10 μ M, less than 1

μM, less than 500 nM, less than 400 nM, less than 300 nM, less than 250 nM, less than 200 nM, less than 150 nM, less than 100 nM, or less than 50 nM.

[0031] In some embodiments, the at least one polypeptide comprises at least one mutant RAS peptide sequence that binds to a protein encoded by an HLA allele with a stability of greater than 24 hours, greater than 12 hours, greater than 9 hours, greater than 6 hours, greater than 5 hours, greater than 4 hours, greater than 3 hours, greater than 2 hours, greater than 1 hour, greater than 45 minutes, greater than 30 minutes, greater than 15 minutes, or greater than 10 minutes.

[0032] In some embodiments, the HLA allele is selected from the group consisting of HLA-A02:01 allele, an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, an HLA-A74:01 allele, and/or an HLA-C08:02 allele and any combination thereof.

[0033] In some embodiments, the at least one polypeptide comprises at least one of the following sequences: LVVVGACGV, KLVVVGACGV, LVVVGADGV, KLVVVGADGV, LVVVGAVGV, KLVVVGAVGV, VVGACGVGK, VVVGACGVGK, VVGADGVGK, VVVGADGVGK, VVGAVGVGK, VVVGAVGVGK, VVGACGVGK, VVGADGVGK, VVVGADGVGK, VVGAVGVGK, and VVVGAVGVGK.

[0034] In some embodiments, the mutant RAS peptide sequences comprise at least one or two of the following sequences: KLVVVGACGV, FLVVVGACGL, FMVVVGACGI, FLVVVGACGI, FMVVVGACGV, FLVVVGACGV, MLVVVGACGV, FMVVVGACGL, YLVVVGACGV, KLVVVGACGV, YMVVVGACGV, and MMVVVGACGV.

[0035] In some embodiments, the mutant RAS peptide sequences comprise at least one or two of the following sequences: TEYKLVVVGAVGV; WQAGILARKLVVVGAVGVQGQNLKYQ; HSYTTAEKLVVVGAVGVILGVLILLI; PLTEEKIKLVVVGAVGVEKEGKISK; GALHFKPGSRKLVVVGAVGVAASDFIFLVT; RRANKDATAEKLVVVGAVGVKELKQVASPF; KAFISHEEKRLVVVGAVGVKKKLINEKKE; TDLSSRFSKSKLVVVGAVGVKKCDISLQFF; FDLGGGTFDVKLVVVGAVGVKSTAGDTHLG; or CLLHYSVSKKLVVVGAVGVATFYVAVTVP.

[0036] In some embodiments, (Xaa)N comprises an amino acid sequence of IDIIMKIRNA, FFFFFFFFFFFFFFFFFFFFFIIFIFFWMC, FFFFFFFFFFFFFFFFFFFFFFAAFWFW, IFFIFFIIFFFFFFFFFFFFFIIFIIIIWEC, FIFFIIFFFFFFFFFFFFFIIFIIIIIFWEC, TEY, WQAGILAR, HSYTTAE, PLTEEKIK, GALHFKPGSR, RRANKDATAE, KAFISHEEKR, TDLSSRFSKS, FDLGGGTFDV, CLLHYSVSK, or MTEYKLVVV.

[0037] In some embodiments, (Xaa)C comprises an amino acid sequence of KKNKKDDIKD, AGNDDDDDDDDDDDDDDDDDDDDKDKDDDDDD, AGNKKKKKKKNNNNNNNNNNNNNNNNNNNNNN, AGRDDDDDDDDDDDDDDDDDDDDDDDDDDDDDD, GKSALTIQL, GKSALTI, QGQNLKYQ, ILGVLLLI, EKEGKISK, AASDFIFLVT, KELKQVASPF, KKKLINEKKE, KKCDISLQFF,

KSTAGDTHLG, ATFYVAVTVP, LTIQLIQNHVFVDEYDPTIEDSYRKQVVIDG, or
TIQLIQNHVFVDEYDPTIEDSYRKQVVIDGE.

[0038] In some embodiments, a first mutant RAS peptide sequence comprises a first neoepitope of a mutant RAS protein and a second mutant RAS peptide sequence comprises a second neoepitope of a mutant RAS protein, wherein the first mutant RAS peptide sequence is different from the mutant RAS peptide sequence, and wherein the first neoepitope comprises at least one mutant amino acid and the second neoepitope comprises the same mutant amino acid.

[0039] In some embodiments, at least one of the mutant RAS peptide sequences comprises a mutant amino acid not encoded by the genome of a cancer cell of a subject.

[0040] In some embodiments, each of the mutant RAS peptide sequences are present at a concentration at least 1 $\mu\text{g/mL}$, at least 10 $\mu\text{g/mL}$, at least 25 $\mu\text{g/mL}$, at least 50 $\mu\text{g/mL}$, or at least 100 $\mu\text{g/mL}$.

[0041] In some embodiments, each of the mutant RAS peptide sequences are present at a concentration at most 5000 $\mu\text{g/mL}$, at most 2500 $\mu\text{g/mL}$, at most 1000 $\mu\text{g/mL}$, at most 750 $\mu\text{g/mL}$, at most 500 $\mu\text{g/mL}$, at most 400 $\mu\text{g/mL}$, or at most 300 $\mu\text{g/mL}$.

[0042] In some embodiments, each of the mutant RAS peptide sequences are present at a concentration of from 10 $\mu\text{g/mL}$ to 5000 $\mu\text{g/mL}$, 10 $\mu\text{g/mL}$ to 4000 $\mu\text{g/mL}$, 10 $\mu\text{g/mL}$ to 3000 $\mu\text{g/mL}$, 10 $\mu\text{g/mL}$ to 2000 $\mu\text{g/mL}$, 10 $\mu\text{g/mL}$ to 1000 $\mu\text{g/mL}$, 25 $\mu\text{g/mL}$ to 500 $\mu\text{g/mL}$, or 50 $\mu\text{g/mL}$ to 300 $\mu\text{g/mL}$.

[0043] In some embodiments, the composition further comprises different mutant RAS peptide sequence with a G13A, G13C, G13D, G13R, G13S, G13V, G12A, G12C, G12D, G12R, G12S, G12V or a Q61 mutation.

[0044] In some embodiments, the composition further comprises an immunomodulatory agent or an adjuvant.

[0045] In some embodiments, the adjuvant is polyICLC.

[0046] In some aspects, provided herein is a pharmaceutical composition comprising: a composition described herein and a pharmaceutically acceptable excipient.

[0047] In some embodiments, the pharmaceutical composition comprises a pH modifier present at a concentration of less than 1 mM or greater than 1mM.

[0048] In some embodiments, the pharmaceutical composition is a vaccine composition.

[0049] In some embodiments, the pharmaceutical composition is aqueous.

[0050] In some embodiments, one or more of the at least one polypeptide is bounded by $\text{pI} > 5$ and $\text{HYDRO} > -6$, $\text{pI} > 8$ and $\text{HYDRO} > -8$, $\text{pI} < 5$ and $\text{HYDRO} > -5$, $\text{pI} > 9$ and $\text{HYDRO} < -8$, $\text{pI} > 7$ and a HYDRO value of > -5.5 , $\text{pI} < 4.3$ and $-4 \geq \text{HYDRO} \geq -8$, $\text{pI} > 0$ and $\text{HYDRO} < -8$, $\text{pI} > 0$ and $\text{HYDRO} > -4$, or $\text{pI} > 4.3$ and $-4 \geq \text{HYDRO} \geq -8$, $\text{pI} > 0$ and $\text{HYDRO} > -4$, or $\text{pI} > 4.3$ and $\text{HYDRO} \leq -4$, $\text{pI} > 0$ and $\text{HYDRO} > -4$, or $\text{pI} > 4.3$ and $-4 \geq \text{HYDRO} \geq -9$, $5 \geq \text{pI} \geq 12$ and $-4 \geq \text{HYDRO} \geq -9$.

[0051] In some embodiments, the pH modifier is a base.

[0052] In some embodiments, the pH modifier is a conjugate base of a weak acid.

[0053] In some embodiments, the pH modifier is a pharmaceutically acceptable salt.

- [0054] In some embodiments, the pH modifier is a dicarboxylate or tricarboxylate salt.
- [0055] In some embodiments, the pH modifier is citric acid and/or a citrate salt.
- [0056] In some embodiments, the citrate salt is disodium citrate and/or trisodium citrate.
- [0057] In some embodiments, the pH modifier is succinic acid and/or a succinate salt.
- [0058] In some embodiments, the succinate salt is a disodium succinate and/or a monosodium succinate.
- [0059] In some embodiments, the succinate salt is disodium succinate hexahydrate.
- [0060] In some embodiments, the pH modifier is present at a concentration of from 0.1 mM – 1 mM.
- [0061] In some embodiments, the pharmaceutically acceptable carrier comprises a liquid.
- [0062] In some embodiments, the pharmaceutically acceptable carrier comprises water.
- [0063] In some embodiments, the pharmaceutically acceptable carrier comprises a sugar.
- [0064] In some embodiments, the sugar comprises dextrose or mannitol.
- [0065] In some embodiments, the dextrose is present at a concentration of from 1-10% w/v.
- [0066] In some embodiments, the sugar comprises trehalose.
- [0067] In some embodiments, the sugar comprises sucrose.
- [0068] In some embodiments, the pharmaceutically acceptable carrier comprises dimethyl sulfoxide (DMSO).
- [0069] In some embodiments, the DMSO is present at a concentration from 0.1% to 10%, 0.5% to 5%, or 1% to 3%.
- [0070] In some embodiments, the pharmaceutically acceptable carrier does not comprise dimethyl sulfoxide (DMSO).
- [0071] In some embodiments, the pharmaceutical composition is lyophilizable.
- [0072] In some embodiments, the pharmaceutical composition further comprises an immunomodulator or adjuvant.
- [0073] In some embodiments, the immunomodulator or adjuvant is selected from the group consisting of poly-ICLC, 1018 ISS, aluminum salts, Amplivax, AS15, BCG, CP-870,893, CpG7909, CyaA, ARNAX, STING agonists, dSLIM, GM-CSF, FLT-3L, IC30, IC31, Imiquimod, ImuFact IMP321, IS Patch, ISS, ISCOMATRIX, JuvImmune, LipoVac, MF59, monophosphoryllipid A, Montanide IMS 1312, Montanide ISA 206, Montanide ISA 50V, Montanide ISA-51, OK-432, OM-174, OM-197-MP-EC, ONTAK, PepTel®, vector system, PLGA microparticles, resiquimod, SRL172, Virosomes and other Virus-like particles, YF-17D, VEGF trap, R848, beta-glucan, Pam3Cys, and Aquila's QS21 stimulon.
- [0074] In some embodiments, the immunomodulator or adjuvant comprises poly-ICLC.
- [0075] In some embodiments, a ratio of poly-ICLC to peptides in the pharmaceutical composition is from 2:1 to 1:10 v:v.
- [0076] In some embodiments, the ratio of poly-ICLC to peptides in the pharmaceutical composition is about 1:1, 1:2, 1:3, 1:4 or 1:5 v:v.

[0077] In some embodiments, the ratio of poly-ICLC to peptides in the pharmaceutical composition is about 1:3v:v.

[0078] In some aspects, provided herein is a method of treating a subject with cancer comprising administering to the subject a pharmaceutical composition described herein.

[0079] In some aspects, provided herein is a method of treating a subject with cancer comprising administering to the subject a peptide with a sequence of VVGADGVGK, VVGACGVGK, VVGAVGVGK, VVVGADGVGK, VVVGACGVGK, VVVGAVGVGK, wherein the subject expresses a protein encoded by an HLA-A02:01 allele, an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, an HLA-A74:01 allele, or an HLA-C08:02 allele of the subject's genome.

[0080] In some aspects, provided herein is a method of treating a subject with cancer comprising administering to the subject a mutant RAS peptide or a nucleic acid encoding the mutant RAS peptide, wherein the mutant RAS peptide comprises at least 8 contiguous amino acids of a mutant RAS protein comprising a mutation at G12, wherein the peptide comprises the mutation at G12 and binds to HLA-A11:01 or HLA-A03:01, wherein the subject is identified as expressing a protein encoded by an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, or an HLA-A74:01 allele.

[0081] In some aspects, provided herein is a method of treating a subject with cancer comprising administering to the subject a peptide comprising a sequence GADGVGKSAL, GACGVGKSAL, GAVGVGKSAL, GADGVGKSA, GACGVGKSA, or GAVGVGKSA; wherein the subject expresses a protein encoded by an HLA-A02:01 allele, an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, an HLA-A74:01 allele, or an HLA-C08:02 allele of the subject's genome that binds to the peptide.

[0082] In some aspects, provided herein is a method of treating a subject with cancer comprising administering to the subject a first and a second peptide or a nucleic acid encoding the first and second peptide, wherein the first and second peptides comprise at least two of: (1) KLVVVGADGV, KLVVVGACGV, KLVVVGAVGV, LVVVGADGV, LVVVGACGV, LVVVGAVGV; (2) GADGVGKSAL, GACGVGKSAL, GAVGVGKSAL, GADGVGKSA, GACGVGKSA, GAVGVGKSA; and (3) VVGADGVGK, VVGACGVGK, VVGAVGVGK, VVVGADGVGK, VVVGACGVGK, VVVGAVGVGK; wherein the subject's HLA allele expression is unknown at the time of administration.

[0083] In some aspects, provided herein is a method of treating a subject with cancer comprising administering to the subject a mutant RAS peptide or a nucleic acid encoding the mutant RAS peptide, wherein the mutant RAS peptide comprises at least 8 contiguous amino acids of a mutant RAS protein comprising a G12C mutation, wherein the peptide comprises the G12C mutation, and further wherein the peptide comprises a stabilizing mutation not encoded by a genome of a cancer cell, wherein the subject expresses a protein encoded by an HLA-A02:01 allele, an HLA-A03:01 allele, an HLA-A11:01 allele, an

HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, an HLA-A74:01 allele, or an HLA-C08:02 allele.

[0084] In some aspects, provided herein is a method of identifying a subject with cancer as a candidate for a therapeutic, the method comprising identifying the subject as a subject that expresses a protein encoded by an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, or an HLA-A74:01 allele, wherein the therapeutic is a mutant RAS peptide or a nucleic acid encoding the mutant RAS peptide, wherein the mutant RAS peptide comprises at least 8 contiguous amino acids of a mutant RAS protein comprising a mutation at G12, wherein the peptide comprises the mutation at G12 and binds to a protein encoded by an HLA-A03:01 allele, an HLA-A11:01 allele, an HLA-A03:02 allele, an HLA-A30:01 allele, an HLA-A31:01 allele, an HLA-A33:01 allele, an HLA-A33:03 allele, an HLA-A68:01 allele, or an HLA-A74:01 allele.

[0085] In some embodiments, the method further comprises administering the therapeutic to the subject.

[0086] In some aspects, provided herein is a method of treating a subject with cancer, the method comprising: (a) identifying a first protein expressed by the subject, wherein the first protein is encoded by a first HLA allele of the subject and wherein the first HLA allele is an HLA allele provided in any one of Tables 1 to 14; and (b) administering to the subject (i) a first mutant RAS peptide, wherein the first mutant RAS peptide is a peptide to the first HLA allele provided in any one of Tables 1 to 14, or (ii) a polynucleic acid encoding the first mutant RAS peptide.

[0087] In some embodiments, the method further comprises identifying a second protein expressed by the subject, wherein the second protein is encoded by a second HLA allele of the subject and wherein the second HLA allele is an HLA allele provided in any one of Tables 1 to 14.

[0088] In some embodiments, the method further comprises administering to the subject (i) a second mutant RAS peptide, wherein the second mutant RAS peptide is a peptide to the second HLA allele provided in any one of Tables 1 to 14, or (ii) a polynucleic acid encoding the second mutant RAS peptide.

[0089] In some embodiments, the first HLA allele is different from the second HLA allele.

[0090] In some embodiments, the first mutant RAS peptide is different from the second mutant RAS peptide.

[0091] For example, in some embodiments, the first protein expressed by a subject is encoded by HLA-A03:01 as provided, e.g., in Table 11, and the method comprises administering to the subject a first mutant RAS peptide comprising a sequence of VVGASGVGK or a polynucleic acid encoding the first mutant RAS peptide.

[0092] For example, in some embodiments, the first protein expressed by a subject is encoded by HLA-A03:01 as provided, e.g., in Table 5, and the method comprises administering to the subject a first

mutant RAS peptide comprising a sequence of CLLDILDITAGK or a polynucleic acid encoding the first mutant RAS peptide.

[0093] For another example, in some embodiments, the second protein expressed by a subject is encoded by HLA-A11:01 as provided, e.g., in Table 11, and the method comprises administering to the subject a second mutant RAS peptide comprising a sequence of VVVGASGVGK or a polynucleic acid encoding the second mutant RAS peptide.

[0094] For yet another example, in some embodiments, the second protein expressed by a subject is encoded by HLA-C08:02 as provided, e.g., in Table 9, and the method comprises administering to the subject a second mutant RAS peptide comprising a sequence of GADGVGKSAL or a polynucleic acid encoding the second mutant RAS peptide.

[0095] In some embodiments, an immune response is elicited in the subject.

[0096] In some embodiments, the immune response is a humoral response.

[0097] In some embodiments, the mutant RAS peptide sequences are administered simultaneously, separately or sequentially.

[0098] In some embodiments, the first peptide is sequentially administered after a time period sufficient for the second peptide to activate the second T cells.

[0099] In some embodiments, the cancer is selected from the group consisting of lung cancer, non-small cell lung cancer, pancreatic cancer, colorectal cancer, uterine cancer and liver cancer.

[0100] In some embodiments, the method further comprises administering at least one additional therapeutic agent or modality.

[0101] In some embodiments, the at least one additional therapeutic agent or modality is surgery, a checkpoint inhibitor, an antibody or fragment thereof, a chemotherapeutic agent, radiation, a vaccine, a small molecule, a T cell, a vector, and APC, a polynucleotide, an oncolytic virus or any combination thereof.

[0102] In some embodiments, the at least one additional therapeutic agent is an anti-PD-1 agent and anti-PD-L1 agent, an anti-CTLA-4 agent, or an anti-CD40 agent.

[0103] In some embodiments, the additional therapeutic agent is administered before, simultaneously, or after administering the mutant RAS peptide sequences.

BRIEF DESCRIPTION OF THE DRAWINGS

[0104] The features of the present disclosure are set forth with particularity in the appended claims. A better understanding of the features and advantages of the present will be obtained by reference to the following detailed description that sets forth illustrative embodiments, in which the principles of the disclosure are utilized, and the accompanying drawings of which:

[0105] FIG. 1 illustrates an exemplary workflow for determination of RAS epitopes that can induce CD8+ and/or CD4+ T cells.

[0106] FIG. 2A and 2B illustrate a summary of experiments showing that predicted RAS G12C epitopes to HLA-A11:01 (left), and RAS G12V epitopes to HLA-A11:01 (right) can be detected by mass spectrometry.

[0107] FIGs. 3A and 3B depict illustrative multimer plots of RAS-mutant specific CD8⁺ T cell responses.

[0108] FIG. 3C depicts example results showing antigen specific CD8⁺ T cell responses to a long peptide containing the minimal epitope for KRAS G12V on HLA-A11:01. The sequences of the long peptide used to stimulate the response is indicated, as well as the sequence of the minimal epitope used for the multimer staining.

[0109] FIG. 4A is a graph showing antigen-specific induction of IFN γ . The IFN γ levels of samples mock transduced or transduced with a lentiviral expression vector encoding a mutant RAS peptide are shown.

[0110] FIG. 4B is a graph showing upregulation of active caspase 3 on target cells. The percent live caspase-A positive target cells of samples mock transduced or transduced with a lentiviral expression vector encoding a mutant RAS peptide are shown.

[0111] FIG. 5A is a graph showing antigen-specific induction of IL-2 by co-culturing T cells expressing a TCR specific to a mutant RAS peptide with 9mer or 11mer mutant RAS peptide-transduced target cells. The data shows that RAS specific T cells recognize mutated cells and upregulate cytotoxic machinery.

[0112] FIG. 5B is a graph showing antigen-specific induction of IL-2 by co-culturing T cells expressing a TCR specific to a 9mer or 11mer mutant RAS peptide with target cells loaded with increasing concentrations of a mutant RAS peptide. The data shows that RAS specific T cells recognize mutated cells and upregulate cytotoxic machinery.

[0113] FIG. 5C is a graph showing antigen-specific induction of IL-2 by co-culturing T cells expressing a TCR specific to a mutant RAS peptide with 9mer mutant RAS peptide-transduced target cells. The data shows that RAS specific T cells recognize mutated cells and upregulate cytotoxic machinery.

[0114] FIG. 5D is a graph showing antigen-specific induction of IL-2 by co-culturing T cells expressing a TCR specific to a 9mer mutant RAS peptide with target cells loaded with increasing concentrations of a mutant RAS peptide. The data shows that RAS specific T cells recognize mutated cells and upregulate cytotoxic machinery.

[0115] FIGs. 5E-5H demonstrate antigen-specific cytotoxicity activity of T cells expressing a TCR specific to mutant RAS peptides. The data shows that RAS specific TCRs can elicit specific recognition of cells carrying the mutated peptide and the proper MHC-I and upregulate cytotoxic machinery.

[0116] FIG. 6 depicts a FACS analysis of antigen-specific induction of IFN γ levels of CD4⁺ cells from a healthy donor stimulated with APCs loaded with or without a mutant RAS peptide.

DETAILED DESCRIPTION

[0117] Described herein are new immunotherapeutic agents and uses thereof based on the discovery of neoantigens arising from mutational events unique to an individual's tumor. Accordingly, the present disclosure described herein provides peptides, polynucleotides encoding the peptides, and peptide binding agents that can be used, for example, to stimulate an immune response to a tumor associated antigen or neoepitope, to create an immunogenic composition or cancer vaccine for use in treating disease.

[0118] The following description and examples illustrate embodiments of the present disclosure in detail. It is to be understood that this present disclosure is not limited to the particular embodiments described herein and as such can vary. Those of skill in the art will recognize that there are numerous variations and modifications of this present disclosure, which are encompassed within its scope.

[0119] All terms are intended to be understood as they would be understood by a person skilled in the art. Unless defined otherwise, all technical and scientific terms used herein have the same meaning as commonly understood by one of ordinary skill in the art to which the disclosure pertains.

[0120] The section headings used herein are for organizational purposes only and are not to be construed as limiting the subject matter described.

[0121] Although various features of the present disclosure may be described in the context of a single embodiment, the features may also be provided separately or in any suitable combination. Conversely, although the present disclosure may be described herein in the context of separate embodiments for clarity, the present disclosure may also be implemented in a single embodiment.

[0122] The following definitions supplement those in the art and are directed to the current application and are not to be imputed to any related or unrelated case, *e.g.*, to any commonly owned patent or application. Although any methods and materials similar or equivalent to those described herein can be used in the practice for testing of the present disclosure, the preferred materials and methods are described herein. Accordingly, the terminology used herein is for the purpose of describing particular embodiments only, and is not intended to be limiting.

I. Definitions

[0123] The terminology used herein is for the purpose of describing particular cases only and is not intended to be limiting. In this application, the use of the singular includes the plural unless specifically stated otherwise. As used herein, the singular forms "a", "an" and "the" are intended to include the plural forms as well, unless the context clearly indicates otherwise.

[0124] In this application, the use of "or" means "and/or" unless stated otherwise. The terms "and/or" and "any combination thereof" and their grammatical equivalents as used herein, can be used interchangeably. These terms can convey that any combination is specifically contemplated. Solely for illustrative purposes, the following phrases "A, B, and/or C" or "A, B, C, or any combination thereof" can mean "A individually; B individually; C individually; A and B; B and C; A and C; and A, B, and C." The term "or" can be used conjunctively or disjunctively, unless the context specifically refers to a disjunctive use.

[0125] The term “about” or “approximately” can mean within an acceptable error range for the particular value as determined by one of ordinary skill in the art, which will depend in part on how the value is measured or determined, *i.e.*, the limitations of the measurement system. For example, “about” can mean within 1 or more than 1 standard deviation, per the practice in the art. Alternatively, “about” can mean a range of up to 20%, up to 10%, up to 5%, or up to 1% of a given value. Alternatively, particularly with respect to biological systems or processes, the term can mean within an order of magnitude, within 5-fold, and more preferably within 2-fold, of a value. Where particular values are described in the application and claims, unless otherwise stated the term “about” meaning within an acceptable error range for the particular value should be assumed.

[0126] As used in this specification and claim(s), the words “comprising” (and any form of comprising, such as “comprise” and “comprises”), “having” (and any form of having, such as “have” and “has”), “including” (and any form of including, such as “includes” and “include”) or “containing” (and any form of containing, such as “contains” and “contain”) are inclusive or open-ended and do not exclude additional, unrecited elements or method steps. It is contemplated that any embodiment discussed in this specification can be implemented with respect to any method or composition of the present disclosure, and vice versa. Furthermore, compositions of the present disclosure can be used to achieve methods of the present disclosure.

[0127] Reference in the specification to “some embodiments,” “an embodiment,” “one embodiment” or “other embodiments” means that a particular feature, structure, or characteristic described in connection with the embodiments is included in at least some embodiments, but not necessarily all embodiments, of the present disclosures. To facilitate an understanding of the present disclosure, a number of terms and phrases are defined below.

[0128] “Major Histocompatibility Complex” or “MHC” is a cluster of genes that plays a role in control of the cellular interactions responsible for physiologic immune responses. In humans, the MHC complex is also known as the human leukocyte antigen (HLA) complex. For a detailed description of the MHC and HLA complexes, see, Paul, *Fundamental Immunology*, 3rd Ed., Raven Press, New York (1993). “Proteins or molecules of the major histocompatibility complex (MHC)”, “MHC molecules”, “MHC proteins” or “HLA proteins” are to be understood as meaning proteins capable of binding peptides resulting from the proteolytic cleavage of protein antigens and representing potential lymphocyte epitopes, (*e.g.*, T cell epitope and B cell epitope) transporting them to the cell surface and presenting them there to specific cells, in particular cytotoxic T-lymphocytes, T-helper cells, or B cells. The major histocompatibility complex in the genome comprises the genetic region whose gene products expressed on the cell surface are important for binding and presenting endogenous and/or foreign antigens and thus for regulating immunological processes. The major histocompatibility complex is classified into two gene groups coding for different proteins, namely molecules of MHC class I and molecules of MHC class II. The cellular biology and the expression patterns of the two MHC classes are adapted to these different roles.

[0129] “Human Leukocyte Antigen” or “HLA” is a human class I or class II Major Histocompatibility Complex (MHC) protein (see, *e.g.*, Stites, et al., Immunology, 8th Ed., Lange Publishing, Los Altos, Calif. (1994).

[0130] “Polypeptide”, “peptide” and their grammatical equivalents as used herein refer to a polymer of amino acid residues, typically L-amino acids, connected one to the other, typically by peptide bonds between the α -amino and carboxyl groups of adjacent amino acids. Polypeptides and peptides include, but are not limited to, mutant peptides, “neoantigen peptides” and “neoantigenic peptides”. Polypeptides or peptides can be a variety of lengths, either in their neutral (uncharged) forms or in forms which are salts, and either free of modifications such as glycosylation, side chain oxidation, or phosphorylation or containing these modifications, subject to the condition that the modification not destroy the biological activity of the polypeptides as herein described. A “mature protein” is a protein which is full-length and which, optionally, includes glycosylation or other modifications typical for the protein in a given cellular environment. Polypeptides and proteins disclosed herein (including functional portions and functional variants thereof) can comprise synthetic amino acids in place of one or more naturally-occurring amino acids. Such synthetic amino acids are known in the art, and include, for example, aminocyclohexane carboxylic acid, norleucine, α -amino n-decanoic acid, homoserine, S-acetylamino-methyl-cysteine, trans-3- and trans-4-hydroxyproline, 4-aminophenylalanine, 4-nitrophenylalanine, 4-chlorophenylalanine, 4-carboxyphenylalanine, β -phenylserine β -hydroxyphenylalanine, phenylglycine, α -naphthylalanine, cyclohexylalanine, cyclohexylglycine, indoline-2-carboxylic acid, 1,2,3,4-tetrahydroisoquinoline-3-carboxylic acid, aminomalonic acid, aminomalonic acid monoamide, N¹-benzyl-N¹-methyl-lysine, N¹,N¹-dibenzyl-lysine, 6-hydroxylysine, ornithine, α -aminocyclopentane carboxylic acid, α -aminocyclohexane carboxylic acid, α -aminocycloheptane carboxylic acid, α -(2-amino-2-norbornane)-carboxylic acid, α,γ -diaminobutyric acid, α,β -diaminopropionic acid, homophenylalanine, and α -tert-butylglycine. The present disclosure further contemplates that expression of polypeptides described herein in an engineered cell can be associated with post-translational modifications of one or more amino acids of the polypeptide constructs. Non-limiting examples of post-translational modifications include phosphorylation, acylation including acetylation and formylation, glycosylation (including N-linked and O-linked), amidation, hydroxylation, alkylation including methylation and ethylation, ubiquitination, addition of pyrrolidone carboxylic acid, formation of disulfide bridges, sulfation, myristoylation, palmitoylation, isoprenylation, farnesylation, geranylation, glypiation, lipoylation and iodination.

[0131] A peptide or polypeptide may comprise at least one flanking sequence. The term “flanking sequence” as used herein refers to a fragment or region of a peptide that is not a part of an epitope.

[0132] An “immunogenic” peptide or an “immunogenic” epitope or “peptide epitope” is a peptide that comprises an allele-specific motif such that the peptide will bind an HLA molecule and induce a cell-mediated or humoral response, for example, cytotoxic T lymphocyte (CTL (*e.g.*, CD8⁺)), helper T lymphocyte (Th (*e.g.*, CD4⁺)) and/or B lymphocyte response. Thus, immunogenic peptides described

herein are capable of binding to an appropriate HLA molecule and thereafter inducing a CTL (cytotoxic) response, or a HTL (and humoral) response, to the peptide.

[0133] “Neoantigen” means a class of tumor antigens which arise from tumor-specific changes in proteins. Neoantigens encompass, but are not limited to, tumor antigens which arise from, for example, substitution in the protein sequence, frame shift mutation, fusion polypeptide, in-frame deletion, insertion, expression of endogenous retroviral polypeptides, and tumor-specific overexpression of polypeptides.

[0134] The term “residue” refers to an amino acid residue or amino acid mimetic residue incorporated into a peptide or protein by an amide bond or amide bond mimetic, or nucleic acid (DNA or RNA) that encodes the amino acid or amino acid mimetic.

[0135] A “neoepitope”, “tumor specific neoepitope” or “tumor antigen” refers to an epitope or antigenic determinant region that is not present in a reference, such as a non-diseased cell, *e.g.*, a non-cancerous cell or a germline cell, but is found in a diseased cell, *e.g.*, a cancer cell. This includes situations where a corresponding epitope is found in a normal non-diseased cell or a germline cell but, due to one or more mutations in a diseased cell, *e.g.*, a cancer cell, the sequence of the epitope is changed so as to result in the neoepitope. The term “neoepitope” as used herein refers to an antigenic determinant region within the peptide or neoantigenic peptide. A neoepitope may comprise at least one “anchor residue” and at least one “anchor residue flanking region.” A neoepitope may further comprise a “separation region.” The term “anchor residue” refers to an amino acid residue that binds to specific pockets on HLAs, resulting in specificity of interactions with HLAs. In some cases, an anchor residue may be at a canonical anchor position. In other cases, an anchor residue may be at a non-canonical anchor position. Neoepitopes may bind to HLA molecules through primary and secondary anchor residues protruding into the pockets in the peptide-binding grooves. In the peptide-binding grooves, specific amino acids compose pockets that accommodate the corresponding side chains of the anchor residues of the presented neoepitopes. Peptide-binding preferences exist among different alleles of both of HLA I and HLA II molecules. HLA class I molecules bind short neoepitopes, whose N- and C-terminal ends are anchored into the pockets located at the ends of the neoepitope binding groove. While the majority of the HLA class I binding neoepitopes are of about 9 amino acids, longer neoepitopes can be accommodated by the bulging of their central portion, resulting in binding neoepitopes of about 8 to 12 amino acids. Neoepitopes binding to HLA class II proteins are not constrained in size and can vary from about 16 to 25 amino acids. The neoepitope binding groove in the HLA class II molecules is open at both ends, which enables binding of peptides with relatively longer length. Though the core 9 amino acid residues long segment contributes the most to the recognition of the neoepitope, the anchor residue flanking regions are also important for the specificity of the peptide to the HLA class II allele. In some cases, the anchor residue flanking region is N-terminus residues. In another case, the anchor residue flanking region is C-terminus residues. In yet another case, the anchor residue flanking region is both N-terminus residues and C-terminus residues. In some cases, the anchor residue flanking region is flanked by at least two anchor residues. An anchor residue flanking region flanked by anchor residues is a “separation region.”

[0136] A “reference” can be used to correlate and compare the results obtained in the methods of the present disclosure from a tumor specimen. Typically the “reference” may be obtained on the basis of one or more normal specimens, in particular specimens which are not affected by a cancer disease, either obtained from a patient or one or more different individuals, for example, healthy individuals, in particular individuals of the same species. A “reference” can be determined empirically by testing a sufficiently large number of normal specimens.

[0137] An “epitope” is the collective features of a molecule, such as primary, secondary and tertiary peptide structure, and charge, that together form a site recognized by, for example, an immunoglobulin, T cell receptor, HLA molecule, or chimeric antigen receptor. Alternatively, an epitope can be defined as a set of amino acid residues which is involved in recognition by a particular immunoglobulin, or in the context of T cells, those residues necessary for recognition by T cell receptor proteins, chimeric antigen receptors, and/or Major Histocompatibility Complex (MHC) receptors. A “T cell epitope” is to be understood as meaning a peptide sequence which can be bound by the MHC molecules of class I or II in the form of a peptide-presenting MHC molecule or MHC complex and then, in this form, be recognized and bound by T cells, such as T-lymphocytes or T-helper cells. Epitopes can be prepared by isolation from a natural source, or they can be synthesized according to standard protocols in the art. Synthetic epitopes can comprise artificial amino acid residues, “amino acid mimetics,” such as D isomers of naturally-occurring L amino acid residues or non-naturally-occurring amino acid residues such as cyclohexylalanine. Throughout this disclosure, epitopes may be referred to in some cases as peptides or peptide epitopes. It is to be appreciated that proteins or peptides that comprise an epitope or an analog described herein as well as additional amino acid(s) are still within the bounds of the present disclosure. In certain embodiments, the peptide comprises a fragment of an antigen. In certain embodiments, there is a limitation on the length of a peptide of the present disclosure. The embodiment that is length-limited occurs when the protein or peptide comprising an epitope described herein comprises a region (*i.e.*, a contiguous series of amino acid residues) having 100% identity with a native sequence. In order to avoid the definition of epitope from reading, *e.g.*, on whole natural molecules, there is a limitation on the length of any region that has 100% identity with a native peptide sequence. Thus, for a peptide comprising an epitope described herein and a region with 100% identity with a native peptide sequence, the region with 100% identity to a native sequence generally has a length of: less than or equal to 600 amino acid residues, less than or equal to 500 amino acid residues, less than or equal to 400 amino acid residues, less than or equal to 250 amino acid residues, less than or equal to 100 amino acid residues, less than or equal to 85 amino acid residues, less than or equal to 75 amino acid residues, less than or equal to 65 amino acid residues, and less than or equal to 50 amino acid residues. In certain embodiments, an “epitope” described herein is comprised by a peptide having a region with less than 51 amino acid residues that has 100% identity to a native peptide sequence, in any increment down to 5 amino acid residues; for example 50, 49, 48, 47, 46, 45, 44, 43, 42, 41, 40, 39, 38, 37, 36, 35, 34, 33, 32, 31, 30, 29, 28, 27, 26, 25, 24, 23, 22, 21, 20, 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2 or 1 amino acid residues.

[0138] The nomenclature used to describe peptides or proteins follows the conventional practice wherein the amino group is presented to the left (the amino- or N-terminus) and the carboxyl group to the right (the carboxy- or C-terminus) of each amino acid residue. When amino acid residue positions are referred to in a peptide epitope they are numbered in an amino to carboxyl direction with position one being the residue located at the amino terminal end of the epitope, or the peptide or protein of which it can be a part. In the formula representing selected specific embodiments of the present disclosure, the amino- and carboxyl-terminal groups, although not specifically shown, are in the form they would assume at physiologic pH values, unless otherwise specified. In the amino acid structure formula, each residue is generally represented by standard three letter or single letter designations. The L-form of an amino acid residue is represented by a capital single letter or a capital first letter of a three-letter symbol, and the D-form for those amino acid residues having D-forms is represented by a lower case single letter or a lower case three letter symbol. However, when three letter symbols or full names are used without capitals, they can refer to L amino acid residues. Glycine has no asymmetric carbon atom and is simply referred to as “Gly” or “G”. The amino acid sequences of peptides set forth herein are generally designated using the standard single letter symbol. (A, Alanine; C, Cysteine; D, Aspartic Acid; E, Glutamic Acid; F, Phenylalanine; G, Glycine; H, Histidine; I, Isoleucine; K, Lysine; L, Leucine; M, Methionine; N, Asparagine; P, Proline; Q, Glutamine; R, Arginine; S, Serine; T, Threonine; V, Valine; W, Tryptophan; and Y, Tyrosine.)

[0139] The term “mutation” refers to a change of or difference in the nucleic acid sequence (nucleotide substitution, addition or deletion) compared to a reference. A “somatic mutation” can occur in any of the cells of the body except the germ cells (sperm and egg) and therefore are not passed on to children. These alterations can (but do not always) cause cancer or other diseases. In some embodiments, a mutation is a non-synonymous mutation. The term “non-synonymous mutation” refers to a mutation, for example, a nucleotide substitution, which does result in an amino acid change such as an amino acid substitution in the translation product. A “frameshift” occurs when a mutation disrupts the normal phase of a gene’s codon periodicity (also known as “reading frame”), resulting in the translation of a non-native protein sequence. It is possible for different mutations in a gene to achieve the same altered reading frame.

[0140] A “conservative” amino acid substitution is one in which one amino acid residue is replaced with another amino acid residue having a similar side chain. Families of amino acid residues having similar side chains have been defined in the art, including basic side chains (*e.g.*, lysine, arginine, histidine), acidic side chains (*e.g.*, aspartic acid, glutamic acid), uncharged polar side chains (*e.g.*, glycine, asparagine, glutamine, serine, threonine, tyrosine, cysteine), nonpolar side chains (*e.g.*, alanine, valine, leucine, isoleucine, proline, phenylalanine, methionine, tryptophan), beta-branched side chains (*e.g.*, threonine, valine, isoleucine) and aromatic side chains (*e.g.*, tyrosine, phenylalanine, tryptophan, histidine). For example, substitution of a phenylalanine for a tyrosine is a conservative substitution. Methods of identifying nucleotide and amino acid conservative substitutions which do not eliminate peptide function are well-known in the art.

[0141] As used herein, the term “affinity” refers to a measure of the strength of binding between two members of a binding pair, for example, an HLA-binding peptide and a class I or II HLA. K_D is the dissociation constant and has units of molarity. The affinity constant is the inverse of the dissociation constant. An affinity constant is sometimes used as a generic term to describe this chemical entity. It is a direct measure of the energy of binding. Affinity may be determined experimentally, for example by surface plasmon resonance (SPR) using commercially available Biacore SPR units. Affinity may also be expressed as the inhibitory concentration 50 (IC_{50}), that concentration at which 50% of the peptide is displaced. Likewise, $\ln(IC_{50})$ refers to the natural log of the IC_{50} . K_{off} refers to the off-rate constant, for example, for dissociation of an HLA-binding peptide and a class I or II HLA. Throughout this disclosure, “binding data” results can be expressed in terms of “ IC_{50} .” IC_{50} is the concentration of the tested peptide in a binding assay at which 50% inhibition of binding of a labeled reference peptide is observed. Given the conditions in which the assays are run (*i.e.*, limiting HLA protein and labeled reference peptide concentrations), these values approximate K_D values. Assays for determining binding are well known in the art and are described in detail, for example, in PCT publications WO 94/20127 and WO 94/03205, and other publications such as Sidney et al., *Current Protocols in Immunology* 18.3.1 (1998); Sidney, et al., *J. Immunol.* 154:247 (1995); and Sette, et al., *Mol. Immunol.* 31:813 (1994). Alternatively, binding can be expressed relative to binding by a reference standard peptide. For example, can be based on its IC_{50} , relative to the IC_{50} of a reference standard peptide. Binding can also be determined using other assay systems including those using: live cells (*e.g.*, Ceppellini et al., *Nature* 339:392 (1989); Christnick et al., *Nature* 352:67 (1991); Busch et al., *Int. Immunol.* 2:443 (1990); Hill et al., *J. Immunol.* 147:189 (1991); del Guercio et al., *J. Immunol.* 154:685 (1995)), cell free systems using detergent lysates (*e.g.*, Cerundolo et al., *J. Immunol.* 21:2069 (1991)), immobilized purified MHC (*e.g.*, Hill et al., *J. Immunol.* 152, 2890 (1994); Marshall et al., *J. Immunol.* 152:4946 (1994)), ELISA systems (*e.g.*, Reay et al., *EMBO J.* 11:2829 (1992)), surface plasmon resonance (*e.g.*, Khilko et al., *J. Biol. Chem.* 268:15425 (1993)); high flux soluble phase assays (Hammer et al., *J. Exp. Med.* 180:2353 (1994)), and measurement of class I MHC stabilization or assembly (*e.g.*, Ljunggren et al., *Nature* 346:476 (1990); Schumacher et al., *Cell* 62:563 (1990); Townsend et al., *Cell* 62:285 (1990); Parker et al., *J. Immunol.* 149:1896 (1992)). “Cross-reactive binding” indicates that a peptide is bound by more than one HLA molecule; a synonym is degenerate binding.

[0142] The term “derived” and its grammatical equivalents when used to discuss an epitope is a synonym for “prepared” and its grammatical equivalents. A derived epitope can be isolated from a natural source, or it can be synthesized according to standard protocols in the art. Synthetic epitopes can comprise artificial amino acid residues “amino acid mimetics,” such as D isomers of natural occurring L amino acid residues or non-natural amino acid residues such as cyclohexylalanine. A derived or prepared epitope can be an analog of a native epitope.

[0143] A “native” or a “wild type” sequence refers to a sequence found in nature. Such a sequence can comprise a longer sequence in nature.

[0144] A “receptor” is to be understood as meaning a biological molecule or a molecule grouping capable of binding a ligand. A receptor may serve, to transmit information in a cell, a cell formation or an organism. The receptor comprises at least one receptor unit, for example, where each receptor unit may consist of a protein molecule. The receptor has a structure which complements that of a ligand and may complex the ligand as a binding partner. The information is transmitted in particular by conformational changes of the receptor following complexation of the ligand on the surface of a cell. In some embodiments, a receptor is to be understood as meaning in particular proteins of MHC classes I and II capable of forming a receptor/ligand complex with a ligand, in particular a peptide or peptide fragment of suitable length.

[0145] A “ligand” is to be understood as meaning a molecule which has a structure complementary to that of a receptor and is capable of forming a complex with this receptor. In some embodiments, a ligand is to be understood as meaning a peptide or peptide fragment which has a suitable length and suitable binding motifs in its amino acid sequence, so that the peptide or peptide fragment is capable of forming a complex with proteins of MHC class I or MHC class II.

[0146] In some embodiments, a “receptor/ligand complex” is also to be understood as meaning a “receptor/peptide complex” or “receptor/peptide fragment complex”, including a peptide- or peptide fragment-presenting MHC molecule of class I or of class II.

[0147] “Synthetic peptide” refers to a peptide that is obtained from a non-natural source, *e.g.*, is man-made. Such peptides can be produced using such methods as chemical synthesis or recombinant DNA technology. “Synthetic peptides” include “fusion proteins.”

[0148] The term “motif” refers to a pattern of residues in an amino acid sequence of defined length, for example, a peptide of less than about 15 amino acid residues in length, or less than about 13 amino acid residues in length, for example, from about 8 to about 13 amino acid residues (*e.g.*, 8, 9, 10, 11, 12, or 13) for a class I HLA motif and from about 6 to about 25 amino acid residues (*e.g.*, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, or 25) for a class II HLA motif, which is recognized by a particular HLA molecule. Motifs are typically different for each HLA protein encoded by a given human HLA allele. These motifs differ in their pattern of the primary and secondary anchor residues. In some embodiments, an MHC class I motif identifies a peptide of 9, 10, or 11 amino acid residues in length.

[0149] The term “naturally occurring” and its grammatical equivalents as used herein refer to the fact that an object can be found in nature. For example, a peptide or nucleic acid that is present in an organism (including viruses) and can be isolated from a source in nature and which has not been intentionally modified by man in the laboratory is naturally occurring.

[0150] According to the present disclosure, the term “vaccine” relates to a pharmaceutical preparation (pharmaceutical composition) or product that upon administration induces an immune response, for example, a cellular or humoral immune response, which recognizes and attacks a pathogen or a diseased cell such as a cancer cell. A vaccine may be used for the prevention or treatment of a disease. The term “individualized cancer vaccine” or “personalized cancer vaccine” concerns a particular cancer patient and

means that a cancer vaccine is adapted to the needs or special circumstances of an individual cancer patient.

[0151] A “protective immune response” or “therapeutic immune response” refers to a CTL and/or an HTL response to an antigen derived from a pathogenic antigen (*e.g.*, a tumor antigen), which in some way prevents or at least partially arrests disease symptoms, side effects or progression. The immune response can also include an antibody response which has been facilitated by the stimulation of helper T cells.

[0152] “Antigen processing” or “processing” and its grammatical equivalents refers to the degradation of a polypeptide or antigen into procession products, which are fragments of said polypeptide or antigen (*e.g.*, the degradation of a polypeptide into peptides) and the association of one or more of these fragments (*e.g.*, via binding) with MHC molecules for presentation by cells, for example, antigen presenting cells, to specific T cells.

[0153] “Antigen presenting cells” (APC) are cells which present peptide fragments of protein antigens in association with MHC molecules on their cell surface. Some APCs may activate antigen specific T cells. Professional antigen-presenting cells are very efficient at internalizing antigen, either by phagocytosis or by receptor-mediated endocytosis, and then displaying a fragment of the antigen, bound to a class II MHC molecule, on their membrane. The T cell recognizes and interacts with the antigen-class II MHC molecule complex on the membrane of the antigen presenting cell. An additional co-stimulatory signal is then produced by the antigen presenting cell, leading to activation of the T cell. The expression of co-stimulatory molecules is a defining feature of professional antigen-presenting cells. The main types of professional antigen-presenting cells are dendritic cells, which have the broadest range of antigen presentation, and are probably the most important antigen presenting cells, macrophages, B-cells, and certain activated epithelial cells. Dendritic cells (DCs) are leukocyte populations that present antigens captured in peripheral tissues to T cells via both MHC class II and I antigen presentation pathways. It is well known that dendritic cells are potent inducers of immune responses and the activation of these cells is a critical step for the induction of antitumoral immunity. Dendritic cells are conveniently categorized as “immature” and “mature” cells, which can be used as a simple way to discriminate between two well characterized phenotypes. However, this nomenclature should not be construed to exclude all possible intermediate stages of differentiation. Immature dendritic cells are characterized as antigen presenting cells with a high capacity for antigen uptake and processing, which correlates with the high expression of Fc receptor (FcR) and mannose receptor. The mature phenotype is typically characterized by a lower expression of these markers, but a high expression of cell surface molecules responsible for T cell activation such as class I and class II MHC, adhesion molecules (*e.g.*, CD54 and CD11) and costimulatory molecules (*e.g.*, CD40, CD80, CD86 and 4-1 BB).

[0154] The terms “identical” and its grammatical equivalents as used herein or “sequence identity” in the context of two nucleic acid sequences or amino acid sequences of polypeptides refers to the residues in the two sequences which are the same when aligned for maximum correspondence over a specified

comparison window. A “comparison window”, as used herein, refers to a segment of at least about 20 contiguous positions, usually about 50 to about 200, more usually about 100 to about 150 in which a sequence may be compared to a reference sequence of the same number of contiguous positions after the two sequences are aligned optimally. Methods of alignment of sequences for comparison are well-known in the art. Optimal alignment of sequences for comparison may be conducted by the local homology algorithm of Smith and Waterman, *Adv. Appl. Math.*, 2:482 (1981); by the alignment algorithm of Needleman and Wunsch, *J. Mol. Biol.*, 48:443 (1970); by the search for similarity method of Pearson and Lipman, *Proc. Nat. Acad. Sci. U.S.A.*, 85:2444 (1988); by computerized implementations of these algorithms (including, but not limited to CLUSTAL in the PC/Gene program by Intelligenetics, Mountain View Calif., GAP, BESTFIT, BLAST, FASTA, and TFASTA in the Wisconsin Genetics Software Package, Genetics Computer Group (GCG), 575 Science Dr., Madison, Wis., U.S.A.); the CLUSTAL program is well described by Higgins and Sharp, *Gene*, 73:237-244 (1988) and Higgins and Sharp, *CABIOS*, 5:151-153 (1989); Corpet et al., *Nucleic Acids Res.*, 16:10881-10890 (1988); Huang et al., *Computer Applications in the Biosciences*, 8:155-165 (1992); and Pearson et al., *Methods in Molecular Biology*, 24:307-331 (1994). Alignment is also often performed by inspection and manual alignment. In one class of embodiments, the polypeptides herein have at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a reference polypeptide, or a fragment thereof, *e.g.*, as measured by BLASTP (or CLUSTAL, or any other available alignment software) using default parameters. Similarly, nucleic acids can also be described with reference to a starting nucleic acid, *e.g.*, they can have 50%, 60%, 70%, 75%, 80%, 85%, 90%, 98%, 99% or 100% sequence identity to a reference nucleic acid or a fragment thereof, *e.g.*, as measured by BLASTN (or CLUSTAL, or any other available alignment software) using default parameters. When one molecule is said to have certain percentage of sequence identity with a larger molecule, it means that when the two molecules are optimally aligned, said percentage of residues in the smaller molecule finds a match residue in the larger molecule in accordance with the order by which the two molecules are optimally aligned.

[0155] The term “substantially identical” and its grammatical equivalents as applied to nucleic acid or amino acid sequences mean that a nucleic acid or amino acid sequence comprises a sequence that has at least 90% sequence identity or more, at least 95%, at least 98% and at least 99%, compared to a reference sequence using the programs described above, *e.g.*, BLAST, using standard parameters. For example, the BLASTN program (for nucleotide sequences) uses as defaults a word length (W) of 11, an expectation (E) of 10, M=5, N=-4, and a comparison of both strands. For amino acid sequences, the BLASTP program uses as defaults a word length (W) of 3, an expectation (E) of 10, and the BLOSUM62 scoring matrix (see Henikoff & Henikoff, *Proc. Natl. Acad. Sci. USA* 89:10915 (1992)). Percentage of sequence identity is determined by comparing two optimally aligned sequences over a comparison window, wherein the portion of the polynucleotide sequence in the comparison window may comprise additions or

deletions (*i.e.*, gaps) as compared to the reference sequence (which does not comprise additions or deletions) for optimal alignment of the two sequences. The percentage is calculated by determining the number of positions at which the identical nucleic acid base or amino acid residue occurs in both sequences to yield the number of matched positions, dividing the number of matched positions by the total number of positions in the window of comparison and multiplying the result by 100 to yield the percentage of sequence identity. In embodiments, the substantial identity exists over a region of the sequences that is at least about 50 residues in length, over a region of at least about 100 residues, and in embodiments, the sequences are substantially identical over at least about 150 residues. In embodiments, the sequences are substantially identical over the entire length of the coding regions.

[0156] The term “vector” as used herein means a construct, which is capable of delivering, and usually expressing, one or more gene(s) or sequence(s) of interest in a host cell. Examples of vectors include, but are not limited to, viral vectors, naked DNA or RNA expression vectors, plasmid, cosmid, or phage vectors, DNA or RNA expression vectors associated with cationic condensing agents, and DNA or RNA expression vectors encapsulated in liposomes.

[0157] A polypeptide, antibody, polynucleotide, vector, cell, or composition which is “isolated” is a polypeptide, antibody, polynucleotide, vector, cell, or composition which is in a form not found in nature. Isolated polypeptides, antibodies, polynucleotides, vectors, cells, or compositions include those which have been purified to a degree that they are no longer in a form in which they are found in nature. In some embodiments, a polypeptide, antibody, polynucleotide, vector, cell, or composition which is isolated is substantially pure. In some embodiments, an “isolated polynucleotide” encompasses a PCR or quantitative PCR reaction comprising the polynucleotide amplified in the PCR or quantitative PCR reaction.

[0158] The term “isolated”, “biologically pure” or their grammatical equivalents refers to material which is substantially or essentially free from components which normally accompany the material as it is found in its native state. Thus, isolated peptides described herein do not contain some or all of the materials normally associated with the peptides in their in situ environment. An “isolated” epitope refers to an epitope that does not include the whole sequence of the antigen from which the epitope was derived. Typically the “isolated” epitope does not have attached thereto additional amino acid residues that result in a sequence that has 100% identity over the entire length of a native sequence. The native sequence can be a sequence such as a tumor-associated antigen from which the epitope is derived. Thus, the term “isolated” means that the material is removed from its original environment (*e.g.*, the natural environment if it is naturally occurring). An “isolated” nucleic acid is a nucleic acid removed from its natural environment. For example, a naturally-occurring polynucleotide or peptide present in a living animal is not isolated, but the same polynucleotide or peptide, separated from some or all of the coexisting materials in the natural system, is isolated. Such a polynucleotide could be part of a vector, and/or such a polynucleotide or peptide could be part of a composition, and still be “isolated” in that such vector or composition is not part of its natural environment. Isolated RNA molecules include *in vivo* or *in vitro*

RNA transcripts of the DNA molecules described herein, and further include such molecules produced synthetically.

[0159] The term “substantially purified” and its grammatical equivalents as used herein refer to a nucleic acid sequence, polypeptide, protein or other compound which is essentially free, *i.e.*, is more than about 50% free of, more than about 70% free of, more than about 90% free of, the polynucleotides, proteins, polypeptides and other molecules that the nucleic acid, polypeptide, protein or other compound is naturally associated with.

[0160] The term “substantially pure” as used herein refers to material which is at least 50% pure (*i.e.*, free from contaminants), at least 90% pure, at least 95% pure, at least 98% pure, or at least 99% pure.

[0161] The terms “polynucleotide”, “nucleotide”, “nucleic acid”, “polynucleic acid” or “oligonucleotide” and their grammatical equivalents are used interchangeably herein and refer to polymers of nucleotides of any length, and include DNA and RNA, for example, mRNA. Thus, these terms includes double and single stranded DNA, triplex DNA, as well as double and single stranded RNA. It also includes modified, for example, by methylation and/or by capping, and unmodified forms of the polynucleotide. The term is also meant to include molecules that include non-naturally occurring or synthetic nucleotides as well as nucleotide analogs. The nucleic acid sequences and vectors disclosed or contemplated herein may be introduced into a cell by, for example, transfection, transformation, or transduction. The nucleotides can be deoxyribonucleotides, ribonucleotides, modified nucleotides or bases, and/or their analogs, or any substrate that can be incorporated into a polymer by DNA or RNA polymerase. In some embodiments, the polynucleotide and nucleic acid can be *in vitro* transcribed mRNA. In some embodiments, the polynucleotide that is administered using the methods of the present disclosure is mRNA.

[0162] “Transfection,” “transformation,” or “transduction” as used herein refer to the introduction of one or more exogenous polynucleotides into a host cell by using physical or chemical methods. Many transfection techniques are known in the art and include, for example, calcium phosphate DNA co-precipitation (see, *e.g.*, Murray E. J. (ed.), *Methods in Molecular Biology*, Vol. 7, *Gene Transfer and Expression Protocols*, Humana Press (1991)); DEAE-dextran; electroporation; cationic liposome-mediated transfection; tungsten particle-facilitated microparticle bombardment (Johnston, *Nature*, 346: 776-777 (1990)); and strontium phosphate DNA co-precipitation (Brash et al., *Mol. Cell Biol.*, 7: 2031-2034 (1987)). Phage or viral vectors can be introduced into host cells, after growth of infectious particles in suitable packaging cells, many of which are commercially available.

[0163] Nucleic acids and/or nucleic acid sequences are “homologous” when they are derived, naturally or artificially, from a common ancestral nucleic acid or nucleic acid sequence. Proteins and/or protein sequences are “homologous” when their encoding DNAs are derived, naturally or artificially, from a common ancestral nucleic acid or nucleic acid sequence. The homologous molecules can be termed homologs. For example, any naturally occurring proteins, as described herein, can be modified by any available mutagenesis method. When expressed, this mutagenized nucleic acid encodes a polypeptide that

is homologous to the protein encoded by the original nucleic acid. Homology is generally inferred from sequence identity between two or more nucleic acids or proteins (or sequences thereof). The precise percentage of identity between sequences that is useful in establishing homology varies with the nucleic acid and protein at issue, but as little as 25% sequence identity is routinely used to establish homology. Higher levels of sequence identity, *e.g.*, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 95% or 99% or more can also be used to establish homology. Methods for determining sequence identity percentages (*e.g.*, BLASTP and BLASTN using default parameters) are described herein and are generally available.

[0164] The term “subject” refers to any animal (*e.g.*, a mammal), including, but not limited to, humans, non-human primates, canines, felines, rodents, and the like, which is to be the recipient of a particular treatment. Typically, the terms “subject” and “patient” are used interchangeably herein in reference to a human subject.

[0165] The terms “effective amount” or “therapeutically effective amount” or “therapeutic effect” refer to an amount of a therapeutic effective to “treat” a disease or disorder in a subject or mammal. The therapeutically effective amount of a drug has a therapeutic effect and as such can prevent the development of a disease or disorder; slow down the development of a disease or disorder; slow down the progression of a disease or disorder; relieve to some extent one or more of the symptoms associated with a disease or disorder; reduce morbidity and mortality; improve quality of life; or a combination of such effects.

[0166] The terms “treating” or “treatment” or “to treat” or “alleviating” or “to alleviate” refer to both (1) therapeutic measures that cure, slow down, lessen symptoms of, and/or halt progression of a diagnosed pathologic condition or disorder; and (2) prophylactic or preventative measures that prevent or slow the development of a targeted pathologic condition or disorder. Thus those in need of treatment include those already with the disorder; those prone to have the disorder; and those in whom the disorder is to be prevented.

[0167] “Pharmaceutically acceptable” refers to a generally non-toxic, inert, and/or physiologically compatible composition or component of a composition.

[0168] A “pharmaceutical excipient” or “excipient” comprises a material such as an adjuvant, a carrier, pH-adjusting and buffering agents, tonicity adjusting agents, wetting agents, preservatives, and the like. A “pharmaceutical excipient” is an excipient which is pharmaceutically acceptable.

II. Neoantigens and Uses Thereof

[0169] One of the critical barriers to developing curative and tumor-specific immunotherapy is the identification and selection of highly specific and restricted tumor antigens to avoid autoimmunity. Tumor neoantigens, which arise as a result of genetic change (*e.g.*, inversions, translocations, deletions, missense mutations, splice site mutations, etc.) within malignant cells, represent the most tumor-specific class of antigens. Neoantigens have rarely been used in cancer vaccine or immunogenic compositions due to technical difficulties in identifying them, selecting optimized antigens, and producing neoantigens for use in a vaccine or immunogenic composition. These problems may be addressed by: identifying

mutations in neoplasias/tumors which are present at the DNA level in tumor but not in matched germline samples from a high proportion of subjects having cancer; analyzing the identified mutations with one or more peptide-MHC binding prediction algorithms to generate a plurality of neoantigen T cell epitopes that are expressed within the neoplasia/tumor and that bind to a high proportion of patient HLA alleles; and synthesizing the plurality of neoantigenic peptides selected from the sets of all neoantigen peptides and predicted binding peptides for use in a cancer vaccine or immunogenic composition suitable for treating a high proportion of subjects having cancer.

[0170] For example, translating peptide sequencing information into a therapeutic vaccine may include prediction of mutated peptides that can bind to HLA molecules of a high proportion of individuals. Efficiently choosing which particular mutations to utilize as immunogen requires the ability to predict which mutated peptides would efficiently bind to a high proportion of patient's HLA alleles. Recently, neural network based learning approaches with validated binding and non-binding peptides have advanced the accuracy of prediction algorithms for the major HLA-A and -B alleles. However, even using advanced neural network-based algorithms to encode HLA-peptide binding rules, several factors limit the power to predict peptides presented on HLA alleles.

[0171] Another example of translating peptide sequencing information into a therapeutic vaccine may include formulating the drug as a multi-epitope vaccine of long peptides. Targeting as many mutated epitopes as practically possible takes advantage of the enormous capacity of the immune system, prevents the opportunity for immunological escape by down-modulation of an immune targeted gene product, and compensates for the known inaccuracy of epitope prediction approaches. Synthetic peptides provide a useful means to prepare multiple immunogens efficiently and to rapidly translate identification of mutant epitopes to an effective vaccine. Peptides can be readily synthesized chemically and easily purified utilizing reagents free of contaminating bacteria or animal substances. The small size allows a clear focus on the mutated region of the protein and also reduces irrelevant antigenic competition from other components (non-mutated protein or viral vector antigens).

[0172] Yet another example of translating peptide sequencing information into a therapeutic vaccine may include a combination with a strong vaccine adjuvant. Effective vaccines may require a strong adjuvant to initiate an immune response. For example, poly-ICLC, an agonist of TLR3 and the RNA helicase-domains of MDA5 and RIG3, has shown several desirable properties for a vaccine adjuvant. These properties include the induction of local and systemic activation of immune cells *in vivo*, production of stimulatory chemokines and cytokines, and stimulation of antigen-presentation by DCs. Furthermore, poly-ICLC can induce durable CD4⁺ and CD8⁺ responses in humans. Importantly, striking similarities in the upregulation of transcriptional and signal transduction pathways were seen in subjects vaccinated with poly-ICLC and in volunteers who had received the highly effective, replication-competent yellow fever vaccine. Furthermore, >90% of ovarian carcinoma patients immunized with poly-ICLC in combination with a NYESO-1 peptide vaccine (in addition to Montanide) showed induction of CD4⁺ and CD8⁺ T cell, as well as antibody responses to the peptide in a recent phase 1 study. At the same

time, poly-ICLC has been extensively tested in more than 25 clinical trials to date and exhibited a relatively benign toxicity profile.

[0173] In some aspects, provided herein is a composition comprising: a first peptide comprising a first neoepitope of a protein and a second peptide comprising a second neoepitope of the same protein, a polynucleotide encoding the first peptide and the second peptide, one or more APCs comprising the first peptide and the second peptide, or a first T cell receptor (TCR) specific for the first neoepitope in complex with an HLA protein and a second TCR specific for the second neoepitope in complex with an HLA protein; wherein the first peptide is different from the second peptide, and wherein the first neoepitope comprises a mutation and the second neoepitope comprises the same mutation.

[0174] In some aspects, provided herein is a composition comprising: a first peptide comprising a first neoepitope of a region of a protein and a second peptide comprising a second neoepitope of the region of the same protein, wherein the first neoepitope and the second neoepitope comprise at least one amino acid of the region that is the same, a polynucleotide encoding the first peptide and the second peptide, on or more APCs comprising the first peptide and the second peptide, or a first T cell receptor (TCR) specific for the first neoepitope in complex with an HLA protein and a second TCR specific for the second neoepitope in complex with an HLA protein; wherein the first peptide is different from the second peptide, and wherein the first neoepitope comprises a first mutation and the second neoepitope comprises a second mutation.

[0175] In some embodiments, the first mutation and the second mutation are the same. In some embodiments, the first peptide and the second peptide are different molecules. In some embodiments, the first neoepitope comprises a first neoepitope of a region of the same protein, wherein the second neoepitope comprises a second neoepitope of the region of the same protein. In some embodiments, the first neoepitope and the second neoepitope comprise at least one amino acid of the region that is the same. In some embodiments, the region of the protein comprises at least 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 40, 50, 60, 70, 80, 90, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, or 1,000 contiguous amino acids of the protein. In some embodiments, the region of the protein comprises at most 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 40, 50, 60, 70, 80, 90, 100, 150, 200, 250, 300, 350, 400, 450, 500, 600, 700, 800, 900, or 1,000 contiguous amino acids of the protein. In some embodiments, the first neoepitope binds to a class I HLA protein to form a class I HLA-peptide complex. In some embodiments, the second neoepitope binds to a class II HLA protein to form a class II HLA-peptide complex. In some embodiments, the second neoepitope binds to a class I HLA protein to form a class I HLA-peptide complex. In some embodiments, the first neoepitope binds to a class II HLA protein to form a class II HLA-peptide complex. In some embodiments, the first neoepitope is a first neoepitope peptide processed from the first peptide and/or the second neoepitope is a second neoepitope peptide processed from the second peptide. In some embodiments, the first neoepitope is shorter in length than first peptide and/or the second neoepitope is shorter in length than second peptide. In some embodiments, the first neoepitope peptide is processed by

an antigen presenting cell (APC) comprising the first peptide and/or the second neoepitope peptide is processed by an APC comprising the second peptide. In some embodiments, the first neoepitope activates CD8⁺ T cells. In some embodiments, the second neoepitope activates CD4⁺ T cells. In some embodiments, the second neoepitope activates CD8⁺ T cells. In some embodiments, the first neoepitope activates CD4⁺ T cells. In some embodiments, a TCR of a CD4⁺ T cell binds to a class II HLA-peptide complex comprising the first or second peptide. In some embodiments, a TCR of a CD8⁺ T cell binds to a class I HLA-peptide complex comprising the first or second peptide. In some embodiments, a TCR of a CD4⁺ T cell binds to a class I HLA-peptide complex comprising the first or second peptide. In some embodiments, a TCR of a CD8⁺ T cell binds to a class II HLA-peptide complex comprising the first or second peptide. In some embodiments, the one or more APCs comprise a first APC comprising the first peptide and a second APC comprising the second peptide. In some embodiments, the mutation is selected from the group consisting of a point mutation, a splice-site mutation, a frameshift mutation, a read-through mutation, a gene fusion mutation and any combination thereof. In some embodiments, the first neoepitope and the second neoepitope comprises a sequence encoded by a gene of Table 1 or 2. In some embodiments, the protein is encoded by a gene of Table 1 or 2. In some embodiments, the mutation is a mutation of column 2 of Table 1 or 2. In some embodiments, the mutation is a mutation of column 1 of Tables 3 to 14. In some embodiments, the protein is KRAS. In some embodiments, a single polypeptide comprises the first peptide and the second peptide, or a single polynucleotide encodes the first peptide and the second peptide. In some embodiments, the first peptide and the second peptide are encoded by a sequence transcribed from a same transcription start site. In some embodiments, the first peptide is encoded by a sequence transcribed from a first transcription start site and the second peptide is encoded by a sequence transcribed from a second transcription start site. In some embodiments, the single polypeptide has a length of at least 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 40; 50; 60; 70; 80; 90; 100; 150; 200; 250; 300; 350; 400; 450; 500; 600; 700; 800; 900; 1,000; 1,500; 2,000; 2,500; 3,000; 4,000; 5,000; 7,500; or 10,000 amino acids. In some embodiments, the polypeptide comprises a first sequence with at least 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%, 96%, 97%, 98%, or 99%, sequence identity to a first corresponding wild-type sequence; and a second sequence with at least 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%, 96%, 97%, 98%, or 99%, sequence identity to a corresponding second wild-type sequence. In some embodiments, the polypeptide comprises a first sequence of at least 8 or 9 contiguous amino acids with at least 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%, 96%, 97%, 98%, or 99%, sequence identity to a corresponding first wild-type sequence; and a second sequence of at least 16 or 17 contiguous amino acids with at least 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%, 96%, 97%, 98%, or 99%, sequence identity to a corresponding second wild-type sequence. In some embodiments, the second peptide is longer than the first peptide. In some embodiments, the first peptide is longer than the second peptide. In some embodiments, the first peptide has a length of at least 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 40; 50; 60; 70; 80; 90; 100; 150; 200; 250; 300; 350; 400; 450; 500; 600; 700; 800; 900; 1,000; 1,500; 2,000; 2,500; 3,000; 4,000; 5,000; 7,500; or 10,000 amino acids. In some embodiments, the second peptide has a length of at least 17; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 40; 50; 60; 70; 80; 90; 100; 150; 200; 250; 300; 350; 400; 450; 500; 600; 700; 800; 900; 1,000; 1,500; 2,000; 2,500; 3,000; 4,000; 5,000; 7,500; or 10,000 amino acids. In some embodiments, the first peptide comprises a sequence of at least 9 contiguous amino acids with at least 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%, 96%, 97%, 98%, or 99% identity to a corresponding wild-type sequence. In some embodiments, the second peptide comprises a sequence of at least 17 contiguous amino acids with at least 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%, 96%, 97%, 98%, or 99% identity to a corresponding wild-type sequence. In some embodiments, the second neopeptide is longer than the first neopeptide. In some embodiments, the first neopeptide has a length of at least 8 amino acids. In some embodiments, the first neopeptide has a length of from 8 to 12 amino acids. In some embodiments, the first neopeptide comprises a sequence of at least 8 contiguous amino acids, wherein at least 2 of the 8 contiguous amino acids are different at corresponding positions of a wild-type sequence. In some embodiments, the second neopeptide has a length of at least 16 amino acids. In some embodiments, the second neopeptide has a length of from 16 to 25 amino acids. In some embodiments, the second neopeptide comprises a sequence of at least 16 contiguous amino acids, wherein at least 2 of the 16 contiguous amino acids are different at corresponding positions of a wild-type sequence.

[0176] In some embodiments, the first peptide comprises at least one additional mutation. In some embodiments, one or more of the at least one additional mutation is not a mutation in the first neopeptide. In some embodiments, one or more of the at least one additional mutation is a mutation in the first neopeptide. In some embodiments, the second peptide comprises at least one additional mutation. In some embodiments, one or more of the at least one additional mutation is not a mutation in the second neopeptide. In some embodiments, one or more of the at least one additional mutation is a mutation in the second neopeptide. In some embodiments, the first peptide, the second peptide or both comprise at least one flanking sequence, wherein the at least one flanking sequence is upstream or downstream of the neopeptide. In some embodiments, the at least one flanking sequence has at least 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%, 96%, 97%, 98%, 99%, or 100% sequence identity to a corresponding wild-type sequence. In some embodiments, the at least one

flanking sequence comprises a non-wild-type sequence. In some embodiments, the at least one flanking sequence is a N-terminus flanking sequence. In some embodiments, the at least one flanking sequence is a C-terminus flanking sequence. In some embodiments, the at least one flanking sequence of the first peptide has at least 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%, 96%, 97%, 98%, 99%, or 100% sequence identity to the at least one flanking sequence of the second peptide. In some embodiments, the at least one flanking region of the first peptide is different from the at least one flanking region of the second peptide. In some embodiments, the at least one flanking residue comprises the mutation. In some embodiments, the first neoepitope, the second neoepitope or both comprises at least one anchor residue. In some embodiments, the at least one anchor residue of the first neoepitope is at a canonical anchor position. In some embodiments, the at least one anchor residue of the first neoepitope is at a non-canonical anchor position. In some embodiments, the at least one anchor residue of the second neoepitope is at a canonical anchor position. In some embodiments, the at least one anchor residue of the second neoepitope is at a non-canonical anchor position. In some embodiments, the at least one anchor residue of the first neoepitope is different from the at least one anchor residue of the second neoepitope. In some embodiments, the at least one anchor residue is a wild-type residue. In some embodiments, the at least one anchor residue is a substitution. In some embodiments, the first neoepitope and/or the second neoepitope binds to an HLA protein with a greater affinity than a corresponding neoepitope without the substitution. In some embodiments, the first neoepitope and/or the second neoepitope binds to an HLA protein with a greater affinity than a corresponding wild-type sequence without the substitution. In some embodiments, at least one anchor residue does not comprise the mutation. In some embodiments, the first neoepitope, the second neoepitope or both comprise at least one anchor residue flanking region. In some embodiments, the neoepitope comprises at least one anchor residue. In some embodiments, the at least one anchor residues comprises at least two anchor residues. In some embodiments, the at least two anchor residues are separated by a separation region comprising at least 1 amino acid. In some embodiments, the at least one anchor residue flanking region is not within the separation region. In some embodiments, the at least one anchor residue flanking region is upstream of a N-terminal anchor residue of the at least two anchor residues downstream of a C-terminal anchor residue of the at least two anchor residue both (a) and (b).

[0177] In some embodiments, composition comprises an adjuvant. In some embodiments, the composition comprises one or more additional peptides, wherein the one or more additional peptides comprise a third neoepitope. In some embodiments, the first and/or second neoepitope binds to an HLA protein with a greater affinity than a corresponding wild-type sequence. In some embodiments, the first and/or second neoepitope binds to an HLA protein with a K_D or an IC_{50} less than 1000 nM, 900 nM, 800 nM, 700 nM, 600 nM, 500 nM, 250 nM, 150 nM, 100 nM, 50 nM, 25 nM or 10 nM. In some embodiments, the first and/or second neoepitope binds to an HLA class I protein with a K_D or an IC_{50} less than 1000 nM, 900 nM, 800 nM, 700 nM, 600 nM, 500 nM, 250 nM, 150 nM, 100 nM, 50 nM, 25 nM or

10 nM. In some embodiments, the first and/or second neoepitope binds to an HLA class II protein with a K_D or an IC_{50} less than 1000 nM, 900 nM, 800 nM, 700 nM, 600 nM, 500 nM, 250 nM, 150 nM, 100 nM, 50 nM, 25 nM or 10 nM. In some embodiments, the first and/or second neoepitope binds to a protein encoded by an HLA allele expressed by a subject. In some embodiments, the mutation is not present in non-cancer cells of a subject. In some embodiments, the first and/or second neoepitope is encoded by a gene or an expressed gene of a subject's cancer cells. In some embodiments, the composition comprises a first T cell comprising the first TCR. In some embodiments, the composition comprises a second T cell comprising the second TCR. In some embodiments, the first TCR comprises a non-native intracellular domain and/or the second TCR comprises a non-native intracellular domain. In some embodiments, the first TCR is a soluble TCR and/or the second TCR is a soluble TCR. In some embodiments, the first and/or second T cell is a cytotoxic T cell. In some embodiments, the first and/or second T cell is a gamma delta T cell. In some embodiments, the first and/or second T cell is a helper T cell. In some embodiments, the first T cell is a T cell stimulated, expanded or induced with the first neoepitope and/or the second T cell is a T cell stimulated, expanded or induced with the second neoepitope. In some embodiments, the first and/or second T cell is an autologous T cell. In some embodiments, the first and/or second T cell is an allogenic T cell. In some embodiments, the first and/or second T cell is an engineered T cell. In some embodiments, the first and/or second T cell is a T cell of a cell line. In some embodiments, the first and/or second TCR binds to an HLA-peptide complex with a K_D or an IC_{50} of less than 1000 nM, 900 nM, 800 nM, 700 nM, 600 nM, 500 nM, 250 nM, 150 nM, 100 nM, 50 nM, 25 nM or 10 nM. In some aspects, provided herein is a vector comprising a polynucleotide encoding a first and a second peptide described herein. In some embodiments, the polynucleotide is operably linked to a promoter. In some embodiments, the vector is a self-amplifying RNA replicon, plasmid, phage, transposon, cosmid, virus, or virion. In some embodiments, the vector is a viral vector. In some embodiments, the vector is derived from a retrovirus, lentivirus, adenovirus, adeno-associated virus, herpes virus, pox virus, alpha virus, vaccinia virus, hepatitis B virus, human papillomavirus or a pseudotype thereof. In some embodiments, the vector is a non-viral vector. In some embodiments, the non-viral vector is a nanoparticle, a cationic lipid, a cationic polymer, a metallic nanopolymer, a nanorod, a liposome, a micelle, a microbubble, a cell-penetrating peptide, or a liposphere.

[0178] In some aspects, provided herein is a pharmaceutical composition comprising: a composition described herein, or a vector described herein; and a pharmaceutically acceptable excipient.

[0179] In some embodiments, the plurality of cells is autologous cells. In some embodiments, the plurality of APC cells is autologous cells. In some embodiments, the plurality of T cells is autologous cells. In some embodiments, the pharmaceutical composition further comprises an immunomodulatory agent or an adjuvant. In some embodiments, the immunomodulatory agent is a cytokine. In some embodiments, the adjuvant is Hiltonol.

[0180] In some aspects, provided herein is a method of treating cancer, the method comprising administering to a subject in need thereof a pharmaceutical composition described herein.

[0181] In some aspects, provided herein is a method of preventing resistance to a cancer therapy, the method comprising administering to a subject in need thereof a pharmaceutical composition described herein.

[0182] In some aspects, provided herein is a method of inducing an immune response, the method comprising administering to a subject in need thereof a pharmaceutical composition described herein.

[0183] In some embodiments, the immune response is a humoral response. In some embodiments, the first peptide and the second peptide are administered simultaneously, separately or sequentially. In some embodiments, the first peptide is sequentially administered after the second peptide. In some embodiments, the second peptide is sequentially administered after the first peptide. In some embodiments, the first peptide is sequentially administered after a time period sufficient for the second peptide to activate the T cells. In some embodiments, the second peptide is sequentially administered after a time period sufficient for the first peptide to activate the T cells. In some embodiments, the first peptide is sequentially administered after the second peptide to restimulate the T cells. In some embodiments, the second peptide is sequentially administered after the first peptide to restimulate the T cells. In some embodiments, the first peptide is administered to stimulate the T cells and the second peptide is administered after the first peptide to restimulate the T cells. In some embodiments, the second peptide is administered to stimulate the T cells and the first peptide is administered after the second peptide to restimulate the T cells. In some embodiments, the subject has cancer, wherein the cancer is selected from the group consisting of melanoma, ovarian cancer, lung cancer, prostate cancer, breast cancer, colorectal cancer, endometrial cancer, and chronic lymphocytic leukemia (CLL). In some embodiments, the subject has a breast cancer that is resistant to anti-estrogen therapy. In some embodiments, the breast cancer expresses an estrogen receptor with a mutation. In some embodiments, the subject has a CLL that is resistant to ibrutinib therapy. In some embodiments, the CLL expresses a Bruton tyrosine kinase with a mutation, such as a C481S mutation. In some embodiments, the subject has a lung cancer that is resistant to a tyrosine kinase inhibitor. In some embodiments, the lung cancer expresses an epidermal growth factor receptor (EGFR) with a mutation, such as a T790M, L792F, or C797S mutation. In some embodiments, the plurality of APC cells comprising the first peptide and the plurality of APC cells comprising the second peptide are administered simultaneously, separately or sequentially. In some embodiments, the plurality of T cells comprising the first TCR and the plurality of T cells comprising the second TCR are administered simultaneously, separately or sequentially. In some embodiments, the method further comprises administering at least one additional therapeutic agent or modality. In some embodiments, the at least one additional therapeutic agent or modality is surgery, a checkpoint inhibitor, an antibody or fragment thereof, a chemotherapeutic agent, radiation, a vaccine, a small molecule, a T cell, a vector, and APC, a polynucleotide, an oncolytic virus or any combination thereof. In some embodiments, the at least one additional therapeutic agent is an anti-PD-1 agent and anti-PD-L1 agent, an anti-CTLA-4 agent, or an anti-CD40 agent. In some embodiments, the additional therapeutic agent is

administered before, simultaneously, or after administering a pharmaceutical composition according described herein.

III. Peptides

[0184] In aspects, the present disclosure provides isolated peptides that comprise a tumor specific mutation from **Table 1 to 14**. These peptides and polypeptides are referred to herein as “neoantigenic peptides” or “neoantigenic polypeptides”. The polypeptides or peptides can be a variety of lengths, either in their neutral (uncharged) forms or in forms which are salts, and either free of modifications such as glycosylation, side chain oxidation, or phosphorylation or containing these modifications, subject to the condition that the modification not destroy the biological activity of the polypeptides as herein described.

Table 1

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
TABLE 1A POINT MUTATION ¹				
ABL1	E255K	VADGLITTLHYPAPKR NKPTVYGVSPNYDKW EMERTDITMKHKLGG GQYGKVVYEGVWKKY SLTVAVKTLKEDTME VEEFLKEAAVMKEIK HPNLVQLLGVC	GQYGKVVYEG (A02.01) GQYGKVVYEGV (A02.01) KLGGGQYGGK (A03.01) KLGGGQYGGKV (A02.01) KVYEGVWKK (A02.01, A03.01) KVYEGVWKKY (A03.01) QYGKVVYEGV (A24.02) QYGKVVYEGVW (A24.02)	Chronic myeloid leukemia (CML), Acute lymphocytic leukemia (ALL), Gastrointestinal stromal tumors (GIST)
ABL1	E255V	VADGLITTLHYPAPKR NKPTVYGVSPNYDKW EMERTDITMKHKLGG GQYGVVYEGVWKKY SLTVAVKTLKEDTME VEEFLKEAAVMKEIK HPNLVQLLGVC	GQYGVVYEG (A02.01) GQYGVVYEGV (A02.01) KLGGGQYGV (A02.01) KLGGGQYGVV (A02.01) QYGVVYEGV (A24.02) QYGVVYEGVW (A24.02) VVYEGVWKK (A02.01, A03.01) VVYEGVWKKY (A03.01)	Chronic myeloid leukemia (CML), Acute lymphocytic leukemia (ALL), Gastrointestinal stromal tumors (GIST)
ABL1	M351T	LLGVCTREPPFYIITEF MTYGNLLDYLRECNR QEVNAVLLYMATQI SSATEYLEKKNFIHRD LAARNCLVGENHLVK VADFGLSRLMTGDTY TAHAGAKF	ATQISSATEY (A01.01) ISSATEYLEK (A03.01) SSATEYLEK (A03.01) TQISSATEYL (A02.01) YMATQISSAT (A02.01)	Chronic myeloid leukemia (CML), Acute lymphocytic leukemia (ALL), Gastrointestinal stromal tumors (GIST)
ABL1	T315I	SLTVAVKTLKEDTME VEEFLKEAAVMKEIK HPNLVQLLGVC FYIIIEFMTYGNLLDYL RECNRQEVNAVLLY MATQISSAMEYLEKK NFIHRDLA	FYIIIEFMTY (A24.02) IIIEFMTYGNL (A02.01) IIIEFMTYGN (A02.01) IIIEFMTYGN (A02.01) YIIIEFMTYGN (A02.01)	Chronic myeloid leukemia (CML), Acute lymphocytic leukemia (ALL), Gastrointestinal stromal tumors (GIST)

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
ABL1	Y253H	STVADGLITTLHYPAP KRNKPTVYGVSPNYD KWEMERTDITMKHKL GGGQHGEVYEGVWK KYSLTVAVKTLKEDT MEVEEFLKEAAVMKE IKHPNLVQLLG	GQHGEVYEGV (A02.01) KLGGGQHGEV (A02.01)	Chronic myeloid leukemia (CML), Acute lymphocytic leukemia (ALL), Gastrointestinal stromal tumors (GIST)
ALK	G1269A	SSLAMLDLLHVARDI ACGCQYLEENHFIHR DIAARNCLLTCGPGR VAKIADFGMARDIYR ASYRKGKGCAMLPVK WMPPEAFMEGIFTSKT DTWSFGVLL	KIADFGMAR (A03.01) RVAKIADFGM (A02.01, B07.02)	NSCLC
ALK	L1196M	QVAVKTLPEVCSEQD ELDFLMEALIISKFNH QNIVRCIGVSLQSLPRF ILMELMAGGDLKSFL RETRPRPSQPSSLAML DLLHVARDIACGCQY LEENHFI	FILMELMAGG (A02.01) ILMELMAGG (A02.01) ILMELMAGGD (A02.01) LMELMAGGDL (A02.01) LPRFILMEL (B07.02, B08.01) LPRFILMELM (B07.02) LQSLPRFILM (A02.01, B08.01) SLPRFILMEL (A02.01, A24.02, B07.02, B08.01)	NSCLC
BRAF	V600E	MIKLIDIARQTAQGMD YLHAKSIIHRDLKSNN IFLHEDLTVKIGDFGL ATEKSRWSGSHQFEQ LSGSILWMAPEVIRMQ DKNPYSFQSDVYAFGI VLYELM	LATEKSRWS (A02.01, B08.01) LATEKSRWSG (A02.01, B08.01)	CRC, GBM, KIRP, LUAD, SKCM, THCA
BTK	C481S	MIKEGSMSEDEFIEEA KVMMNLSHEKLVQL YGVCTKQRPIFIITEY MANGSLLNYLREMRH RFQTQQLLEMCKDVC EAMEYLESKQFLHRD LAARNCLVND	EYMANGSLL (A24.02) MANGSLLNY (A01.01, A03.01, A11.01) MANGSLLNYL (A02.01, B07.02, B08.01) SLLNYLREM (A02.01, B07.02, B08.01) YMANGSLLN (A02.01) YMANGSLLNY (A01.01, A03.01, A11.01)	CLL
EEF1B2	S43G	MGFGDLKSPAGLQVL NDYLADKSYIEGYVPS QADVAVFEAVSGPPP ADLCHALRWYNHIKS YEKEKASLPGVKKAL GKYGPADVEDTTGSG AT	GPPPADLCHAL (B07.02)	BLCA, KIRP, PRAD, SKCM

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
EGFR	S492R	SLNITSLGLRSLKEISD GDVIISGKNKLCYANT INWKKLFGTSGQKTKI IRNRGENSCKATGQV CHALCSPEGCWGPEP RDCVSCRNVSRGREG VDKCNLL	IIRNRGENSCK (A03.01)	CRC
EGFR	T790M	IPVAIKELREATSPKA NKEILDEAYVMASVD NPHVCRLGICLTSTV QLIMQLMPFGCLLDY VREHKDNIGSQYLLN WCVQIAKGMNYLED RRLVHRDLAA	CLTSTVQLIM (A01.01, A02.01) IMQLMPFGC (A02.01) IMQLMPFGCL (A02.01, A24.02, B08.01) LIMQLMPFG (A02.01) LIMQLMPFGC (A02.01) LTSTVQLIM (A01.01) MQLMPFGCL (A02.01, B07.02, B08.01) MQLMPFGCLL (A02.01, A24.02, B08.01) QLIMQLMPF (A02.01, A24.02, B08.01) QLIMQLMPFG (A02.01) STVQLIMQL (A02.01) VQLIMQLMPF (A02.01, A24.02, B08.01)	NSCLC, PRAD
ERBB3	V104M	ERCEVVMGNLEIVLT GHNADLSFLQWIREV TGYVLVAMNEFSTLP LPNLRMVVRRGTQVYDG KFAIFVMLNYNTNSSH ALRQLRLTQLTEILSG GVYIEKNDK		CRC, Stomach Cancer
ESR1	D538G	HLMKAGLTLQQQH QRLAQLLLILSHIRHM SNKGMHEHLYSMKCK NVVPLYGLLLEMLDA HRLHAPTSRGGASVE ETDQSHLATAGSTSSH SLQKYYITGEA	GLLLEMLDA (A02.01) LYGLLLEML (A24.02) NVVPLYGLL (A02.01) PLYGLLLEM (A02.01) PLYGLLLEML (A02.01, A24.02) VPLYGLLLEM (B07.02) VVPLYGLLL (A02.01, A24.02)	Breast Cancer
ESR1	S463P	NQGKCVEGMVEIFDM LLATSSRFRMMNLQG EEFVCLKSIILLNSGVY TFLPSTLKSLEEKDHIH RVLDKITDTLIHLMK AGLTLQQQHQLAQL LLILSH	FLPSTLKSL (A02.01, A24.02, B08.01) GVYTFLPST (A02.01) GVYTFLPSTL (A02.01, A24.02) TFLPSTLKSL (A24.02) VYTFLPSTL (A24.02) YTFLPSTLK (A03.01)	Breast Cancer

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
ESR1	Y537C	IHLMAKAGLTLQQQH QRLAQLLLILSHIRHM SNKGMHEHLYSMKCK NVVPLCDLLEMLDA HRLHAPTSRGGASVE ETDQSHLATAGSTSSH SLQKYYITGE	NVVPLCDLL (A02.01) NVVPLCDLLL (A02.01) PLCDLLEML (A02.01) PLCDLLEML (A02.01) VPLCDLLEML (B07.02) VVPLCDLLL (A02.01, A24.02)	Breast Cancer
ESR1	Y537N	IHLMAKAGLTLQQQH QRLAQLLLILSHIRHM SNKGMHEHLYSMKCK NVVPLNDLLEMLDA HRLHAPTSRGGASVE ETDQSHLATAGSTSSH SLQKYYITGE	NVVPLNDLL (A02.01) NVVPLNDLLL (A02.01) PLNDLLEML (A02.01) PLNDLLEML (A02.01) VPLNDLLEML (B07.02)	Breast Cancer
ESR1	Y537S	IHLMAKAGLTLQQQH QRLAQLLLILSHIRHM SNKGMHEHLYSMKCK NVVPLSDLLEMLDA HRLHAPTSRGGASVE ETDQSHLATAGSTSSH SLQKYYITGE	NVVPLSDLL (A02.01) NVVPLSDLLL (A02.01) PLSDLLEML (A02.01) PLSDLLEML (A02.01) VPLSDLLEML (B07.02) VVPLSDLLL (A02.01, A24.02)	Breast Cancer
FGFR3	S249C	HRIGGIKLRHQQWSL VMESVVPDRGNYTC VVENKFGSIRQTYTLD VLERCPHRPILQAGLP ANQTAVLGSDVEFHC KVYSDAQPHIQWLKH VEVNGSKVG	VLERCPHRPI (A02.01, B08.01) YTLDVLERC (A02.01)	BLCA, HNSC, KIRP, LUSC
FRG1B	L52S	AVKLSDSRIALKSGYG KYLGINDELVGHS AIGPREQWEPVFQNG KMALSA NSCFIRCNE AGDIEAKSKTAGEEE MIKIRSCAEKETKKKD DIPEEDKG	FQNGKMALS (A02.01)	GBM, KIRP, PRAD, SKCM
HER2	V777L (Resistance)	GSGAFGTVYKGIWIPD GENVKIPVAIKVLREN TSPKANKEILDEAYV MAGLGSPYVSRLGIC LTSTVQLVTQLMPYG CLLDHVREN RGR LGS QDLLN WCM	VMAGLGSPYV (A02.01, A03.01)	BRCA
IDH1	R132H	RVEEFKLLQMWKSPN GTIRNILGGTVFREAII CKNIPRLVSGWVKPIII GHHAYGDQYRATDF VVPGPVKVEITYTPSD GTQKVTYLVHNFEEG GGVAMGM	KPIIIGHHA (B07.02)	BLCA, GBM, PRAD

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
IDH1	R132C	RVEEFKLLKQMWKSPN GTIRNILGGTVFREAI CKNIPRLVSGWVKPIII GCHAYGDQYRATDFV VPGPGKVEITYTPSDG TQKVITYLVHNFEEGG GVAMGM	KPIIIGCHA (B07.02)	BLCA, GBM, PRAD
IDH1	R132G	RVEEFKLLKQMWKSPN GTIRNILGGTVFREAI CKNIPRLVSGWVKPIII GGHAYGDQYRATDF VPGPGKVEITYTPSD GTQKVITYLVHNFEEG GGVAMGM	KPIIIGGHA (B07.02)	BLCA, BRCA, CRC, GBM, HNSC, LUAD, PAAD, PRAD, UCEC
IDH1	R132S	RVEEFKLLKQMWKSPN GTIRNILGGTVFREAI CKNIPRLVSGWVKPIII GSHAYGDQYRATDFV VPGPGKVEITYTPSDG TQKVITYLVHNFEEGG GVAMGM	KPIIIGSHA (B07.02)	BLCA, BRCA, GBM, HNSC, LIHC, LUAD, LUSC, PAAD, SKCM, UCEC
KIT	T670I	VAVKMLKPSAHLTER EALMSELKVLSYLG HMNIVNLLGACTIGGP TLVIEYCCYGDLLNF LRRKRDSFICSKQEDH AEAALYKNLLHSKES SCSDSTNE	IIIEYCCYGD (A02.01) TIGGPTLVII (A02.01) VIEYCCYG (A02.01)	Gastrointestinal stromal tumors (GIST)
KIT	V654A	VEATAYGLIKSDAAM TVAVKMLKPSAHLTE REALMSELKVLSYLG NHMNIANLLGACTIG GPTLVITEYCCYGDLL NFLRRKRDSFICSKQE DHAEALYK	HMNIANLLGA (A02.01) IANLLGACTI (A02.01) MNIANLLGA (A02.01) YLGNHMNI (A02.01, B08.01) YLGNHMNIAN (A02.01)	Gastrointestinal stromal tumors (GIST)
MEK	C121S	ISELGAGNGGVVFKVS HKPSGLVMARKLIHL EIKPAIRNQIIRELQVL HESNSPYIVGFYGFY SDGEISICMEHMDGGS LDQVLKKAGRIPEQIL GKVS	VLHESNSPY (A03.01) VLHESNSPYI (A02.01)	Melanoma
MEK	P124L	LGAGNGGVVFKVSHK PSGLVMARKLIHLEIK PAIRNQIIRELQVLHEC NSLYIVGFYGFYSDG EISICMEHMDGGS LDQVLKKAGRIPEQIL GKVSIAVI	LQVLHECNSL (A02.01, B08.01) LYIVGFYGFY (A24.02) NSLYIVGFY (A01.01) QVLHECNSL (A02.01, B08.01) SLYIVGFY (A02.01) SLYIVGFYGA (A02.01) VLHECNSLY (A03.01) VLHECNSLYI (A02.01, A03.01)	Melanoma

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
MYC	E39D	MPLNVSFTNRNYDL YDSVQPYFYCDEEEN FYQQQQQSDLQPPAPS EDIWKKFELLPTPLSP SRRSGLCSPSYVAVTP FSLRGDNDGG	FYQQQQQSDL (A24.02) QQQSDLQPPA (A02.01) QQSDLQPPA (A02.01) YQQQQQSDL (A02.01, B08.01)	Lymphoid Cancer; Burkitt Lymphoma
MYC	P57S	FTNRNYDLDYDSVQP YFYCDEEENFYQQQQ QSELQPPAPSEDIWKK FELLSTPPLSPSRRSGL CSPSYVAVTPFSLRGD NDGGGGSFSTADQLE MVTELLG	FELLSTPPL (A02.01, B08.01) LLSTPPLSPS (A02.01)	Lymphoid Cancer
MYC	T58I	TNRNYDLDYDSVQPY FYCDEEENFYQQQQQ SELQPPAPSEDIWKKF ELLPIPPLSPSRRSGLC SPSYVAVTPFSLRGDN DGGGGSFSTADQLEM VTELLGG	FELLPIPPL (A02.01) IWKKFELLPI (A24.02) LLPIPPLSPS (A02.01, B07.02) LPIPPLSPS (B07.02)	Neuroblastoma
PDGFRa	T674I	VAVKMLKPTARSSEK QALMSELKIMTHLGP HLNIVNLLGACTKSGP IYIIIEYCFYGDLVNYL HKNRDSFSLSHHPEKPK KELDIFGLNPADESTR SYVILS	IIIEYCFYGDL (A02.01) IIIEYCFYG (A02.01) IYIIIEYCF (A24.02) IYIIIEYCFY (A24.02) YIIIEYCFYG (A02.01)	Chronic Eosinophilic Leukemia
PIK3CA	E542K	IEEHANWSVSREAGFS YSHAGLSNRLARDNE LRENDKEQLKAISTRD PLSKITEQEKDFLWSH RHYCVTIPEILPKLLLS VKWNSRDEVAQMYC LVKDWPP	KITEQEKDFL (A02.01)	BLCA, BRCA, CESC, CRC, GBM, HNSC, KIRC, KIRP, LIHC, LUAD, LUSC, PRAD, UCEC
PIK3CA	E545K	HANWSVSREAGFSYS HAGLSNRLARDNELR ENDKEQLKAISTRDPL SEITKQEKDFLWSHRH YCVTIPEILPKLLLSVK WNSRDEVAQMYCLV KDWPPIKP	STRDPLSEITK (A03.01) DPLSEITK (A03.01)	BLCA, BRCA, CESC, CRC, GBM, HNSC, KIRC, KIRP, LIHC, LUAD, LUSC, PRAD, SKCM, UCEC
PIK3CA	H1047R	LFINLFSMMLGSGMPE LQSFDDIAYIRKTLAL DKTEQEALEYFMKQM NDARHGGWTTKMDW IFHTIKQHALN		BRCA, CESC, CRC, GBM, HNSC, LIHC, LUAD, LUSC, PRAD, UCEC

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
POLE	P286R	QRGGVITDEEETSKKI ADQLDNIVDMREYDV PYHIRLSIDIETTKLPL KFRDAETDQIMMISY MIDGQGYLITNREIVS EDIEDFEFTPKEYEGP FCVFN	LPLKFRDAET (B07.02)	Colorectal adenocarcinoma; Uterine/Endometrium Adenocarcinoma; Colorectal adenocarcinoma, MSI+; Uterine/Endometrium Adenocarcinoma, MSI+; Endometrioid carcinoma; Endometrium Serous carcinoma; Endometrium Carcinosarcoma-malignant mesodermal mixed tumor; Glioma; Astrocytoma; GBM
PTEN	R130Q	KFNCRVAQYPFEDHN PPQLELIKPFCELDQ WLSEDDNHVAAIHCK AGKGQTGVMICAYLL HRGKFLKAQEALDFY GEVTRDKKGV TIPSQ RRYVYYYSY	QTGVMICAYL (A02.01)	BRCA, CESC, CRC, GBM, KIRC, LUSC, UCEC
RAC1	P29S	MQAIKCVVVG DGAV GKTCLLISYTTNAFSG EYIPTVFDNYSANVM VDGKPVNLGLWDTA GQEDYDRLRPLSYPQ TVGET	AFSGEYIPTV (A02.01, A24.02)	Melanoma
TP53	G245S	IRVEGNLRVEYLDDR NTRFRHSVVVPYEPPEV GSDCTTIHYNMCNS SCMGSMNRRPILTIITL EDSSGNLLGRNSFEVR VCACPGRDRRTEEN LRKKGEP	SMNRRPILT (A02.01, B08.01) YMCNSSCMGS (A02.01)	BLCA, BRCA, CRC, GBM, HNSC, LUSC, PAAD, PRAD
TP53	R175H	TYSPALNKMFCQLAK TCPVQLWVDSTPPPGT RVRAMAIYKQSQHMT EVVRHCPHHERCSDS DGLAPPQHILRVEGNL RVEYLDDRNTFRHSV VVPYEPPEV		BLCA, BRCA, CRC, GBM, HNSC, LUAD, PAAD, PRAD, UCEC

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
TP53	R248Q	EGNLRVEYLDDRNTF RHSVVVPYEPPEVGS CTTIHYNMCMSSCM GGMNQRPIITITLED SGNLLGRNSFEVRVC ACPGRRRTEENLR KKGEPHHE	GMNQRPIIT (A02.01)	BLCA, BRCA, CRC, GBM, HNSC, KIRC, LIHC, LUSC, PAAD, PRAD, UCEC
TP53	R248W	EGNLRVEYLDDRNTF RHSVVVPYEPPEVGS CTTIHYNMCMSSCM GGMNWRPIITITLED SSGNLLGRNSFEVRVC ACPGRRRTEENLR KKGEPHHE	GMNWRPIIT (A02.01)	BLCA, BRCA, CRC, GBM, HNSC, LIHC, LUSC, PAAD, SKCM, UCEC
TP53	R273C	PEVGSDCCTTIHYNM CNSSCMGGMNRRPIL TIITLEDSSGNLLGRNS FEVCVCACPGRRRT EEENLRKKGEPHHELP PGSTKRALPNNTSSSP QPKKKPL	LLGRNSFEVC (A02.01)	BLCA, BRCA, CRC, GBM, HNSC, LUSC, PAAD, UCEC
TABLE 1B MSI-ASSOCIATED FRAMESHIFTS ¹				
ACVR2 A	D96fs; +1	GVEPCYGDKDKRRHC FATWKNISGSIEIVKQ GCWLDDINCYDRDTC VEKKRQP*		MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
ACVR2 A	D96fs; -1	GVEPCYGDKDKRRHC FATWKNISGSIEIVKQ GCWLDDINCYDRDTC VEKKTALKYIFVAVR <u>AICVMKSFLIFRRWKS</u> <u>HSPLOIQLHLSHPITTS</u> <u>CSIPWCHLC*</u>	ALKYIFVAV (A02.01, B08.01) ALKYIFVAVR (A03.01) AVRAICVMK (A03.01) AVRAICVMKS (A03.01) CVEKKTALK (A03.01) CVEKKTALKY (A01.01) CVMKSFLIF (A24.02, B08.01) CVMKSFLIFR (A03.01) FLIFRRWKS (A02.01, B08.01) FRRWKSHSPL (B08.01) FVAVRAICV (A02.01, B08.01) FVAVRAICVM (B08.01) IQLHLSHPI (A02.01) KSFLIFRRWK (A03.01) KTALKYIFV (A02.01) KYIFVAVRAI (A24.02) RWKSHSPLQI (A24.02) TALKYIFVAV (A02.01, B08.01) VAVRAICVMK (A03.01) VMKSFLIFR (A03.01) VMKSFLIFRR (A03.01) YIFVAVRAI (A02.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
C15ORF40	L132fs; +1	TAEAVNVAIAAPPSEG EANAELCRYLSKVLE LRKSDVVLKDKVGLAL FFFFFETKSCSVAQAG <u>VQWRSLGSLQPPPGF</u> <u>KLFSCLSFLSSWDYRR</u> <u>MPPCLANFCIFNRDGV</u> <u>SPCWGWS*</u>	ALFFFFFET (A02.01) ALFFFFFETK (A03.01) AQAGVQWRSL (A02.01) CLANFCIFNR (A03.01) CLSFLSSWDY (A01.01, A03.01) FFETKSCSV (B08.01) FFFETKSCSV (A02.01) FKLFSCLSFL (A02.01) FLSSWDYRRM (A02.01) GFKLFSCLSF (A24.02) KLFSCLSFL (A02.01, A03.01) KLFSCLSFLS (A02.01, A03.01) LALFFFFFET (A02.01) LFFFFFETK (A03.01) LSFLSSWDY (A01.01) LSFLSSWDYR (A03.01) RMPPCLANF (A24.02) RRMPPCLANF (A24.02) SLQPPPGFK (A03.01) VQWRSLGSL (A02.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
CNOT1	L1544fs; +1	LSVIIFFFVYIHWAL PLILNNHHICLMSSIIL DCNSVRQSIMSVCF <u>FSVIFSTRCLTDSRYPN</u> <u>ICWFK*</u>	FFFSVIFST (A02.01) MSVCFFFFSV (A02.01) SVCFFFFSV (A02.01, B08.01) SVCFFFFSVI (A02.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
CNOT1	L1544fs; -1	LSVIIFFFVYIHWAL PLILNNHHICLMSSIIL DCNSVRQSIMSVCF <u>FCYILNTMFDR*</u>	FFCYILNTMF (A24.02) MSVCFFFFCY (A01.01) SVCFFFFCYI (A02.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
EIF2B3	A151fs; -1	VLVLSCDLITDVALHE VVDLFRAYDASLAML MRKGQDSIEPVP GKKKQWSSVTSLEWT <u>AQERGCSSWLMKQT</u> <u>WMKSWSLRDPSYRSI</u> <u>LEYVSTRVLWMPST</u> <u>V*</u>	KQWSSVTSL (A02.01) VLWMPSTTV (A02.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
EPHB2	K1020fs; -1	SIQVMRAQMNQIQSV EGQPLARRPRATGRT KRCQPRDVTKKTCNS NDGKKREWEKRKQIL <u>GGGGKYKEYFLKRILI</u> <u>RKAMTVLAGDKKGL</u> <u>GRFMRCVQSETKAVS</u> <u>LQLPLGR*</u>	ILIRKAMTV (A02.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
ESRP1	N512fs; +1	LDFLGEFATDIRTHGV HMLVNHQGRPSGDAF IQMKSADRAFMAAQK CHKKKHEGQIC*		MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
ESRP1	N512fs; -1	LDFLGEFATDIRTHGV HMVLNHQGRPSGDAF IQMKSADRAFMAAQK <u>CHKKT*</u>		MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
FAM111B	A273fs; -1	GALCKDGRFRSDIGEF EWKLKEGHKKIYGKQ SMVDEVSGKVLEMDI <u>SKKKHYNRKISIKLNL</u> <u>RMKVPLMKLITRV*</u>	RMKVPLMK (A03.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
GBP3	T585fs; -1	RERAQLLEEQEKTLS KLQEQARVLKERCCQ ESTQLQNEIQKLQKTL <u>KKKPRDICRIS*</u>	TLKKKPRDI (B08.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
JAK1	P861fs; +1	VNTLKEGKRLPCPPNC PDEVYQLMRKCWEFQ PSNRTSFQNLIEGFEAL <u>LKTSN*</u>	LIEGFEALLK (A03.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
JAK1	K860fs; -1	CRPVTPSCKELADLM TRCMNYDPNQRPFRR AIMRDINKLEEQNPDI <u>VSEKNQQLKWTPHIL</u> <u>KSAS*</u>	QQLKWTPHI (A02.01) QLKWTPHILK (A03.01) IVSEKNQQLK (A03.01) QLKWTPHILK (A03.01) QQLKWTPHI (A24.02) NQLKWTPHIL (B08.01) NQLKWTPHI (B08.01) QLKWTPHIL (B08.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
LMAN1	E305fs; +1	DDHDVLSFLTFQLTEP GKEPPTPDKEISEKEK EKYQEEFEHFQQELD <u>KKKRGIPGPPRPPRA</u> <u>ACGGNI*</u>	GPPRPPRAAC (B07.02) PPRPPRAAC (B07.02)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
LMAN1	E305fs; -1	DDHDVLSFLTFQLTEP GKEPPTPDKEISEKEK EKYQEEFEHFQQELD <u>KKKRNSRRATPTSKG</u> <u>SLRRKYLRV*</u>	SLRRKYLRV (B08.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
MSH3	N385fs; +1	TKSTLIGEDVNPLIKL DDAVNVDEIMTDTST SYLLCISENKENVRDK <u>KKGQHFYWHCGSAA</u> <u>CHRRGCV*</u>	SAACHRRGCV (B08.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
MSH3	K383fs; -1	LYTKSTLIGEDVNPLI KLDDAVNVDEIMTDT STSYLLCISENKENVR DKKRATFLLALWECS <u>LPQARLCLIVSRTLLL</u> <u>VQS*</u>	ALWECSLPQA (A02.01) CLIVSRTLL (B08.01) CLIVSRTLLL (A02.01, B08.01) FLLALWECS (A02.01) FLLALWECSL (A02.01, B08.01) IVSRTLLL (A02.01) LIVSRTLLL (A02.01, B08.01) LIVSRTLLL (A02.01) LLALWECSL (A02.01, B08.01) LPQARLCLI (B08.01, B07.02) LPQARLCLIV (B08.01) NVRDKKRATF (B08.01) SLPQARLCLI (A02.01, B08.01)	MSI+CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
NDUFC 2	A70fs; +1	LPPPKLTDPRLLYIGFL GYCSGLIDNLIRRRPIA TAGLHRQLLYITAFF <u>CWILSCKT*</u>	FFCWILSCK (A03.01) FFFCWILSCK (A03.01) ITAFFFCWI (A02.01) LYITAFFFCW (A24.02) YITAFFFCWI (A02.01)	MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
NDUFC 2	F69fs; -1	SLPPPCLTDPRLLYIGF LGYCSGLIDNLIRRRPI ATAGLHRQLLYITAFF <u>LLDIIL*</u>	ITAFFLLDI (A02.01) LLYITAFFL (A02.01, B08.01) LLYITAFFLL (A02.01, A24.02) LYITAFFLL (A24.02) LYITAFFLLD (A24.02) YITAFFLLDI (A02.01)	MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
RBM27	Q817; +1	NQSGGAGEDCQIFSTP GHPKMIYSSSNLKTSP KLCSGSKSHDVQEV KKKTGSNEVTTRYEE <u>KKTGSVRKANRMPKD</u> <u>VNIQVRKKQKHETRR</u> <u>KSKYNEDFERAWRED</u> <u>LTIKR*</u>	GSNEVTTRY (A01.01) MPKDVNIQV (B07.02) TGSNEVTTRY (A01.01)	MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
RPL22	K16fs; +1	MAPVKKLVVKGKK <u>KEASSEVHS*</u>		MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
RPL22	K15fs; -1	MAPVKKLVVKGKK <u>RSKF*</u>		MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
SEC31A	I462fs; +1	MPSHQGAEQQQQH HVFISQVVTEKEFLSR SDQLQQAVQSQGF <u>IN</u> <u>YCQKKN*</u>		MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
SEC31A	I462fs; -1	MPSHQGAEQQQQQH HVFISQVVTEKEFLSR SDQLQQAVQSQGFIN <u>YCQKKLMLLRNLRK</u> <u>MCGPF*</u>	KKLMLLRNL (A02.01) KLMLLRNL (A02.01, A03.01, B07.02, B08.01) KLMLLRNLNR (A03.01) LLRLNLRKM (B08.01) LMLLRNL (B08.01) LMLLRNLNRK (A03.01) LNLKMCMPF (B08.01) MLLRNLNRK (A03.01) MLLRNLNRKM (A02.01, A03.01, B08.01) NLRKMCMPF (B08.01) NYCQKKLMLL (A24.02) YCQKKLMLL (B08.01)	MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
SEC63	K530fs; +1	AEVFEKEQSICAAEEQ PAEDGQGETNKNRKT GGWQQKSKGPKKTA KSKKKETFKKKTYTC <u>AITTVKATETKAGKW</u> <u>SRWE*</u>	FKKKTYTCAI (B08.01) ITTVKATETK (A03.01) KSKKKETFK (A03.01) KSKKKETFKK (A03.01) KTYTCAITTV (A02.01, A24.02) TFKKKTYTC (B08.01) TYTCAITTV (A24.02) TYTCAITTVK (A03.01) YTCAITTVK (A03.01)	MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
SEC63	K529fs; -1	MAEVFEKEQSICAAEE QPAEDGQGETNKNRT KGGWQQKSKGPKKT <u>AKSKKRNL*</u>	TAKSKKRNL (B08.01)	MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
SLC35F 5	C248fs; -1	NIMEIRQLPSSHALEA KLSRMSYPVKEQESIL KTVGKLTAQVAKISF <u>FFALCGFWQICHIKKH</u> <u>FQTHKLL*</u>	FALCGFWQI (A02.01)	MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
SMAP1	K172fs; +1	YEKKKYYDKNAIAIT NISSDAPLQPLVSSPS LQAAVDKNKLEKEKE <u>KKKGREKERKGARKA</u> <u>GKTTYS*</u>		MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
SMAP1	K171fs; -1	KYEKKKYYDKNAIAI TNISSDAPLQPLVSSP SLQAAVDKNKLEKEK <u>EKKRKRKREKRSQKS</u> <u>RQNHQLKSCRKISN</u> <u>WSLKKVPALKLRSP</u> <u>LWIF*</u>	LKKLRSP (B08.01) SLKKVPAL (B08.01) RKISNWSLKK (A03.01) VPALKLRSP (B07.02)	MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome
TFAM	E148fs; +1	IYQDAYRAEWQVYKE EISRFKEQLTPSQIMSL EKEIMDKHLKRKAMT <u>KKKRVNTAWKTKT</u> <u>SFSL*</u>	KRVNTAWKTK (A03.01) MTKKRVNTA (B08.01) RVNTAWKTK (A03.01) RVNTAWKTKK (A03.01) TKKKRVNTA (B08.01) WKTKTSFSL (B08.01)	MSI+ CRC, MSI+ Uterine/Endometriu m Cancer, MSI+ Stomach Cancer, Lynch syndrome

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
TFAM	E148fs; -1	IYQDAYRAEWQVYKE EISRFKEQLTPSQIMSL EKEIMDKHLKRRKAMT KKKS*		MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
TGFBR2	P129fs; +1	KPQEVCVAVWRKND ENITLETVCHDPKLPY HDFILEDAAASPKCIMK EKKKAW*		MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
TGFBR2	K128fs: -1	EKPQEVCVAVWRKN DENITLETVCHDPKLP YHDFILEDAAASPKCIM KEKKSRLSSCVPA LMSAMTTSSSQKNITP AILTCC*	ALMSAMTTS (A02.01) AMTTSSSQK (A03.01, A11.01) AMTTSSSQKN (A03.01) CIMKEKKS (B08.01) CIMKEKKS (B08.01) IMKEKKS (B08.01) IMKEKKS (B08.01) KSLVRLSSCV (A02.01) LVRLSSCV (A02.01) RLSSCVPA (A02.01, A03.01) RLSSCVPA (A02.01) SAMTTSSSQK (A03.01, A11.01) SLVRLSSCV (A02.01) VPVALMSAM (B07.02) VRLSSCVPA (A02.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
THAP5	K99fs; -1	VPSKYQFLCSDHFTP SLDIRWGIRYLKQTAV PTIFSLPEDNQGKDPS KKNPRRKTWKMRRK YAQKPSQKNHLY*	KMRKKYAQK (A03.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
TTK	R854fs; -1	GTTEEMKYVLGQLVG LNSPNSILKAAKTLYE HYSGGESHNSSSSKTF EKKGEKNDLQLFVMS DTTYKIYWTVILLNPC GNLHLKTTSL*	FVMSDTTYK (A03.01) FVMSDTTYKI (A02.01) KTFEKKGEK (A03.01) LFVMSDTTYK (A03.01) MSDTTYKIY (A01.01) VMSDTTYKI (A02.01) VMSDTTYKIY (A01.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
XPOT	F126fs; -1	QQLIRETLISWLQAQM LNPQPEKTFIRNKAQ VFALLFVTEYLTKWP KFFLTFSQ*	YLTKWPKFFL (A02.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome

TABLE 1C FRAMESHIFT ¹

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
APC	V1352fs F1354fs Q1378fs S1398fs	<u>AKFQQCHSTLEPNPA</u> <u>DCRVLVYLVYLNQPGTK</u> <u>LLNFLQERNLPPKVVL</u> <u>RHPKVHLNTMFRRPH</u> <u>SCLADVLLSVHLIVLR</u> <u>VVRLPAPFRVNHAVE</u> <u>W*</u>	FLQERNLPP (A02.01) FRRPHSCLA (B08.01) LIVLRVVRL (B08.01) LLSVHLIVL (A02.01, B08.01)	CRC, LUAD, UCEC, STAD
APC	S1421fs R1435fs T1438fs P1442fs P1443fs V1452fs P1453fs K1462fs E1464fs	<u>APVIFQIALDKPCHQA</u> <u>EVKHLHHLLKQLKPS</u> <u>EKYLKIKHLLLRERV</u> <u>DLSKLQ*</u>	EVKHLHHLL (B08.01) HLHLLKQLK (A03.01) HLLKRRERV (B08.01) KIKHLLKR (A03.01) KPSEKYLKI (B07.02) KYLKIKHLL (A24.02) KYLKIKHLLL (A24.02) LLKQLKPSEK (A03.01) LLKRERVDL (B08.01) LLLKRERVDL (B08.01) QLKPSEKYLK (A03.01) YLIKIKHLLL (A02.01, B08.01) YLIKIKHLLK (A03.01)	CRC, LUAD, UCEC, STAD
APC	T1487fs H1490fs L1488fs	<u>MLOFRGSRFFQMLILY</u> <u>YILPRKVLQMDFLVHP</u> <u>A*</u>	ILPRKVLQM (B08.01) KVLQMDFLV (A02.01, A24.02) LPRKVLQMDF (B07.02, B08.01) LQMDFLVHPA (A02.01) QMDFLVHPA (A02.01) YILPRKVLQM (A02.01, B08.01)	CRC, LUAD, UCEC, STAD
ARID1A	Q1306fs S1316fs Y1324fs T1348fs G1351fs G1378fs P1467fs	<u>ALGPHSRISCLPTQTR</u> <u>GCILLAATPRSSSSSSS</u> <u>NDMIPMAISSPPKAPL</u> <u>LAAPSPASRLQCINSN</u> <u>SRITSGQWMAHMALL</u> <u>PSGTKGRCTACTAL</u> <u>GRGSLSSSSCPQSPSL</u> <u>PASNKLPSLPLSKMYT</u> <u>TSMAMPILPLPQLLS</u> <u>ADQQAAPRTNHFSSL</u> <u>AETVSLHPLAPMPSKT</u> <u>CHHK*</u>	APSPASRLQC (B07.02) HPLAPMPSKT (B07.02) ILPLPQLL (A02.01) LLLSADQQA (A02.01) LPTQTRGCI (B07.02) LPTQTRGCIL (B07.02) RISCLPTQTR (A03.01) SLAETVSLH (A03.01) TPRSSSSSS (B07.02) TPRSSSSSS (B07.02)	STAD, UCEC, BLCA, BRCA, LUSC, CESC, KIRC, UCS

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
ARID1A	S674fs P725fs R727fs I736fs	<u>AHOGFPAAKESRVIQL</u> <u>SLLSLLIPPLTCLASEA</u> <u>LPRPLLALPPVLLSLA</u> <u>QDHSRLLQCQATRCH</u> <u>LGHPVASRTASCILP*</u>	ALPPVLLSL (A02.01) ALPPVLLSLA (A02.01) ALPRLLAL (A02.01) ASRTASCIL (B07.02) EALPRLLAL (B08.01) HLGHPVASR (A03.01) HPVASRTAS (B07.02) HPVASRTASC (B07.02) IIQLSLLSLL (A02.01) IQLSLLSLL (A02.01) IQLSLLSLLI (A02.01, A24.02) LLALPPVLL (A02.01) LLIPPLTCL (A02.01) LLIPPLTCLA (A02.01) LLSLLIPPL (A02.01) LLSLLIPPLT (A02.01) LPRPLLALPP (B07.02) QLSLLSLLI (A02.01) RLLQCQATR (A03.01) RPLLALPPV (B07.02) RPLLALPPVL (B07.02) SLAQDHSRL (A02.01) SLAQDHSRLL (A02.01) SLLIPPLTCL (A02.01) SLLSLLIPP (A02.01) SLLSLLIPPL (A02.01, B08.01)	STAD, UCEC, BLCA, BRCA, LUSC, CESC, KIRC, UCS

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
ARID1A	G414fs Q473fs H477fs S499fs P504fs Q548fs P549fs	<u>PILAATGTSVRTAART</u> <u>WVPRAAIRVPDPAAV</u> <u>PDDHAGPGAECHGRP</u> <u>LLYTADSSLWTTTRPQ</u> <u>RVWSTGPDLSIQPAKS</u> <u>SPSAAAATLLPATTVP</u> <u>DPSCPTFVSAAATVST</u> <u>TTAPVLSASILPAAIPA</u> <u>STSAVPGSIPLPAVDD</u> <u>TAAPPEPAPLLTATGS</u> <u>VSLPAAATSAASTLDA</u> <u>LPAGCVSSAPVSAVPA</u> <u>NCLFPAALPSTAGAIS</u> <u>RFIWSGILSPLNDLQ*</u>	AAATSAASTL (B07.02) AAIPASTSAV (B07.02) AIPASTSAV (A02.01) ALPAGCVSSA (A02.01) APLLATGGSV (B07.02) APVLSASIL (B07.02) ATLLPATTV (A02.01) ATVSTTTAPV (A02.01) AVPANCLFPA (A02.01) CLFPAALPST (A02.01) CPTFVSAAA (B07.02) FPAALPSTA (B07.02) FPAALPSTAG (B07.02) GAECHGRPL (B07.02) GAISRFIWV (A02.01) ILPAAIPAST (A02.01) IWVSGILSPL (A24.02) LLTATGSVSL (A02.01) LLYTADSSL (A02.01) LPAAATSAA (B07.02) LPAAATSAAS (B07.02) LPAAIPAST (B07.02) LPAGCVSSA (B07.02) LPAGCVSSAP (B07.02) LYTADSSLW (A24.02) QPAKSSPSA (B07.02) QPAKSSPSAA (B07.02) RFIWVSGIL (A24.02) RPQRVWSTG (B07.02) RVWSTGPDLSI (A02.01) SAVPGSIPL (B07.02) SILPAAIPA (A02.01) SLPAAATSA (A02.01) SLPAAATSAA (A02.01) SLWTTTRPQR (A03.01) SLWTTTRPQRV (A02.01) SPSAAAATL (B07.02) SPSAAAATLL (B07.02) TLDALPAGCV (A02.01) TVSTTTAPV (A02.01) VLSASILPA (A02.01) VLSASILPAA (A02.01) VPANCLFPA (B07.02) VPANCLFPAA (B07.02) VPDPCPTF (B07.02) VPGSIPLPA (B07.02) VPGSIPLPAV (B07.02) WVSGILSPL (A02.01) YTADSSLWTT (A02.01)	STAD, UCEC, BLCA, BRCA, LUSC, CESC, KIRC, UCS

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
ARID1A	T433fs A441fs Y447fs P483fs P484fs P504fs S519fs H544fs P549fs P554fs Q563fs	<u>PCRAGRRVPWAASLI</u> <u>HSRFLMDNKAPAGM</u> <u>VNRARLHITTSKVLTL</u> <u>SSSSHPTPSNHRPRPL</u> <u>MPNLRISSSHSLNHHS</u> <u>SSPLSLHTPSSHPSLHI</u> <u>SSPRLHTPPSSRRHSST</u> <u>PRASPPTHSHRLSLLTS</u> <u>SSNLSSQHPRRSPSRL</u> <u>RILSPSLSSPSKLPPISS</u> <u>ASLHRRSYLKIHLGLR</u> <u>HPQPPQ*</u>	APAGMVNRA (B07.02) ASLHRRSYL (B08.01) ASLHRRSYLK (A03.01) FLLMDNKAPA (A02.01) HPRRSPSRL (B07.02, B08.01) HPSLHISSP (B07.02) HRRSYLKIHL (B08.01) HSRFLMDNK (A03.01) KLPIPSSASL (A02.01) KVLTLSSSSH (A03.01) LIHSRFLM (B08.01) LLMDNKAPA (A02.01) LMDNKAPAGM (A02.01) LPIPSSASL (B07.02) MPNLRISSS (B07.02, B08.01) MPNLRISSSH (B07.02) NLRISSSHSL (B07.02, B08.01) PPTHSHRLSL (B07.02) RAGRRVPWAA (B08.01) RARLHITTSK (A03.01) RISSSHSLNH (A03.01) RLHTPPSSR (A03.01) RLHTPPSSRR (A03.01) RLRILSPSL (A02.01, B07.02, B08.01) RPLMPNLRI (B07.02) RPRPLMPNL (B07.02) SASLHRRSYL (B07.02, B08.01) SLHISSPRL (A02.01) SLHRRSYLK (A03.01) SLHRRSYLKI (B08.01) SLIHSRFL (A02.01) SLIHSRFLM (A02.01, B08.01) SLLTSSSNL (A02.01) SLNHSSSPL (A02.01, B07.02, B08.01) SLSSPSKLP (A02.01) SPLSLHTPS (B07.02) SPLSLHTPSS (B07.02) SPPTHSHRL (B07.02) SPRLHTPPS (B07.02) SPRLHTPPSS (B07.02) SPSLSSPSK (B07.02) SYLKIHLGL (A24.02) TPSNHRPRPL (B07.02, B08.01) TPSSHPSLHI (B07.02)	STAD, UCEC, BLCA, BRCA, LUSC, CESC, KIRC, UCS

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
ARID1A	A2137fs P2139fs L1970fs V1994fs	<u>RTNPTVRMRPHCVPF</u> <u>WTGRILLPSAASVCPIP</u> <u>FEACHLCQAMTLRCP</u> <u>NTQGCCSSWAS*</u>	CVPFWTGRIL (B07.02) HCVFWTGRIL (B07.02) ILLPSAASV (A02.01) ILLPSAASVC (A02.01) LLPSAASVCPI (A02.01) LPSAASVCPI (B07.02) MRPHCVPF (B08.01) RILLPSAASV (A02.01) RMRPHCVPF (A24.02, B07.02, B08.01) RMRPHCVPF (A24.02) RTNPTVRMR (A03.01) SVCPIFEA (A02.01) TVRMRPHCV (B08.01) TVRMRPHCVPF (B08.01) VPFWTGRIL (B07.02) VPFWTGRILL (B07.02) VRMRPHCVPF (B08.01)	STAD, UCEC, BLCA, BRCA, LUSC, CESC, KIRC, UCS
ARID1A	N756fs S764fs T783fs Q799fs A817fs	<u>TNQALPKIEVICRGTP</u> <u>RCPSTVPPSPAQPYLR</u> <u>VSLPEDRYTQAWAPT</u> <u>SRTPWGAMVPRGVS</u> <u>MAHKVATPGSQTIMP</u> <u>CPMPTTPVQAWLEA*</u>	AMVPRGVSM (B07.02, B08.01) AMVPRGVSM (A02.01) AWAPTSRTPW (A24.02) CPMPTTPVQA (B07.02) CPSTVPPSPA (B07.02) GAMVPRGVSM (B07.02, B08.01) MPCMPTTPV (B07.02) MPTTPVQAW (B07.02) MPTTPVQAWL (B07.02) SLPEDRYTQA (A02.01) SPAQPYLRV (B07.02) SPAQPYLRVS (B07.02) TIMPCMPT (A02.01) TPVQAWLEA (B07.02) TSRTPWGAM (B07.02) VPPSPAQPYL (B07.02) VPRGVSM (B07.02)	STAD, UCEC, BLCA, BRCA, LUSC, CESC, KIRC, UCS
β 2M	N62fs E67fs L74fs F82fs T91fs E94fs	<u>RMERELKKWSIQTCL</u> <u>SARTGLSISCTTLNSPP</u> <u>LKKMSMPAV*</u>	CLSARTGLSI (B08.01) CTTLNSPPLK (A03.01) GLSISCTTL (A02.01) SPPLKKMSM (B07.02, B08.01) TLNSPPLKK (A03.01) TTLNSPPLK (A03.01) TTLNSPPLKK (A03.01)	CRC, STAD, SKCM, HNSC
β 2M	L13fs S14fs	<u>LCSRYSLFLAWRLSSV</u> <u>LQRFRFTHVIOQRMES</u> <u>QIS*</u>	LQRFRFTHV (B08.01) LQRFRFTHVI (B08.01) RLSSVLQRF (A24.02) RLSSVLQRF (A03.01) VLQRFRFTHV (A02.01, B08.01)	CRC, STAD, SKCM, HNSC

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
CDH1	A691fs P708fs L711fs	<u>RSACVTVKGPLASVG</u> <u>RHLSLKQDCKFLPFW</u> <u>GFLEEFLLC*</u>	ASVGRHLSLK (A03.01) KFLPFWGFL (A24.02) LASVGRHSL (B07.02) LPFWGFLEEF (B07.02) PFWGFLEEF (A24.02) SVGRHLSLK (A03.01)	ILC LumA Breast Cancer
CDH1	H121fs P126fs H128fs N144fs V157fs P159fs N166fs N181fs F189fs P201fs F205fs	<u>IQWGTTPAPRPIRPPFL</u> <u>ESKQNCSEHPTPLLAS</u> <u>EDRRETGLFLPSAAQK</u> <u>MKKAHFLKTWFRSNP</u> <u>TKTKKARFSTASLAKE</u> <u>LTHPLLVSLLLKEKQD</u> <u>G*</u>	APRPIRPPF (B07.02) APRPIRPPFL (B07.02) AQKMKKAHFL (B08.01) FLPSAAQKM (A02.01) GLFLPSAAQK (A03.01) HPLLVSLLL (B07.02) KAHFLKTWFR (A03.01) KARFSTASL (B07.02) KMKKAHFLK (A03.01) KTWFRSNPTK (A03.01) LAKELTHPL (B07.02, B08.01) LAKELTHPLL (B08.01) NPTKTKKARF (B07.02) QKMKKAHFL (B08.01) RFSTASLAK (A03.01) RPIRPPFLES (B07.02) RSNPTKTKK (A03.01) SLAKELTHPL (A02.01, B08.01) TKKARFSTA (B08.01)	ILC LumA Breast Cancer
CDH1	V114fs P127fs V132fs P160fs	<u>PTDPFLGLRLGLHLQK</u> <u>VFHQSHAEYSGAPPPP</u> <u>PAPSGLRFWNPSRIAH</u> <u>ISQLLWPQKTEERLG</u> <u>YSSHQLPRK*</u>	GLRFWNPSR (A03.01) ISQLLWPQK (A03.01) RIAHISQLL (A02.01) RLGYSSHQL (A02.01) SQLLWPQK (A03.01) SRIAHISQL (B08.01) WPQKTEERL (B07.02) YSSHQLPRK (A03.01)	ILC LumA Breast Cancer
CDH1	L731fs R749fs E757fs G759fs	<u>FCCSCFFGGERWSKS</u> <u>PYCPQRMTPGTTFITM</u> <u>MKKEAEKRTRTLT*</u>	CPQRMTPGTT (B07.02) EAEKRTRTL (B08.01) GTTFITMMK (A03.01) GTTFITMMKK (A03.01) ITMMKKEAEK (A03.01) RMTPGTTFI (A02.01) SPYCPQRMT (B07.02) TMMKKEAEK (A03.01) TPGTTFITM (B07.02) TPGTTFITMM (B07.02) TTFITMMKK (A03.01)	ILC LumA Breast Cancer
CDH1	S19fs E24fs S36fs	<u>WRNCKAPVSLRKS</u> <u>QTPARSSPARPDRTR</u> <u>LPSLGVPQOPWALGA</u> <u>AASRRCCCCRSPLGS</u> <u>ARSRSPATLALTPRAT</u> <u>RSRCPGATWREAASW</u> <u>AE*</u>	CPGATWREA (B07.02) CPGATWREAA (B07.02) RSRCPGATWR (A03.01) TPRATRSRC (B07.02)	ILC LumA Breast Cancer

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
GATA3	P394fs P387fs S398fs H400fs M401fs S408fs P409fs S408fs P409fs T419fs H424fs P425fs S427fs F431fs S430fs H434fs H435fs S438fs M443fs G444fs *445fs	<u>PGRPLQTHVLPEPHLA</u> <u>LOPLOPHADHAHADA</u> <u>PAIQPVLTWTPPLQHG</u> <u>HRHGLEPCSMLTGPP</u> <u>ARVPAVPFDLHFCRSS</u> <u>IMKPKRDGYMFLKAE</u> <u>SKIMFATLQRSSLWCL</u> <u>CSNH*</u>	HVLPEPHLAL (B07.02) RPLQTHVLPE (B07.02) VLWTTPLQH (A03.01)	Breast Cancer
GATA3	P426fs H434fs P433fs T441fs	<u>PRPRRCTRHPACPLDH</u> <u>TTPPAWSPWVRALL</u> <u>DAHRAPSESPCFRL</u> <u>AFLQEYHEA*</u>	APSESPSPF (B07.02) CPLDHTTPPA (B07.02) FLQEYHEA (A02.01, B08.01) RLAFLQEYH (A03.01) SPCSPFLAF (B07.02) SPPWVRALL (B07.02) YPACPLDHTT (B07.02)	Breast Cancer

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
MLL2	P519fs E524fs P647fs S654fs L656fs R755fs L761fs Q773fs	<u>TRRCHCCPHLRSHPCP</u> <u>HHLRNHPRPHHLRHH</u> <u>ACHHHLRNCPPHFL</u> <u>RHCTCPGRWRNRPSL</u> <u>RRLRSLCLPHLNHHL</u> <u>FLHWSRCPCLHRKSH</u> <u>PLLHLRRLYPHHLK</u> <u>HRPCPHHLKNLLCPR</u> <u>HLRNCPLPRHLKHLA</u> <u>CLHHLRSHPCPLHLKS</u> <u>HPCLHRRHLVCSHH</u> <u>LKSLLCPLHLRSLPFP</u> <u>HHLRHHACPHHLRTR</u> <u>LCPHHLKNHLCPPHLR</u> <u>YRAYPPCLWCHACLH</u> <u>RLRNLPCHRLRSLPR</u> <u>PLHLRLHASPHHLRTP</u> <u>PHPHHLRTHLLPHHR</u> <u>TRSCPCRWRSHPCCH</u> <u>YLRSRNSAPGPRGRTC</u> <u>HPGLRSRTCPPGLRSH</u> <u>TYLRRLRSHTCPPSLR</u> <u>SHAYALCLRSHTCPPR</u> <u>LRDHICPLSLRNCTCP</u> <u>PRLRSRTCLLCLRSA</u> <u>CPPNLRNHTCPPSLRS</u> <u>HACPPGLRNRICPLSL</u> <u>RSHPCLGLKSPLRSQ</u> <u>ANALHLRSCPCSLPLG</u> <u>NHPYLPCLESQPCLSL</u> <u>GNHLCPLCPRSCRCPH</u> <u>LGSHPCRLS*</u>	ALHLRSCPC (B08.01) CLHRRHLV (B08.01) CLHRRHLVC (B08.01) CLHRKSHPHL (B08.01) CLRSHACPP (B08.01) CLRSHTCPP (B08.01) CLWCHACLH (A03.01) CPHHLKNHL (B07.02) CPHHLKNLL (B07.02) CPHHLRTRL (B07.02, B08.01) CPLHLRSLPF (B07.02, B08.01) CPLPRHLKHL (B07.02, B08.01) CPLSLRSHPC (B07.02) CPRHLRNCPL (B07.02, B08.01) FPHHLRHHHA (B07.02, B08.01) FPHHLRHHAC (B07.02, B08.01) GLRSRTCPC (B08.01) HACLHRLRNL (B08.01) HLACLHHLR (A03.01) HLCPPHLRY (A03.01) HLCPPHLRYR (A03.01) HLKHLACLH (A03.01) HLKHRPCPH (B08.01) HLKNHLCPP (B08.01) HLKSHPCPLH (A03.01) HLKSLLCPL (A02.01, B08.01) HLLHLRRLY (A03.01) HLRNCPLPR (A03.01) HLRNCPLPRH (A03.01) HLRRLYPHHL (B08.01) HLRSHPCPL (B07.02, B08.01) HLRSHPCPLH (A03.01) HLRSLPFP (A03.01) HLRTRLCPLH (A03.01, B08.01) HLVCSSHLLK (A03.01) HPCLHRRHL (B07.02, B08.01) HPGLRSRTC (B07.02) HPHLLHLRRL (B07.02, B08.01) HRKSHPLL (B08.01) HRRTRSCPC (B08.01) KSHPLLHLR (A03.01) KSLLCPLHLR (A03.01) LLCPLHLRSL (A02.01, B08.01) LLHLRRLYPH (B08.01) LPRHLKHLA (B07.02) LPRHLKHLAC (B07.02, B08.01) LRRLRSHTC (B08.01)	STAD, BLCA, CRC, HNSC, BRCA

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
PTEN	I122fs I135fs A148fs L152fs D162fs I168fs	<u>SWKGTNWCNDMCIFI</u> <u>TSGQIFKGTRGPRFLW</u> <u>GSKDQRQKGSNYSQS</u> <u>EALCVLL*</u>	FITSGQIFK (A03.01) IFITSGQIF (A24.02) SQSEALCVL (A02.01) SQSEALCVLL (A02.01)	UCEC, PRAD, SKCM, STAD, BRCA, LUSC, KIRC, LIHC, KIRP, GBM
PTEN	L265fs K266fs	<u>KRTKCFTFG*</u>		UCEC, PRAD, SKCM, STAD, BRCA, LUSC, KIRC, LIHC, KIRP, GBM
PTEN	A39fs E40fs V45fs R47fs N48fs	<u>PIFIQTLLLWDFLOKD</u> <u>LKAYTGILMM*</u>	AYTGILMM (A24.02) DLKAYTGIL (B08.01)	UCEC, PRAD, SKCM, STAD, BRCA, LUSC, KIRC, LIHC, KIRP, GBM
PTEN	T319fs T321fs K327fs A328fs A333fs	<u>QKMILTKQIKTKPTDT</u> <u>FLQILR*</u>	ILTKQIKTK (A03.01) KMILTKQIK (A03.01) KPTDTFLQI (B07.02) KPTDTFLQIL (B07.02) MILTKQIKTK (A03.01)	UCEC, PRAD, SKCM, STAD, BRCA, LUSC, KIRC, LIHC, KIRP, GBM
PTEN	N63fs E73fs A86fs N94fs	<u>GFWIQSIKTITRYTIFV</u> <u>LKDIMTPPNLIAELHNI</u> <u>LLKTITHHS*</u>	ITRYTIFVLK (A03.01) LIAELHNIL (A02.01) LIAELHNILL (A02.01) MTPPNLIAEL (A02.01) NLIAELHNI (A02.01) NLIAELHNIL (A02.01) RYTIFVLKDI (A24.02) TITRYTIFVL (A02.01) TPPNLIAEL (B07.02)	UCEC, PRAD, SKCM, STAD, BRCA, LUSC, KIRC, LIHC, KIRP, GBM
PTEN	T202fs G209fs C211fs I224fs G230fs P231fs R233fs D236fs	<u>NYSNVQWRNLQSSVC</u> <u>GLPAKGEDIFLOFRTH</u> <u>ITGRQVHVL*</u>	FLQFRTHTT (A02.01, B08.01) LPAKGEDIFL (B07.02) LQFRTHTTGR (A03.01) NLQSSVCGL (A02.01) SSVCGLPAK (A03.01) VQWRNLQSSV (A02.01)	UCEC, PRAD, SKCM, STAD, BRCA, LUSC, KIRC, LIHC, KIRP, GBM
PTEN	G251fs E256fs K260fs Q261fs L265fs M270fs H272fs T286fs E288fs	<u>YQSRVLPQTEQDAKK</u> <u>GQNVSLGKYILHTRT</u> <u>RGNLRKSRKWKSM*</u>	GQNVSLGK (A03.01) HTRTRGNLRK (A03.01) ILHTRTRGNL (B08.01) KGQNVSLGK (A03.01) LLGKYILHT (A02.01) LRKSRKWKSM (B08.01) SLLGKYILH (A03.01) SLLGKYILHT (A02.01)	UCEC, PRAD, SKCM, STAD, BRCA, LUSC, KIRC, LIHC, KIRP, GBM

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
TP53	A70fs P72fs A76fs A79fs P89fs W91fs S96fs V97fs V97fs G108fs G117fs S121fs V122fs C124fs K139fs V143fs	<u>SSQNARGCSPRGPCTS</u> <u>SSYTGGPCTSPLLAPVI</u> <u>FCFPENLPGQLRFP</u> <u>GLLAFWDSQVCDLHV</u> <u>LPCPQQDVLPTGQDLP</u> <u>CAAVG*</u>	CTSPLLAPV (A02.01) FPENLPGQL (B07.02) GLLAFWDSQV (A02.01) IFCPFPENL (A24.02) LLAFWDSQV (A02.01) LLAPVIFCP (A02.01) LLAPVIFCPF (A02.01, A24.02) LPCPQQDVL (B07.02) RFPSGLLAF (A24.02) RFPSGLLAFW (A24.02) SPLLAPVIF (B07.02) SPRGPCTSS (B07.02) SPRGPCTSSS (B07.02) SQVCDLHV (A02.01) VIFCPFPENL (A02.01)	BRCA, CRC, LUAD, PRAD, HNSC, LUSC, PAAD, STAD, BLCA, OV, LIHC, SKCM, UCEC, LAML, UCS, KICH, GBM, ACC
TP53	V173fs H178fs D186fs H193fs L194fs E198fs V203fs E204fs L206fs D207fs N210fs T211fs F212fs V225fs S241fs	<u>GAAPTMSAAQIAMV</u> <u>WPLLSILSEWKEICVW</u> <u>SIWMTETLFDIVWWC</u> <u>PMSRLRLALTVPSTT</u> <u>TTCVTVPAWAA*</u>	AMVWPLLSI (A02.01) AMVWPLLSIL (A02.01) AQIAMVWPL (A02.01, A24.02) AQIAMVWPLL (A02.01) CPMSRLRLA (B07.02, B08.01) CPMSRLRLAL (B07.02, B08.01) IAMVWPLLSI (A02.01, A24.02, B08.01) ILSEWKEICV (A02.01) IVWWCPMSR (A03.01) IVWWCPMSRL (A02.01) IWMTETLFDI (A24.02) LLSILSEWK (A03.01) MSAAQIAMV (A02.01) MSRLRLALT (B08.01) MSRLRLALTV (B08.01) MVWPLLSIL (A02.01) RLALTVPST (A02.01) TLFDIVWWC (A02.01) TLFDIVWWCP (A02.01) TMSAAQIAMV (A02.01) VWSIWMTETL (A24.02) WMTETLFDI (A02.01, A24.02) WMTETLFDIV (A01.01, A02.01)	BRCA, CRC, LUAD, PRAD, HNSC, LUSC, PAAD, STAD, BLCA, OV, LIHC, SKCM, UCEC, LAML, UCS, KICH, GBM, ACC

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
TP53	R248fs P250fs S260fs N263fs G266fs N268fs V272fs V274fs P278fs D281fs R282fs T284fs E285fs L289fs K292fs P301fs S303fs T312fs S314fs K319fs K320fs P322fs Y327fs F328fs L330fs R333fs R335fs R337fs E339fs	<u>TGGPSSPSSHWKTPVV</u> <u>IYWDGTALRCVFVPV</u> <u>LGETGAQRKRISARK</u> <u>GSLTTSCPQGALSEHC</u> <u>PTTPAPLPSQRRNH</u> <u>MENISPFERSVGVASR</u> <u>CSES*</u>	ALRCVFVPV (A02.01, B08.01) ALRCVFVPVL (A02.01, B08.01) ALSEHCPTT (A02.01) AQRKRISARK (A03.01) GAQRKRISA (B08.01) HWMENISPF (A24.02) LPSQRRNH (B07.02) LPSQRRNHWM (B07.02, B08.01) NISPFERSVGV (A02.01) RISARKGSL (B07.02, B08.01) SPFRSVGVSA (B07.02) SPSSHWKTPV (B07.02, B08.01) TALRCVFVPV (A02.01) VIYWDGTAL (A02.01) VIYWDGTALR (A03.01) VLGETGAQRK (A03.01)	BRCA, CRC, LUAD, PRAD, HNSC, LUSC, PAAD, STAD, BLCA, OV, LIHC, SKCM, UCEC, LAML, UCS, KICH, GBM, ACC
TP53	S149fs P151fs P152fs V157fs Q165fs S166fs H168fs V173fs	<u>FHTPARHPRRHGHL</u> <u>QAVTAHDGGCEALPP</u> <u>p*</u>	HPRPRHGHL (B07.02, B08.01) HPRPRHGHLQ (B07.02) RPRHGHLQA (B07.02) RPRHGHLQAV (B07.02, B08.01)	BRCA, CRC, LUAD, PRAD, HNSC, LUSC, PAAD, STAD, BLCA, OV, LIHC, SKCM, UCEC, LAML, UCS, KICH, GBM, ACC

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
TP53	P47fs D48fs D49fs Q52fs F54fs E56fs P58fs P60fs E62fs M66fs P72fs V73fs P75fs A78fs P82fs P85fs S96fs P98fs T102fs Y103fs G108fs F109fs R110fs G117fs	<u>CCPRTILNNGSLKTQV</u> <u>QMKLPECQRLPPWP</u> <u>LHQQLHRRPLHOPPP</u> <u>GPCHELLSLPRKPTRAA</u> <u>TVSVWASCILGQPSL*</u>	GSLKTQVQMK (A03.01) PPGPCHLLSL (B07.02) RTILNNGSLK (A03.01) SLKTQVQMK (A03.01) SLKTQVQMKL (B08.01) TILNNGSLK (A03.01)	BRCA, CRC, LUAD, PRAD, HNSC, LUSC, PAAD, STAD, BLCA, OV, LIHC, SKCM, UCEC, LAML, UCS, KICH, GBM, ACC
TP53	L26fs P27fs P34fs P36fs A39fs Q38fs	<u>VRKHFQTYGNYFLKT</u> <u>TFCPPCRPKQWMI*</u>	CPPCRPKQWM (B07.02) TTFCPPCRPK (A03.01)	BRCA, CRC, LUAD, PRAD, HNSC, LUSC, PAAD, STAD, BLCA, OV, LIHC, SKCM, UCEC, LAML, UCS, KICH, GBM, ACC
TP53	C124fs L130fs N131fs C135fs K139fs A138fs T140fs V143fs Q144fs V147fs T150fs P151fs P152fs G154fs R156fs R158fs A161fs	<u>LARTPLPSTRCFANWP</u> <u>RPALCSCGLIPHRPAP</u> <u>ASAPWPSTSSHST*</u>	CFANWWRPAL (A24.02) FANWWRPAL (B07.02, B08.01) GLIPHRPA (A02.01) HRPAPASA (B07.02, B08.01) HRPAPASAP (B07.02) IPHRPAPA (B07.02, B08.01) IPHRPAPAS (B07.02) RPALCSCGL (B07.02) RPALCSCGLI (B07.02) TPLPSTRCF (B07.02) WWRPALCSC (B07.02) WWRPALCSCG (B07.02)	BRCA, CRC, LUAD, PRAD, HNSC, LUSC, PAAD, STAD, BLCA, OV, LIHC, SKCM, UCEC, LAML, UCS, KICH, GBM, ACC

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
VHL	L178fs D179fs L184fs T202fs R205fs D213fs G212fs	<u>ELQETGHRQVALRRS</u> <u>GRPPKCAERPGAADT</u> <u>GAHCTSTDGRLKISVE</u> <u>TYTVSSQLLMVLSL</u> <u>DLDTGLVPSLVSKCLI</u> <u>LRVK*</u>	ALRRSGRPPK (A03.01) GLVPSLVSK (A03.01) KISVETYTV (A02.01) LLMVLSLDL (A02.01, B08.01) LMSLDLDTGL (A02.01) LMVLSLDL (A02.01) LVSKCLILRV (A02.01) QLLMVLSL (A02.01, B08.01) RPGAADTGA (B07.02) RPGAADTGAH (B07.02) SLDLDTGLV (A02.01) SLVSKCLIL (A02.01, B08.01) SQLLMVLSL (A02.01) TVSSQLLMV (A02.01) TYTVSSQLL (A24.02) TYTVSSQLLM (A24.02) VLMSLDLDT (A02.01) VPSLVSKCL (B07.02) VSKCLILRVK (A03.01) YTVSSQLLM (A01.01) YTVSSQLLMV (A02.01)	KIRC, KIRP
VHL	L158fs K159fs R161fs Q164fs	<u>KSDASRLSGA*</u>		KIRC, KIRP
VHL	P146fs I147fs F148fs L158fs	<u>RTAYFCQYHTASVYS</u> <u>ERAMPPGCPEPSQA*</u>	FCQYHTASV (B08.01)	KIRC, KIRP
VHL	S68fs S72fs I75fs S80fs P86fs P97fs I109fs H115fs L116fs G123fs T124fs N131fs L135fs V137fs G144fs D143fs I147fs	<u>TRASPPRSSSAIAVRAS</u> <u>CCPYGSTSTASRSPTQ</u> <u>RCRLARAAASTATEV</u> <u>TFGSSEMQGHTMGFW</u> <u>LTKLNYLCHLSMLTD</u> <u>SLFLPISHCQCIL*</u>	CPYGSTSTA (B07.02) CPYGSTSTAS (B07.02) LARAAASTAT (B07.02) MLTDSLFLP (A02.01) PPRSSSAIAV (B07.02) RAAASTATEV (B07.02) SPPRSSSAI (B07.02) SPPRSSSAIA (B07.02) SPTQRCRLA (B07.02) TQRCRLARA (B08.01) TQRCRLARAA (B08.01)	KIRC, KIRP

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
VHL	K171fs P172fs N174fs L178fs D179fs L188fs	<u>SSLRITGDWTSSGRST</u> <u>KIWKTTQMCRKTWSG</u> * -	KIWKTTQMCR (A03.01) WTSSGRSTK (A03.01)	KIRC, KIRP
VHL	V62fs V66fs Q73fs V84fs F91fs T100fs P103fs S111fs L116fs H115fs D126fs	<u>RRRRGGVRRGVRRPG</u> <u>RVRPGGTGRRGGDGG</u> <u>RAAAARAALGELARA</u> <u>LPGHLLQSOSARRAA</u> <u>RMAQLRRRAAALPNA</u> <u>AAWHGPPHPQLPRSP</u> <u>LALQRCRDTRWASG*</u>	ALGELARAL (A02.01) AQLRRRAAA (B08.01) AQLRRRAAAL (B08.01) ARRAARMAQL (B08.01) HPQLPRSPL (B07.02, B08.01) HPQLPRSPLA (B07.02) LARALPGHL (B07.02) LARALPGHLL (B07.02) MAQLRRRAA (B07.02, B08.01) MAQLRRRAAA (B07.02, B08.01) QLRRRAAAL (B07.02, B08.01) RAAALPNAAA (B07.02) RMAQLRRRAA (B07.02, B08.01) SQSARRAARM (B08.01)	KIRC, KIRP
TABLE 1D CRYPTIC EXON¹				
AR-v7	cryptic final exon	<u>SCKVFFKRAAEGKQK</u> <u>YLCASRNDCTIDKFRR</u> <u>KNCPSCLRLKCYEAG</u> <u>MTLGEKFRVGNCKHL</u> <u>KMTRP*</u>	GMTLGEKFRV (A02:01) RVGNCKHLK (A03.01)	Prostate Cancer, Castration-resistant Prostate Cancer
TABLE 1E OUT OF FRAME FUSIONS^{1,3}				
AC0119 97.1:LR RC69	AC011997.1:L RRC69 *out-of-frame	<u>MAGAPPPASLPPCSLIS</u> <u>DCCASNQRDSVGVGP</u> <u>SEP:G:NNIKICNESAS</u> <u>RK*</u>	GPSEPGNNI (B07.02) KICNESASRK (A03.01)	LUSC, Breast Cancer, Head and Neck Cancer, LUAD
EEF1DP 3	EEF1DP3:FR Y *out-of-frame	<u>HGWRPFLPVRARSRW</u> <u>NRRLDVTVANGR:S:W</u> <u>KYGWSLLRVQVNG</u> <u>IQVLNVSLKSSSNVIS</u> <u>YE*</u>	GIQVLNVSLK (A03.01) IQVLNVSLK (A03.01) KSSSNVISY (A01.01, A03.01) KYGWSLLRV (A24.02) RSWKYGWSL (A02.01) SLKSSSNVI (B08.01) SWKYGWSLL (A24.02) TVANGRSWK (A03.01) VPQVNGIQV (B07.02) VPQVNGIQVL (B07.02) VTVANGRSWK (A03.01) WSLLRVPQV (B08.01)	Breast Cancer

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
MAD1L1:MAFK	MAD1L1:MAFK	RLKEVFQTKIQEFRKACYTLTGYQIDITTENQYRLTSLYAEHPGDCLIFK:: <u>LRVPGSSVLVTV PGL*</u>	HPGDCLIFKL (B07.02) KLRVPGSSV (B07.02) KLRVPGSSVL (B07.02) RVPGSSVLV (A02.01) SVLVTVPGL (A02.01) VPGSSVLVTV (B07.02)	CLL
PPP1R1B:STAR D3	PPP1R1B:STAR D3	AEVLKVIHQASAGQKTTCGQGLEGPWERPPPLDESERDGGSEDQVEDPALS:A: <u>LLLRPRPPREVG AHODEOAAOGA DPRLGAQPACRGLP GLLTVPOPEPLLAPP SAA*</u>	ALLLRPRPPR (A03.01) ALSALLRPR (A03.01)	Breast Cancer
Table 1F		IN FRAME DELETIONS and FUSIONS^{1,2}		
BCR:ABL	BCR:ABL	ERAEWRENIREQQKCFRSLTSVELQMLTNSCVKLQTVHSIPLTINKE:: <u>EALQRPVASF EPQGLSEARWNSKENLLAGPSENDPNLF VALYDFVASG</u>	LTINKEEAL (A02.01, B08.01)	CML, AML
BCR:ABL	BCR:ABL	ELQMLTNSCVKLQTVHSIPLTINKEDDESPGLYGFLNVIVHSATGFKQSS: <u>K:ALQRPVASF EPQGLSEARWNSKENLLAGPSENDPNLFV ALYDFVASGD</u>	IVHSATGFK (A03.01) ATGFKQSSK (A03.01)	CML, AML
C11orf95:RELA	C11orf95:RELA	ISNSWDAHLGLGACGEAEGLVQGAEEEEEEEEEGAGVPACPPKGP:E: <u>LFPLIFPAEP AQASGPYVEIIEQPK QRGMRFRYKCEGRS AGSIPGERSTD</u>	ELFPLIFPA (A02.01, B08.01) KGPELFPLI (A02.01, A24.02) KGPELFPLIF (A24.02)	Supratentorial ependyomas
CBFB:MYH11	(variant "type a")	LQRDGMGCLFDEERAQQEDALAQAFEEARRRTREFEDRDRSHREEME:: <u>VHELEKSKRALETQMEEMKTQLE ELEDLQATEDAKL RLEVNMQALKGQF</u>		AML
CD74:ROS1	(exon6:exon32)	KGSFPENLRHLKNTMETIDWKFVSWMHHWLLFEMSRHSLEQKPTDAPPK:: <u>AGVPNKPG IPKLLEGSKNSIQWE KAEDNGCRITYYILEI RKSTSNLQNG</u>	KPTDAPPKAGV (B07.02)	NSCLC, Crizotinib resistance

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
EGFR	EGFRvIII (internal deletion)	MRPSGTAGAALLALL AALCPASRALEEKK:G :NYVVTDHGCVRAC GADSYEMEEDGVRKC KKCEGPCRKVCNGIGI GEFKD	ALEEKKGNYV (A02.01)	GBM
EGFR:SEPT14	EGFR:SEPT14	LPQPPICTIDVYMIMV KCWMIDADSRPKFRE LIEFSKMARDPQRYL VIQ::LQDKFEHLKMI QQEEIRKLEEEKKQL EGEIIDFYKMKAAASE ALQTQLSTD	IQLQDKFEHL (A02.01, B08.01) QLQDKFEHL (A02.01, B08.01) QLQDKFEHLK (A03.01) YLVIQLQDKF (A02.01, A24.02)	GBM, Glioma, Head and Neck Cancer
EML4:ALK	EML4:ALK	SWENSDDSRNKLSKIP STPKLIPKVTKTADKH KDVIINQAKMSTREK NSQ:V:YRRKHQELQ AMQMELQSPEYKLS KLRTSTIMTDYNPNY CFAGKTSSISDL	QVYRRKHQEL (B08.01) STREKNSQV (B08.01) VYRRKHQEL (A24.02, B08.01)	NSCLC
FGFR3:TACC3	FGFR3:TACC3	EGHRMDKPANCTHDL YMIMRECWHAAPSQR PTFKQLVEDLDRVLT VTSTD::VKATQEENR ELRSRCEELHGKNLE LGKIMDRFEEVVYQ AMEEVQKQKELS	VLTVTSTDV (A02.01) VLTVTSTDVK (A03.01)	Bladder Cancer, LUSC
NAB:STAT6	NAB:STAT6	RDNTLLRRVELFSL RQVARESTYLSSLKGS RLHPEELGGPPLKLLK QE::ATSKSQIMSLWG LVSKMPPEKVQRLY VDFPQHLRHLLGDW LESQPWEFLVGSDAF CC	IMSLWGLVS (A02.01) IMSLWGLVSK (A03.01) KLKQEATSK (A03.01) QIMSLWGLV (A02.01) SQIMSLWGL (A02.01, A24.02, B08.01) SQIMSLWGLV (A02.01) TSKSQIMSL (B08.01)	Solitary fibrous tumors
NDRG1:ERG	NDRG1:ERG	MSREMQDVDLAEVKP LVEKGETITGLLQEFD VQ::EALSVSEEDQSL FECAYGTPHLAKTE MTASSSSDYGQTSK MSPRVPQQDW	LLQEFDVQEA (A02.01) LQEFDVQEAL (A02.01)	Prostate Cancer
PML:RARARA	PML:RARA (exon3:exon3)	VLDMHGFLRQALCRL RQEEPQSLQAAVRTD GFDEFKVRLLQDLSSCI TQGK:A:IETQSSSSEE IVSPSPSPPLPRIYKP CFVCQDKSSGYHYG VSACEGCKG		Acute promyelocytic leukemia

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
PML:RA RA	PML:RARA (exon6:exon3)	RSSPEQPRPSTSKAVSP PHLDGPPSPRSPVIGSE VFLPNSNHVASGAGE A:A: <u>I</u> ETQSSS <u>S</u> EEIVPS PPSPPLPRIYKPCFV CQDKSSGYHYGVSA CEGCKG		Acute promyelocytic leukemia
RUNX1	RUNX1(ex5)- RUNX1T1(ex 2)	VARFNDLRFVGRSGR GKSFTLTITVFTNPPQ VATYHRAIKITVDGPR EPR: <u>N</u> : RTEKHSTMPD SPVDVKTQSRLTPPT MPPPPTTQGAPRTSS FTPTTLTNGT	GPREPRNRT (B07.02) RNRTEKHSTM (B08.01)	AML
TMPRS S2:ERG	TMPRSS2:ER G	MALNS::EALSVVSED QSLFECAYGTPHLAKT EMTASSSSDYGQTSK MSPRVPQQDW	ALNSEALSV (A02.01) ALNSEALSVV (A02.01) MALNSEALSV (A02.01, B08.01)	Prostate Cancer

¹Underlined AAs represent non-native AAs

²Bolded AAs represent native AAs of the amino acid sequence encoded by the second of the two fused genes

³Bolded and underlined AAs represent non-native AAs of the amino acid sequence encoded by the second of the two fused genes due to a frameshift.

Table 2

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
Table 2A POINT MUTATIONS¹				
AKT1	E17K	MSDVAIVKEGWLHKR G <u>K</u> YIKTWRPRYFLLK NDGTFIGYKERPDV DQREAPLNNFSVAQC QLMKTER	KYIKTWRPRY (A24.02) WLHKRGKYI (A02.01, B07.02, B08.01) WLHKRGKYIK (A03.01)	BRCA, CESC, HNSC, LUSC, PRAD, SKCM, THCA
ANAPC1	T537A	TMLVLEGSGLVLYT GVVVRVGKVFIPGLPAP SLTMSNTMPRPSTPLD GVSAPKPLSKLLGSLD EVVLLSPVPELDRSSK LHDSLYNEDCTFQQL GTYIHSI	APKPLSKLL (B07.02) GVSAPKPLSK (A03.01) VSAPKPLSK (A03.01)	GBM, LUSC, PAAD, PRAD, SKCM
FGFR3	S249C	HRIGGIKLRHQQWSL VMESVVPDRGNITC VVENKFGSIRQTYTLD VLERCPHRPILQAGLP ANQTAVLGSDVEFHC KVYSDAQPHIQWLKH VEVNGSKVG	CPHRPILQA (B07.02)	BLCA, HNSC, KIRP, LUSC

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
FRG1B	I10T	MREPIYMHSTMVFLP WELHTKKGPSPPEQF MAVKLSDSRTALKSG YGKYLGINSD EL VGH SDAIGPREQWEPVFQ NGKMALLASNSCFIR	KLSDSRTAL (A02.01, B07.02, B08.01) KLSDSRTALK (A03.01) LSDSRTALK (A01.01, A03.01) RTALKSGYGK (A03.01) TALKSGYGK (A03.01)	KIRP, PRAD, SKCM
FRG1B	L52S	AVKLSDSRIALKSGYG KYLGINSD EL VGHSD AIGPREQWEPVFQNG KMAL S ASNSCFIRCNE AGDIEAKSKTAGEEE MIKIRSCAEKETKKKD DIPEEDKG	ALSASNSCF (A02.01, A24.02, B07.02) ALSASNSCFI (A02.01) FQNGKMALSA (A02.01, B08.01)	GBM, KIRP, PRAD, SKCM
HER2	L755S (Resistance)	AMPNQAQMRILKETE LRKVKVLGSGAFGTV YKGIWIPDGENVKIPV AIKVSRENTSPKANKE ILDEAYVMAGVGS PYVSRLLGICLTSTVQLV TQLMPYGC	KVSRENTSPK (A03.01)	BRCA
IDH1	R132G	RVEEFK L KQMWKSPN GTIRN L GGTVFREAII CKNIPRLVSGWVKPIII GGHAYGDQYRATDF VVPGPGKVEITYTPSD GTQKVTYLVHNFEEG GGVAMGM	KPIIIGGHAY (B07.02)	BLCA, BRCA, CRC, GBM, HNSC, LUAD, PAAD, PRAD, UCEC
KRAS	G12C	MTEYKLVVVGAC G V GKSALTIQLIQNH F V EYDPTIEDSYRKQVVI DGETCLLDILD T AGQE	KLVVVGACGV (A02.01) LVVVGACGV (A02.01) VVGACGVGK (A03.01, A11.01) VVVGACGVGK (A03.01)	BRCA, CESC, CRC, HNSC, LUAD, PAAD, UCEC
KRAS	G12D	MTEYKLVVVGAD G V GKSALTIQLIQNH F V EYDPTIEDSYRKQVVI DGETCLLDILD T AGQE	VVGADGVGK (A11.01) VVVGADGVGK (A11.01) KLVVVGADGV (A02.01) LVVVGADGV (A02.01)	BLCA, BRCA, CESC, CRC, GBM, HNSC, KIRP, LIHC, LUAD, PAAD, SKCM, UCEC
KRAS	G12V	MTEYKLVVVGA V GV GKSALTIQLIQNH F V EYDPTIEDSYRKQVVI DGETCLLDILD T AGQE	KLVVVGAVGV (A02.01) LVVVGAVGV (A02.01) VVGAVGVGK (A03.01, A11.01) VVVGAVGVGK (A03.01, A11.01)	BRCA, CESC, CRC, LUAD, PAAD, THCA, UCEC
KRAS	Q61H	AGGVGKSALTIQLIQN HFVDEYDPTIEDSYRK QVVIDGETCLLDILD T AGHEEYSAMRDQYM RTGEGFLCVFAINNTK SFEDIH H YREQIKRVK DSEDVPM	ILD T AGHEEY (A01.01)	CRC, LUSC, PAAD, SKCM, UCEC

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
KRAS	Q61L	AGGVGKSALTIQLIQN HFVDEYDPTIEDSYRK QVVIDGETCLLDILDT AGLEEYSAMRDQYM RTGEGFLCVFAINNTK SFEDIHHYREQIKRVK DSEDVPM	ILDTAGLEEY (A01.01) LLDILDTAGL (A02.01)	CRC, GBM, HNSC, LUAD, SKCM, UCEC
NRAS	Q61K	AGGVGKSALTIQLIQN HFVDEYDPTIEDSYRK QVVIDGETCLLDILDT AGKEEYSAMRDQYM RTGEGFLCVFAINNSK SFADINLYREQIKRVK DSDDVPM	ILDTAGKEEY (A01.01)	BLCA, CRC, LIHC, LUAD, LUSC, SKCM, THCA, UCEC
NRAS	Q61R	AGGVGKSALTIQLIQN HFVDEYDPTIEDSYRK QVVIDGETCLLDILDT AGREEYSAMRDQYM RTGEGFLCVFAINNSK SFADINLYREQIKRVK DSDDVPM	ILDTAGREEY (A01.01)	BLCA, CRC, LUSC, PAAD, PRAD, SKCM, THCA, UCEC
PIK3CA	E542K	IEEHANWSVSREAGFS YSHAGLSNRLARDNE LRENDKEQLKAISTRD PLSKITEQEKDFLWSH RHYCVTIPEILPKLLS VKWNSRDEVAQMYC LVKDWPP	AISTRDPLSK (A03.01)	BLCA, BRCA, CESC, CRC, GBM, HNSC, KIRC, KIRP, LIHC, LUAD, LUSC, PRAD, UCEC
PTEN	R130Q	KFNCRVAQYPFEDHN PPQLELIKPFCELDQ WLSEDDNHVAAIHCK AGKGQTGVMICAYLL HRGKFLKAQEALDFY GEVRTRDKKGV TIPSQ RRYVYYYSY	QTGVMICAY (A01.01)	BRCA, CESC, CRC, GBM, KIRC, LUSC, UCEC
RAC1	P29S	MQAICVVVGDGAV GKTCLLISYTTNAFSG EYIPTVFDNYSANVM VDGKPVNLGLWDTA GQEDYDRLRPLSYPQ TVGET	FSGEYIPTV (A02.01) TTNAFSGEY (A01.01) YTTNAFSGEY (A01.01)	Melanoma

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
SF3B1	K700E	AVCKSKKSWQARHT GIKIVQQAIALMGCAIL PHLRSLVEIIEHGLVD EQQEVRTISALAI AAL AEAATPYGIESFDSVL KPLWKGIRQHRGKGL AAFLKAI	GLVDEQQEV (A02.01)	AML associated with MDS; Chronic lymphocytic leukemia-small lymphocytic lymphoma; Myelodysplastic syndrome; AML; Luminal NS carcinoma of breast; Chronic myeloid leukemia; Ductal carcinoma of pancreas; Chronic myelomonocytic leukemia; Chronic lymphocytic leukemia-small lymphocytic lymphoma; Myelofibrosis; Myelodysplastic syndrome; PRAD; Essential thrombocythaemia; Medullomyoblastoma
SPOP	F133L	YLSLYLLL VSCP KSEV RAKFKFSILNAKGEET KAMESQRAYRFVQG KDWGLKKFIRRD FLL DEANGLLPDDKLT L F CEVSVVQDSVNISGQ NTMNMVKVPE	FVQ GKDWGL (A02.01, B08.01)	PRAD
SPOP	F133V	YLSLYLLL VSCP KSEV RAKFKFSILNAKGEET KAMESQRAYRFVQG KDWGVKKFIRRD FLL DEANGLLPDDKLT L F CEVSVVQDSVNISGQ NTMNMVKVPE	FVQ GKDWGV (A02.01)	PRAD
TP53	G245S	IRVEGNLRVEYLDDR NTRHSVVVPYEPPEV GSDCTTIHYNM CN S SCMGSMNRRPILTIITL EDSSGNLLGRNSFEVR VCACPGRDRRTEEN LRKKGEP	CMGSMNRRPI (A02.01, B08.01) GSMNRRPIL (B08.01) MGSMNRRPI (B08.01) MGSMNRRPIL (B08.01) SMNRRPILTI (A02.01, A24.02, B08.01)	BLCA, BRCA, CRC, GBM, HNSC, LUSC, PAAD, PRAD
TP53	R248Q	EGNLRVEYLDDRNTF RHSVVVPYEPPEVGS DCTTIHYNM CN SSC MGGMNQRPIITITL DSSGNLLGRNSFEVR VCACPGRDRRTEEN LRKKGEPHHE	CMGGMNQRPI (A02.01, B08.01) GMNQRPIITLTI (A02.01, B08.01) NQRPIITLTI (A02.01, B08.01)	BLCA, BRCA, CRC, GBM, HNSC, KIRC, LIHC, LUSC, PAAD, PRAD, UCEC

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
TP53	R248W	EGNLRVEYLDDRNTF RHSVVVPYEPPEVGS DCTTIHYNMCMSSC MGGMNWRPILTIITLE DSSGNLLGRNSFEVR VCACPGRDRRTEEN LRKKGEPHHE	CMGGMNWRPI (A02.01, A24.02, B08.01) GMNWRPILTI (A02.01, B08.01) MNWRPILTI (A02.01, A24.02, B08.01) MNWRPILTI (A02.01, A24.02)	BLCA, BRCA, CRC, GBM, HNSC, LIHC, LUSC, PAAD, SKCM, UCEC
TP53	R273C	PEVGSDCTTIHYNM CNSSCMGGMNRRLPIL TIITLEDSSGNLLGRNS FEVCVCACPGRDRRT EENLRKKGEPHHELP PGSTKRALPNNTSSSP QPKKKPL	NSFEVCVCA (A02.01)	BLCA, BRCA, CRC, GBM, HNSC, LUSC, PAAD, UCEC
TP53	R273H	PEVGSDCTTIHYNM CNSSCMGGMNRRLPIL TIITLEDSSGNLLGRNS FEVHVCACPGRDRRT EENLRKKGEPHHELP PGSTKRALPNNTSSSP QPKKKPL	NSFEVHVCA (A02.01)	BRCA, CRC, GBM, HNSC, LIHC, LUSC, PAAD, UCEC
TP53	Y220C	TEVVRRCPHHERCSD SDGLAPPQHLIRVEGN LRVEYLDDRNTFRHS VVVPCEPPEVGS DCTTIHYNMCMSSCMGG MNRRLPILTIITLEDSSG NLLGRNSF	VVPCEPPEV (A02.01) VVVPCEPPEV (A02.01)	BLCA, BRCA, GBM, HNSC, LIHC, LUAD, LUSC, PAAD, SKCM, UCEC
Table 2B MSI-ASSOCIATED FRAMESHIFTS¹				
MSH6	F1088fs; +1	YNFDKNYKDWQSAV ECIAVLDVLLCLANYS RGGDGPMCRPVILLPE DTPPLLRA	ILLPEDTPPL (A02.01) LLPEDTPPL (A02.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer, Lynch syndrome
Table 2C FRAMESHIFT¹				

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
APC	F1354fs	<u>AKFQOCHSTLEPNPA</u> <u>DCRVLVYLQNPQGTK</u> <u>LLNFLQERNLPPKVVL</u> <u>RHPKVHLNTMFRRPH</u> <u>SCLADVLLSVHLIVLR</u> <u>VVRLPAPFRVNHAVE</u> <u>W*</u>	APFRVNHAV (B07.02) CLADVLLSV (A02.01) FLQERNLPPK (A03.01) HLIVLRVVRL (A02.01, B08.01) HPKVHLNTM (B07.02, B08.01) HPKVHLNTMF (B07.02, B08.01) KVHLNTMFR (A03.01) KVHLNTMFRR (A03.01) LPAPFRVNHA (B07.02) MFRRPHSCL (B07.02, B08.01) MFRRPHSCLA (B08.01) NTMFRRPHSC (B08.01) RPHSCLADV (B07.02) RPHSCLADV (B07.02) RVVRLPAPFR (A03.01) SVHLIVLRV (A02.01) TMFRRPHSC (B08.01) TMFRRPHSCL (A02.01, B08.01) VLLSVHLIV (A02.01) VLLSVHLIVL (A02.01) VLRVVRLPA (B08.01) VVRLPAPFR (A03.01)	CRC, LUAD, UCEC, STAD

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
ARID1A	Y1324fs	<u>ALGPHSRISCLPTQTR</u> <u>GCILLAATPRSSSSSSS</u> <u>NDMIPMAISSPPKAPL</u> <u>LAAPSPASRLQCINSN</u> <u>SRITSGQWMAHMALL</u> <u>PSGTKGRCTACHTAL</u> <u>GRGSLSSSSCPQPSPSL</u> <u>PASNKLPSLPLSKMYT</u> <u>TSMAMPILPLPQLLS</u> <u>ADQQAAPRTNFHSSL</u> <u>AETVSLHPLAPMPSKT</u> <u>CHHK*</u>	AMPILPLPQL (A02.01) APLLAAPSPA (B07.02) APRTNFHSS (B07.02) APRTNFHSSL (B07.02, B08.01) CPQPSPSLPA (B07.02) GQWMAHMAL (A02.01) GQWMAHMALL (A02.01) HMALLPSGTK (A03.01) HTALGRGSL (B07.02) IPMAISSPP (B07.02) IPMAISSPPK (B07.02) KLPSLPLSK (A03.01) KLPSLPLSKM (A02.01) KMYTTSMAM (A02.01, A03.01) LLAAPSPASR (A03.01) LLSADQQAA (A02.01) LLSADQQAA (A02.01) LPASNKLPS (B07.02) LPASNKLPSL (B07.02, B08.01) LPLPQLLSA (B07.02) LPSLPLSKM (B07.02) LSKMYTTSM (B08.01) MALLPSGTK (A03.01) MPILPLPQL (B07.02) MPILPLPQLL (B07.02) MYTTSMAMPI (A24.02) PMAISSPPK (A03.01) QWMAHMALL (A24.02) SKMYTTSMAM (B07.02) SMAMPILPL (A02.01, B07.02, B08.01) SNKLPSLPL (B08.01) SPASRLQCI (B07.02, B08.01) SPPKAPLLAA (B07.02) SPSLPASNKL (B07.02) YTSMAMPI (A02.01) YTSMAMPIL (A02.01)	STAD, UCEC, BLCA, BRCA, LUSC, CESC, KIRC, UCS
ARID1A	G1848fs	<u>RSYRRMIHLWWTAQI</u> <u>SLGVCRSLTVACCTG</u> <u>GLVGGTPLSISRPTSR</u> <u>ARQSCCLPGLTHPAH</u> <u>QPLGSM*</u>	CLPGLTHPA (A02.01) GLTHPAHQPL (A02.01) HPAHQPLGSM (B07.02) LTHPAHQPL (B07.02) RPTSRARQSC (B07.02) RQSCCLPGL (A02.01) TSRARQSCCL (B08.01)	STAD, UCEC, BLCA, BRCA, LUSC, CESC, KIRC, UCS

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
β2M	L13fs	<u>QHSGRDVSLRGLSCA</u> <u>RATLSFWPGGYPAYS</u> <u>KDSGLLTSSSREWKV</u> <u>KFPELLCVWVSSIRH*</u>	ELLCVWVSSI (A02.01) EWKVKFPEL (B08.01) KFPELLCVW (A24.02) LLCVWVSSI (A02.01) LLTSSSREWK (A03.01) LTSSSREWK (A03.01) YPAYSKDSSL (B07.02)	CRC, STAD, SKCM, HNSC
GATA3	L328fs N334fs	<u>AQAKAVCSQESRDVL</u> <u>CELSDHHNHTLEEEC</u> <u>QWGPCLQCLWALLO</u> <u>ASQY*</u>	CLQCLWALL (A02.01) CQWGPCLQCL (A02.01) QWGPCLQCL (A24.02) QWGPCLQCLW (A24.02)	Breast Cancer
GATA3	H400fs S408fs S408fs S430fs H434fs H435fs	<u>PGRPLQTHVLPEPHLA</u> <u>LQPLOPHADHAHADA</u> <u>PAIQPVLWTTTPLOHG</u> <u>HRHGLEPCSMLTGPP</u> <u>ARVPAVPFDLHFCRSS</u> <u>IMKPKRDGYMFLKAE</u> <u>SKIMFATLQRSSLWCL</u> <u>CSNH*</u>	AIQPVLWTT (A02.01) ALQPLQPHA (A02.01) DLHFCRSSIM (B08.01) EPHLALQPL (B07.02, B08.01) ESKIMFATL (B08.01) FATLQRSSL (B07.02, B08.01) FLKAESKIM (B08.01) FLKAESKIMF (B08.01) GPPARVPAV (B07.02) IMKPKRDGYM (B08.01) KIMFATLQR (A03.01) KPKRDGYMF (B07.02) KPKRDGYMFL (B07.02) LHFCRSSIM (B08.01) LQHGHRHGL (B08.01) MFATLQRSSL (B07.02, B08.01) MFLKAESKI (A24.02) MLTGPPARV (A02.01) QPVLWTTPL (B07.02) SMLTGPPARV (A02.01) TLQRSSLWCL (A02.01) VLPEPHLAL (A02.01) VPAVPFDLHF (B07.02) YMFLKAESK (A03.01) YMFLKAESKI (A02.01, A03.01, A24.02, B08.01)	Breast Cancer

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
MLL2	P647fs L656fs	<p>APGPRGRTC (B07.02) CLRSHTCPPR (A03.01) CLWCHACLHR (A03.01) CPHLGSHPC (B07.02) CPLGLKSPL (B07.02) CPRSCRCPH (B07.02) CPRSCRCPHL (B07.02, B08.01) CSLPLGNHPY (A01.01) GLRNRICPL (A02.01, B07.02, B08.01) GLRSHTYLR (A03.01) GLRSHTYLRR (A03.01) GPRGRTCHPG (B07.02) HLGSHPCRL (B08.01) HLRLHASP (A03.01) HLRSCPCSL (B07.02, B08.01) HLRTHLLPH (A03.01) HLRTHLLPHH (A03.01) HLRAYPP (B08.01) HLRAYPPC (B08.01) HPHHLRTHL (B07.02) HPHHLRTHLL (B07.02, B08.01) HTYLRRLRSH (A03.01) LPCPHRLRSL (B07.02, B08.01) LPHHRRTRSC (B07.02, B08.01) LPLGNHPYL (B07.02) LPRPLHLRL (B07.02, B08.01) NLRNHTCPP (B08.01) PPRLRSRTCL (B07.02, B08.01) RLHASP (A02.01) RLHASP (A03.01) RLRDHICPL (A02.01, B07.02, B08.01) RLRNLPCPH (A03.01) RLRNLPCPHR (A03.01) RLRSHTCPP (B08.01) RLRSLPRPL (B07.02, B08.01) RLRSLPRPLH (A03.01) RLRRTCLL (B07.02, B08.01) RNRICPLSL (B07.02, B08.01) RPLHLRLHA (B07.02) RPLHLRLHAS (B07.02) RSHACPPGLR (A03.01) RSHACPPNLR (A03.01) RSHAYALCLR (A03.01) RSHPCCHYLR (A03.01) RSHPCPLGLK (A03.01) RSHTCPPSLR (A03.01) RSLPRPLHLR (A03.01) RSRTCLLCL (B07.02) RSRTCLLCLR (A03.01) RSRTCPPGL (B07.02) RSRTCPPGLR (A03.01) RTHLLPHHR (A03.01) RTRSCPCRWR (A03.01) RYRAYPPCL (A24.02)</p> <p><u>TRRCHCCPHLRSHPCP</u> <u>HHLRNHPRPHHLRHH</u> <u>ACHHHLRNCPPHFL</u> <u>RHCTCPGRWRNRPSL</u> <u>RRLRSLCPLHLNHHI</u> <u>FLHWRSRPCLHRKSH</u> <u>PHLLHLRRLYPHHLK</u> <u>HRPCPHHLKLLCPR</u> <u>HLRNCPLPRHLKHLA</u> <u>CLHHLRSHPCPLHLKS</u> <u>HPCLHHRRHLVCSHH</u> <u>LKSLCPLHLRSLPFP</u> <u>HHLRHHACPHHLRTR</u> <u>LCPHHLKNHLCPPHL</u> <u>RYRAYPPCLWCHACL</u> <u>HRLRNLPCHRLRSLP</u> <u>RPLHLRLHASP (A03.01)</u> <u>PPHHLRTHLLPHHR</u> <u>RTRSCPCRWRSHPCP</u> <u>HYLRSRNSAPGPRGR</u> <u>TCHPGLRSRTCPPGLR</u> <u>SHTYLRLRSHTCPPS</u> <u>LRSHAYALCLRSHTCP</u> <u>PRLRDHICPLSLRNCT</u> <u>CPPRLRSRTCLLCLRS</u> <u>HACPPNLRNHTCPPSL</u> <u>RSHACPPGLRNRICPL</u> <u>SLRSHPCPLGLKSPLR</u> <u>SQANALHLRSCPCSLP</u> <u>LGNHPYLPCLSQPCL</u> <u>SLGNHLCPLCPRSCRC</u> <u>PHLGSHPCRLS*</u></p>	<p>APGPRGRTC (B07.02) CLRSHTCPPR (A03.01) CLWCHACLHR (A03.01) CPHLGSHPC (B07.02) CPLGLKSPL (B07.02) CPRSCRCPH (B07.02) CPRSCRCPHL (B07.02, B08.01) CSLPLGNHPY (A01.01) GLRNRICPL (A02.01, B07.02, B08.01) GLRSHTYLR (A03.01) GLRSHTYLRR (A03.01) GPRGRTCHPG (B07.02) HLGSHPCRL (B08.01) HLRLHASP (A03.01) HLRSCPCSL (B07.02, B08.01) HLRTHLLPH (A03.01) HLRTHLLPHH (A03.01) HLRAYPP (B08.01) HLRAYPPC (B08.01) HPHHLRTHL (B07.02) HPHHLRTHLL (B07.02, B08.01) HTYLRRLRSH (A03.01) LPCPHRLRSL (B07.02, B08.01) LPHHRRTRSC (B07.02, B08.01) LPLGNHPYL (B07.02) LPRPLHLRL (B07.02, B08.01) NLRNHTCPP (B08.01) PPRLRSRTCL (B07.02, B08.01) RLHASP (A02.01) RLHASP (A03.01) RLRDHICPL (A02.01, B07.02, B08.01) RLRNLPCPH (A03.01) RLRNLPCPHR (A03.01) RLRSHTCPP (B08.01) RLRSLPRPL (B07.02, B08.01) RLRSLPRPLH (A03.01) RLRRTCLL (B07.02, B08.01) RNRICPLSL (B07.02, B08.01) RPLHLRLHA (B07.02) RPLHLRLHAS (B07.02) RSHACPPGLR (A03.01) RSHACPPNLR (A03.01) RSHAYALCLR (A03.01) RSHPCCHYLR (A03.01) RSHPCPLGLK (A03.01) RSHTCPPSLR (A03.01) RSLPRPLHLR (A03.01) RSRTCLLCL (B07.02) RSRTCLLCLR (A03.01) RSRTCPPGL (B07.02) RSRTCPPGLR (A03.01) RTHLLPHHR (A03.01) RTRSCPCRWR (A03.01) RYRAYPPCL (A24.02)</p>	<p>STAD, BLCA, CRC, HNSC, BRCA</p>

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
MLL2	P2354fs	<u>GPRSHPLPRLWHL</u> <u>LQVTQTSFALAPTL</u> <u>THMLSPH*</u>	ALAPTLTHM (A02.01) ALAPTLTHML (A02.01) LLQVTQTSFA (A02.01) LQVTQTSFAL (A02.01) RLWHLLLQV (A02.01) RLWHLLLQVT (A02.01)	STAD, BLCA, CRC, HNSC, BRCA
RNF43	G659fs	<u>PLGLVPWTRWCPQGK</u> <u>PRFPAMSTTTATGTTT</u> <u>TKSGSSGMAGSLAQK</u> <u>PESPSGGLFLGHSPSQ</u> <u>SHLLLISKSPDPTQQPL</u> <u>RGGSLTHSAPGPSLSQ</u> <u>PLAQLTPPASAPVPAV</u> <u>CSTCKNPASLPDTHRG</u> <u>KGGGVPPSPPLALGPR</u> <u>MQLCTQLARFFPITPP</u> <u>VWHILGPQRHTP*</u>	CTQLARFFPI (A24.02) FFPITPPVW (A24.02) FPITPPVWHI (B07.02) GPRMQLCTQL (B07.02, B08.01) ITPPVWHIL (A24.02) LALGPRMQL (B07.02) MQLCTQLARF (A24.02) RFFPITPPV (A02.01, A24.02) RFFPITPPVW (A24.02) RMQLCTQLA (A02.01) RMQLCTQLAR (A03.01) SPPLALGPRM (B07.02) TQLARFFPI (A02.01, A24.02, B08.01)	STAD
SMAP1	E169fs	<u>KYEKKKYYDKNAIAI</u> <u>TNISSDAPLQPLVSSP</u> <u>SLQAAVDKNKLEKEK</u> <u>EKKRKRKREKRSQKS</u> <u>RQNHLOLKSCRRKISN</u> <u>WSLKKVPALKKLRSP</u> <u>LWIF</u>	KSRQNHQL (B07.02) ALKKLRSP (B08.01, B07.02) HLQLKSCRRK (A03.01) KISNWSLKK (A03.01, A11.01) KISNWSLKKV (A03.01) KLRSPWIF (A24.02) KSRQNHQLK (A03.01) NWSLKKVPAL (B08.01) SLKKVPALK (A03.01, A11.01) SLKKVPALKK (A03.01) SQKSRQNH (B08.01) WSLKKVPAL (B08.01) WSLKKVPALK (A03.01)	MSI+ CRC, MSI+ Uterine/Endometrium Cancer, MSI+ Stomach Cancer
TP53	P58fs P72fs G108fs R110fs	<u>CCPRTILNNGSLKTQV</u> <u>QMKLPECORLLPPWP</u> <u>LHQQLLHRRPLHQPPP</u> <u>GPCHLLSLPRKPTRAA</u> <u>TVSVWASCILGQPSL*</u>	KLPECQRLL (A02.01) KPTRAATVSV (B07.02) LPPWPLHQQL (B07.02) LPRKPTRAA (B07.02, B08.01) LPRKPTRAA (B07.02) QQLLHRRPL (B08.01) RLLPPWPLH (A03.01)	BRCA, CRC, LUAD, PRAD, HNSC, LUSC, PAAD, STAD, BLCA, OV, LIHC, SKCM, UCEC, LAML, UCS, KICH, GBM, ACC
TP53	P152fs	<u>LARTPLPSTRCFANWP</u> <u>RPALCSCGLIPHRPA</u> <u>PASAPWPSTSSHST*</u>	APASAPWPST (B07.02) APWPSTSSH (B07.02) RPAPASAPW (B07.02) WPSTSSHST (B07.02)	BRCA, CRC, LUAD, PRAD, HNSC, LUSC, PAAD, STAD, BLCA, OV, LIHC, SKCM, UCEC, LAML, UCS, KICH, GBM, ACC

Gene	Exemplary Protein Change	Mutation Sequence Context	Peptides (HLA allele example(s))	Exemplary Diseases
UBR5	K2120fs	<u>SQGLYSSSASSGKCL</u> <u>MEVTVDNRNCLEVLPT</u> <u>KMSYAANLKNVMNM</u> <u>QNRQKKKGKNSPCCQ</u> <u>KKLRVQNQGHLLMIL</u> <u>LHN*</u>	RVQNQGHLL (B07.02)	
VHL	L116fs G123fs	<u>TRASPPRSSSAIAVRA</u> <u>SCCPYGSTSTASRSPT</u> <u>QRCRLARAAASTATE</u> <u>VTFGSSEMQGHTMGF</u> <u>WLTKLNYLCHLSMLT</u> <u>DSLFLPISHCQCIL*</u>	FLPISHCQCI (A02.01) FWLTKLNYL (A24.02, B08.01) HLSMLTDSL (A02.01) HTMGFWLTK (A03.01) HTMGFWLTKL (A02.01) KLNYLCHLSM (A02.01) LPISHCQCI (B07.02, B08.01) LPISHCQCIL (B07.02, B08.01) LTDSLFLPI (A01.01, A02.01) LTKLNYLCHL (B08.01) MLTDSLFLPI (A01.01, A02.01, B08.01) MQGHTMGFWL (A02.01) NYLCHLSML (A24.02) SMLTDSLFL (A02.01) TMGFWLTKL (A02.01) YLCHLSMLT (A02.01)	KIRC, KIRP
TABLE 2 D INSERT ¹				
HER2	G776insYVM A	<u>LGSGAFGTVYKGIWIP</u> <u>DGENVKIPVAIKVLRE</u> <u>NTSPKANKEILDEAYV</u> <u>MAYVMAGVGSPPYVS</u> <u>RLLGICLTSTVQLVTQ</u> <u>LMPYGCLLDHVREN</u> <u>GRLGSQDLLNW</u>	ILDEAYVMAY (A01.01) VMAYVMAGV (A02.01) YVMAYVMAG (A02.01, B07.02, B08.01) YVMAYVMAGV (A02.01, B07.02, B08.01)	Lung Cancer

¹Underlined AAs represent non-native AAs

²Bolded AAs represent native AAs of the amino acid sequence encoded by the second of the two fused genes

³Bolded and underlined AAs represent non-native AAs of the amino acid sequence encoded by the second of the two fused genes due to a frameshift.

[0185] In the Tables above, for one or more of the exemplary fusions, a sequence that comes before the first “:” belongs to an exon sequence of a polypeptide encoded by a first gene, a sequence that comes after the second “:” belongs to an exon sequence of a polypeptide encoded by a second gene, and an amino acid that appears between “:” symbols is encoded by a codon that is split between the exon sequence of a polypeptide encoded by a first gene and the exon sequence of a polypeptide encoded by a second gene.

[0186] However, in some embodiments, for example, NAB:STAT6, the NAB exon is linked to the 5’ UTR of STAT6 and the first amino acid that appears after the junction is the normal start codon of STAT6 (there is no frame present at this site (as it is not normally translated).

[0187] AR-V7 in the tables above can also be considered, in some embodiments, a splice variant of the AR gene that encodes a protein that lacks the ligand binding domain found in full length AR.

[0188] In some embodiments, sequencing methods are used to identify tumor specific mutations. Any suitable sequencing method can be used according to the present disclosure, for example, Next Generation Sequencing (NGS) technologies. Third Generation Sequencing methods might substitute for the NGS technology in the future to speed up the sequencing step of the method. For clarification purposes: the terms “Next Generation Sequencing” or “NGS” in the context of the present disclosure mean all novel high throughput sequencing technologies which, in contrast to the “conventional” sequencing methodology known as Sanger chemistry, read nucleic acid templates randomly in parallel along the entire genome by breaking the entire genome into small pieces. Such NGS technologies (also known as massively parallel sequencing technologies) are able to deliver nucleic acid sequence information of a whole genome, exome, transcriptome (all transcribed sequences of a genome) or methylome (all methylated sequences of a genome) in very short time periods, *e.g.* within 1-2 weeks, for example, within 1-7 days or within less than 24 hours and allow, in principle, single cell sequencing approaches. Multiple NGS platforms which are commercially available or which are mentioned in the literature can be used in the context of the present disclosure *e.g.* those described in detail in WO 2012/159643.

[0189] In certain embodiments, the peptide described herein can comprise, but is not limited to, about 5, about 6, about 7, about 8, about 9, about 10, about 11, about 12, about 13, about 14, about 15, about 16, about 17, about 18, about 19, about 20, about 21, about 22, about 23, about 24, about 25, about 26, about 27, about 28, about 29, about 30, about 31, about 32, about 33, about 34, about 35, about 36, about 37, about 38, about 39, about 40, about 41, about 42, about 43, about 44, about 45, about 46, about 47, about 48, about 49, about 50, about 60, about 70, about 80, about 90, about 100, about 110, about 120, about 150, about 200, about 300, about 350, about 400, about 450, about 500, about 600, about 700, about 800, about 900, about 1,000, about 1,500, about 2,000, about 2,500, about 3,000, about 4,000, about 5,000, about 7,500, about 10,000 amino acids or greater amino acid residues, and any range derivable therein. In specific embodiments, a neoantigenic peptide molecule is equal to or less than 100 amino acids.

[0190] In some embodiments, the peptides can be from about 8 and about 50 amino acid residues in length, or from about 8 and about 30, from about 8 and about 20, from about 8 and about 18, from about 8 and about 15, or from about 8 and about 12 amino acid residues in length. In some embodiments, the peptides can be from about 8 and about 500 amino acid residues in length, or from about 8 and about 450, from about 8 and about 400, from about 8 and about 350, from about 8 and about 300, from about 8 and about 250, from about 8 and about 200, from about 8 and about 150, from about 8 and about 100, from about 8 and about 50, or from about 8 and about 30 amino acid residues in length.

[0191] In some embodiments, the peptides can be at least 8, 9, 10, 11, 12, 13, 14, 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, or more amino acid residues in length. In some embodiments, the peptides can be at least 8, 9,

10, 11, 12, 13, 14, 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, 55, 60, 70, 80, 90, 100, 150, 200, 250, 300, 350, 400, 450, 500, or more amino acid residues in length. In some embodiments, the peptides can be at most 8, 9, 10, 11, 12, 13, 14, 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, or less amino acid residues in length. In some embodiments, the peptides can be at most 8, 9, 10, 11, 12, 13, 14, 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, 55, 60, 70, 80, 90, 100, 150, 200, 250, 300, 350, 400, 450, 500, or less amino acid residues in length.

[0192] In some embodiments, the peptides has a total length of at least 8, at least 9, at least 10, at least 11, at least 12, at least 13, at least 14, at least 15, at least 16, at least 17, at least 18, at least 19, at least 20, at least 21, at least 22, at least 23, at least 24, at least 25, at least 26, at least 27, at least 28, at least 29, at least 30, at least 40, at least 50, at least 60, at least 70, at least 80, at least 90, at least 100, at least 150, at least 200, at least 250, at least 300, at least 350, at least 400, at least 450, or at least 500 amino acids.

[0193] In some embodiments, the peptides has a total length of at most 8, at most 9, at most 10, at most 11, at most 12, at most 13, at most 14, at most 15, at most 16, at most 17, at most 18, at most 19, at most 20, at most 21, at most 22, at most 23, at most 24, at most 25, at most 26, at most 27, at most 28, at most 29, at most 30, at most 40, at most 50, at most 60, at most 70, at most 80, at most 90, at most 100, at most 150, at most 200, at most 250, at most 300, at most 350, at most 400, at most 450, or at most 500 amino acids.

[0194] A longer peptide can be designed in several ways. In some embodiments, when HLA-binding peptides are predicted or known, a longer peptide comprises (1) individual binding peptides with extensions of 2-5 amino acids toward the N- and C-terminus of each corresponding gene product; or (2) a concatenation of some or all of the binding peptides with extended sequences for each. In other embodiments, when sequencing reveals a long (>10 residues) neoepitope sequence present in the tumor (*e.g.*, due to a frameshift, read-through or intron inclusion that leads to a novel peptide sequence), a longer peptide could consist of the entire stretch of novel tumor-specific amino acids as either a single longer peptide or several overlapping longer peptides. In some embodiments, use of a longer peptide is presumed to allow for endogenous processing by patient cells and can lead to more effective antigen presentation and induction of T cell responses. In some embodiments, two or more peptides can be used, where the peptides overlap and are tiled over the long neoantigenic peptide.

[0195] In some embodiments, the peptides can have a pI value of from about 0.5 to about 12, from about 2 to about 10, or from about 4 to about 8. In some embodiments, the peptides can have a pI value of at least 4.5, 5, 5.5, 6, 6.5, 7, 7.5, or more. In some embodiments, the peptides can have a pI value of at most 4.5, 5, 5.5, 6, 6.5, 7, 7.5, or less.

[0196] In some embodiments, the peptide described herein can be in solution, lyophilized, or can be in crystal form. In some embodiments, the peptide described herein can be prepared synthetically, by recombinant DNA technology or chemical synthesis, or can be isolated from natural sources such as

native tumors or pathogenic organisms. Neoepitopes can be synthesized individually or joined directly or indirectly in the peptide. Although the peptide described herein can be substantially free of other naturally occurring host cell proteins and fragments thereof, in some embodiments, the peptide can be synthetically conjugated to be joined to native fragments or particles.

[0197] In some embodiments, the peptide described herein can be prepared in a wide variety of ways. In some embodiments, the peptides can be synthesized in solution or on a solid support according to conventional techniques. Various automatic synthesizers are commercially available and can be used according to known protocols. See, for example, Stewart & Young, *Solid Phase Peptide Synthesis*, 2d. Ed., Pierce Chemical Co., 1984. Further, individual peptides can be joined using chemical ligation to produce larger peptides that are still within the bounds of the present disclosure.

[0198] Alternatively, recombinant DNA technology can be employed wherein a nucleotide sequence which encodes the peptide inserted into an expression vector, transformed or transfected into an appropriate host cell and cultivated under conditions suitable for expression. These procedures are generally known in the art, as described generally in Sambrook et al., *Molecular Cloning, A Laboratory Manual*, Cold Spring Harbor Press, Cold Spring Harbor, N.Y. (1989). Thus, recombinant peptides, which comprise one or more neoantigenic peptides described herein, can be used to present the appropriate T cell epitope.

[0199] In some embodiments, the peptide is encoded by a gene with a point mutation resulting in an amino acid substitution of the native peptide. In some embodiments, the peptide is encoded by a gene with a point mutation resulting in frame shift mutation. A frameshift occurs when a mutation disrupts the normal phase of a gene's codon periodicity (also known as "reading frame"), resulting in the translation of a non-native protein sequence. It is possible for different mutations in a gene to achieve the same altered reading frame. In some embodiments, the peptide is encoded by a gene with a mutation resulting in fusion polypeptide, in-frame deletion, insertion, expression of endogenous retroviral polypeptides, and tumor-specific overexpression of polypeptides. In some embodiments, the peptide is encoded by a fusion of a first gene with a second gene. In some embodiments, the peptide is encoded by an in-frame fusion of a first gene with a second gene. In some embodiments, the peptide is encoded by a fusion of a first gene with an exon of a splice variant of the first gene. In some embodiments, the peptide is encoded by a fusion of a first gene with a cryptic exon of the first gene. In some embodiments, the peptide is encoded by a fusion of a first gene with a second gene, wherein the peptide comprises an amino acid sequence encoded by an out of frame sequence resulting from the fusion.

[0200] In some aspects, the present disclosure provides a composition comprising at least two or more than two peptides. In some embodiments, the composition described herein contains at least two distinct peptides. In some embodiments, the composition described herein contains a first peptide comprising a first neoepitope and a second peptide comprising a second neoepitope. In some embodiments, the first and second peptides are derived from the same protein. The at least two distinct peptides may vary by length, amino acid sequence or both. The peptides can be derived from any protein known to or have been

found to contain a tumor specific mutation. In some embodiments, the composition described herein comprises a first peptide comprising a first neoepitope of a protein and a second peptide comprising a second neoepitope of the same protein, wherein the first peptide is different from the second peptide, and wherein the first neoepitope comprises a mutation and the second neoepitope comprises the same mutation. In some embodiments, the composition described herein comprises a first peptide comprising a first neoepitope of a first region of a protein and a second peptide comprising a second neoepitope of a second region of the same protein, wherein the first region comprises at least one amino acid of the second region, wherein the first peptide is different from the second peptide and wherein the first neoepitope comprises a first mutation and the second neoepitope comprises a second mutation. In some embodiments, the first mutation and the second mutation are the same. In some embodiments, the mutation is selected from the group consisting of a point mutation, a splice-site mutation, a frameshift mutation, a read-through mutation, a gene fusion mutation and any combination thereof.

[0201] In some embodiments, the peptide can be derived from a protein with a substitution mutation, *e.g.*, the KRAS G12C, G12D, G12V, Q61H or Q61L mutation, or the NRAS Q61K or Q61R mutation. The substitution may be positioned anywhere along the length of the peptide. For example, it can be located in the N terminal third of the peptide, the central third of the peptide or the C terminal third of the peptide. In another embodiment, the substituted residue is located 2-5 residues away from the N terminal end or 2-5 residues away from the C terminal end. The peptides can similarly derived from tumor specific insertion mutations where the peptide comprises one or more, or all of the inserted residues.

[0202] In some embodiments, the first peptide comprises at least one an additional mutation. In some embodiments, one or more of the at least one additional mutation is not a mutation in the first neoepitope. In some embodiments, one or more of the at least one additional mutation is a mutation in the first neoepitope. In some embodiments, the second peptide comprises at least one additional mutation. In some embodiments, one or more of the at least one additional mutation is not a mutation in the second neoepitope. In some embodiments, one or more of the at least one additional mutation is a mutation in the second neoepitope.

[0203] In some aspects, the present disclosure provides a composition comprising a single polypeptide comprises the first peptide and the second peptide, or a single polynucleotide encodes the first peptide and the second peptide. In some embodiments, the composition provided herein comprises one or more additional peptides, wherein the one or more additional peptides comprise a third neoepitope. In some embodiments, the first peptide and the second peptide are encoded by a sequence transcribed from the same transcription start site. In some embodiments, the first peptide is encoded by a sequence transcribed from a first transcription start site and the second peptide is encoded by a sequence transcribed from a second transcription start site. In some embodiments, wherein the polypeptide has a length of at least 26; 27; 28; 29; 30; 40; 50; 60; 70; 80; 90; 100; 150; 200; 250; 300; 350; 400; 450; 500; 600; 700; 800; 900; 1,000; 1,500; 2,000; 2,500; 3,000; 4,000; 5,000; 7,500; or 10,000 amino acids. In some embodiments, the polypeptide comprises a first sequence with at least 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%, 96%, 97%, 98%, or 99% sequence identity to a corresponding wild-type sequence; and a second sequence with at least 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%, 96%, 97%, 98%, or 99% sequence identity to a corresponding wild-type sequence. In some embodiments, the polypeptide comprises a first sequence of at least 8 or 9 contiguous amino acids with at least 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%, 96%, 97%, 98%, or 99% sequence identity to a corresponding wild-type sequence; and a second sequence of at least 16 or 17 contiguous amino acids with at least 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%, 96%, 97%, 98%, or 99% sequence identity to a corresponding wild-type sequence.

[0204] In some embodiments, the second peptide is longer than the first peptide. In some embodiments, the first peptide is longer than the second peptide. In some embodiments, the first peptide has a length of at least 9; 10; 11; 12; 13; 14; 15; 16; 17; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 40; 50; 60; 70; 80; 90; 100; 150; 200; 250; 300; 350; 400; 450; 500; 600; 700; 800; 900; 1,000; 1,500; 2,000; 2,500; 3,000; 4,000; 5,000; 7,500; or 10,000 amino acids. In some embodiments, the second peptide has a length of at least 17; 18; 19; 20; 21; 22; 23; 24; 25; 26; 27; 28; 29; 30; 40; 50; 60; 70; 80; 90; 100; 150; 200; 250; 300; 350; 400; 450; 500; 600; 700; 800; 900; 1,000; 1,500; 2,000; 2,500; 3,000; 4,000; 5,000; 7,500; or 10,000 amino acids. In some embodiments, the first peptide comprises a sequence of at least 9 contiguous amino acids with at least 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%, 96%, 97%, 98%, or 99% identity to a corresponding wild-type sequence. In some embodiments, the second peptide comprises a sequence of at least 17 contiguous amino acids with at least 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%, 96%, 97%, 98%, or 99% sequence identity to a corresponding wild-type sequence.

[0205] In some embodiments, the first peptide, the second peptide or both comprise at least one flanking sequence, wherein the at least one flanking sequence is upstream or downstream of the neopeptide. In some embodiments, the at least one flanking sequence has at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild-type sequence. In some embodiments, the at least one flanking sequence comprises a non-wild-type sequence. In some embodiments, the at least one flanking

sequence is a N-terminus flanking sequence. In some embodiments, the at least one flanking sequence is a C-terminus flanking sequence. In some embodiments, the at least one flanking sequence of the first peptide has at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to the at least one flanking sequence of the second peptide. In some embodiments, the at least one flanking region of the first peptide is different from the at least one flanking region of the second peptide. In some embodiments, the at least one flanking residue comprises the mutation.

[0206] In some embodiments, a peptide comprises a neoepitope sequence comprising at least one mutant amino acid. In some embodiments, a peptide comprises a neoepitope sequence comprising at least 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 or more mutant amino acids. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid and at least 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 or more non-mutant amino acids. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid and at least 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 or more non-mutant amino acids upstream of the least one mutant amino acid. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid and at least 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 or more non-mutant amino acids downstream of the least one mutant amino acid. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid; at least 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 or more non-mutant amino acids upstream of the least one mutant amino acid; and at least 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 or more non-mutant amino acids downstream of the least one mutant amino acid.

[0207] In some embodiments, a peptide comprises a neoantigenic peptide sequence depicted in **Tables 1 to 14**. In some embodiments, a peptide comprises a neoepitope sequence depicted in **Tables 1 to 14**. In some embodiments, a peptide comprises a neoepitope sequence comprising at least one mutant amino acid (underlined amino acid) as depicted in **Tables 1 to 14**. In some embodiments, a peptide comprises a neoepitope sequence comprising at least 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 or more mutant amino acids (underlined amino acids) as depicted in **Tables 1 to 14**. In some embodiments, a peptide comprises a neoepitope sequence comprising at least one mutant amino acid (underlined amino acid) and at least one **bolded** amino acid as depicted in **Tables 1 to 14**. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid (underlined amino acid) and at least 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 or more non-mutant amino acids as

depicted in **Tables 1 to 14**. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid (underlined amino acid) and at least 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 or more non-mutant amino acids upstream of the least one mutant amino acid as depicted in **Tables 1 to 14**. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid (underlined amino acid) and at least 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 or more non-mutant amino acids downstream of the least one mutant amino acid as depicted in **Tables 1 to 14**. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid (underlined amino acid), at least 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 or more non-mutant amino acids upstream of the least one mutant amino acid, and at least 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 or more non-mutant amino acids downstream of the least one mutant amino acid as depicted in **Tables 1 to 14**.

[0208] In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid and a sequence upstream of the least one mutant amino acid with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid and a sequence downstream of the least one mutant amino acid with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid, a sequence upstream of the least one mutant amino acid with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence, and a sequence downstream of the least one mutant amino acid with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence.

[0209] In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid and a sequence upstream of the least one mutant amino acid comprising least 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 or more contiguous amino acids with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid and a sequence downstream of the least one mutant amino acid comprising least 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 or more contiguous amino acids with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid, a sequence upstream of the least one mutant amino acid comprising least 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 or more contiguous amino acids with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence, and a sequence downstream of the least one mutant amino acid comprising least 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 or more contiguous amino acids with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence.

[0210] In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid (underlined amino acid) as depicted in **Tables 1 to 14** and a sequence upstream of the least one mutant amino acid with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid (underlined amino acid) as depicted in **Tables 1 to 14** and a sequence downstream of the least one mutant amino acid with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid (underlined amino acid) as depicted in **Tables 1 to 14**, a sequence upstream of the least one mutant amino acid with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence, and a sequence downstream of the least one mutant amino acid with at

least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence.

[0211] In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid (underlined amino acid) as depicted in **Tables 1 to 14** and a sequence upstream of the least one mutant amino acid comprising least 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 or more contiguous amino acids with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid (underlined amino acid) as depicted in **Tables 1 to 14** and a sequence downstream of the least one mutant amino acid comprising least 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 or more contiguous amino acids with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence. In some embodiments, a peptide comprises a neoepitope sequence derived from a protein comprising at least one mutant amino acid (underlined amino acid) as depicted in **Tables 1 to 14**, a sequence upstream of the least one mutant amino acid comprising least 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 or more contiguous amino acids with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence, and a sequence downstream of the least one mutant amino acid comprising least 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 or more contiguous amino acids with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a corresponding wild type sequence.

[0212] In some embodiments, a peptide comprising a KRAS G12C mutation comprises a sequence of MTEYKLVVVGACGVGKSALTIQLIQNHFVDEYDPTIEDSYRKQVVIDGETC LLDILDTAGQE. In some embodiments, a peptide comprising a KRAS G12 C mutation comprises a neoepitope sequence of KLVVVGACGV. In some embodiments, a peptide comprising a KRAS G12 C mutation comprises a neoepitope sequence of LVVVGACGV. In some embodiments, a peptide comprising a KRAS G12 C mutation comprises a neoepitope sequence of VVGACGVGK. In some embodiments, a peptide comprising a KRAS G12 C mutation comprises a neoepitope sequence of VVVGACGVGK.

[0213] In some embodiments, a peptide comprising a KRAS G12D mutation comprises a sequence of MTEYKLVVVGADGVGKSALTIQLIQNHVFVEYDPTIEDSYRKQVVIDGETCLLDILDITAGQE. In some embodiments, a peptide comprising a KRAS G12D mutation comprises a neoepitope sequence of VVGADGVGK. In some embodiments, a peptide comprising a KRAS G12D mutation comprises a neoepitope sequence of VVVGADGVGK. In some embodiments, a peptide comprising a KRAS G12D mutation comprises a neoepitope sequence of KLVVVGADGV. In some embodiments, a peptide comprising a KRAS G12D mutation comprises a neoepitope sequence of LVVVGADGV.

[0214] In some embodiments, a peptide comprising a KRAS G12V mutation comprises a sequence of MTEYKLVVVGAVGVGKSALTIQLIQNHVFVEYDPTIEDSYRKQVVIDGETCLLDILDITAGQE. In some embodiments, a peptide comprising a KRAS G12V mutation comprises a neoepitope sequence of KLVVVGAVGV. In some embodiments, a peptide comprising a KRAS G12V mutation comprises a neoepitope sequence of LVVVGAVGV. In some embodiments, a peptide comprising a KRAS G12V mutation comprises a neoepitope sequence of VVGAVGVGK. In some embodiments, a peptide comprising a KRAS G12V mutation comprises a neoepitope sequence of VVVGAVGVGK.

[0215] In some embodiments, a peptide comprising a KRAS Q61H mutation comprises a sequence of AGGVGKSALTIQLIQNHVFVEYDPTIEDSYRKQVVIDGETCLLDILDITAGHEEYSAMRDQYMRTGEGFLCVFAINNTKSFEDIHHYREQIKRVKDSSEVPM. In some embodiments, a peptide comprising a KRAS Q61H mutation comprises a neoepitope sequence of ILDTAGHEEY.

[0216] In some embodiments, a peptide comprising a KRAS Q61L mutation comprises a sequence of AGGVGKSALTIQLIQNHVFVEYDPTIEDSYRKQVVIDGETCLLDILDITAGLEEYSAMRDQYMRTGEGFLCVFAINNTKSFEDIHHYREQIKRVKDSSEVPM. In some embodiments, a peptide comprising a KRAS Q61L mutation comprises a neoepitope sequence of ILDTAGLEEY. In some embodiments, a peptide comprising a KRAS Q61L mutation comprises a neoepitope sequence of LLDILDITAGL.

[0217] In some embodiments, a peptide comprising a NRAS Q61K mutation comprises a sequence of AGGVGKSALTIQLIQNHVFVEYDPTIEDSYRKQVVIDGETCLLDILDITAGKEEYSAMRDQYMRTGEGFLCVFAINNSKSFADINLYREQIKRVKDSDDVPM. In some embodiments, a peptide comprising a NRAS Q61K mutation comprises a neoepitope sequence of ILDTAGKEEY.

[0218] In some embodiments, a peptide comprising a NRAS Q61R mutation comprises a sequence of AGGVGKSALTIQLIQNHVFVEYDPTIEDSYRKQVVIDGETCLLDILDITAGREEYSAMRDQYMRTGEGFLCVFAINNSKSFADINLYREQIKRVKDSDDVPM. In some embodiments, a peptide comprising a NRAS Q61R mutation comprises a neoepitope sequence of ILDTAGREEY.

[0219] In some embodiments, a peptide comprising a mutation of a TMPRSS2:ERG fusion comprises a neoepitope sequence of MALNS::EALSVVSEDQSLFECAYGTPHLAKTEMTASSSSDYGQTSKMSRPVQQDWALNSEALS V. In some embodiments, a peptide comprising a mutation of a TMPRSS2:ERG fusion comprises a neoepitope sequence of ALNSEALSVV. In some embodiments, a peptide comprising a mutation of a TMPRSS2:ERG fusion comprises a neoepitope sequence of MALNSEALSV. In some embodiments, a

peptide comprising a RAS Q61H mutation comprises a sequence of TCLLDILDTAGHEEYSAMRDQYM.

[0220] In some embodiments, a peptide comprising a RAS Q61H mutation comprises a sequence provided in Table 3. In some embodiments, a peptide sequence provided in Table 3 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 3 next to the peptide sequence.

Table 3. Peptide Sequences Comprising RAS Q61H Mutation, Corresponding HLA Allele, and Rank of Binding Potential

Peptide	Allele	Rank of Binding Potential
ILDTAGHEEY	HLA-A36:01	1
ILDTAGHEEY	HLA-A01:01	2
DTAGHEEYSAM	HLA-A26:01	3
DTAGHEEYSAM	HLA-A25:01	4
GHEEYSAM	HLA-B15:09	4
DTAGHEEY	HLA-A26:01	5
ILDTAGHEE	HLA-C08:02	5
AGHEEYSAM	HLA-C01:02	6
AGHEEYSAM	HLA-B46:01	6
DTAGHEEY	HLA-A25:01	6
DTAGHEEY	HLA-A01:01	6
DTAGHEEY	HLA-B18:01	7
DTAGHEEY	HLA-A36:01	7
ILDTAGHEE	HLA-C05:01	7
ILDTAGHEE	HLA-A02:07	7
ILDTAGHEEY	HLA-A29:02	7
ILDTAGHEEY	HLA-C08:02	7
HEEYSAMRD	HLA-B49:01	8
TAGHEEYSA	HLA-B35:03	8
DTAGHEEYS	HLA-A68:02	9
DTAGHEEYSAMR	HLA-A68:01	9
GHEEYSAM	HLA-B39:01	9
ILDTAGHEE	HLA-A01:01	9
LDTAGHEEY	HLA-B53:01	9
HEEYSAMRD	HLA-B41:01	10
ILDTAGHEE	HLA-A36:01	10
DTAGHEEY	HLA-B58:01	11
LLDILDTAGH	HLA-A01:01	12
TAGHEEYSAM	HLA-B35:03	12
LDTAGHEEY	HLA-B35:01	13
DILDTAGHE	HLA-A26:01	14
DTAGHEEY	HLA-C12:03	14
ILDTAGHEEY	HLA-C05:01	14
AGHEEYSAM	HLA-A30:02	15

DILDTAGHEEY	HLA-A25:01	15
DTAGHEEY	HLA-C02:02	15
ILDTAGHEE	HLA-C04:01	15
DILDTAGH	HLA-A26:01	16
ILDTAGHEE	HLA-A02:01	16
LDTAGHEEY	HLA-A29:02	16
ILDTAGHE	HLA-A01:01	17
LDTAGHEEY	HLA-B18:01	17
AGHEEYSAM	HLA-C14:03	18
DILDTAGHEEY	HLA-A29:02	18
DTAGHEEYS	HLA-A26:01	18
ILDTAGHEEY	HLA-B15:01	18
DTAGHEEYSA	HLA-A68:02	19
ILDTAGHE	HLA-C05:01	19
ILDTAGHEEY	HLA-A02:07	19
ILDTAGHEEY	HLA-A30:02	19
LDTAGHEEY	HLA-A36:01	19
AGHEEYSAM	HLA-C14:02	20
AGHEEYSAM	HLA-B15:03	20
LLDILDTAGH	HLA-A02:07	20

[0221] In some embodiments, a peptide comprising a RAS Q61R mutation comprises a sequence of TCLLDILDTAGREEYSAMRDQYM. In some embodiments, a peptide comprising a RAS Q61R mutation comprises a sequence provided in Table 4. In some embodiments, a peptide sequence provided in Table 4 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 4 next to the peptide sequence.

Table 4. Peptide Sequences Comprising RAS Q61R Mutation, Corresponding HLA Allele, and Rank of Binding Potential

Peptide	Allele	Rank of Binding Potential
ILDTAGREEY	HLA-A36:01	1
ILDTAGREEY	HLA-A01:01	2
DTAGREEYSAM	HLA-A26:01	3
DILDTAGR	HLA-A33:03	4
DILDTAGR	HLA-A68:01	5
DTAGREEY	HLA-A26:01	6
DTAGREEYSAM	HLA-A25:01	6
CLLDILDTAGR	HLA-A74:01	7
DTAGREEY	HLA-A01:01	7
REEYSAMRD	HLA-B41:01	7
GREEYSAMR	HLA-B27:05	8
ILDTAGREE	HLA-C08:02	8
ILDTAGREEY	HLA-A29:02	8
REEYSAMRD	HLA-B49:01	8
AGREEYSAM	HLA-B46:01	9
DTAGREEY	HLA-B18:01	9

DTAGREEY	HLA-A25:01	9
DTAGREEY	HLA-A36:01	9
DILDTAGR	HLA-A74:01	10
DILDTAGRE	HLA-A26:01	10
ILDTAGREE	HLA-C05:01	10
DILDTAGR	HLA-A26:01	11
GREEYSAM	HLA-B39:01	11
AGREEYSAM	HLA-B15:03	12
GREEYSAM	HLA-C07:02	12
ILDTAGREE	HLA-A01:01	12
TAGREEYSA	HLA-B35:03	12
ILDTAGREEY	HLA-A30:02	13
DTAGREEYS	HLA-A68:02	14
ILDTAGRE	HLA-A01:01	14
CLLDILDTAGR	HLA-A31:01	15
DTAGREEYSAMR	HLA-A68:01	15
LLDILDTAGR	HLA-A01:01	15
DTAGREEY	HLA-B58:01	16
ILDTAGREEY	HLA-C08:02	16
DILDTAGR	HLA-A31:01	17
ILDTAGREE	HLA-C04:01	17
ILDTAGREEY	HLA-A32:01	17
LLDILDTAGR	HLA-A74:01	17
TAGREEYSAM	HLA-B35:03	17
DILDTAGREEY	HLA-A32:01	18
ILDTAGRE	HLA-C05:01	18
ILDTAGREE	HLA-A02:07	18
REEYSAMRD	HLA-B40:01	18
AGREEYSAM	HLA-B15:01	19
AGREEYSAMR	HLA-A31:01	19
ILDTAGRE	HLA-A36:01	19
LDILDTAGR	HLA-A68:01	19
LDTAGREEY	HLA-A29:02	19
LDTAGREEY	HLA-B35:01	19
REEYSAMRD	HLA-B45:01	19
REEYSAMRDQY	HLA-A36:01	19
DTAGREEY	HLA-C02:02	20

[0222] In some embodiments, a peptide comprising a RAS Q61K mutation comprises a sequence of TCLLDILDITAGKEEYSAMRDQYM. In some embodiments, a peptide comprising a RAS Q61K mutation comprises a sequence provided in Table 5. In some embodiments, a peptide sequence provided in Table 5 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 5 next to the peptide sequence.

Table 5. Peptide Sequences Comprising RAS Q61K Mutation, Corresponding HLA Allele, and Rank of Binding Potential

Peptide	Allele	Rank of Binding Potential
ILDTAGKEEY	HLA-A36:01	1
ILDTAGKEEY	HLA-A01:01	2
DTAGKEEYSAM	HLA-A26:01	3
CLLDILDTAGK	HLA-A03:01	4
DTAGKEEY	HLA-A01:01	5
DTAGKEEY	HLA-A26:01	5
DTAGKEEYSAM	HLA-A25:01	5
AGKEEYSAM	HLA-B46:01	6
DILDTAGKE	HLA-A26:01	7
KEEYSAMRD	HLA-B41:01	7
DTAGKEEY	HLA-B18:01	8
GKEEYSAM	HLA-B15:03	8
ILDTAGKEE	HLA-C08:02	8
ILDTAGKEEY	HLA-A29:02	8
DTAGKEEYS	HLA-A68:02	9
LDTAGKEEY	HLA-B53:01	9
TAGKEEYSA	HLA-B35:03	9
DILDTAGK	HLA-A68:01	10
DTAGKEEY	HLA-A36:01	10
KEEYSAMRD	HLA-B49:01	10
LDTAGKEEY	HLA-C07:01	10
DTAGKEEYSAMR	HLA-A68:01	11
ILDTAGKEE	HLA-C05:01	11
ILDTAGKEEY	HLA-C08:02	11
LLDILDTAGK	HLA-A01:01	12
AGKEEYSAM	HLA-A30:02	13
DTAGKEEY	HLA-A25:01	13
DTAGKEEYS	HLA-A26:01	13
ILDTAGKE	HLA-C05:01	13
LDTAGKEEY	HLA-B35:01	13
AGKEEYSAMR	HLA-A31:01	14
DILDTAGK	HLA-A33:03	14
ILDTAGKE	HLA-A01:01	14
ILDTAGKEE	HLA-A01:01	14
ILDTAGKEE	HLA-A02:07	14
TAGKEEYSAM	HLA-B35:03	14
AGKEEYSAM	HLA-B15:01	15
ILDTAGKEEY	HLA-A30:02	15
LDTAGKEEY	HLA-B46:01	15
DTAGKEEY	HLA-B58:01	16
ILDTAGKEEY	HLA-C05:01	17
AGKEEYSAM	HLA-A30:01	18

AGKEEYSAM	HLA-B15:03	18
DTAGKEEY	HLA-C02:02	18
LDTAGKEEY	HLA-A29:02	18

[0223] In some embodiments, a peptide comprising a RAS Q61L mutation comprises a sequence of TCLLDILDTAGLEEYSAMRDQYM. In some embodiments, a peptide comprising a RAS Q61L mutation comprises a sequence provided in Table 6. In some embodiments, a peptide sequence provided in Table 6 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 6 next to the peptide sequence.

Table 6. Peptide Sequences Comprising RAS Q61L Mutation, Corresponding HLA Allele, and Rank of Binding Potential

Peptide	Allele	Rank of Binding Potential
ILDTAGLEEY	HLA-A36:01	1
ILDTAGLEEY	HLA-A01:01	2
LLDILDTAGL	HLA-A02:07	3
GLEEYSAMRDQY	HLA-A36:01	4
DTAGLEEY	HLA-A25:01	5
DTAGLEEY	HLA-A26:01	5
DTAGLEEYSAM	HLA-A26:01	5
DTAGLEEY	HLA-A01:01	6
ILDTAGLEE	HLA-C08:02	6
ILDTAGLEE	HLA-A01:01	6
CLLDILDTAGL	HLA-A02:04	7
ILDTAGLEE	HLA-A36:01	7
LLDILDTAGL	HLA-A01:01	7
DILDTAGL	HLA-B14:02	8
DILDTAGLEEY	HLA-A25:01	8
DTAGLEEYS	HLA-A68:02	8
DTAGLEEYSAM	HLA-A25:01	8
GLEEYSAMR	HLA-A74:01	8
ILDTAGLE	HLA-A01:01	8
DILDTAGLEEY	HLA-A26:01	9
DTAGLEEY	HLA-A36:01	9
ILDTAGLEEY	HLA-A29:02	9
DILDTAGL	HLA-B08:01	10
DTAGLEEY	HLA-B18:01	10
ILDTAGLEE	HLA-A02:07	10
LDTAGLEEY	HLA-B35:01	10
CLLDILDTAGL	HLA-A02:01	11
DTAGLEEY	HLA-C02:02	11
ILDTAGLEE	HLA-C05:01	11
ILDTAGLEEY	HLA-C08:02	11
ILDTAGLEEY	HLA-A02:07	11

LLDILDTAGL	HLA-C08:02	11
DILDTAGL	HLA-A26:01	12
LDTAGLEEY	HLA-B53:01	12
DTAGLEEY	HLA-C03:02	13
DTAGLEEY	HLA-B58:01	13
ILDTAGLEEY	HLA-A30:02	13
LLDILDTAGL	HLA-C05:01	13
LLDILDTAGL	HLA-C04:01	13
DTAGLEEYSAMR	HLA-A68:01	14
ILDTAGLE	HLA-A36:01	15
LLDILDTAGL	HLA-A02:01	15
AGLEEYSAM	HLA-B15:03	16
DTAGLEEYSA	HLA-A68:02	16
GLEEYSAMRDQY	HLA-A01:01	16
ILDTAGLE	HLA-C04:01	16
ILDTAGLEEY	HLA-B15:01	16
LDILDTAGL	HLA-B37:01	16
AGLEEYSAM	HLA-A30:02	17
AGLEEYSAM	HLA-B48:01	17
AGLEEYSAMR	HLA-A31:01	17
ILDTAGLEE	HLA-C04:01	17
LDTAGLEEY	HLA-C03:02	17
AGLEEYSAM	HLA-C14:02	18
GLEEYSAMR	HLA-A31:01	18
LEEYSAMRD	HLA-B41:01	18
LLDILDTAGLE	HLA-A01:01	18
AGLEEYSAM	HLA-C14:03	19
LDILDTAGL	HLA-B40:02	19
LDTAGLEEY	HLA-A29:02	19
DILDTAGLE	HLA-A26:01	20
DTAGLEEY	HLA-B15:01	20
ILDTAGLEEY	HLA-A02:01	20
LDTAGLEEY	HLA-A36:01	20
LDTAGLEEY	HLA-B46:01	20
DTAGLEEY	HLA-A68:02	21
DTAGLEEY	HLA-C12:03	21
ILDTAGLE	HLA-C05:01	21
LDTAGLEEY	HLA-B18:01	21
LEEYSAMRD	HLA-B49:01	21
TAGLEEYSA	HLA-B54:01	21
DILDTAGLEEY	HLA-A29:02	22
GLEEYSAM	HLA-C05:01	22

[0224] In some embodiments, a peptide comprising a RAS G12A mutation comprises a sequence of MTEYKLVVVG AAGV GKSALTIQL. In some embodiments, a peptide comprising a RAS G12A

mutation comprises a sequence provided in Table 7. In some embodiments, a peptide sequence provided in Table 7 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 7 next to the peptide sequence.

Table 7. Peptide Sequences Comprising RAS G12A Mutation, Corresponding HLA Allele, and Rank of Binding Potential

Peptide	Allele	Rank of Binding Potential
AAGVGKSAL	HLA-C03:04	1
VVVGAAAGVGK	HLA-A11:01	1
VVGAAGVGK	HLA-A11:01	2
TEYKLVVVGAA	HLA-B50:01	3
VVGAAGVGK	HLA-A03:01	3
VVVGAAAGVGK	HLA-A68:01	3
AAGVGKSAL	HLA-C08:02	4
AAGVGKSAL	HLA-C08:01	4
AAGVGKSAL	HLA-B46:01	4
AAGVGKSAL	HLA-B81:01	5
GAAGVGKSAL	HLA-B48:01	5
LVVVGAAAGV	HLA-A68:02	5
AAGVGKSAL	HLA-C03:04	1
VVVGAAAGVGK	HLA-A11:01	1
VVGAAGVGK	HLA-A11:01	2
TEYKLVVVGAA	HLA-B50:01	3
VVGAAGVGK	HLA-A03:01	3
VVVGAAAGVGK	HLA-A68:01	3
AAGVGKSAL	HLA-C08:02	4
AAGVGKSAL	HLA-C08:01	4
AAGVGKSAL	HLA-B46:01	4
AAGVGKSAL	HLA-B81:01	5
AAGVGKSAL	HLA-C03:02	5
AAGVGKSAL	HLA-C01:02	5
GAAGVGKSAL	HLA-B48:01	5
LVVVGAAAGV	HLA-A68:02	5
AAGVGKSAL	HLA-C03:03	6
VVGAAGVGK	HLA-A68:01	6
GAAGVGKSAL	HLA-B81:01	7
VVVGAAAGVGK	HLA-A03:01	7
AAGVGKSAL	HLA-C05:01	8
AAGVGKSAL	HLA-C12:03	8
GAAGVGKSA	HLA-B46:01	8
VVGAAGVGK	HLA-A30:01	8
GAAGVGKSA	HLA-B55:01	9
KLVVVGAAGV	HLA-A02:01	9
AGVGKSAL	HLA-B08:01	10
GAAGVGKSAL	HLA-C03:04	10

AAGVGKSAL	HLA-C17:01	11
GAAGVGKSAL	HLA-C03:03	11
VVVGAAAGV	HLA-A68:02	11
YKLVVVGAA	HLA-B54:01	11
AAGVGKSAL	HLA-B48:01	12
AGVGKSAL	HLA-C03:04	12
AGVGKSAL	HLA-C07:01	12
VVVGAAAGVGK	HLA-A30:01	12
AAGVGKSA	HLA-B46:01	13
KLVVVGAAAGV	HLA-A02:07	13
YKLVVVGAA	HLA-B50:01	13
AAGVGKSAL	HLA-B07:02	14
GAAGVGKSAL	HLA-A68:02	14
VVVGAAAGVGK	HLA-A74:01	14
AGVGKSAL	HLA-C08:01	15
GAAGVGKSAL	HLA-C17:01	15
GAAGVGKSAL	HLA-C08:01	16
GAAGVGKSAL	HLA-B35:03	16
AAGVGKSAL	HLA-C02:02	17
AAGVGKSAL	HLA-B35:03	17
AAGVGKSAL	HLA-C12:02	17
AAGVGKSAL	HLA-C14:03	17
GAAGVGKSA	HLA-B50:01	17
AGVGKSAL	HLA-C03:02	18
GAAGVGKSA	HLA-C03:04	18
LVVVGAAAGV	HLA-B55:01	18
TEYKLVVVGAA	HLA-B41:01	18
AGVGKSAL	HLA-C01:02	19
GAAGVGKSA	HLA-B54:01	19
GAAGVGKSAL	HLA-B07:02	19
VGAAGVGKSA	HLA-B55:01	19
AGVGKSAL	HLA-B48:01	20
AGVGKSALTI	HLA-B49:01	20
VVVGAAAGV	HLA-B55:01	20

[0225] In some embodiments, a peptide comprising a RAS G12C mutation comprises a sequence of MTEYKLVVVGACGVGKSALTIQL. In some embodiments, a peptide comprising a RAS G12C mutation comprises a sequence provided in Table 8. In some embodiments, a peptide sequence provided in Table 8 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 8 next to the peptide sequence.

Table 8. Peptide Sequences Comprising RAS G12C Mutation, Corresponding HLA Allele, and Rank of

Binding Potential

Peptide	Allele	Rank of Binding Potential
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VVVGACGVGK	HLA-A11:01	1
VVGACGVGK	HLA-A03:01	2
VVGACGVGK	HLA-A11:01	3
VVVGACGVGK	HLA-A68:01	4
VVGACGVGK	HLA-A68:01	5
VVVGACGVGK	HLA-A03:01	5
VVGACGVGK	HLA-A30:01	6
ACGVGKSAL	HLA-B81:01	7
ACGVGKSAL	HLA-C01:02	7
ACGVGKSAL	HLA-C14:03	8
ACGVGKSAL	HLA-C03:04	9
VVVGACGVGK	HLA-A30:01	9
ACGVGKSAL	HLA-C14:02	10
CGVGKSAL	HLA-B08:01	10
KLVVVGACGV	HLA-A02:01	10
ACGVGKSAL	HLA-B07:02	11
GACGVGKSAL	HLA-B48:01	12
GACGVGKSAL	HLA-C03:03	13
ACGVGKSAL	HLA-B48:01	14
ACGVGKSAL	HLA-B40:01	14
YKLVVVGAC	HLA-B48:01	14
YKLVVVGAC	HLA-B15:03	14
GACGVGKSA	HLA-B46:01	15
GACGVGKSAL	HLA-C03:04	15
GACGVGKSAL	HLA-C01:02	15
LVVVGACGV	HLA-A68:02	15
CGVGKSAL	HLA-C03:04	16
GACGVGKSAL	HLA-C08:02	16
VVGACGVGK	HLA-A74:01	16

[0226] In some embodiments, a peptide comprising a RAS G12D mutation comprises a sequence of MTEYKLVVVGADGVGKSALTIQL. In some embodiments, a peptide comprising a RAS G12D mutation comprises a sequence provided in Table 9. In some embodiments, a peptide sequence provided in Table 9 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 9 next to the peptide sequence

Table 9. Peptide Sequences Comprising RAS G12D Mutation, Corresponding HLA Allele, and Rank of Binding Potential

Peptide	Allele	Rank of Binding Potential
GADGVGKSAL	HLA-C08:02	1
GADGVGKSAL	HLA-C05:01	2
VVVGADGVGK	HLA-A11:01	3
DGVGKSAL	HLA-B14:02	4
VVGADGVGK	HLA-A11:01	4

VVGADGVGK	HLA-A03:01	5
DGVGKSAL	HLA-B08:01	6
VVVGADGVGK	HLA-A68:01	6
GADGVGKSAL	HLA-C03:03	7
VVGADGVGK	HLA-A30:01	7
ADGVGKSAL	HLA-B37:01	8
GADGVGKSAL	HLA-C08:01	8
VVGADGVGK	HLA-A68:01	8
GADGVGKSA	HLA-C08:02	9
GADGVGKSAL	HLA-B35:03	9
GADGVGKS	HLA-C05:01	10
GADGVGKSA	HLA-C05:01	10
ADGVGKSAL	HLA-C07:01	11
VVVGADGVGK	HLA-A03:01	11
ADGVGKSAL	HLA-B40:02	12
ADGVGKSAL	HLA-B46:01	13
GADGVGKSAL	HLA-C03:04	13
ADGVGKSAL	HLA-B81:01	14
GADGVGKSAL	HLA-C17:01	14
VVVGADGVGK	HLA-A30:01	14
GADGVGKSA	HLA-B35:03	15
GADGVGKSA	HLA-B46:01	15
GADGVGKSAL	HLA-B48:01	15
KLVVVGADGV	HLA-A02:01	15
LVVVGADGV	HLA-A68:02	15
VGADGVGKSA	HLA-B55:01	15
VVGADGVGK	HLA-A74:01	16
GADGVGKSA	HLA-B53:01	17
KLVVVGADGV	HLA-A02:07	17
VGADGVGK	HLA-A68:01	17
YKLVVVGAD	HLA-B48:01	17
ADGVGKSAL	HLA-C14:03	18
DGVGKSALTI	HLA-B51:01	18
VGADGVGK	HLA-A11:01	18

[0227] In some embodiments, a peptide comprising a RAS G12R mutation comprises a sequence of MTEYKLVVVGARGVGKSALTIQL. In some embodiments, a peptide comprising a RAS G12R mutation comprises a sequence provided in Table 10. In some embodiments, a peptide sequence provided in Table 10 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 10 next to the peptide sequence.

Table 10. Peptide Sequences Comprising RAS G12R Mutation, Corresponding HLA Allele, and Rank of Binding Potential

Peptide	Allele	Rank of Binding Potential
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VVGARGVGK	HLA-A11:01	1
VVVGARGVGK	HLA-A68:01	1
GARGVGKSA	HLA-B46:01	2
ARGVGKSAL	HLA-B27:05	3
GARGVGKSA	HLA-B55:01	3
RGVGKSAL	HLA-C07:01	4
VVGARGVGK	HLA-A30:01	5
ARGVGKSAL	HLA-B38:01	6
ARGVGKSAL	HLA-B14:02	6
VVGARGVGK	HLA-A68:01	6
VVVGARGVGK	HLA-A03:01	7
GARGVGKSAL	HLA-B48:01	8
RGVGKSAL	HLA-B48:01	8
RGVGKSALTI	HLA-A23:01	8
ARGVGKSAL	HLA-C06:02	9
GARGVGKSA	HLA-A30:01	9
GARGVGKSAL	HLA-B81:01	9
VVVGARGVGK	HLA-A30:01	9
GARGVGKSAL	HLA-B07:02	10
LVVVGARGV	HLA-C06:02	10
RGVGKSAL	HLA-B81:01	10
VVGARGVGK	HLA-A74:01	11
KLVVVGARGV	HLA-A02:01	12
LVVVGARGV	HLA-B55:01	12
YKLVVVGAR	HLA-A33:03	12
KLVVVGAR	HLA-A74:01	13
KLVVVGARGV	HLA-B13:02	13
RGVGKSAL	HLA-C01:02	13
LVVVGARGV	HLA-A68:02	14
VVVGARGV	HLA-B55:01	14
ARGVGKSAL	HLA-B15:09	15
ARGVGKSAL	HLA-C14:03	16
GARGVGKSA	HLA-B54:01	16
VVVGARGV	HLA-B52:01	16

[0228] In some embodiments, a peptide comprising a RAS G12S mutation comprises a sequence of MTEYKLVVVGASGVGKSALTIQL. In some embodiments, a peptide comprising a RAS G12S mutation comprises a sequence provided in Table 11. In some embodiments, a peptide sequence provided in Table 11 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 11 next to the peptide sequence.

Table 11. Peptide Sequences Comprising RAS G12S Mutation, Corresponding HLA Allele, and Rank of Binding Potential

Peptide	Allele	Rank of Binding Potential
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VVVGASGVGK	HLA-A11:01	1
VVGASGVGK	HLA-A11:01	2
VVGASGVGK	HLA-A03:01	3
VVVGASGVGK	HLA-A68:01	4
ASGVGKSAL	HLA-C03:04	5
ASGVGKSAL	HLA-B46:01	5
VVGASGVGK	HLA-A68:01	6
VVVGASGVGK	HLA-A03:01	6
ASGVGKSAL	HLA-C01:02	7
GASGVGKSAL	HLA-B48:01	7
ASGVGKSAL	HLA-C07:01	8
ASGVGKSAL	HLA-C08:02	9
GASGVGKSAL	HLA-B81:01	9
SGVGKSAL	HLA-B08:01	9
ASGVGKSAL	HLA-C03:03	10
ASGVGKSAL	HLA-C03:02	10
SGVGKSAL	HLA-B14:02	10
VVGASGVGK	HLA-A30:01	10
ASGVGKSAL	HLA-C08:01	11
VVVGASGVGK	HLA-A30:01	11
GASGVGKSAL	HLA-B35:03	12
SGVGKSAL	HLA-C07:01	12
ASGVGKSAL	HLA-B81:01	13
GASGVGKSA	HLA-B55:01	13
GASGVGKSAL	HLA-C03:03	13
KLVVVGASGV	HLA-A02:01	13
LVVVGASGV	HLA-A68:02	13
SGVGKSAL	HLA-C01:02	13
ASGVGKSA	HLA-B46:01	14
ASGVGKSAL	HLA-C15:02	14
GASGVGKSAL	HLA-C08:01	15
SGVGKSAL	HLA-C03:04	15
ASGVGKSAL	HLA-C05:01	16
GASGVGKSAL	HLA-C03:04	16
VVGASGVGK	HLA-A74:01	16
ASGVGKSAL	HLA-B48:01	17
GASGVGKSAL	HLA-C01:02	17
SGVGKSAL	HLA-C03:02	17
SGVGKSALTI	HLA-A23:01	17
VGASGVGKSA	HLA-B55:01	18
ASGVGKSAL	HLA-C12:03	19
ASGVGKSAL	HLA-B57:03	19
KLVVVGASGV	HLA-A02:07	19
SGVGKSAL	HLA-B81:01	19
ASGVGKSAL	HLA-C17:01	20
KLVVVGASG	HLA-A32:01	20

[0229] In some embodiments, a peptide comprising a RAS G12V mutation comprises a sequence of MTEYKLVVVGAVGVGKSALTIQL. In some embodiments, a peptide comprising a RAS G12V mutation comprises a sequence provided in Table 12. In some embodiments, a peptide sequence provided in Table 12 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 12 next to the peptide sequence.

Table 12. Peptide Sequences Comprising RAS G12V Mutation, Corresponding HLA Allele, and Rank of Binding Potential

Peptide	Allele	Rank of Binding Potential
VVGAVGVGK	HLA-A03:01	1
VVGAVGVGK	HLA-A11:01	2
VVVGAVGVGK	HLA-A11:01	2
VVVGAVGVGK	HLA-A68:01	3
VVGAVGVGK	HLA-A68:01	4
LVVVGAVGV	HLA-A68:02	5
VVGAVGVGK	HLA-A30:01	5
AVGVGKSAL	HLA-B81:01	6
KLVVVGAVGV	HLA-A02:01	6
AVGVGKSAL	HLA-B46:01	7
GAVGVGKSAL	HLA-C03:03	7
GAVGVGKSAL	HLA-B48:01	7
VVVGAVGVGK	HLA-A03:01	7
AVGVGKSAL	HLA-C03:04	8
GAVGVGKSAL	HLA-C03:04	8
KLVVVGAVGV	HLA-A02:07	9
VGVGKSAL	HLA-B08:01	9
VVVGAVGV	HLA-A68:02	9
AVGVGKSAL	HLA-C08:02	10
AVGVGKSAL	HLA-B07:02	10
GAVGVGKSAL	HLA-B35:03	10
AVGVGKSAL	HLA-C08:01	11
AVGVGKSAL	HLA-C01:02	11
GAVGVGKSA	HLA-B55:01	11
GAVGVGKSAL	HLA-B81:01	11
GAVGVGKSAL	HLA-C08:01	11
KLVVVGAVGV	HLA-B13:02	11
VGVGKSAL	HLA-C03:04	11
AVGVGKSAL	HLA-A32:01	12
GAVGVGKSA	HLA-B46:01	12
VGVGKSAL	HLA-C03:02	12
VGVGKSALTI	HLA-A23:01	12
GAVGVGKSA	HLA-B54:01	13
VGVGKSAL	HLA-C01:02	.3

AVGVGKSAL	HLA-B48:01	14
AVGVGKSAL	HLA-C03:03	14
AVGVGKSAL	HLA-B42:01	14
LVVVGAVGV	HLA-B55:01	14
VGVGKSAL	HLA-C08:01	14
VVGAVGVGK	HLA-A74:01	14
AVGVGKSAL	HLA-C05:01	15
AVGVGKSAL	HLA-C03:02	15
GAVGVGKSA	HLA-C03:04	15
KLVVVGAVGV	HLA-A02:04	15
LVVVGAVGV	HLA-A02:07	15
VGVGKSAL	HLA-B14:02	15
VVVGAVGVGK	HLA-A30:01	15
VVGAVGVGK	HLA-B81:01	16
VVVGAVGV	HLA-B55:01	16
AVGVGKSAL	HLA-C14:03	17
AVGVGKSAL	HLA-B15:01	17
LVVVGAVGV	HLA-B54:01	17
AVGVGKSA	HLA-B55:01	18
AVGVGKSAL	HLA-C17:01	18
GAVGVGKSA	HLA-B50:01	19
GAVGVGKSAL	HLA-C17:01	19
YKLVVVGAV	HLA-A02:04	19
GAVGVGKSAL	HLA-B35:01	20
VVGAVGVGK	HLA-A31:01	20
YKLVVVGAV	HLA-B51:01	20

[0230] In some embodiments, a peptide comprising a RAS G13C mutation comprises a sequence of MTEYKLVVVGAGCVGKSALTIQL. In some embodiments, a peptide comprising a RAS G13C mutation comprises a sequence provided in Table 13. In some embodiments, a peptide sequence provided in Table 13 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 13 next to the peptide sequence.

Table 13. Peptide Sequences Comprising RAS G13C Mutation, Corresponding HLA Allele, and Rank of Binding Potential

Peptide	Allele	Rank of Binding Potential
VVVGAGCVGK	HLA-A11:01	1
VVGAGCVGK	HLA-A11:01	2
AGCVGKSAL	HLA-C01:02	3
VVGAGCVGK	HLA-A03:01	4
VVVGAGCVGK	HLA-A68:01	4
CVGKSALTI	HLA-B13:02	5
VVGAGCVGK	HLA-A68:01	5
VVGAGCVGK	HLA-A30:01	6

AGCVGKSAL	HLA-B48:01	7
AGCVGKSAL	HLA-C03:04	8
GCVGKSALTI	HLA-B49:01	8
AGCVGKSAL	HLA-C08:02	9
VVVGAGCVGK	HLA-A03:01	9
KLVVVGAGC	HLA-A30:02	10
GCVGKSAL	HLA-C07:01	11
VVGAGCVGK	HLA-A74:01	12
AGCVGKSAL	HLA-C14:03	13
KLVVVGAGC	HLA-B15:01	14

[0231] In some embodiments, a peptide comprising a RAS G13D mutation comprises a sequence of MTEYKLVVVGAGDVVGKSALTIQL. In some embodiments, a peptide comprising a RAS G13D mutation comprises a sequence provided in Table 14. In some embodiments, a peptide sequence provided in Table 14 binds to or is predicted to bind to a protein encoded by an HLA allele, which allele is provided in a corresponding column in Table 14 next to the peptide sequence.

Table 14. Peptide Sequences Comprising RAS G13D Mutation, Corresponding HLA Allele, and Rank of Binding Potential

Peptide	Allele	Rank of Binding Potential
AGDVGKSAL	HLA-C08:02	1
AGDVGKSAL	HLA-C05:01	2
VVGAGDVGK	HLA-A11:01	3
VVVGAGDVGK	HLA-A11:01	3
VVVGAGDVGK	HLA-A68:01	4
GAGDVGKSA	HLA-B46:01	5
GAGDVGKSAL	HLA-B48:01	5
VVGAGDVGK	HLA-A68:01	5
VVGAGDVGK	HLA-A03:01	5
AGDVGKSAL	HLA-C03:04	6
AGDVGKSAL	HLA-C04:01	6
AGDVGKSAL	HLA-C01:02	6
DVGKSALTI	HLA-B13:02	6
DVGKSALTI	HLA-A25:01	6
GDVGKSAL	HLA-C07:01	6
GDVGKSAL	HLA-B40:02	7
GDVGKSAL	HLA-B37:01	8
AGDVGKSAL	HLA-B48:01	9
DVGKSALTI	HLA-B51:01	10
VVGAGDVGK	HLA-A30:01	10
GAGDVGKSAL	HLA-C08:01	11
GAGDVGKSAL	HLA-B81:01	11
AGDVGKSAL	HLA-C08:01	12
GAGDVGKSAL	HLA-C03:04	12

DVGKSALTI	HLA-B53:01	13
AGDVGKSAL	HLA-B07:02	14
AGDVGKSAL	HLA-B46:01	14
DVGKSALTI	HLA-A26:01	14
VVGAGDVGK	HLA-A74:01	14
GAGDVGKSA	HLA-B54:01	15
DVGKSALTI	HLA-B38:01	16
GAGDVGKSAL	HLA-C03:03	16
VVGAGDVGK	HLA-A03:01	16

A. Peptide Modification

[0232] In some embodiments, the present disclosure includes modified peptides. A modification can include a covalent chemical modification that does not alter the primary amino acid sequence of the antigenic peptide itself. Modifications can produce peptides with desired properties, for example, prolonging the *in vivo* half-life, increasing the stability, reducing the clearance, altering the immunogenicity or allergenicity, enabling the raising of particular antibodies, cellular targeting, antigen uptake, antigen processing, HLA affinity, HLA stability or antigen presentation. In some embodiments, a peptide may comprise one or more sequences that enhance processing and presentation of epitopes by APCs, for example, for generation of an immune response.

[0233] In some embodiments, the peptide may be modified to provide desired attributes. For instance, the ability of the peptides to induce CTL activity can be enhanced by linkage to a sequence which contains at least one epitope that is capable of inducing a T helper cell response. In some embodiments, immunogenic peptides/T helper conjugates are linked by a spacer molecule. In some embodiments, a spacer comprises relatively small, neutral molecules, such as amino acids or amino acid mimetics, which are substantially uncharged under physiological conditions. Spacers can be selected from, *e.g.*, Ala, Gly, or other neutral spacers of nonpolar amino acids or neutral polar amino acids. It will be understood that the optionally present spacer need not be comprised of the same residues and thus may be a hetero- or homo-oligomer. The neoantigenic peptide may be linked to the T helper peptide either directly or via a spacer either at the amino or carboxy terminus of the peptide. The amino terminus of either the neoantigenic peptide or the T helper peptide may be acylated. Examples of T helper peptides include tetanus toxoid residues 830-843, influenza residues 307-319, and malaria circumsporozoite residues 382-398 and residues 378-389.

[0234] The peptide sequences of the present disclosure may optionally be altered through changes at the DNA level, particularly by mutating the DNA encoding the peptide at preselected bases such that codons are generated that will translate into the desired amino acids.

[0235] In some embodiments, the peptide described herein can contain substitutions to modify a physical property (*e.g.*, stability or solubility) of the resulting peptide. For example, the peptides can be modified by the substitution of a cysteine (C) with α -amino butyric acid (“B”). Due to its chemical nature, cysteine has the propensity to form disulfide bridges and sufficiently alter the peptide structurally so as to

reduce binding capacity. Substituting α -amino butyric acid for C not only alleviates this problem, but actually improves binding and cross-binding capability in certain instances. Substitution of cysteine with α -amino butyric acid can occur at any residue of a neoantigenic peptide, *e.g.*, at either anchor or non-anchor positions of an epitope or analog within a peptide, or at other positions of a peptide.

[0236] The peptide may also be modified by extending or decreasing the compound's amino acid sequence, *e.g.*, by the addition or deletion of amino acids. The peptides or analogs can also be modified by altering the order or composition of certain residues. It will be appreciated by the skilled artisan that certain amino acid residues essential for biological activity, *e.g.*, those at critical contact sites or conserved residues, may generally not be altered without an adverse effect on biological activity. The non-critical amino acids need not be limited to those naturally occurring in proteins, such as L- α -amino acids, or their D-isomers, but may include non-natural amino acids as well, such as β - γ - δ -amino acids, as well as many derivatives of L- α -amino acids.

[0237] In some embodiments, the peptide may be modified using a series of peptides with single amino acid substitutions to determine the effect of electrostatic charge, hydrophobicity, etc. on HLA binding. For instance, a series of positively charged (*e.g.*, Lys or Arg) or negatively charged (*e.g.*, Glu) amino acid substitutions may be made along the length of the peptide revealing different patterns of sensitivity towards various HLA molecules and T cell receptors. In addition, multiple substitutions using small, relatively neutral moieties such as Ala, Gly, Pro, or similar residues may be employed. The substitutions may be homo-oligomers or hetero-oligomers. The number and types of residues which are substituted or added depend on the spacing necessary between essential contact points and certain functional attributes which are sought (*e.g.*, hydrophobicity versus hydrophilicity). Increased binding affinity for an HLA molecule or T cell receptor may also be achieved by such substitutions, compared to the affinity of the parent peptide. In any event, such substitutions should employ amino acid residues or other molecular fragments chosen to avoid, for example, steric and charge interference which might disrupt binding. Amino acid substitutions are typically of single residues. Substitutions, deletions, insertions or any combination thereof may be combined to arrive at a final peptide.

[0238] In some embodiments, the peptide described herein can comprise amino acid mimetics or unnatural amino acid residues, *e.g.* D- or L-naphylalanine; D- or L-phenylglycine; D- or L-2-thienylalanine; D- or L-1-, -2, 3-, or 4-pyrenylalanine; D- or L-3 thienylalanine; D- or L-(2-pyridinyl)-alanine; D- or L-(3-pyridinyl)-alanine; D- or L-(2-pyrazinyl)-alanine; D- or L-(4-isopropyl)-phenylglycine; D-(trifluoromethyl)-phenylglycine; D-(trifluoro-methyl)-phenylalanine; D-*p*-fluorophenylalanine; D- or L-*p*-biphenyl-phenylalanine; D- or L-*p*-methoxybiphenylphenylalanine; D- or L-2-indole(allyl)alanines; and, D- or L-alkylalanines, where the alkyl group can be a substituted or unsubstituted methyl, ethyl, propyl, hexyl, butyl, pentyl, isopropyl, iso-butyl, sec-isotyl, iso-pentyl, or a non-acidic amino acid residues. Aromatic rings of a non-natural amino acid include, *e.g.*, thiazolyl, thiophenyl, pyrazolyl, benzimidazolyl, naphthyl, furanyl, pyrrolyl, and pyridyl aromatic rings. Modified

peptides that have various amino acid mimetics or unnatural amino acid residues may have increased stability *in vivo*. Such peptides may also have improved shelf-life or manufacturing properties.

[0239] In some embodiments, a peptide described herein can be modified by terminal-NH₂ acylation, *e.g.*, by alkanoyl (C₁-C₂₀) or thioglycolyl acylation, terminal-carboxyl amidation, *e.g.*, ammonia, methylamine, etc. In some embodiments these modifications can provide sites for linking to a support or other molecule. In some embodiments, the peptide described herein can contain modifications such as but not limited to glycosylation, side chain oxidation, biotinylation, phosphorylation, addition of a surface active material, *e.g.* a lipid, or can be chemically modified, *e.g.*, acetylation, etc. Moreover, bonds in the peptide can be other than peptide bonds, *e.g.*, covalent bonds, ester or ether bonds, disulfide bonds, hydrogen bonds, ionic bonds, etc.

[0240] In some embodiments, a peptide described herein can comprise carriers such as those well known in the art, *e.g.*, thyroglobulin, albumins such as human serum albumin, tetanus toxoid, polyamino acid residues such as poly L-lysine and poly L-glutamic acid, influenza virus proteins, hepatitis B virus core protein, and the like.

[0241] The peptides can be further modified to contain additional chemical moieties not normally part of a protein. Those derivatized moieties can improve the solubility, the biological half-life, absorption of the protein, or binding affinity. The moieties can also reduce or eliminate any desirable side effects of the peptides and the like. An overview for those moieties can be found in Remington's Pharmaceutical Sciences, 20th ed., Mack Publishing Co., Easton, PA (2000). For example, neoantigenic peptides having the desired activity may be modified as necessary to provide certain desired attributes, *e.g.* improved pharmacological characteristics, while increasing or at least retaining substantially all of the biological activity of the unmodified peptide to bind the desired HLA molecule and activate the appropriate T cell. For instance, the peptide may be subject to various changes, such as substitutions, either conservative or non-conservative, where such changes might provide for certain advantages in their use, such as improved HLA binding. Such conservative substitutions may encompass replacing an amino acid residue with another amino acid residue that is biologically and/or chemically similar, *e.g.*, one hydrophobic residue for another, or one polar residue for another. The effect of single amino acid substitutions may also be probed using D- amino acids. Such modifications may be made using well known peptide synthesis procedures, as described in *e.g.*, Merrifield, *Science* 232:341-347 (1986), Barany & Merrifield, *The Peptides*, Gross & Meienhofer, eds. (N.Y., Academic Press), pp. 1-284 (1979); and Stewart & Young, *Solid Phase Peptide Synthesis*, (Rockford, Ill., Pierce), 2d Ed. (1984).

[0242] In some embodiments, the peptide described herein may be conjugated to large, slowly metabolized macromolecules such as proteins; polysaccharides, such as sepharose, agarose, cellulose, cellulose beads; polymeric amino acids such as polyglutamic acid, polylysine; amino acid copolymers; inactivated virus particles; inactivated bacterial toxins such as toxoid from diphtheria, tetanus, cholera, leukotoxin molecules; inactivated bacteria; and dendritic cells.

[0243] Changes to the peptide that may include, but are not limited to, conjugation to a carrier protein, conjugation to a ligand, conjugation to an antibody, PEGylation, polysialylation HESylation, recombinant PEG mimetics, Fc fusion, albumin fusion, nanoparticle attachment, nanoparticulate encapsulation, cholesterol fusion, iron fusion, acylation, amidation, glycosylation, side chain oxidation, phosphorylation, biotinylation, the addition of a surface active material, the addition of amino acid mimetics, or the addition of unnatural amino acids.

[0244] Glycosylation can affect the physical properties of proteins and can also be important in protein stability, secretion, and subcellular localization. Proper glycosylation can be important for biological activity. In fact, some genes from eukaryotic organisms, when expressed in bacteria (*e.g.*, *E. coli*) which lack cellular processes for glycosylating proteins, yield proteins that are recovered with little or no activity by virtue of their lack of glycosylation. Addition of glycosylation sites can be accomplished by altering the amino acid sequence. The alteration to the peptide or protein may be made, for example, by the addition of, or substitution by, one or more serine or threonine residues (for *O*-linked glycosylation sites) or asparagine residues (for *N*-linked glycosylation sites). The structures of *N*-linked and *O*-linked oligosaccharides and the sugar residues found in each type may be different. One type of sugar that is commonly found on both is *N*-acetylneuraminic acid (hereafter referred to as sialic acid). Sialic acid is usually the terminal residue of both *N*-linked and *O*-linked oligosaccharides and, by virtue of its negative charge, may confer acidic properties to the glycoprotein. Embodiments of the present disclosure comprise the generation and use of *N*-glycosylation variants. Removal of carbohydrates may be accomplished chemically or enzymatically, or by substitution of codons encoding amino acid residues that are glycosylated. Chemical deglycosylation techniques are known, and enzymatic cleavage of carbohydrate moieties on polypeptides can be achieved by the use of a variety of endo- and exo-glycosidases.

[0245] Additional suitable components and molecules for conjugation include, for example, molecules for targeting to the lymphatic system, thyroglobulin; albumins such as human serum albumin (HAS); tetanus toxoid; Diphtheria toxoid; polyamino acids such as poly(D-lysine:D-glutamic acid); VP6 polypeptides of rotaviruses; influenza virus hemagglutinin, influenza virus nucleoprotein; Keyhole Limpet Hemocyanin (KLH); and hepatitis B virus core protein and surface antigen; or any combination of the foregoing.

[0246] Another type of modification is to conjugate (*e.g.*, link) one or more additional components or molecules at the N- and/or C-terminus of a polypeptide sequence, such as another protein (*e.g.*, a protein having an amino acid sequence heterologous to the subject protein), or a carrier molecule. Thus, an exemplary polypeptide sequence can be provided as a conjugate with another component or molecule. In some embodiments, fusion of albumin to the peptide or protein of the present disclosure can, for example, be achieved by genetic manipulation, such that the DNA coding for HSA, or a fragment thereof, is joined to the DNA coding for the one or more polypeptide sequences. Thereafter, a suitable host can be transformed or transfected with the fused nucleotide sequences in the form of, for example, a suitable plasmid, so as to express a fusion polypeptide. The expression may be effected *in vitro* from, for example,

prokaryotic or eukaryotic cells, or *in vivo* from, for example, a transgenic organism. In some embodiments of the present disclosure, the expression of the fusion protein is performed in mammalian cell lines, for example, CHO cell lines. Furthermore, albumin itself may be modified to extend its circulating half-life. Fusion of the modified albumin to one or more polypeptides can be attained by the genetic manipulation techniques described above or by chemical conjugation; the resulting fusion molecule has a half-life that exceeds that of fusions with non-modified albumin (see, *e.g.*, WO2011/051489). Several albumin-binding strategies have been developed as alternatives for direct fusion, including albumin binding through a conjugated fatty acid chain (acylation). Because serum albumin is a transport protein for fatty acids, these natural ligands with albumin-binding activity have been used for half-life extension of small protein therapeutics.

[0247] Additional candidate components and molecules for conjugation include those suitable for isolation or purification. Non-limiting examples include binding molecules, such as biotin (biotin-avidin specific binding pair), an antibody, a receptor, a ligand, a lectin, or molecules that comprise a solid support, including, for example, plastic or polystyrene beads, plates or beads, magnetic beads, test strips, and membranes. Purification methods such as cation exchange chromatography may be used to separate conjugates by charge difference, which effectively separates conjugates into their various molecular weights. The content of the fractions obtained by cation exchange chromatography may be identified by molecular weight using conventional methods, for example, mass spectroscopy, SDS-PAGE, or other known methods for separating molecular entities by molecular weight.

[0248] In some embodiments, the amino- or carboxyl- terminus of the peptide or protein sequence of the present disclosure can be fused with an immunoglobulin Fc region (*e.g.*, human Fc) to form a fusion conjugate (or fusion molecule). Fc fusion conjugates have been shown to increase the systemic half-life of biopharmaceuticals, and thus the biopharmaceutical product may require less frequent administration. Fc binds to the neonatal Fc receptor (FcRn) in endothelial cells that line the blood vessels, and, upon binding, the Fc fusion molecule is protected from degradation and re-released into the circulation, keeping the molecule in circulation longer. This Fc binding is believed to be the mechanism by which endogenous IgG retains its long plasma half-life. More recent Fc-fusion technology links a single copy of a biopharmaceutical to the Fc region of an antibody to optimize the pharmacokinetic and pharmacodynamics properties of the biopharmaceutical as compared to traditional Fc-fusion conjugates.

[0249] The present disclosure contemplates the use of other modifications, currently known or developed in the future, of the peptides to improve one or more properties. One such method for prolonging the circulation half-life, increasing the stability, reducing the clearance, or altering the immunogenicity or allergenicity of the peptide of the present disclosure involves modification of the peptide sequences by hesylation, which utilizes hydroxyethyl starch derivatives linked to other molecules in order to modify the molecule's characteristics. Various aspects of hesylation are described in, for example, U.S. Patent Appln. Nos. 2007/0134197 and 2006/0258607.

[0250] Peptide stability can be assayed in a number of ways. For instance, peptidases and various biological media, such as human plasma and serum, have been used to test stability. See, *e.g.*, Verhoef, et al., *Eur. J. Drug Metab. Pharmacokinetics* 11:291 (1986). Half-life of the peptides described herein is conveniently determined using a 25% human serum (v/v) assay. The protocol is as follows: pooled human serum (Type AB, non-heat inactivated) is dilapidated by centrifugation before use. The serum is then diluted to 25% with RPMI-1640 or another suitable tissue culture medium. At predetermined time intervals, a small amount of reaction solution is removed and added to either 6% aqueous trichloroacetic acid (TCA) or ethanol. The cloudy reaction sample is cooled (4 °C) for 15 minutes and then spun to pellet the precipitated serum proteins. The presence of the peptides is then determined by reversed-phase HPLC using stability-specific chromatography conditions.

[0251] Issues associated with short plasma half- life or susceptibility to protease degradation may be overcome by various modifications, including conjugating or linking the peptide or protein sequence to any of a variety of non-proteinaceous polymers, *e.g.*, polyethylene glycol (PEG), polypropylene glycol, or polyoxyalkylenes (see, for example, typically via a linking moiety covalently bound to both the protein and the nonproteinaceous polymer, *e.g.*, a PEG). Such PEG conjugated biomolecules have been shown to possess clinically useful properties, including better physical and thermal stability, protection against susceptibility to enzymatic degradation, increased solubility, longer *in vivo* circulating half-life and decreased clearance, reduced immunogenicity and antigenicity, and reduced toxicity.

[0252] PEGs suitable for conjugation to a polypeptide or protein sequence are generally soluble in water at room temperature, and have the general formula $R-(O-CH_2-CH_2)_n-O-R$, where R is hydrogen or a protective group such as an alkyl or an alkanol group, and where n is an integer from 1 to 1000. When R is a protective group, it generally has from 1 to 8 carbons. The PEG conjugated to the polypeptide sequence can be linear or branched. Branched PEG derivatives, “star-PEGs” and multi-armed PEGs are contemplated by the present disclosure. The present disclosure also contemplates compositions of conjugates wherein the PEGs have different n values and thus the various different PEGs are present in specific ratios. For example, some compositions comprise a mixture of conjugates where n = 1, 2, 3 and 4. In some compositions, the percentage of conjugates where n=1 is 18-25%, the percentage of conjugates where n = 2 is 50-66%, the percentage of conjugates where n=3 is 12-16%, and the percentage of conjugates where n = 4 is up to 5%. Such compositions can be produced by reaction conditions and purification methods known in the art. For example, cation exchange chromatography may be used to separate conjugates, and a fraction is then identified which contains the conjugate having, for example, the desired number of PEGs attached, purified free from unmodified protein sequences and from conjugates having other numbers of PEGs attached.

[0253] PEG may be bound to the peptide or protein of the present disclosure via a terminal reactive group (a “spacer”). The spacer is, for example, a terminal reactive group which mediates a bond between the free amino or carboxyl groups of one or more of the polypeptide sequences and PEG. The PEG having the spacer which may be bound to the free amino group includes N-hydroxysuccinylimide PEG

which may be prepared by activating succinic acid ester of PEG with N-hydroxysuccinylimide. Another activated PEG which may be bound to a free amino group is 2,4-bis(O-methoxypolyethyleneglycol)-6-chloro-s-triazine which may be prepared by reacting PEG monomethyl ether with cyanuric chloride. The activated PEG which is bound to the free carboxyl group includes polyoxyethylenediamine.

[0254] Conjugation of one or more of the peptide or protein sequences of the present disclosure to PEG having a spacer may be carried out by various conventional methods. For example, the conjugation reaction can be carried out in solution at a pH of from 5 to 10, at temperature from 4°C to room temperature, for 30 minutes to 20 hours, utilizing a molar ratio of reagent to peptide/protein of from 4: 1 to 30: 1. Reaction conditions may be selected to direct the reaction towards producing predominantly a desired degree of substitution. In general, low temperature, low pH (*e.g.*, pH=5), and short reaction time tend to decrease the number of PEGs attached, whereas high temperature, neutral to high pH (*e.g.*, pH>7), and longer reaction time tend to increase the number of PEGs attached. Various means known in the art may be used to terminate the reaction. In some embodiments the reaction is terminated by acidifying the reaction mixture and freezing at, *e.g.*, -20°C.

[0255] The present disclosure also contemplates the use of PEG mimetics. Recombinant PEG mimetics have been developed that retain the attributes of PEG (*e.g.*, enhanced serum half- life) while conferring several additional advantageous properties. By way of example, simple polypeptide chains (comprising, for example, Ala, Glu, Gly, Pro, Ser and Thr) capable of forming an extended conformation similar to PEG can be produced recombinantly already fused to the peptide or protein drug of interest (*e.g.*, Amunix XTEN technology; Mountain View, CA). This obviates the need for an additional conjugation step during the manufacturing process. Moreover, established molecular biology techniques enable control of the side chain composition of the polypeptide chains, allowing optimization of immunogenicity and manufacturing properties.

B. Neoepitopes

[0256] A neoepitope comprises a neoantigenic determinant part of a neoantigenic peptide or neoantigenic polypeptide that is recognized by immune system. A neoepitope refers to an epitope that is not present in a reference, such as a non-diseased cell, *e.g.*, a non-cancerous cell or a germline cell, but is found in a diseased cell, *e.g.*, a cancer cell. This includes situations where a corresponding epitope is found in a normal non-diseased cell or a germline cell but, due to one or more mutations in a diseased cell, *e.g.*, a cancer cell, the sequence of the epitope is changed so as to result in the neoepitope. The term “neoepitope” is used interchangeably with “tumor specific neoepitope” in the present specification to designate a series of residues, typically L-amino acids, connected one to the other, typically by peptide bonds between the α -amino and carboxyl groups of adjacent amino acids. The neoepitope can be a variety of lengths, either in their neutral (uncharged) forms or in forms which are salts, and either free of modifications such as glycosylation, side chain oxidation, or phosphorylation or containing these modifications, subject to the condition that the modification not destroy the biological activity of the

polypeptides as herein described. The present disclosure provides isolated neoepitopes that comprise a tumor specific mutation from **Tables 1 to 14**.

[0257] In some embodiments, neoepitopes described herein for HLA Class I are 13 residues or less in length and usually consist of between about 8 and about 12 residues, particularly 9 or 10 residues. In some embodiments, neoepitopes described herein for HLA Class II are 25 residues or less in length and usually consist of between about 16 and about 25 residues.

[0258] In some embodiments, the composition described herein comprises a first peptide comprising a first neoepitope of a protein and a second peptide comprising a second neoepitope of the same protein, wherein the first peptide is different from the second peptide, and wherein the first neoepitope comprises a mutation and the second neoepitope comprises the same mutation. In some embodiments, the composition described herein comprises a first peptide comprising a first neoepitope of a first region of a protein and a second peptide comprising a second neoepitope of a second region of the same protein, wherein the first region comprises at least one amino acid of the second region, wherein the first peptide is different from the second peptide and wherein the first neoepitope comprises a first mutation and the second neoepitope comprises a second mutation. In some embodiments, the first mutation and the second mutation are the same. In some embodiments, the mutation is selected from the group consisting of a point mutation, a splice-site mutation, a frameshift mutation, a read-through mutation, a gene fusion mutation and any combination thereof.

[0259] In some embodiments, the first neoepitope binds to a class I HLA protein to form a class I HLA-peptide complex. In some embodiments, the second neoepitope binds to a class II HLA a protein to form a class II HLA-peptide complex. In some embodiments, the second neoepitope binds to a class I HLA protein to form a class I HLA-peptide complex. In some embodiments, the first neoepitope binds to a class II HLA protein to form a class II HLA-peptide complex. In some embodiments, the first neoepitope activates CD8⁺ T cells. In some embodiments, the first neoepitope activates CD4⁺ T cells. In some embodiments, the second neoepitope activates CD4⁺ T cells. In some embodiments, the second neoepitope activates CD8⁺ T cells. In some embodiments, a TCR of a CD4⁺ T cell binds to a class II HLA-peptide complex. In some embodiments, a TCR of a CD8⁺ T cell binds to a class II HLA-peptide complex. In some embodiments, a TCR of a CD8⁺ T cell binds to a class I HLA-peptide complex. In some embodiments, a TCR of a CD4⁺ T cell binds to a class I HLA-peptide complex.

[0260] In some embodiments, the second neoepitope is longer than the first neoepitope. In some embodiments, the first neoepitope has a length of at least 8 amino acids. In some embodiments, the first neoepitope has a length of from 8 to 12 amino acids. In some embodiments, the first neoepitope comprises a sequence of at least 8 contiguous amino acids, wherein at least 1 of the 8 contiguous amino acids are different at corresponding positions of a wild-type sequence. In some embodiments, the first neoepitope comprises a sequence of at least 8 contiguous amino acids, wherein at least 2 of the 8 contiguous amino acids are different at corresponding positions of a wild-type sequence. In some embodiments, the second neoepitope has a length of at least 16 amino acids. In some embodiments, the

second neoepitope has a length of from 16 to 25 amino acids. In some embodiments, the second neoepitope comprises a sequence of at least 16 contiguous amino acids, wherein at least 1 of the 16 contiguous amino acids are different at corresponding positions of a wild-type sequence. In some embodiments, the second neoepitope comprises a sequence of at least 16 contiguous amino acids, wherein at least 2 of the 16 contiguous amino acids are different at corresponding positions of a wild-type sequence.

[0261] In some embodiments, the neoepitope comprises at least one anchor residue. In some embodiments, the first neoepitope, the second neoepitope or both comprises at least one anchor residue. In one embodiment, the at least one anchor residue of the first neoepitope is at a canonical anchor position or a non-canonical anchor position. In another embodiment, the at least one anchor residue of the second neoepitope is at a canonical anchor position or a non-canonical anchor position. In yet another embodiment, the at least one anchor residue of the first neoepitope is different from the at least one anchor residue of the second neoepitope.

[0262] In some embodiments, the at least one anchor residue is a wild-type residue. In some embodiments, the at least one anchor residue is a substitution. In some embodiments, at least one anchor residue does not comprise the mutation.

[0263] In some embodiments, the second neoepitope or both comprise at least one anchor residue flanking region. In some embodiments, the neoepitope comprises at least one anchor residue. In some embodiments, the at least one anchor residues comprises at least two anchor residues. In some embodiments, the at least two anchor residues are separated by a separation region comprising at least 1 amino acid. In some embodiments, the at least one anchor residue flanking region is not within the separation region. In some embodiments, the at least one anchor residue flanking region is (a) upstream of a N-terminal anchor residue of the at least two anchor residues; (b) downstream of a C-terminal anchor residue of the at least two anchor residues; or both (a) and (b).

[0264] In some embodiments, the neoepitopes bind an HLA protein (*e.g.*, HLA class I or HLA class II). In some embodiments, the neoepitopes bind an HLA protein with greater affinity than the corresponding wild-type peptide. In some embodiments, the neoepitope has an IC₅₀ of less than 5,000 nM, less than 1,000 nM, less than 500 nM, less than 100 nM, less than 50 nM, or less.

[0265] In some embodiments, the neoepitope can have an HLA binding affinity of between about 1pM and about 1 mM, about 100 pM and about 500 μM, about 500 pM and about 10 μM, about 1 nM and about 1 μM, or about 10 nM and about 1 μM. In some embodiments, the neoepitope can have an HLA binding affinity of at least 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 700, 800, 900, or 1,000 nM, or more. In some embodiments, the neoepitope can have an HLA binding affinity of at most 2, 3, 4, 5, 6, 7, 8, 9, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65, 70, 75, 80, 85, 90, 95, 100, 150, 200, 250, 300, 350, 400, 450, 500, 550, 600, 700, 800, 900, or 1,000 nM.

[0266] In some embodiments, the first and/or second neoepitope binds to an HLA protein with a greater affinity than a corresponding wild-type neoepitope. In some embodiments, the first and/or second neoepitope binds to an HLA protein with a K_D or an IC_{50} less than 1,000 nM, 900 nM, 800 nM, 700 nM, 600 nM, 500 nM, 250 nM, 150 nM, 100 nM, 50 nM, 25 nM or 10 nM. In some embodiments, the first and/or second neoepitope binds to an HLA class I protein with a K_D or an IC_{50} less than 1,000 nM, 900 nM, 800 nM, 700 nM, 600 nM, 500 nM, 250 nM, 150 nM, 100 nM, 50 nM, 25 nM or 10 nM. In some embodiments, the first and/or second neoepitope binds to an HLA class II protein with a K_D or an IC_{50} less than 2,000 nM, 1,500 nM, 1,000 nM, 900 nM, 800 nM, 700 nM, 600 nM, 500 nM, 250 nM, 150 nM, 100 nM, 50 nM, 25 nM or 10 nM.

[0267] In an aspect, the first and/or second neoepitope binds to a protein encoded by an HLA allele expressed by a subject. In another aspect, the mutation is not present in non-cancer cells of a subject. In yet another aspect, the first and/or second neoepitope is encoded by a gene or an expressed gene of a subject's cancer cells.

[0268] In some embodiments, the first neoepitope comprises a mutation as depicted in column 2 of **Table 1 or 2** or column 1 of **Tables 3 to 14**. In some embodiments, the second neoepitope comprises a mutation as depicted in column 2 of **Table 1 or 2** or column 1 of **Tables 3 to 14**. In some embodiments, the first neoepitope and the second neoepitope is derived from a TMPRSS2:ERG fusion protein. In some embodiments, the first neoepitope and the second neoepitope is derived from a TMPRSS2:ERG fusion protein comprising a sequence of S::E from the sequence MALNS::EALSVSEDQSLFECAYGTPHLAKTEMTASSSSDYGQTSKMSRPVQQDWALNSEALS V. For example, the first neoepitope and the second neoepitope can comprise a sequence ALNSEALSVV. For example, the first neoepitope and the second neoepitope can comprise a sequence MALNSEALSV.

[0269] In some embodiments, the first neoepitope and the second neoepitope is derived from a KRAS protein. In some embodiments, the first neoepitope and the second neoepitope is derived from a NRAS protein. In some embodiments, the first neoepitope and the second neoepitope is derived from a KRAS protein comprising a mutation of G12C, G12D, G12V, Q61H or Q61L substitution. In some embodiments, the first neoepitope and the second neoepitope is derived from a NRAS protein comprising a mutation of Q61K or Q61R substitution. In some embodiments, the neoepitope comprises a substitution mutation, *e.g.*, the KRAS G12C, G12D, G12V, Q61H or Q61L mutation, or the NRAS Q61K or Q61R mutation. In some embodiments, the first neoepitope and the second neoepitope is derived from a KRAS or NRAS protein sequence of

MTEYKLVVVGACGVGKSALTIQLIQNHFVDEYDPTIEDSYRKQVVIDGETCLLDILDITAGQE. For example, the first neoepitope and the second neoepitope can comprise a sequence KLVVVGACGV. For example, the first neoepitope and the second neoepitope can comprise a sequence LVVVGACGV. For example, the first neoepitope and the second neoepitope can comprise a sequence VVGACGVGK. For example, the first neoepitope and the second neoepitope can comprise a sequence VVVGACGVGK. In some embodiments, the first neoepitope and the second neoepitope is derived from a KRAS or NRAS

protein sequence of

MTEYKLVVVGADGVGKSALTIQLIQNHFVDEYDPTIEDSYRKQVVIDGETCLLDILDTAGQEVV
GADGVGK. For example, the first neoepitope and the second neoepitope can comprise a sequence
VVVGADGVGK. For example, the first neoepitope and the second neoepitope can comprise a
sequence KLVVVGADGV. For example, the first neoepitope and the second neoepitope can
comprise a sequence LVVVGADGV.

[0270] In some embodiments, the first neoepitope and the second neoepitope is derived from a KRAS
or NRAS protein sequence of

MTEYKLVVVGAVGVGKSALTIQLIQNHFVDEYDPTIEDSYRKQVVIDGETCLLDILDTAGQE. For
example, the first neoepitope and the second neoepitope can comprise a sequence KLVVVGAVGV. For
example, the first neoepitope and the second neoepitope can comprise a sequence LVVVGAVGV. For
example, the first neoepitope and the second neoepitope can comprise a sequence VVGAVGVGK. For
example, the first neoepitope and the second neoepitope can comprise a sequence VVVGAVGVGK.

[0271] In some embodiments, the first neoepitope and the second neoepitope is derived from a KRAS
or NRAS protein sequence of

AGGVGKSALTIQLIQNHFVDEYDPTIEDSYRKQVVIDGETCLLDILDTAGHEEYSAMRDQYMRT
GEGFLCVFAINNTKSFEDIHHYREQIKRVKDSDEVPM. For example, the first neoepitope and
the second neoepitope can comprise a sequence ILDTAGHEEY.

[0272] In some embodiments, the first neoepitope and the second neoepitope is derived from a KRAS
or NRAS protein sequence of

AGGVGKSALTIQLIQNHFVDEYDPTIEDSYRKQVVIDGETCLLDILDTAGLEEYSAMRDQYMRTG
EGFLCVFAINNTKSFEDIHHYREQIKRVKDSDEVPM. For example, the first neoepitope and
the second neoepitope can comprise a sequence ILDTAGLEEY. For example, the first neoepitope and
the second neoepitope can comprise a sequence LLDILDTAGL.

[0273] In some embodiments, the first neoepitope and the second neoepitope is derived from a KRAS
or NRAS protein sequence of

AGGVGKSALTIQLIQNHFVDEYDPTIEDSYRKQVVIDGETCLLDILDTAGKEEYSAMRDQYMRT
GEGFLCVFAINNSKSFADINLYREQIKRVKDSDDVPM. For example, the first neoepitope and
the second neoepitope can comprise a sequence ILDTAGKEEY.

[0274] In some embodiments, the first neoepitope and the second neoepitope is derived from a KRAS
or NRAS protein sequence of

AGGVGKSALTIQLIQNHFVDEYDPTIEDSYRKQVVIDGETCLLDILDTAGREEYSAMRDQYMRT
GEGFLCVFAINNSKSFADINLYREQIKRVKDSDDVPM. For example, the first neoepitope and
the second neoepitope can comprise a sequence ILDTAGREEY.

[0275] In some embodiments, the neoepitope comprises a sequence selected from a group consisting
of: DTAGHEEY, TAGHEEYSAM, DILDTAGHE, DILDTAGH, ILDTAGHEE, ILDTAGHE,
DILDTAGHEEY, DTAGHEEYS, LLDILDTAGH, DILDTAGRE, DILDTAGR, ILDTAGREE,

ILDTAGRE, CLLDILDTAGR, TAGREEYSAM, REEYSAMRD, DTAGKEEYSAM, CLLDILDTAGK, DTAGKEEY, LLDILDTAGK, ILDTAGKE, ILDTAGKEE, DTAGLEEY, ILDTAGLE, DILDTAGL, ILDTAGLEE, GLEEYSAMRDQY, LLDILDTAGLE, LDILDTAGL, DILDTAGLE, DILDTAGLEEY, AGVVGKSAL, GAAGVVGKSAL, AAGVVGKSAL, CGVVGKSAL, ACGVVGKSAL, DGVVGKSAL, ADGVVGKSAL, DGVVGKSALTI, GARGVVGKSA, KLVVVGARGV, VVVGARGV, SGVVGKSAL, VVVGASGVGK, GASGVVGKSAL, VGVVGKSAL, VVVGAGCVGK, KLVVVGAGC, GDVVGKSAL, DVGKSALTI, VVVGAGDVGK, TAGKEEYSAM, DTAGHEEYSAM, TAGHEEYSA, DTAGREEYSAM, TAGKEEYSA, AAGVVGKSA, AGCVVGKSAL, AGDVGKSAL, AGKEEYSAMR, AGVVGKSALTI, ARGVVGKSAL, ASGVVGKSA, ASGVVGKSAL, AVGVVGKSA, CVGKSALTI, DILDTAGK, DILDTAGREEY, DTAGHEEYSAMR, DTAGKEEYS, DTAGKEEYSAMR, DTAGLEEYS, DTAGLEEYSA, DTAGLEEYSAMR, DTAGREEYS, DTAGREEYSAMR, GAAGVVGKSA, GACGVVGKSA, GACGVVGKSAL, GADGVGKS, GAGDVGKSA, GAGDVGKSAL, GASGVVGKSA, GCVVGKSAL, GCVVGKSALTI, GHEEYSAM, GKEEYSAM, GLEEYSAMR, GREEYSAM, GREEYSAMR, HEEYSAMRD, KEEYSAMRD, KLVVVGASG, LDILDTAGR, LEEYSAMRD, LVVVGARGV, LVVVGASGV, REEYSAMRDQY, RGVVGKSAL, TAGLEEYSA, TEYKLVVVGAA, VGAAGVVGKSA, VGADGVGK, VGASGVVGKSA, VGVVGKSALTI, VVVGAAAGV, VVVGAVGV, YKLVVVGAC, YKLVVVGAD, YKLVVVGAR, and DILDTAGKE.

[0276] The substitution may be positioned anywhere along the length of the neopeptide. For example, it can be located in the N terminal third of the peptide, the central third of the peptide or the C terminal third of the peptide. In another embodiment, the substituted residue is located 2-5 residues away from the N terminal end or 2-5 residues away from the C terminal end. The peptides can be similarly derived from tumor specific insertion mutations where the peptide comprises one or more, or all of the inserted residues.

[0277] In some embodiments, the peptide as described herein can be readily synthesized chemically utilizing reagents that are free of contaminating bacterial or animal substances (Merrifield RB: Solid phase peptide synthesis. I. The synthesis of a tetrapeptide. J. Am. Chem. Soc.85:2149-54, 1963). In some embodiments, peptides are prepared by (1) parallel solid-phase synthesis on multi-channel instruments using uniform synthesis and cleavage conditions; (2) purification over a RP-HPLC column with column stripping; and re-washing, but not replacement, between peptides; followed by (3) analysis with a limited set of the most informative assays. The Good Manufacturing Practices (GMP) footprint can be defined around the set of peptides for an individual patient, thus requiring suite changeover procedures only between syntheses of peptides for different patients.

C. Polynucleotides

[0278] Alternatively, a nucleic acid (*e.g.*, a polynucleotide) encoding the peptide of the present disclosure may be used to produce the neoantigenic peptide *in vitro*. The polynucleotide may be, *e.g.*, DNA, cDNA, PNA, CNA, RNA, either single- and/or double-stranded, or native or stabilized forms of polynucleotides, such as *e.g.* polynucleotides with a phosphorothiate backbone, or combinations thereof

and it may or may not contain introns so long as it codes for the peptide. In some embodiments *in vitro* translation is used to produce the peptide.

[0279] Provided herein are neoantigenic polynucleotides encoding each of the neoantigenic peptides described in the present disclosure. The term “polynucleotide”, “nucleotides” or “nucleic acid” is used interchangeably with “mutant polynucleotide”, “mutant nucleotide”, “mutant nucleic acid”, “neoantigenic polynucleotide”, “neoantigenic nucleotide” or “neoantigenic mutant nucleic acid” in the present disclosure. Various nucleic acid sequences can encode the same peptide due to the redundancy of the genetic code. Each of these nucleic acids falls within the scope of the present disclosure. Nucleic acids encoding peptides can be DNA or RNA, for example, mRNA, or a combination of DNA and RNA. In some embodiments, a nucleic acid encoding a peptide is a self-amplifying mRNA (Brito et al., *Adv. Genet.* 2015; 89:179-233). Any suitable polynucleotide that encodes a peptide described herein falls within the scope of the present disclosure.

[0280] The term “RNA” includes and in some embodiments relates to “mRNA.” The term “mRNA” means “messenger-RNA” and relates to a “transcript” which is generated by using a DNA template and encodes a peptide or polypeptide. Typically, an mRNA comprises a 5'-UTR, a protein coding region, and a 3'-UTR. mRNA only possesses limited half-life in cells and *in vitro*. In some embodiments, the mRNA is self-amplifying mRNA. In the context of the present disclosure, mRNA may be generated by *in vitro* transcription from a DNA template. The *in vitro* transcription methodology is known to the skilled person. For example, there is a variety of *in vitro* transcription kits commercially available.

[0281] The stability and translation efficiency of RNA may be modified as required. For example, RNA may be stabilized and its translation increased by one or more modifications having a stabilizing effects and/or increasing translation efficiency of RNA. Such modifications are described, for example, in PCT/EP2006/009448, incorporated herein by reference. In order to increase expression of the RNA used according to the present disclosure, it may be modified within the coding region, *i.e.*, the sequence encoding the expressed peptide or protein, without altering the sequence of the expressed peptide or protein, so as to increase the GC-content to increase mRNA stability and to perform a codon optimization and, thus, enhance translation in cells.

[0282] The term “modification” in the context of the RNA used in the present disclosure includes any modification of an RNA which is not naturally present in said RNA. In some embodiments, the RNA does not have uncapped 5'-triphosphates. Removal of such uncapped 5'-triphosphates can be achieved by treating RNA with a phosphatase. In other embodiments, the RNA may have modified ribonucleotides in order to increase its stability and/or decrease cytotoxicity. In some embodiments, 5-methylcytidine can be substituted partially or completely in the RNA, for example, for cytidine. Alternatively, pseudouridine is substituted partially or completely, for example, for uridine.

[0283] In some embodiments, the term “modification” relates to providing an RNA with a 5'-cap or 5'-cap analog. The term “5'-cap” refers to a cap structure found on the 5'-end of an mRNA molecule and generally consists of a guanosine nucleotide connected to the mRNA via an unusual 5' to 5' triphosphate

linkage. In some embodiments, this guanosine is methylated at the 7-position. The term “conventional 5’-cap” refers to a naturally occurring RNA 5’-cap, to the 7-methylguanosine cap (m⁷G). In the context of the present disclosure, the term “5’-cap” includes a 5’-cap analog that resembles the RNA cap structure and is modified to possess the ability to stabilize RNA and/or enhance translation of RNA if attached thereto, *in vivo* and/or in a cell.

[0284] In certain embodiments, an mRNA encoding a neoantigenic peptide of the present disclosure is administered to a subject in need thereof. In some embodiments, the present disclosure provides RNA, oligoribonucleotide, and polyribonucleotide molecules comprising a modified nucleoside, gene therapy vectors comprising same, gene therapy methods and gene transcription silencing methods comprising same. In some embodiments, the mRNA to be administered comprises at least one modified nucleoside.

[0285] The polynucleotides encoding peptides described herein can be synthesized by chemical techniques, for example, the phosphotriester method of Matteucci, et al., *J. Am. Chem. Soc.* 103:3185 (1981). Polynucleotides encoding peptides comprising or consisting of an analog can be made simply by substituting the appropriate and desired nucleic acid base(s) for those that encode the native epitope.

[0286] Polynucleotides described herein can comprise one or more synthetic or naturally-occurring introns in the transcribed region. The inclusion of mRNA stabilization sequences and sequences for replication in mammalian cells can also be considered for increasing polynucleotide expression. In addition, a polynucleotide described herein can comprise immunostimulatory sequences (ISSs or CpGs). These sequences can be included in the vector, outside the polynucleotide coding sequence to enhance immunogenicity.

[0287] In some embodiments, the polynucleotides may comprise the coding sequence for the peptide or protein fused in the same reading frame to a polynucleotide which aids, for example, in expression and/or secretion of the peptide or protein from a host cell (*e.g.*, a leader sequence which functions as a secretory sequence for controlling transport of a polypeptide from the cell). The polypeptide having a leader sequence is a pre-protein and can have the leader sequence cleaved by the host cell to form the mature form of the polypeptide.

[0288] In some embodiments, the polynucleotides can comprise the coding sequence for the peptide or protein fused in the same reading frame to a marker sequence that allows, for example, for purification of the encoded peptide, which may then be incorporated into a personalized disease vaccine or immunogenic composition. For example, the marker sequence can be a hexa-histidine tag supplied by a pQE-9 vector to provide for purification of the mature polypeptide fused to the marker in the case of a bacterial host, or the marker sequence can be a hemagglutinin (HA) tag derived from the influenza hemagglutinin protein when a mammalian host (*e.g.*, COS-7 cells) is used. Additional tags include, but are not limited to, Calmodulin tags, FLAG tags, Myc tags, S tags, SBP tags, Softag 1, Softag 3, V5 tag, Xpress tag, Isopeptag, SpyTag, Biotin Carboxyl Carrier Protein (BCCP) tags, GST tags, fluorescent protein tags (*e.g.*, green fluorescent protein tags), maltose binding protein tags, Nus tags, Strep-tag, thioredoxin tag, TC tag, Ty tag, and the like.

[0289] In some embodiments, the polynucleotides may comprise the coding sequence for one or more the presently described peptides or proteins fused in the same reading frame to create a single concatamerized neoantigenic peptide construct capable of producing multiple neoantigenic peptides.

[0290] In some embodiments, a DNA sequence is constructed using recombinant technology by isolating or synthesizing a DNA sequence encoding a wild-type protein of interest. Optionally, the sequence can be mutagenized by site-specific mutagenesis to provide functional analogs thereof. See, *e.g.* Zoeller et al., Proc. Nat'l. Acad. Sci. USA 81:5662-5066 (1984) and U.S. Pat. No.4,588,585. In another embodiment, a DNA sequence encoding the peptide or protein of interest would be constructed by chemical synthesis using an oligonucleotide synthesizer. Such oligonucleotides can be designed based on the amino acid sequence of the desired peptide and selecting those codons that are favored in the host cell in which the recombinant polypeptide of interest is produced. Standard methods can be applied to synthesize an isolated polynucleotide sequence encoding an isolated polypeptide of interest. For example, a complete amino acid sequence can be used to construct a back-translated gene. Further, a DNA oligomer containing a nucleotide sequence coding for the particular isolated polypeptide can be synthesized. For example, several small oligonucleotides coding for portions of the desired polypeptide can be synthesized and then ligated. The individual oligonucleotides typically contain 5' or 3' overhangs for complementary assembly

[0291] Once assembled (*e.g.*, by synthesis, site-directed mutagenesis, or another method), the polynucleotide sequences encoding a particular isolated polypeptide of interest is inserted into an expression vector and optionally operatively linked to an expression control sequence appropriate for expression of the protein in a desired host. Proper assembly can be confirmed by nucleotide sequencing, restriction mapping, and expression of a biologically active polypeptide in a suitable host. As well known in the art, in order to obtain high expression levels of a transfected gene in a host, the gene can be operatively linked to transcriptional and translational expression control sequences that are functional in the chosen expression host.

[0292] Thus, the present disclosure is also directed to vectors, and expression vectors useful for the production and administration of the neoantigenic peptides and neoepitopes described herein, and to host cells comprising such vectors.

IV. Vectors

[0293] In some embodiments, an expression vector capable of expressing the peptide or protein as described herein can also be prepared. Expression vectors for different cell types are well known in the art and can be selected without undue experimentation. Generally, the DNA is inserted into an expression vector, such as a plasmid, in proper orientation and correct reading frame for expression. If necessary, the DNA may be linked to the appropriate transcriptional and translational regulatory control nucleotide sequences recognized by the desired host (*e.g.*, bacteria), although such controls are generally available in the expression vector. The vector is then introduced into the host bacteria for cloning using standard

techniques (see, *e.g.*, Sambrook et al. (1989) *Molecular Cloning, A Laboratory Manual*, Cold Spring Harbor Laboratory, Cold Spring Harbor, N.Y.).

[0294] A large number of vectors and host systems suitable for producing and administering a neoantigenic peptide described herein are known to those of skill in the art, and are commercially available. The following vectors are provided by way of example. Bacterial: pQE70, pQE60, pQE-9 (Qiagen), pBS, pD10, phagescript, psiX174, pBluescript SK, pbsks, pNH8A, pNH16a, pNH18A, pNH46A (Stratagene); ptrc99a, pKK223-3, pKK233-3, pDR540, pRIT5 (Pharmacia); pCR (Invitrogen). Eukaryotic: pWLNEO, pSV2CAT, pOG44, pXT1, pSG (Stratagene) pSVK3, pBPV, pMSG, pSVL (Pharmacia); p75.6 (Valentis); pCEP (Invitrogen); pCEI (Epimmune). However, any other plasmid or vector can be used as long as it is replicable and viable in the host.

[0295] For expression of the neoantigenic peptides described herein, the coding sequence will be provided operably linked start and stop codons, promoter and terminator regions, and in some embodiments, and a replication system to provide an expression vector for expression in the desired cellular host. For example, promoter sequences compatible with bacterial hosts are provided in plasmids containing convenient restriction sites for insertion of the desired coding sequence. The resulting expression vectors are transformed into suitable bacterial hosts.

[0296] Mammalian expression vectors will comprise an origin of replication, a suitable promoter and enhancer, and also any necessary ribosome binding sites, polyadenylation site, splice donor and acceptor sites, transcriptional termination sequences, and 5' flanking nontranscribed sequences. Such promoters can also be derived from viral sources, such as, *e.g.*, human cytomegalovirus (CMV-IE promoter) or herpes simplex virus type-1 (HSV TK promoter). Nucleic acid sequences derived from the SV40 splice, and polyadenylation sites can be used to provide the required nontranscribed genetic elements.

[0297] Recombinant expression vectors may be used to amplify and express DNA encoding the peptide or protein as described herein. Recombinant expression vectors are replicable DNA constructs which have synthetic or cDNA-derived DNA fragments encoding a peptide or a bioequivalent analog operatively linked to suitable transcriptional or translational regulatory elements derived from mammalian, microbial, viral or insect genes. A transcriptional unit generally comprises an assembly of (1) a genetic element or elements having a regulatory role in gene expression, for example, transcriptional promoters or enhancers, (2) a structural or coding sequence which is transcribed into mRNA and translated into protein, and (3) appropriate transcription and translation initiation and termination sequences, as described in detail herein. Such regulatory elements can include an operator sequence to control transcription. The ability to replicate in a host, usually conferred by an origin of replication, and a selection gene to facilitate recognition of transformants can additionally be incorporated. DNA regions are operatively linked when they are functionally related to each other. For example, DNA for a signal peptide (secretory leader) is operatively linked to DNA for a polypeptide if it is expressed as a precursor which participates in the secretion of the polypeptide; a promoter is operatively linked to a coding sequence if it controls the transcription of the sequence; or a ribosome binding site is operatively linked to

a coding sequence if it is positioned so as to permit translation. Generally, operatively linked means contiguous, and in the case of secretory leaders, means contiguous and in reading frame. Structural elements intended for use in yeast expression systems include a leader sequence enabling extracellular secretion of translated protein by a host cell. Alternatively, where recombinant protein is expressed without a leader or transport sequence, it can include an N-terminal methionine residue. This residue can optionally be subsequently cleaved from the expressed recombinant protein to provide a final product.

[0298] Generally, recombinant expression vectors will include origins of replication and selectable markers permitting transformation of the host cell, *e.g.*, the ampicillin resistance gene of *E. coli* and *S. cerevisiae TRP1* gene, and a promoter derived from a highly-expressed gene to direct transcription of a downstream structural sequence. Such promoters can be derived from operons encoding glycolytic enzymes such as 3-phosphoglycerate kinase (PGK), acid phosphatase, or heat shock proteins, among others. The heterologous structural sequence is assembled in appropriate phase with translation initiation and termination sequences, and in some embodiments, a leader sequence capable of directing secretion of translated protein into the periplasmic space or extracellular medium. Optionally, the heterologous sequence can encode a fusion protein including an N-terminal identification peptide imparting desired characteristics, *e.g.*, stabilization or simplified purification of expressed recombinant product.

[0299] Polynucleotides encoding neoantigenic peptides described herein can also comprise a ubiquitination signal sequence, and/or a targeting sequence such as an endoplasmic reticulum (ER) signal sequence to facilitate movement of the resulting peptide into the endoplasmic reticulum.

[0300] In some embodiments, the neoantigenic peptide described herein can also be administered and/or expressed by viral or bacterial vectors. Examples of expression vectors include attenuated viral hosts, such as vaccinia or fowlpox. As an example of this approach, vaccinia virus is used as a vector to express nucleotide sequences that encode the neoantigenic peptides described herein. Vaccinia vectors and methods useful in immunization protocols are described in, *e.g.*, U.S. Pat. No. 4,722,848. Another vector is BCG (Bacille Calmette Guerin). BCG vectors are described by Stover et al., *Nature* 351:456-460 (1991).

[0301] A wide variety of other vectors useful for therapeutic administration or immunization of the neoantigenic polypeptides described herein, *e.g.* adeno and adeno-associated virus vectors, retroviral vectors, *Salmonella* Typhimurium vectors, detoxified anthrax toxin vectors, Sendai virus vectors, poxvirus vectors, canarypox vectors, and fowlpox vectors, and the like, will be apparent to those skilled in the art from the description herein. In some embodiments, the vector is Modified Vaccinia Ankara (VA) (*e.g.* Bavarian Noridic (MVA-BN)).

[0302] Among vectors that may be used in the practice of the present disclosure, integration in the host genome of a cell is possible with retrovirus gene transfer methods, often resulting in long term expression of the inserted transgene. In some embodiments, the retrovirus is a lentivirus. Additionally, high transduction efficiencies have been observed in many different cell types and target tissues. The tropism of a retrovirus can be altered by incorporating foreign envelope proteins, expanding the potential target

population of target cells. A retrovirus can also be engineered to allow for conditional expression of the inserted transgene, such that only certain cell types are infected by the lentivirus. Cell type specific promoters can be used to target expression in specific cell types. Lentiviral vectors are retroviral vectors (and hence both lentiviral and retroviral vectors may be used in the practice of the present disclosure). Moreover, lentiviral vectors are able to transduce or infect non-dividing cells and typically produce high viral titers. Selection of a retroviral gene transfer system may therefore depend on the target tissue. Retroviral vectors are comprised of *cis*-acting long terminal repeats with packaging capacity for up to 6-10 kb of foreign sequence. The minimum *cis*-acting LTRs are sufficient for replication and packaging of the vectors, which are then used to integrate the desired nucleic acid into the target cell to provide permanent expression. Widely used retroviral vectors that may be used in the practice of the present disclosure include those based upon murine leukemia virus (MuLV), gibbon ape leukemia virus (GaLV), Simian Immunodeficiency virus (SIV), human immunodeficiency virus (HIV), and combinations thereof (see, *e.g.*, Buchscher et al., (1992) *J. Virol.* 66:2731-2739; Johann et al., (1992) *J. Virol.* 66:1635-1640; Sommerfelt et al., (1990) *Virol.* 176:58-59; Wilson et al., (1998) *J. Virol.* 63:2374-2378; Miller et al., (1991) *J. Virol.* 65:2220-2224; PCT/US94/05700).

[0303] Also useful in the practice of the present disclosure is a minimal non-primate lentiviral vector, such as a lentiviral vector based on the equine infectious anemia virus (EIAV). The vectors may have cytomegalovirus (CMV) promoter driving expression of the target gene. Accordingly, the present disclosure contemplates amongst vector(s) useful in the practice of the present disclosure: viral vectors, including retroviral vectors and lentiviral vectors.

[0304] Also useful in the practice of the present disclosure is an adenovirus vector. One advantage is the ability of recombinant adenoviruses to efficiently transfer and express recombinant genes in a variety of mammalian cells and tissues *in vitro* and *in vivo*, resulting in the high expression of the transferred nucleic acids. Further, the ability to productively infect quiescent cells, expands the utility of recombinant adenoviral vectors. In addition, high expression levels ensure that the products of the nucleic acids will be expressed to sufficient levels to generate an immune response (see *e.g.*, U.S. Patent No. 7,029,848, hereby incorporated by reference).

[0305] As to adenovirus vectors useful in the practice of the present disclosure, mention is made of US Patent No. 6,955,808. The adenovirus vector used can be selected from the group consisting of the Ad5, Ad35, Ad11, C6, and C7 vectors. The sequence of the Adenovirus 5 ("Ad5") genome has been published. (Chroboczek, J., Bieber, F., and Jacrot, B. (1992) The Sequence of the Genome of Adenovirus Type 5 and Its Comparison with the Genome of Adenovirus Type 2, *Virology* 186, 280-285; the contents of which is hereby incorporated by reference). Ad35 vectors are described in U.S. Pat. Nos. 6,974,695, 6,913,922, and 6,869,794. Ad11 vectors are described in U.S. Pat. No. 6,913,922. C6 adenovirus vectors are described in U.S. Pat. Nos. 6,780,407; 6,537,594; 6,309,647; 6,265,189; 6,156,567; 6,090,393; 5,942,235 and 5,833,975. C7 vectors are described in U.S. Pat. No. 6,277,558. Adenovirus vectors that are E1-defective or deleted, E3-defective or deleted, and/or E4-defective or deleted may also be used. Certain

adenoviruses having mutations in the E1 region have improved safety margin because E1-defective adenovirus mutants are replication-defective in non-permissive cells, or, at the very least, are highly attenuated. Adenoviruses having mutations in the E3 region may have enhanced the immunogenicity by disrupting the mechanism whereby adenovirus down-regulates MHC class I molecules. Adenoviruses having E4 mutations may have reduced immunogenicity of the adenovirus vector because of suppression of late gene expression. Such vectors may be particularly useful when repeated re-vaccination utilizing the same vector is desired. Adenovirus vectors that are deleted or mutated in E1, E3, E4; E1 and E3; and E1 and E4 can be used in accordance with the present disclosure.

[0306] Furthermore, “gutless” adenovirus vectors, in which all viral genes are deleted, can also be used in accordance with the present disclosure. Such vectors require a helper virus for their replication and require a special human 293 cell line expressing both E1a and Cre, a condition that does not exist in natural environment. Such “gutless” vectors are non-immunogenic and thus the vectors may be inoculated multiple times for re-vaccination. The “gutless” adenovirus vectors can be used for insertion of heterologous inserts/genes such as the transgenes of the present disclosure, and can even be used for co-delivery of a large number of heterologous inserts/genes.

[0307] In some embodiments, the delivery is via an adenovirus, which may be at a single booster dose. In some embodiments, the adenovirus is delivered via multiple doses. In terms of *in vivo* delivery, AAV is advantageous over other viral vectors due to low toxicity and low probability of causing insertional mutagenesis because it doesn't integrate into the host genome. AAV has a packaging limit of 4.5 or 4.75 Kb. Constructs larger than 4.5 or 4.75 Kb result in significantly reduced virus production. There are many promoters that can be used to drive nucleic acid molecule expression. AAV ITR can serve as a promoter and is advantageous for eliminating the need for an additional promoter element.

[0308] For ubiquitous expression, the following promoters can be used: CMV, CAG, CBh, PGK, SV40, Ferritin heavy or light chains, etc. For brain expression, the following promoters can be used: Synapsin I for all neurons, CaMK II alpha for excitatory neurons, GAD67 or GAD65 or VGAT for GABAergic neurons, etc. Promoters used to drive RNA synthesis can include: Pol III promoters such as U6 or H1. The use of a Pol II promoter and intronic cassettes can be used to express guide RNA (gRNA). With regard to AAV vectors useful in the practice of the present disclosure, mention is made of US Patent Nos. 5658785, 7115391, 7172893, 6953690, 6936466, 6924128, 6893865, 6793926, 6537540, 6475769 and 6258595, and documents cited therein. As to AAV, the AAV can be AAV1, AAV2, AAV5 or any combination thereof. One can select the AAV with regard to the cells to be targeted; *e.g.*, one can select AAV serotypes 1, 2, 5 or a hybrid capsid AAV1, AAV2, AAV5 or any combination thereof for targeting brain or neuronal cells; and one can select AAV4 for targeting cardiac tissue. AAV8 is useful for delivery to the liver. In some embodiments the delivery is via an AAV. The dosage may be adjusted to balance the therapeutic benefit against any side effects.

[0309] In some embodiments, a Poxvirus is used in the presently described composition. These include orthopoxvirus, avipox, vaccinia, MVA, NYVAC, canarypox, ALVAC, fowlpox, TROVAC, etc. (see *e.g.*,

Verardiet al., *Hum. Vaccin. Immunother.* 2012 Jul;8(7):961-70; and Moss, *Vaccine*. 2013; 31(39): 4220–4222). Poxvirus expression vectors were described in 1982 and quickly became widely used for vaccine development as well as research in numerous fields. Advantages of the vectors include simple construction, ability to accommodate large amounts of foreign DNA and high expression levels. Information concerning poxviruses that may be used in the practice of the present disclosure, such as Chordopoxvirinae subfamily poxviruses (poxviruses of vertebrates), for instance, orthopoxviruses and avipoxviruses, *e.g.*, vaccinia virus (*e.g.*, Wyeth Strain, WR Strain (*e.g.*, ATCC® VR-1354), Copenhagen Strain, NYVAC, NYVAC.1, NYVAC.2, MVA, MVA-BN), canarypox virus (*e.g.*, Wheatley C93 Strain, ALVAC), fowlpox virus (*e.g.*, FP9 Strain, Webster Strain, TROVAC), dovepox, pigeonpox, quailpox, and raccoon pox, *inter alia*, synthetic or non-naturally occurring recombinants thereof, uses thereof, and methods for making and using such recombinants may be found in scientific and patent literature.

[0310] In some embodiments, the vaccinia virus is used in the disease vaccine or immunogenic composition to express an antigen. (Rolph et al., *Recombinant viruses as vaccines and immunological tools*. *Curr. Opin. Immunol.* 9:517-524, 1997). The recombinant vaccinia virus is able to replicate within the cytoplasm of the infected host cell and the polypeptide of interest can therefore induce an immune response. Moreover, Poxviruses have been widely used as vaccine or immunogenic composition vectors because of their ability to target encoded antigens for processing by the major histocompatibility complex class I pathway by directly infecting immune cells, in particular antigen-presenting cells, but also due to their ability to self-adjunct.

[0311] In some embodiments, ALVAC is used as a vector in a disease vaccine or immunogenic composition. ALVAC is a canarypox virus that can be modified to express foreign transgenes and has been used as a method for vaccination against both prokaryotic and eukaryotic antigens (Horig H, Lee DS, Conkright W, et al. Phase I clinical trial of a recombinant canarypoxvirus (ALVAC) vaccine expressing human carcinoembryonic antigen and the B7.1 co-stimulatory molecule. *Cancer Immunol. Immunother.* 2000;49:504–14; von Mehren M, Arlen P, Tsang KY, et al. Pilot study of a dual gene recombinant avipox vaccine containing both carcinoembryonic antigen (CEA) and B7.1 transgenes in patients with recurrent CEA-expressing adenocarcinomas. *Clin. Cancer. Res.* 2000; 6:2219–28; Musey L, Ding Y, Elizaga M, et al. HIV-1 vaccination administered intramuscularly can induce both systemic and mucosal T cell immunity in HIV-1-uninfected individuals. *J. Immunol.* 2003;171:1094–101; Paoletti E. Applications of pox virus vectors to vaccination: an update. *Proc. Natl. Acad. Sci. U S A* 1996;93:11349–53; U.S. Patent No.7,255,862). In a phase I clinical trial, an ALVAC virus expressing the tumor antigen CEA showed an excellent safety profile and resulted in increased CEA-specific T cell responses in selected patients; objective clinical responses, however, were not observed (Marshall JL, Hawkins MJ, Tsang KY, et al. Phase I study in cancer patients of a replication-defective avipox recombinant vaccine that expresses human carcinoembryonic antigen. *J. Clin. Oncol.* 1999;17:332–7).

[0312] In some embodiments, a Modified Vaccinia Ankara (MVA) virus may be used as a viral vector for an antigen vaccine or immunogenic composition. MVA is a member of the Orthopoxvirus family and

has been generated by about 570 serial passages on chicken embryo fibroblasts of the Ankara strain of Vaccinia virus (CVA) (see, *e.g.*, Mayr, A., et al., *Infection* 3, 6-14, 1975). As a consequence of these passages, the resulting MVA virus contains 31 kilobases less genomic information compared to CVA, and is highly host cell restricted (Meyer, H. et al., *J. Gen. Virol.* 72, 1031-1038, 1991). MVA is characterized by its extreme attenuation, namely, by a diminished virulence or infectious ability, but still holds an excellent immunogenicity. When tested in a variety of animal models, MVA was proven to be avirulent, even in immuno-suppressed individuals. Moreover, MVA-BN®-HER2 is a candidate immunotherapy designed for the treatment of HER-2-positive breast cancer and is currently in clinical trials. (Mandl et al., *Cancer Immunol. Immunother.* Jan 2012; 61(1): 19–29). Methods to make and use recombinant MVA has been described (*e.g.*, see U.S. Patent Nos. 8,309,098 and 5,185,146 hereby incorporated in its entirety).

[0313] Suitable host cells for expression of a polypeptide include prokaryotes, yeast, insect or higher eukaryotic cells under the control of appropriate promoters. Prokaryotes include gram negative or gram positive organisms, for example *E. coli* or bacilli. Higher eukaryotic cells include established cell lines of mammalian origin. Cell-free translation systems could also be employed. Appropriate cloning and expression vectors for use with bacterial, fungal, yeast, and mammalian cellular hosts are well known in the art (see Pouwels et al., *Cloning Vectors: A Laboratory Manual*, Elsevier, N.Y., 1985).

[0314] Various mammalian or insect cell culture systems are also advantageously employed to express recombinant protein. Expression of recombinant proteins in mammalian cells can be performed because such proteins are generally correctly folded, appropriately modified and completely functional. Examples of suitable mammalian host cell lines include the COS-7 lines of monkey kidney cells, described by Gluzman (*Cell* 23:175, 1981), and other cell lines capable of expressing an appropriate vector including, for example, L cells, C127, 3T3, Chinese hamster ovary (CHO), 293, HeLa and BHK cell lines. Mammalian expression vectors can comprise nontranscribed elements such as an origin of replication, a suitable promoter and enhancer linked to the gene to be expressed, and other 5' or 3' flanking nontranscribed sequences, and 5' or 3' nontranslated sequences, such as necessary ribosome binding sites, a polyadenylation site, splice donor and acceptor sites, and transcriptional termination sequences. Baculovirus systems for production of heterologous proteins in insect cells are reviewed by Luckow and Summers, *Bio/Technology* 6:47 (1988).

[0315] Host cells are genetically engineered (transduced or transformed or transfected) with the vectors which can be, for example, a cloning vector or an expression vector. The vector can be, for example, in the form of a plasmid, a viral particle, a phage, etc. The engineered host cells can be cultured in conventional nutrient media modified as appropriate for activating promoters, selecting transformants or amplifying the polynucleotides. The culture conditions, such as temperature, pH and the like, are those previously used with the host cell selected for expression, and will be apparent to the ordinarily skilled artisan.

[0316] As representative examples of appropriate hosts, there can be mentioned: bacterial cells, such as *E. coli*, *Bacillus subtilis*, *Salmonella typhimurium* and various species within the genera *Pseudomonas*, *Streptomyces*, and *Staphylococcus*; fungal cells, such as yeast; insect cells such as *Drosophila* and Sf9; animal cells such as COS-7 lines of monkey kidney fibroblasts, described by Gluzman, *Cell* 23:175 (1981), and other cell lines capable of expressing a compatible vector, for example, the C127, 3T3, CHO, HeLa and BHK cell lines or Bowes melanoma; plant cells, etc. The selection of an appropriate host is deemed to be within the scope of those skilled in the art from the teachings herein.

[0317] Yeast, insect or mammalian cell hosts can also be used, employing suitable vectors and control sequences. Examples of mammalian expression systems include the COS-7 lines of monkey kidney fibroblasts, described by Gluzman, *Cell* 23:175 (1981), and other cell lines capable of expressing a compatible vector, for example, the C127, 3T3, CHO, HeLa and BHK cell lines.

[0318] Polynucleotides described herein can be administered and expressed in human cells (*e.g.*, immune cells, including dendritic cells). A human codon usage table can be used to guide the codon choice for each amino acid. Such polynucleotides comprise spacer amino acid residues between epitopes and/or analogs, such as those described above, or can comprise naturally-occurring flanking sequences adjacent to the epitopes and/or analogs (and/or CTL (*e.g.*, CD8⁺), Th (*e.g.*, CD4⁺), and B cell epitopes).

[0319] Standard regulatory sequences well known to those of skill in the art can be included in the vector to ensure expression in the human target cells. Several vector elements are desirable: a promoter with a downstream cloning site for polynucleotide, *e.g.*, minigene insertion; a polyadenylation signal for efficient transcription termination; an *E. coli* origin of replication; and an *E. coli* selectable marker (*e.g.* ampicillin or kanamycin resistance). Numerous promoters can be used for this purpose, *e.g.*, the human cytomegalovirus (hCMV) promoter. See, *e.g.*, U.S. Pat. Nos. 5,580,859 and 5,589,466 for other suitable promoter sequences. In some embodiments, the promoter is the CMV-IE promoter.

[0320] Useful expression vectors for eukaryotic hosts, especially mammals or humans include, for example, vectors comprising expression control sequences from SV40, bovine papilloma virus, adenovirus and cytomegalovirus. Useful expression vectors for bacterial hosts include known bacterial plasmids, such as plasmids from *Escherichia coli*, including pCR1, pBR322, pMB9 and their derivatives, wider host range plasmids, such as M13 and filamentous single-stranded DNA phages.

[0321] Vectors may be introduced into animal tissues by a number of different methods. The two most popular approaches are injection of DNA in saline, using a standard hypodermic needle, and gene gun delivery. A schematic outline of the construction of a DNA vaccine plasmid and its subsequent delivery by these two methods into a host is illustrated at *Scientific American* (Weiner et al., (1999) *Scientific American* 281 (1): 34–41). Injection in saline is normally conducted intramuscularly (IM) in skeletal muscle, or intradermally (ID), with DNA being delivered to the extracellular spaces. This can be assisted by electroporation by temporarily damaging muscle fibers with myotoxins such as bupivacaine; or by using hypertonic solutions of saline or sucrose (Alarcon et al., (1999). *Adv. Parasitol. Advances in Parasitology* 42: 343–410). Immune responses to this method of delivery can be affected by many factors,

including needle type, needle alignment, speed of injection, volume of injection, muscle type, and age, sex and physiological condition of the animal being injected (Alarcon et al., (1999). Adv. Parasitol. Advances in Parasitology 42: 343–410).

[0322] Gene gun delivery, the other commonly used method of delivery, ballistically accelerates plasmid DNA (pDNA) that has been adsorbed onto gold or tungsten microparticles into the target cells, using compressed helium as an accelerant (Alarcon et al., (1999). Adv. Parasitol. Advances in Parasitology 42: 343–410; Lewis et al., (1999). Advances in Virus Research (Academic Press) 54: 129–88).

[0323] Alternative delivery methods may include aerosol instillation of naked DNA on mucosal surfaces, such as the nasal and lung mucosa, (Lewis et al., (1999). Advances in Virus Research (Academic Press) 54: 129–88) and topical administration of pDNA to the eye and vaginal mucosa (Lewis et al., (1999) Advances in Virus Research (Academic Press) 54: 129–88). Mucosal surface delivery has also been achieved using cationic liposome-DNA preparations, biodegradable microspheres, attenuated *Shigella* or *Listeria* vectors for oral administration to the intestinal mucosa, and recombinant adenovirus vectors. DNA or RNA may also be delivered to cells following mild mechanical disruption of the cell membrane, temporarily permeabilizing the cells. Such a mild mechanical disruption of the membrane can be accomplished by gently forcing cells through a small aperture (Sharei et al., Ex Vivo Cytosolic Delivery of Functional Macromolecules to Immune Cells, PLOS ONE (2015)).

[0324] Chemical means for introducing a polynucleotide into a host cell include colloidal dispersion systems, such as macromolecule complexes, nanocapsules, microspheres, beads, and lipid-based systems including oil-in-water emulsions, micelles, mixed micelles, and liposomes. An exemplary colloidal system for use as a delivery vehicle *in vitro* and *in vivo* is a liposome (*e.g.*, an artificial membrane vesicle). In the case where a non-viral delivery system is utilized, an exemplary delivery vehicle is a liposome. “Liposome” is a generic term encompassing a variety of single and multilamellar lipid vehicles formed by the generation of enclosed lipid bilayers or aggregates. Liposomes can be characterized as having vesicular structures with a phospholipid bilayer membrane and an inner aqueous medium. Multilamellar liposomes have multiple lipid layers separated by aqueous medium. They form spontaneously when phospholipids are suspended in an excess of aqueous solution. The lipid components undergo self-rearrangement before the formation of closed structures and entrap water and dissolved solutes between the lipid bilayers (Ghosh et al., Glycobiology 5: 505-10 (1991)). However, compositions that have different structures in solution than the normal vesicular structure are also encompassed. For example, the lipids may assume a micellar structure or merely exist as nonuniform aggregates of lipid molecules. Also contemplated are lipofectamine-nucleic acid complexes.

[0325] The use of lipid formulations is contemplated for the introduction of the nucleic acids into a host cell (*in vitro*, *ex vivo* or *in vivo*). In another aspect, the nucleic acid may be associated with a lipid. The nucleic acid associated with a lipid may be encapsulated in the aqueous interior of a liposome, interspersed within the lipid bilayer of a liposome, attached to a liposome via a linking molecule that is

associated with both the liposome and the oligonucleotide, entrapped in a liposome, complexed with a liposome, dispersed in a solution containing a lipid, mixed with a lipid, combined with a lipid, contained as a suspension in a lipid, contained or complexed with a micelle, or otherwise associated with a lipid. Lipid, lipid/DNA or lipid/expression vector associated compositions are not limited to any particular structure in solution. For example, they may be present in a bilayer structure, as micelles, or with a “collapsed” structure. They may also simply be interspersed in a solution, possibly forming aggregates that are not uniform in size or shape. Lipids are fatty substances which may be naturally occurring or synthetic lipids. For example, lipids include the fatty droplets that naturally occur in the cytoplasm as well as the class of compounds which contain long-chain aliphatic hydrocarbons and their derivatives, such as fatty acids, alcohols, amines, amino alcohols, and aldehydes.

[0326] Lipids suitable for use can be obtained from commercial sources. For example, dimyristyl phosphatidylcholine (“DMPC”) can be obtained from Sigma, St. Louis, Mo.; dicetyl phosphate (“DCP”) can be obtained from K & K Laboratories (Plainview, N.Y.); cholesterol (“Choi”) can be obtained from Calbiochem-Behring; dimyristyl phosphatidylglycerol (“DMPG”) and other lipids may be obtained from Avanti Polar Lipids, Inc. (Birmingham, Ala.). Stock solutions of lipids in chloroform or chloroform/methanol can be stored at about -20°C. Chloroform is used as the only solvent since it is more readily evaporated than methanol.

[0327] In some embodiments, a vector comprises a polynucleotide encoding a first peptide comprising a first neoepitope and a second peptide comprising a second neoepitope. In some embodiments, the first and second peptides are derived from the same protein. The at least two distinct peptides may vary by length, amino acid sequence or both. The peptides are derived from any protein known to or have been found to contain a tumor specific mutation. In some embodiments, a vector comprises a first peptide comprising a first neoepitope of a protein and a second peptide comprising a second neoepitope of the same protein, wherein the first peptide is different from the second peptide, and wherein the first neoepitope comprises a mutation and the second neoepitope comprises the same mutation. In some embodiments, a vector comprises a first peptide comprising a first neoepitope of a first region of a protein and a second peptide comprising a second neoepitope of a second region of the same protein, wherein the first region comprises at least one amino acid of the second region, wherein the first peptide is different from the second peptide and wherein the first neoepitope comprises a first mutation and the second neoepitope comprises a second mutation. In some embodiments, the first mutation and the second mutation are the same. In some embodiments, the mutation is selected from the group consisting of a point mutation, a splice-site mutation, a frameshift mutation, a read-through mutation, a gene fusion mutation and any combination thereof.

[0328] In some embodiments, a vector comprises a polynucleotide operably linked to a promoter. In some embodiments, the vector is a self-amplifying RNA replicon, plasmid, phage, transposon, cosmid, virus, or virion. In some embodiments, the vector is derived from a retrovirus, lentivirus, adenovirus, adeno-associated virus, herpes virus, pox virus, alpha virus, vaccinia virus, hepatitis B virus, human

papillomavirus or a pseudotype thereof. In some embodiments, the vector is a non-viral vector. In some embodiments, the non-viral vector is a nanoparticle, a cationic lipid, a cationic polymer, a metallic nanopolymer, a nanorod, a liposome, a micelle, a microbubble, a cell-penetrating peptide, or a liposphere.

V. T Cell Receptors

[0329] In one aspect, the present disclosure provides cells expressing a neoantigen-recognizing receptor that activates an immunoresponsive cell (*e.g.*, T cell receptor (TCR) or chimeric antigen receptor (CAR)), and methods of using such cells for the treatment of a disease that requires an enhanced immune response. Such cells include genetically modified immunoresponsive cells (*e.g.*, T cells, Natural Killer (NK) cells, cytotoxic T lymphocytes (CTL (*e.g.*, CD8⁺)) cells, helper T lymphocyte (Th (*e.g.*, CD4⁺)) cells) expressing an antigen-recognizing receptor (*e.g.*, TCR or CAR) that binds one of the neoantigenic peptides described herein, and methods of use therefore for the treatment of neoplasia and other pathologies where an increase in an antigen-specific immune response is desired. T cell activation is mediated by a TCR or a CAR targeted to an antigen.

[0330] The present disclosure provides cells expressing a combination of an antigen-recognizing receptor that activates an immunoresponsive cell (*e.g.*, TCR, CAR) and a chimeric co-stimulating receptor (CCR), and methods of using such cells for the treatment of a disease that requires an enhanced immune response. In some embodiments, tumor antigen-specific T cells, NK cells, CTL cells or other immunoresponsive cells are used as shuttles for the selective enrichment of one or more co-stimulatory ligands for the treatment or prevention of neoplasia. Such cells are administered to a human subject in need thereof for the treatment or prevention of a particular cancer.

[0331] In some embodiments, the tumor antigen-specific human lymphocytes that can be used in the methods of the present disclosure include, without limitation, peripheral donor lymphocytes genetically modified to express chimeric antigen receptors (CARs) (Sadelain, M., et al. 2003 Nat Rev Cancer 3:35-45), peripheral donor lymphocytes genetically modified to express a full-length tumor antigen-recognizing T cell receptor complex comprising the α and β heterodimer (Morgan, R. A., et al. 2006 Science 314:126-129), lymphocyte cultures derived from tumor infiltrating lymphocytes (TILs) in tumor biopsies (Panelli, M. C., et al. 2000 J Immunol 164:495-504; Panelli, M. C., et al. 2000 J Immunol 164:4382-4392), and selectively *in vitro*-expanded antigen-specific peripheral blood leukocytes employing artificial antigen-presenting cells (AAPCs) or pulsed dendritic cells (Dupont, J., et al. 2005 Cancer Res 65:5417-5427; Papanicolaou, G. A., et al. 2003 Blood 102:2498-2505). The T cells may be autologous, allogeneic, or derived *in vitro* from engineered progenitor or stem cells.

[0332] In some embodiments, the immunotherapeutic is an engineered receptor. In some embodiments, the engineered receptor is a chimeric antigen receptor (CAR), a T cell receptor (TCR), or a B-cell receptor (BCR), an adoptive T cell therapy (ACT), or a derivative thereof. In other aspects, the engineered receptor is a chimeric antigen receptor (CAR). In some aspects, the CAR is a first generation CAR. In other aspects, the CAR is a second generation CAR. In still other aspects, the CAR is a third generation CAR. In some aspects, the CAR comprises an extracellular portion, a transmembrane portion,

and an intracellular portion. In some aspects, the intracellular portion comprises at least one T cell co-stimulatory domain. In some aspects, the T cell co-stimulatory domain is selected from the group consisting of CD27, CD28, TNFRS9 (4-1BB), TNFRSF4 (OX40), TNFRSF8 (CD30), CD40LG (CD40L), ICOS, ITGB2 (LFA-1), CD2, CD7, KLRC2 (NKG2C), TNFRS18 (GITR), TNFRSF14 (HVEM), or any combination thereof.

[0333] In some aspects, the engineered receptor binds a target. In some aspects, the binding is specific to a peptide specific to one or more subjects suffering from a disease or condition.

[0334] In some aspects, the immunotherapeutic is a cell as described in detail herein. In some aspects, the immunotherapeutic is a cell comprising a receptor that specifically binds a peptide or neoepitope described herein. In some aspects, the immunotherapeutic is a cell used in combination with the peptides/nucleic acids of the present disclosure. In some embodiments, the cell is a patient cell. In some embodiments, the cell is a T cell. In some embodiments, the cell is tumor infiltrating lymphocyte.

[0335] In some aspects, a subject with a condition or disease is treated based on a T cell receptor repertoire of the subject. In some embodiments, a peptide or neoepitope is selected based on a T cell receptor repertoire of the subject. In some embodiments, a subject is treated with T cells expressing TCRs specific to a peptide or neoepitope as described herein. In some embodiments, a subject is treated with a peptide or neoepitope specific to TCRs, *e.g.*, subject specific TCRs. In some embodiments, a subject is treated with a peptide or neoepitope specific to T cells expressing TCRs, *e.g.*, subject specific TCRs. In some embodiments, a subject is treated with a peptide or neoepitope specific to subject specific TCRs.

[0336] In some embodiments, the composition as described herein is selected based on TCRs identified in one or more subjects. In some embodiments, identification of a T cell repertoire and testing in functional assays is used to determine the composition to be administered to one or more subjects with a condition or disease. In some embodiments, the composition is an antigen vaccine comprising one or more peptides or proteins as described herein. In some embodiments, the vaccine comprises subject specific neoantigenic peptides. In some embodiments, the peptides to be included in the vaccine are selected based on a quantification of subject specific TCRs that bind to the neoepitopes. In some embodiments, the peptides are selected based on a binding affinity of the peptide to a TCR. In some embodiments, the selecting is based on a combination of both the quantity and the binding affinity. For example, a TCR that binds strongly to a neoepitope in a functional assay, but that is not highly represented in a TCR repertoire may be a good candidate for an antigen vaccine because T cells expressing the TCR would be advantageously amplified.

[0337] In some embodiments, the peptide or protein is selected for administering to one or more subjects based on binding to TCRs. In some embodiments, T cells, such as T cells from a subject with a disease or condition, can be expanded. Expanded T cells that express TCRs specific to a neoantigenic peptide or neoepitope can be administered back to a subject. In some embodiments, suitable cells, *e.g.*, PBMCs, are transduced or transfected with polynucleotides for expression of TCRs specific to a neoantigenic peptide or neoepitope and administered to a subject. T cells expressing TCRs specific to a

neoantigenic peptide or neoepitope can be expanded and administered back to a subject. In some embodiments, T cells that express TCRs specific to a neoantigenic peptide or neoepitope that result in cytolytic activity when incubated with autologous diseased tissue can be expanded and administered to a subject. In some embodiments, T cells used in functional assays result in binding to a neoantigenic peptide or neoepitope can be expanded and administered to a subject. In some embodiments, TCRs that have been determined to bind to subject specific neoantigenic peptides or neoepitopes can be expressed in T cells and administered to a subject.

[0338] In an embodiment, the present disclosure provides a composition comprising a first peptide comprising a first neoepitope and a second peptide comprising a second neoepitope, wherein the first peptide is different from the second peptide, and wherein the first neoepitope comprises a mutation and the second neoepitope comprises the same mutation. In some embodiments, the composition as provided herein comprises a first T cell comprising a first T cell receptor (TCR) specific for the first neoepitope and a second T cell comprising a second TCR specific for the second neoepitope. In some embodiments, the first and second peptides are derived from the same protein.

[0339] In another embodiment, the present disclosure provides a composition comprising a first peptide comprising a first neoepitope of a first region of a protein and a second peptide comprising a second neoepitope of a second region of the same protein, wherein the first region comprises at least one amino acid of the second region, wherein the first peptide is different from the second peptide and wherein the first neoepitope comprises a first mutation and the second neoepitope comprises a second mutation. In some embodiments, the composition as provided herein comprises a first T cell comprising a first T cell receptor (TCR) specific for the first neoepitope and a second T cell comprising a second TCR specific for the second neoepitope. In some embodiments, the first mutation and the second mutation are the same.

[0340] In some embodiments, the first neoepitope binds to a class I HLA protein to form a class I HLA-peptide complex. In some embodiments, the first neoepitope binds to a class II HLA protein to form a class II HLA-peptide complex. In some embodiments, the second neoepitope binds to a class II HLA protein to form a class II HLA-peptide complex. In some embodiments, the second neoepitope binds to a class I HLA protein to form a class I HLA-peptide complex. In some embodiments, the first neoepitope activates CD8⁺ T cells. In some embodiments, the first neoepitope activates CD4⁺ T cells. In some embodiments, the second neoepitope activates CD4⁺ T cells. In some embodiments, the second neoepitope activates CD8⁺ T cells. In some embodiments, a TCR of a CD4⁺ T cell binds to a class II HLA-peptide complex. In some embodiments, a TCR of a CD8⁺ T cell binds to a class II HLA-peptide complex. In some embodiments, a TCR of a CD8⁺ T cell binds to a class I HLA-peptide complex. In some embodiments, a TCR of a CD4⁺ T cell binds to a class I HLA-peptide complex.

[0341] In some embodiments, the first TCR is a first chimeric antigen receptor specific for the first neoepitope and the second TCR is a second chimeric antigen receptor specific for the second neoepitope. In some embodiments, the first T cell is a cytotoxic T cell. In some embodiments, the first T cell is a

gamma delta T cell. In some embodiments, the second T cell is a helper T cell. In some embodiments, the first and/or second TCR binds to an HLA-peptide complex with a K_D or an IC_{50} of less than 1,000 nM, 900 nM, 800 nM, 700 nM, 600 nM, 500 nM, 250 nM, 150 nM, 100 nM, 50 nM, 25 nM or 10 nM. In some embodiments, the first and/or second TCR binds to an HLA class I-peptide complex with a K_D or an IC_{50} of less than 1,000 nM, 900 nM, 800 nM, 700 nM, 600 nM, 500 nM, 250 nM, 150 nM, 100 nM, 50 nM, 25 nM or 10 nM. In some embodiments, the first and/or second TCR binds to an HLA class II-peptide complex with a K_D or an IC_{50} of less than 2,000, 1,500, 1,000 nM, 900 nM, 800 nM, 700 nM, 600 nM, 500 nM, 250 nM, 150 nM, 100 nM, 50 nM, 25 nM or 10 nM.

VI. Antigen Presenting Cells

[0342] The neoantigenic peptide or protein can be provided as antigen presenting cells (*e.g.*, dendritic cells) containing such peptides, proteins or polynucleotides as described herein. In other embodiments, such antigen presenting cells are used to stimulate T cells for use in patients. Thus, one embodiment of the present disclosure is a composition containing at least one antigen presenting cell (*e.g.*, a dendritic cell) that is pulsed or loaded with one or more neoantigenic peptides or polynucleotides described herein. In some embodiments, such APCs are autologous (*e.g.*, autologous dendritic cells). Alternatively, peripheral blood mononuclear cells (PBMCs) isolated from a patient can be loaded with neoantigenic peptides or polynucleotides *ex vivo*. In related embodiments, such APCs or PBMCs are injected back into the patient. In some embodiments, the antigen presenting cells are dendritic cells. In related embodiments, the dendritic cells are autologous dendritic cells that are pulsed with the neoantigenic peptide or nucleic acid. The neoantigenic peptide can be any suitable peptide that gives rise to an appropriate T cell response. T cell therapy using autologous dendritic cells pulsed with peptides from a tumor associated antigen is disclosed in Murphy et al. (1996) *The Prostate* 29, 371-380 and Tjua et al. (1997) *The Prostate* 32, 272-278. In some embodiments, the T cell is a CTL (*e.g.*, $CD8^+$). In some embodiments, the T cell is a helper T lymphocyte (Th (*e.g.*, $CD4^+$)).

[0343] In some embodiments, the present disclosure provides a composition comprising a cell-based immunogenic pharmaceutical composition that can also be administered to a subject. For example, an antigen presenting cell (APC) based immunogenic pharmaceutical composition can be formulated using any of the well-known techniques, carriers, and excipients as suitable and as understood in the art. APCs include monocytes, monocyte-derived cells, macrophages, and dendritic cells. Sometimes, an APC based immunogenic pharmaceutical composition can be a dendritic cell-based immunogenic pharmaceutical composition.

[0344] A dendritic cell-based immunogenic pharmaceutical composition can be prepared by any methods well known in the art. In some cases, dendritic cell-based immunogenic pharmaceutical compositions can be prepared through an *ex vivo* or *in vivo* method. The *ex vivo* method can comprise the use of autologous DCs pulsed *ex vivo* with the polypeptides described herein, to activate or load the DCs prior to administration into the patient. The *in vivo* method can comprise targeting specific DC receptors using antibodies coupled with the polypeptides described herein. The DC-based immunogenic

pharmaceutical composition can further comprise DC activators such as TLR3, TLR-7-8, and CD40 agonists. The DC-based immunogenic pharmaceutical composition can further comprise adjuvants, and a pharmaceutically acceptable carrier.

[0345] Antigen presenting cells (APCs) can be prepared from a variety of sources, including human and non-human primates, other mammals, and vertebrates. In certain embodiments, APCs can be prepared from blood of a human or non-human vertebrate. APCs can also be isolated from an enriched population of leukocytes. Populations of leukocytes can be prepared by methods known to those skilled in the art. Such methods typically include collecting heparinized blood, apheresis or leukopheresis, preparation of buffy coats, rosetting, centrifugation, density gradient centrifugation (*e.g.*, using Ficoll, colloidal silica particles, and sucrose), differential lysis non-leukocyte cells, and filtration. A leukocyte population can also be prepared by collecting blood from a subject, defibrillating to remove the platelets and lysing the red blood cells. The leukocyte population can optionally be enriched for monocytic dendritic cell precursors.

[0346] Blood cell populations can be obtained from a variety of subjects, according to the desired use of the enriched population of leukocytes. The subject can be a healthy subject. Alternatively, blood cells can be obtained from a subject in need of immunostimulation, such as, for example, a cancer patient or other patient for which immunostimulation will be beneficial. Likewise, blood cells can be obtained from a subject in need of immune suppression, such as, for example, a patient having an autoimmune disorder (*e.g.*, rheumatoid arthritis, diabetes, lupus, multiple sclerosis, and the like). A population of leukocytes also can be obtained from an HLA-matched healthy individual.

[0347] When blood is used as a source of APC, blood leukocytes may be obtained using conventional methods that maintain their viability. According to one aspect of the present disclosure, blood can be diluted into medium that may or may not contain heparin or other suitable anticoagulant. The volume of blood to medium can be about 1 to 1. Cells can be concentrated by centrifugation of the blood in medium at about 1,000 rpm (150 g) at 4°C. Platelets and red blood cells can be depleted by resuspending the cells in any number of solutions known in the art that will lyse erythrocytes, for example ammonium chloride. For example, the mixture may be medium and ammonium chloride at about 1:1 by volume. Cells may be concentrated by centrifugation and washed in the desired solution until a population of leukocytes, substantially free of platelets and red blood cells, is obtained. Any isotonic solution commonly used in tissue culture may be used as the medium for separating blood leukocytes from platelets and red blood cells. Examples of such isotonic solutions can be phosphate buffered saline, Hanks balanced salt solution, and complete growth media. APCs and/or APC precursor cells may also purified by elutriation.

[0348] In one embodiment, the APCs can be non-nominal APCs under inflammatory or otherwise activated conditions. For example, non-nominal APCs can include epithelial cells stimulated with interferon-gamma, T cells, B cells, and/or monocytes activated by factors or conditions that induce APC activity. Such non-nominal APCs can be prepared according to methods known in the art.

[0349] The APCs can be cultured, expanded, differentiated and/or, matured, as desired, according to the according to the type of APC. The APCs can be cultured in any suitable culture vessel, such as, for example, culture plates, flasks, culture bags, and bioreactors.

[0350] In certain embodiments, APCs can be cultured in suitable culture or growth medium to maintain and/or expand the number of APCs in the preparation. The culture media can be selected according to the type of APC isolated. For example, mature APCs, such as mature dendritic cells, can be cultured in growth media suitable for their maintenance and expansion. The culture medium can be supplemented with amino acids, vitamins, antibiotics, divalent cations, and the like. In addition, cytokines, growth factors and/or hormones, can be included in the growth media. For example, for the maintenance and/or expansion of mature dendritic cells, cytokines, such as granulocyte/macrophage colony stimulating factor (GM-CSF), FMS-like tyrosine kinase 3 ligand (FLT-3L) and/or interleukin 4 (IL-4), can be added. In other embodiments, immature APCs can be cultured and/or expanded. Immature dendritic cells can they retain the ability to uptake target mRNA and process new antigen. In some embodiments, immature dendritic cells can be cultured in media suitable for their maintenance and culture. The culture medium can be supplemented with amino acids, vitamins, antibiotics, divalent cations, and the like. In addition, cytokines, growth factors and/or hormones, can be included in the growth media.

[0351] Other immature APCs can similarly be cultured or expanded. Preparations of immature APCs can be matured to form mature APCs. Maturation of APCs can occur during or following exposure to the neoantigenic peptides. In certain embodiments, preparations of immature dendritic cells can be matured. Suitable maturation factors include, for example, cytokines TNF- α , bacterial products (*e.g.*, BCG), and the like. In another aspect, isolated APC precursors can be used to prepare preparations of immature APCs. APC precursors can be cultured, differentiated, and/or matured. In certain embodiments, monocytic dendritic cell precursors can be cultured in the presence of suitable culture media supplemented with amino acids, vitamins, cytokines, and/or divalent cations, to promote differentiation of the monocytic dendritic cell precursors to immature dendritic cells. In some embodiments, the APC precursors are isolated from PBMCs. The PBMCs can be obtained from a donor, for example, a human donor, and can be used freshly or frozen for future usage. In some embodiments, the APC is prepared from one or more APC preparations. In some embodiments, the APC comprises an APC loaded with the first and second neoantigenic peptides comprising the first and second neopeptides or polynucleotides encoding the first and second neoantigenic peptides comprising the first and second neopeptides. In some embodiments, the APC is an autologous APC, an allogenic APC, or an artificial APC.

[0352] In an embodiment, the present disclosure provides a composition comprising an APC comprising a first peptide comprising a first neopeptide and a second peptide comprising a second neopeptide, wherein the first peptide is different from the second peptide, and wherein the first neopeptide comprises a mutation and the second neopeptide comprises the same mutation. In some embodiments, the first and second peptides are derived from the same protein. In another embodiment, the present

disclosure provides a composition comprising an APC comprising a first peptide comprising a first neoepitope of a first region of a protein and a second peptide comprising a second neoepitope of a second region of the same protein, wherein the first region comprises at least one amino acid of the second region, wherein the first peptide is different from the second peptide and wherein the first neoepitope comprises a first mutation and the second neoepitope comprises a second mutation. In some embodiments, the first mutation and the second mutation are the same.

VII. Adjuvants

[0353] An adjuvant can be used to enhance the immune response (humoral and/or cellular) elicited in a patient receiving a composition as provided herein. Sometimes, adjuvants can elicit a Th1-type response. Other times, adjuvants can elicit a Th2-type response. A Th1-type response can be characterized by the production of cytokines such as IFN- γ as opposed to a Th2-type response which can be characterized by the production of cytokines such as IL-4, IL-5 and IL-10.

[0354] In some aspects, lipid-based adjuvants, such as MPLA and MDP, can be used with the immunogenic pharmaceutical compositions disclosed herein. Monophosphoryl lipid A (MPLA), for example, is an adjuvant that causes increased presentation of liposomal antigen to specific T Lymphocytes. In addition, a muramyl dipeptide (MDP) can also be used as a suitable adjuvant in conjunction with the immunogenic pharmaceutical formulations described herein.

[0355] Suitable adjuvants are known in the art (see, WO 2015/095811) and include, but are not limited to poly(I:C), poly-ICLC, Hiltonol, STING agonist, 1018 ISS, aluminum salts, Amplivax, AS15, BCG, CP-870,893, CpG7909, CyaA, dSLIM, GM-CSF, FLT-3L, IC30, IC31, Imiquimod, ImuFact IMP321, IS Patch, ISS, ISCOMATRIX, JuvImmune, LipoVac, MF59, monophosphoryl lipid A, Montanide IMS 1312, Montanide ISA 206, Montanide ISA 50V, Montanide ISA-51, OK-432, OM-174, OM-197-MP-EC, ONTAK, PepTel®. vector system, PLG microparticles, resiquimod, SRL172, virosomes and other virus-like particles, YF-17D, VEGF trap, R848, beta-glucan, Pam3Cys, Pam3CSK4, Aquila's QS21 stimulon (Aquila Biotech, Worcester, Mass., USA) which is derived from saponin, mycobacterial extracts and synthetic bacterial cell wall mimics, and other proprietary adjuvants such as Ribi's Detox. Quil or Superfos. Adjuvants also include incomplete Freund's or GM-CSF. Several immunological adjuvants (*e.g.*, MF59) specific for dendritic cells and their preparation have been described previously (Dupuis M, et al., Cell Immunol. 1998; 186(1):18-27; Allison A C; Dev. Biol. Stand. 1998; 92:3-11) (Mosca et al. Frontiers in Bioscience, 2007; 12:4050-4060) (Gamvrellis et al. Immunol & Cell Biol. 2004; 82: 506-516).. Also cytokines can be used. Several cytokines have been directly linked to influencing dendritic cell migration to lymphoid tissues (*e.g.*, TNF-alpha), accelerating the maturation of dendritic cells into efficient antigen-presenting cells for T-lymphocytes (*e.g.*, GM-CSF, FLT-3L, PGE1, PGE2, IL-1, IL-1b, IL-4, IL-6 and CD40L) (U.S. Pat. No. 5,849,589 incorporated herein by reference in its entirety) and acting as immunoadjuvants (*e.g.*, IL-12) (Gabilovich D I, et al., J. Immunother. Emphasis Tumor Immunol. 1996 (6):414-418).

[0356] Adjuvant can also comprise stimulatory molecules such as cytokines. Non-limiting examples of cytokines include: CCL20, α -interferon (IFN- α), β -interferon (IFN- β), γ -interferon, platelet derived growth factor (PDGF), TNF α , TNF β (lymphotoxin alpha (LT α)), GM-CSF, FLT-3L, epidermal growth factor (EGF), cutaneous T cell-attracting chemokine (CTACK), epithelial thymus-expressed chemokine (TECK), mucosae-associated epithelial chemokine (MEC), IL-12, IL-15, IL-28, MHC, CD80, CD86, IL-1, IL-2, IL-4, IL-5, IL-6, IL-10, IL-18, MCP-1, MIP-1a, MIP-1, IL-8, L-selectin, P-selectin, E-selectin, CD34, GlyCAM-1, MadCAM-1, LFA-1, VLA-1, Mac-1, p150.95, PECAM, ICAM-1, ICAM-2, ICAM-3, CD2, LFA-3, M-CSF, G-CSF, mutant forms of IL-18, CD40, CD40L, vascular growth factor, fibroblast growth factor, IL-7, nerve growth factor, vascular endothelial growth factor, Fas, TNF receptor, Fit, Apo-1, p55, WSL-1, DR3, TRAMP, Apo-3, AIR, LARD, NGRF, DR4, DRS, KILLER, TRAIL-R2, TRICK2, DR6, Caspase ICE, Fos, c-jun, Sp-1, Ap-1, Ap-2, p38, p65Rel, MyD88, IRAK, TRAF6, I κ B, Inactive NIK, SAP K, SAP-I, JNK, interferon response genes, NF κ B, Bax, TRAIL, TRAILrec, TRAILrecDRC5, TRAIL-R3, TRAIL-R4, RANK, RANK LIGAND, Ox40, Ox40 LIGAND, NKG2D, MICA, MICB, NKG2A, NKG2B, NKG2C, NKG2E, NKG2F, TAPI, and TAP2.

[0357] Additional adjuvants include: MCP-1, MIP-1a, MIP-1p, IL-8, RANTES, L-selectin, P-selectin, E-selectin, CD34, GlyCAM-1, MadCAM-1, LFA-1, VLA-1, Mac-1, p150.95, PECAM, ICAM-1, ICAM-2, ICAM-3, CD2, LFA-3, M-CSF, G-CSF, IL-4, mutant forms of IL-18, CD40, CD40L, vascular growth factor, fibroblast growth factor, IL-7, IL-22, nerve growth factor, vascular endothelial growth factor, Fas, TNF receptor, Fit, Apo-1, p55, WSL-1, DR3, TRAMP, Apo-3, AIR, LARD, NGRF, DR4, DR5, KILLER, TRAIL-R2, TRICK2, DR6, Caspase ICE, Fos, c-jun, Sp-1, Ap-1, Ap-2, p38, p65Rel, MyD88, IRAK, TRAF6, I κ B, Inactive NIK, SAP K, SAP-1, JNK, interferon response genes, NF κ B, Bax, TRAIL, TRAILrec, TRAILrecDRC5, TRAIL-R3, TRAIL-R4, RANK, RANK LIGAND, Ox40, Ox40 LIGAND, NKG2D, MICA, MICB, NKG2A, NKG2B, NKG2C, NKG2E, NKG2F, TAP1, TAP2 and functional fragments thereof.

[0358] In some aspects, an adjuvant can be a modulator of a toll like receptor. Examples of modulators of toll-like receptors include TLR-9 agonists and are not limited to small molecule modulators of toll-like receptors such as Imiquimod. Other examples of adjuvants that are used in combination with an immunogenic pharmaceutical composition described herein can include and are not limited to saponin, CpG ODN and the like. Sometimes, an adjuvant is selected from bacteria toxoids, polyoxypropylene-polyoxyethylene block polymers, aluminum salts, liposomes, CpG polymers, oil-in-water emulsions, or a combination thereof. Sometimes, an adjuvant is an oil-in-water emulsion. The oil-in-water emulsion can include at least one oil and at least one surfactant, with the oil(s) and surfactant(s) being biodegradable (metabolisable) and biocompatible. The oil droplets in the emulsion can be less than 5 μ m in diameter, and can even have a sub-micron diameter, with these small sizes being achieved with a microfluidiser to provide stable emulsions. Droplets with a size less than 220 nm can be subjected to filter sterilization.

VIII. Methods of Treatment and Pharmaceutical Compositions

[0359] The neoantigen therapeutics (*e.g.*, peptides, polynucleotides, TCR, CAR, cells containing TCR or CAR, APC or dendritic cell containing polypeptide, dendritic cell containing polynucleotide, antibody, etc.) described herein are useful in a variety of applications including, but not limited to, therapeutic treatment methods, such as the treatment of cancer. In some embodiments, the therapeutic treatment methods comprise immunotherapy. In certain embodiments, a neoantigenic peptide is useful for activating, promoting, increasing, and/or enhancing an immune response, redirecting an existing immune response to a new target, increasing the immunogenicity of a tumor, inhibiting tumor growth, reducing tumor volume, increasing tumor cell apoptosis, and/or reducing the tumorigenicity of a tumor. The methods of use can be *in vitro*, *ex vivo*, or *in vivo* methods.

[0360] In some aspects, the present disclosure provides methods for activating an immune response in a subject using a neoantigenic peptide or protein described herein. In some embodiments, the present disclosure provides methods for promoting an immune response in a subject using a neoantigenic peptide described herein. In some embodiments, the present disclosure provides methods for increasing an immune response in a subject using a neoantigenic peptide described herein. In some embodiments, the present disclosure provides methods for enhancing an immune response using a neoantigenic peptide. In some embodiments, the activating, promoting, increasing, and/or enhancing of an immune response comprises increasing cell-mediated immunity. In some embodiments, the activating, promoting, increasing, and/or enhancing of an immune response comprises increasing T cell activity or humoral immunity. In some embodiments, the activating, promoting, increasing, and/or enhancing of an immune response comprises increasing CTL or Th activity. In some embodiments, the activating, promoting, increasing, and/or enhancing of an immune response comprises increasing NK cell activity. In some embodiments, the activating, promoting, increasing, and/or enhancing of an immune response comprises increasing T cell activity and increasing NK cell activity. In some embodiments, the activating, promoting, increasing, and/or enhancing of an immune response comprises increasing CTL activity and increasing NK cell activity. In some embodiments, the activating, promoting, increasing, and/or enhancing of an immune response comprises inhibiting or decreasing the suppressive activity of T regulatory (Treg) cells. In some embodiments, the immune response is a result of antigenic stimulation. In some embodiments, the antigenic stimulation is a tumor cell. In some embodiments, the antigenic stimulation is cancer.

[0361] In some embodiments, the present disclosure provides methods of activating, promoting, increasing, and/or enhancing of an immune response using a neoantigenic peptide described herein. In some embodiments, a method comprises administering to a subject in need thereof a therapeutically effective amount of a neoantigenic peptide that delivers a neoantigenic peptide or polynucleotide to a tumor cell. In some embodiments, a method comprises administering to a subject in need thereof a therapeutically effective amount of a neoantigenic peptide internalized by the tumor cell. In some embodiments, a method comprises administering to a subject in need thereof a therapeutically effective amount of a neoantigenic peptide that is internalized by a tumor cell, and the neoantigenic peptide is

processed by the cell. In some embodiments, a method comprises administering to a subject in need thereof a therapeutically effective amount of a neoantigenic polypeptide that is internalized by a tumor cell and a neoepitope is presented on the surface of the tumor cell. In some embodiments, a method comprises administering to a subject in need thereof a therapeutically effective amount of a neoantigenic polypeptide that is internalized by the tumor cell, is processed by the cell, and an antigenic peptide is presented on the surface of the tumor cell.

[0362] In some embodiments, a method comprises administering to a subject in need thereof a therapeutically effective amount of a neoantigenic peptide or polynucleotide described herein that delivers an exogenous polypeptide comprising at least one neoantigenic peptide to a tumor cell, wherein at least one neoepitope derived from the neoantigenic peptide is presented on the surface of the tumor cell. In some embodiments, the antigenic peptide is presented on the surface of the tumor cell in complex with a MHC class I molecule. In some embodiments, the neoepitope is presented on the surface of the tumor cell in complex with a MHC class II molecule.

[0363] In some embodiments, a method comprises contacting a tumor cell with a neoantigenic polypeptide or polynucleotide described herein that delivers an exogenous polypeptide comprising at least one neoantigenic peptide to the tumor cell, wherein at least one neoepitope derived from the at least one neoantigenic peptide is presented on the surface of the tumor cell. In some embodiments, the neoepitope is presented on the surface of the tumor cell in complex with a MHC class I molecule. In some embodiments, the neoepitope is presented on the surface of the tumor cell in complex with a MHC class II molecule.

[0364] In some embodiments, a method comprises administering to a subject in need thereof a therapeutically effective amount of a neoantigenic polypeptide or polynucleotide described herein that delivers an exogenous polypeptide comprising at least one antigenic peptide to a tumor cell, wherein the neoepitope is presented on the surface of the tumor cell, and an immune response against the tumor cell is induced. In some embodiments, the immune response against the tumor cell is increased. In some embodiments, the neoantigenic polypeptide or polynucleotide delivers an exogenous polypeptide comprising at least one neoantigenic peptide to a tumor cell, wherein the neoepitope is presented on the surface of the tumor cell, and tumor growth is inhibited.

[0365] In some embodiments, a method comprises administering to a subject in need thereof a therapeutically effective amount of a neoantigenic polypeptide or polynucleotide described herein that delivers an exogenous polypeptide comprising at least one neoantigenic peptide to a tumor cell, wherein the neoepitope derived from the at least one neoantigenic peptide is presented on the surface of the tumor cell, and T cell killing directed against the tumor cell is induced. In some embodiments, T cell killing directed against the tumor cell is enhanced. In some embodiments, T cell killing directed against the tumor cell is increased.

[0366] In some embodiments, a method of increasing an immune response in a subject comprises administering to the subject a therapeutically effective amount of a neoantigenic therapeutic described

herein, wherein the agent is an antibody that specifically binds the neoantigen described herein. In some embodiments, a method of increasing an immune response in a subject comprises administering to the subject a therapeutically effective amount of the antibody.

[0367] The present disclosure provides methods of redirecting an existing immune response to a tumor. In some embodiments, a method of redirecting an existing immune response to a tumor comprises administering to a subject a therapeutically effective amount of a neoantigen therapeutic described herein. In some embodiments, the existing immune response is against a virus. In some embodiments, the virus is selected from the group consisting of: measles virus, varicella-zoster virus (VZV; chickenpox virus), influenza virus, mumps virus, poliovirus, rubella virus, rotavirus, hepatitis A virus (HAV), hepatitis B virus (HBV), Epstein Barr virus (EBV), and cytomegalovirus (CMV). In some embodiments, the virus is varicella-zoster virus. In some embodiments, the virus is cytomegalovirus. In some embodiments, the virus is measles virus. In some embodiments, the existing immune response has been acquired after a natural viral infection. In some embodiments, the existing immune response has been acquired after vaccination against a virus. In some embodiments, the existing immune response is a cell-mediated response. In some embodiments, the existing immune response comprises cytotoxic T cells (CTLs) or Th cells.

[0368] In some embodiments, a method of redirecting an existing immune response to a tumor in a subject comprises administering a fusion protein comprising (i) an antibody that specifically binds a neoantigen and (ii) at least one neoantigenic peptide described herein, wherein (a) the fusion protein is internalized by a tumor cell after binding to the tumor-associated antigen or the neopeptide; (b) the neoantigenic peptide is processed and presented on the surface of the tumor cell associated with a MHC class I molecule; and (c) the neoantigenic peptide/MHC Class I complex is recognized by cytotoxic T cells. In some embodiments, the cytotoxic T cells are memory T cells. In some embodiments, the memory T cells are the result of a vaccination with the neoantigenic peptide.

[0369] The present disclosure provides methods of increasing the immunogenicity of a tumor. In some embodiments, a method of increasing the immunogenicity of a tumor comprises contacting a tumor or tumor cells with an effective amount of a neoantigen therapeutic described herein. In some embodiments, a method of increasing the immunogenicity of a tumor comprises administering to a subject a therapeutically effective amount of a neoantigen therapeutic described herein.

[0370] The present disclosure also provides methods for inhibiting growth of a tumor using a neoantigen therapeutic described herein. In certain embodiments, a method of inhibiting growth of a tumor comprises contacting a cell mixture with a neoantigen therapeutic *in vitro*. For example, an immortalized cell line or a cancer cell line mixed with immune cells (*e.g.*, T cells) is cultured in medium to which a neoantigenic peptide is added. In some embodiments, tumor cells are isolated from a patient sample, for example, a tissue biopsy, pleural effusion, or blood sample, mixed with immune cells (*e.g.*, T cells), and cultured in medium to which a neoantigen therapeutic is added. In some embodiments, a neoantigen therapeutic increases, promotes, and/or enhances the activity of the immune cells. In some

embodiments, a neoantigen therapeutic inhibits tumor cell growth. In some embodiments, a neoantigen therapeutic activates killing of the tumor cells.

[0371] In certain embodiments, the subject is a human. In certain embodiments, the subject has a tumor or the subject had a tumor which was at least partially removed.

[0372] In some embodiments, a method of inhibiting growth of a tumor comprises redirecting an existing immune response to a new target, comprising administering to a subject a therapeutically effective amount of a neoantigen therapeutic, wherein the existing immune response is against an antigenic peptide delivered to the tumor cell by the neoantigenic peptide.

[0373] In certain embodiments, the tumor comprises cancer stem cells. In certain embodiments, the frequency of cancer stem cells in the tumor is reduced by administration of the neoantigen therapeutic. In some embodiments, a method of reducing the frequency of cancer stem cells in a tumor in a subject, comprising administering to the subject a therapeutically effective amount of a neoantigen therapeutic is provided.

[0374] In addition, in some aspects the present disclosure provides a method of reducing the tumorigenicity of a tumor in a subject, comprising administering to the subject a therapeutically effective amount of a neoantigen therapeutic described herein. In certain embodiments, the tumor comprises cancer stem cells. In some embodiments, the tumorigenicity of a tumor is reduced by reducing the frequency of cancer stem cells in the tumor. In some embodiments, the methods comprise using the neoantigen therapeutic described herein. In certain embodiments, the frequency of cancer stem cells in the tumor is reduced by administration of a neoantigen therapeutic described herein.

[0375] In some embodiments, the tumor is a solid tumor. In certain embodiments, the tumor is a tumor selected from the group consisting of: colorectal tumor, pancreatic tumor, lung tumor, ovarian tumor, liver tumor, breast tumor, kidney tumor, prostate tumor, neuroendocrine tumor, gastrointestinal tumor, melanoma, cervical tumor, bladder tumor, glioblastoma, and head and neck tumor. In certain embodiments, the tumor is a colorectal tumor. In certain embodiments, the tumor is an ovarian tumor. In some embodiments, the tumor is a breast tumor. In some embodiments, the tumor is a lung tumor. In certain embodiments, the tumor is a pancreatic tumor. In certain embodiments, the tumor is a melanoma tumor. In some embodiments, the tumor is a solid tumor.

[0376] The present disclosure further provides methods for treating cancer in a subject comprising administering to the subject a therapeutically effective amount of a neoantigen therapeutic described herein.

[0377] In some embodiments, a method of treating cancer comprises redirecting an existing immune response to a new target, the method comprising administering to a subject a therapeutically effective amount of neoantigen therapeutic, wherein the existing immune response is against an antigenic peptide delivered to the cancer cell by the neoantigenic peptide.

[0378] The present disclosure provides for methods of treating cancer comprising administering to a subject a therapeutically effective amount of a neoantigen therapeutic described herein (*e.g.*, a subject in

need of treatment). In certain embodiments, the subject is a human. In certain embodiments, the subject has a cancerous tumor. In certain embodiments, the subject has had a tumor at least partially removed.

[0379] Subjects can be, for example, mammal, humans, pregnant women, elderly adults, adults, adolescents, pre-adolescents, children, toddlers, infants, newborn, or neonates. A subject can be a patient. In some cases, a subject can be a human. In some cases, a subject can be a child (i.e. a young human being below the age of puberty). In some cases, a subject can be an infant. In some cases, the subject can be a formula-fed infant. In some cases, a subject can be an individual enrolled in a clinical study. In some cases, a subject can be a laboratory animal, for example, a mammal, or a rodent. In some cases, the subject can be a mouse. In some cases, the subject can be an obese or overweight subject.

[0380] In some embodiments, the subject has previously been treated with one or more different cancer treatment modalities. In some embodiments, the subject has previously been treated with one or more of radiotherapy, chemotherapy, or immunotherapy. In some embodiments, the subject has been treated with one, two, three, four, or five lines of prior therapy. In some embodiments, the prior therapy is a cytotoxic therapy.

[0381] In certain embodiments, the cancer is a cancer selected from the group consisting of colorectal cancer, pancreatic cancer, lung cancer, ovarian cancer, liver cancer, breast cancer, kidney cancer, prostate cancer, gastrointestinal cancer, melanoma, cervical cancer, neuroendocrine cancer, bladder cancer, glioblastoma, and head and neck cancer. In certain embodiments, the cancer is pancreatic cancer. In certain embodiments, the cancer is ovarian cancer. In certain embodiments, the cancer is colorectal cancer. In certain embodiments, the cancer is breast cancer. In certain embodiments, the cancer is prostate cancer. In certain embodiments, the cancer is lung cancer. In certain embodiments, the cancer is melanoma. In some embodiments, the cancer is a solid cancer. In some embodiments, the cancer comprises a solid tumor.

[0382] In some embodiments, the cancer is a hematologic cancer. In some embodiment, the cancer is selected from the group consisting of: acute myelogenous leukemia (AML), Hodgkin lymphoma, multiple myeloma, T cell acute lymphoblastic leukemia (T-ALL), chronic lymphocytic leukemia (CLL), hairy cell leukemia, chronic myelogenous leukemia (CML), non-Hodgkin lymphoma, diffuse large B-cell lymphoma (DLBCL), mantle cell lymphoma (MCL), and cutaneous T cell lymphoma (CTCL).

[0383] In some embodiments, the neoantigen therapeutic is administered as a combination therapy. Combination therapy with two or more therapeutic agents uses agents that work by different mechanisms of action, although this is not required. Combination therapy using agents with different mechanisms of action can result in additive or synergetic effects. Combination therapy can allow for a lower dose of each agent than is used in monotherapy, thereby reducing toxic side effects and/or increasing the therapeutic index of the agent(s). Combination therapy can decrease the likelihood that resistant cancer cells will develop. In some embodiments, combination therapy comprises a therapeutic agent that affects the immune response (*e.g.*, enhances or activates the response) and a therapeutic agent that affects (*e.g.*, inhibits or kills) the tumor/cancer cells.

[0384] In some instances, an immunogenic pharmaceutical composition can be administered with an additional agent. The choice of the additional agent can depend, at least in part, on the condition being treated. The additional agent can include, for example, a checkpoint inhibitor agent such as an anti-PD1, anti-CTLA4, anti-PD-L1, anti CD40, or anti-TIM3 agent (e.g., an anti-PD1, anti-CTLA4, anti-PD-L1, anti CD40, or anti-TIM3 antibody); or any agents having a therapeutic effect for a pathogen infection (e.g. viral infection), including, e.g., drugs used to treat inflammatory conditions such as an NSAID, e.g., ibuprofen, naproxen, acetaminophen, ketoprofen, or aspirin. For example, the checkpoint inhibitor can be a PD-1/PD-L1 antagonist selected from the group consisting of: nivolumab (ONO-4538/BMS-936558, MDX1 106, OPDIVO), pembrolizumab (MK-3475, KEYTRUDA), pidilizumab (CT-011), and MPDL3280A (ROCHE). As another example, formulations can additionally contain one or more supplements, such as vitamin C, E or other anti-oxidants.

[0385] The methods of the disclosure can be used to treat any type of cancer known in the art. Non-limiting examples of cancers to be treated by the methods of the present disclosure can include melanoma (e.g., metastatic malignant melanoma), renal cancer (e.g., clear cell carcinoma), prostate cancer (e.g., hormone refractory prostate adenocarcinoma), pancreatic adenocarcinoma, breast cancer, colon cancer, lung cancer (e.g., non-small cell lung cancer), esophageal cancer, squamous cell carcinoma of the head and neck, liver cancer, ovarian cancer, cervical cancer, thyroid cancer, glioblastoma, glioma, leukemia, lymphoma, and other neoplastic malignancies.

[0386] Additionally, the disease or condition provided herein includes refractory or recurrent malignancies whose growth may be inhibited using the methods of treatment of the present disclosure. In some embodiments, a cancer to be treated by the methods of treatment of the present disclosure is selected from the group consisting of carcinoma, squamous carcinoma, adenocarcinoma, sarcomata, endometrial cancer, breast cancer, ovarian cancer, cervical cancer, fallopian tube cancer, primary peritoneal cancer, colon cancer, colorectal cancer, squamous cell carcinoma of the anogenital region, melanoma, renal cell carcinoma, lung cancer, non-small cell lung cancer, squamous cell carcinoma of the lung, stomach cancer, bladder cancer, gall bladder cancer, liver cancer, thyroid cancer, laryngeal cancer, salivary gland cancer, esophageal cancer, head and neck cancer, glioblastoma, glioma, squamous cell carcinoma of the head and neck, prostate cancer, pancreatic cancer, mesothelioma, sarcoma, hematological cancer, leukemia, lymphoma, neuroma, and combinations thereof. In some embodiments, a cancer to be treated by the methods of the present disclosure include, for example, carcinoma, squamous carcinoma (for example, cervical canal, eyelid, tunica conjunctiva, vagina, lung, oral cavity, skin, urinary bladder, tongue, larynx, and gullet), and adenocarcinoma (for example, prostate, small intestine, endometrium, cervical canal, large intestine, lung, pancreas, gullet, rectum, uterus, stomach, mammary gland, and ovary). In some embodiments, a cancer to be treated by the methods of the present disclosure further include sarcomata (for example, myogenic sarcoma), leukosis, neuroma, melanoma, and lymphoma. In some embodiments, a cancer to be treated by the methods of the present disclosure is breast cancer. In some embodiments, a cancer to be treated by the methods of treatment of the present disclosure

is triple negative breast cancer (TNBC). In some embodiments, a cancer to be treated by the methods of treatment of the present disclosure is ovarian cancer. In some embodiments, a cancer to be treated by the methods of treatment of the present disclosure is colorectal cancer.

[0387] In some embodiments, a patient or population of patients to be treated with a pharmaceutical composition of the present disclosure have a solid tumor. In some embodiments, a solid tumor is a melanoma, renal cell carcinoma, lung cancer, bladder cancer, breast cancer, cervical cancer, colon cancer, gall bladder cancer, laryngeal cancer, liver cancer, thyroid cancer, stomach cancer, salivary gland cancer, prostate cancer, pancreatic cancer, or Merkel cell carcinoma. In some embodiments, a patient or population of patients to be treated with a pharmaceutical composition of the present disclosure have a hematological cancer. In some embodiments, the patient has a hematological cancer such as Diffuse large B cell lymphoma (“DLBCL”), Hodgkin’s lymphoma (“HL”), Non-Hodgkin’s lymphoma (“NHL”), Follicular lymphoma (“FL”), acute myeloid leukemia (“AML”), or Multiple myeloma (“MM”). In some embodiments, a patient or population of patients to be treated having the cancer selected from the group consisting of ovarian cancer, lung cancer and melanoma.

[0388] Specific examples of cancers that can be prevented and/or treated in accordance with present disclosure include, but are not limited to, the following: renal cancer, kidney cancer, glioblastoma multiforme, metastatic breast cancer; breast carcinoma; breast sarcoma; neurofibroma; neurofibromatosis; pediatric tumors; neuroblastoma; malignant melanoma; carcinomas of the epidermis; leukemias such as but not limited to, acute leukemia, acute lymphocytic leukemia, acute myelocytic leukemias such as myeloblastic, promyelocytic, myelomonocytic, monocytic, erythroleukemia leukemias and myelodysplastic syndrome, chronic leukemias such as but not limited to, chronic myelocytic (granulocytic) leukemia, chronic lymphocytic leukemia, hairy cell leukemia; polycythemia vera; lymphomas such as but not limited to Hodgkin’s disease, non-Hodgkin’s disease; multiple myelomas such as but not limited to smoldering multiple myeloma, nonsecretory myeloma, osteosclerotic myeloma, plasma cell leukemia, solitary plasmacytoma and extramedullary plasmacytoma; Waldenstrom’s macroglobulinemia; monoclonal gammopathy of undetermined significance; benign monoclonal gammopathy; heavy chain disease; bone cancer and connective tissue sarcomas such as but not limited to bone sarcoma, myeloma bone disease, multiple myeloma, cholesteatoma-induced bone osteosarcoma, Paget’s disease of bone, osteosarcoma, chondrosarcoma, Ewing’s sarcoma, malignant giant cell tumor, fibrosarcoma of bone, chordoma, periosteal sarcoma, soft-tissue sarcomas, angiosarcoma (hemangiosarcoma), fibrosarcoma, Kaposi’s sarcoma, leiomyosarcoma, liposarcoma, lymphangio sarcoma, neurilemmoma, rhabdomyosarcoma, and synovial sarcoma; brain tumors such as but not limited to, glioma, astrocytoma, brain stem glioma, ependymoma, oligodendroglioma, nonglial tumor, acoustic neurinoma, craniopharyngioma, medulloblastoma, meningioma, pineocytoma, pineoblastoma, and primary brain lymphoma; breast cancer including but not limited to adenocarcinoma, lobular (small cell) carcinoma, intraductal carcinoma, medullary breast cancer, mucinous breast cancer, tubular breast cancer, papillary breast cancer, Paget’s disease (including juvenile Paget’s disease) and inflammatory breast

cancer; adrenal cancer such as but not limited to pheochromocytom and adrenocortical carcinoma; thyroid cancer such as but not limited to papillary or follicular thyroid cancer, medullary thyroid cancer and anaplastic thyroid cancer; pancreatic cancer such as but not limited to, insulinoma, gastrinoma, glucagonoma, vipoma, somatostatin-secreting tumor, and carcinoid or islet cell tumor; pituitary cancers such as but limited to Cushing's disease, prolactin-secreting tumor, acromegaly, and diabetes insipidus; eye cancers such as but not limited to ocular melanoma such as iris melanoma, choroidal melanoma, and ciliary body melanoma, and retinoblastoma; vaginal cancers such as squamous cell carcinoma, adenocarcinoma, and melanoma; vulvar cancer such as squamous cell carcinoma, melanoma, adenocarcinoma, basal cell carcinoma, sarcoma, and Paget's disease; cervical cancers such as but not limited to, squamous cell carcinoma, and adenocarcinoma; uterine cancers such as but not limited to endometrial carcinoma and uterine sarcoma; ovarian cancers such as but not limited to, ovarian epithelial carcinoma, borderline tumor, germ cell tumor, and stromal tumor; cervical carcinoma; esophageal cancers such as but not limited to, squamous cancer, adenocarcinoma, adenoid cystic carcinoma, mucoepidermoid carcinoma, adenosquamous carcinoma, sarcoma, melanoma, plasmacytoma, verrucous carcinoma, and oat cell (small cell) carcinoma; stomach cancers such as but not limited to, adenocarcinoma, fungating (polypoid), ulcerating, superficial spreading, diffusely spreading, malignant lymphoma, liposarcoma, fibrosarcoma, and carcinosarcoma; colon cancers; colorectal cancer, KRAS mutated colorectal cancer; colon carcinoma; rectal cancers; liver cancers such as but not limited to hepatocellular carcinoma and hepatoblastoma, gallbladder cancers such as adenocarcinoma; cholangiocarcinomas such as but not limited to papillary, nodular, and diffuse; lung cancers such as KRAS-mutated non-small cell lung cancer, non-small cell lung cancer, squamous cell carcinoma (epidermoid carcinoma), adenocarcinoma, large-cell carcinoma and small-cell lung cancer; lung carcinoma; testicular cancers such as but not limited to germinal tumor, seminoma, anaplastic, classic (typical), spermatocytic, nonseminoma, embryonal carcinoma, teratoma carcinoma, choriocarcinoma (yolk-sac tumor), prostate cancers such as but not limited to, androgen-independent prostate cancer, androgen-dependent prostate cancer, adenocarcinoma, leiomyosarcoma, and rhabdomyosarcoma; penial cancers; oral cancers such as but not limited to squamous cell carcinoma; basal cancers; salivary gland cancers such as but not limited to adenocarcinoma, mucoepidermoid carcinoma, and adenoidecystic carcinoma; pharynx cancers such as but not limited to squamous cell cancer, and verrucous; skin cancers such as but not limited to, basal cell carcinoma, squamous cell carcinoma and melanoma, superficial spreading melanoma, nodular melanoma, lentigo malignant melanoma, acral lentiginous melanoma; kidney cancers such as but not limited to renal cell cancer, adenocarcinoma, hypernephroma, fibrosarcoma, transitional cell cancer (renal pelvis and/or uterer); renal carcinoma; Wilms' tumor; bladder cancers such as but not limited to transitional cell carcinoma, squamous cell cancer, adenocarcinoma, carcinosarcoma. In addition, cancers include myxosarcoma, osteogenic sarcoma, endotheliosarcoma, lymphangioendotheliosarcoma, mesothelioma, synovioma, hemangioblastoma, epithelial carcinoma, cystadenocarcinoma, bronchogenic carcinoma, sweat gland carcinoma, sebaceous gland carcinoma, papillary carcinoma and papillary adenocarcinomas.

[0389] Cancers include, but are not limited to, B cell cancer, *e.g.*, multiple myeloma, Waldenstrom's macroglobulinemia, the heavy chain diseases, such as, for example, alpha chain disease, gamma chain disease, and mu chain disease, benign monoclonal gammopathy, and immunocytic amyloidosis, melanomas, breast cancer, lung cancer, bronchus cancer, colorectal cancer, prostate cancer (*e.g.*, metastatic, hormone refractory prostate cancer), pancreatic cancer, stomach cancer, ovarian cancer, urinary bladder cancer, brain or central nervous system cancer, peripheral nervous system cancer, esophageal cancer, cervical cancer, uterine or endometrial cancer, cancer of the oral cavity or pharynx, liver cancer, kidney cancer, testicular cancer, biliary tract cancer, small bowel or appendix cancer, salivary gland cancer, thyroid gland cancer, adrenal gland cancer, osteosarcoma, chondrosarcoma, cancer of hematological tissues, and the like. Other non-limiting examples of types of cancers applicable to the methods encompassed by the present disclosure include human sarcomas and carcinomas, *e.g.*, fibrosarcoma, myxosarcoma, liposarcoma, chondrosarcoma, osteogenic sarcoma, chordoma, angiosarcoma, endotheliosarcoma, lymphangiosarcoma, lymphangi endotheliosarcoma, synovioma, mesothelioma, Ewing's tumor, leiomyosarcoma, rhabdomyosarcoma, colon carcinoma, colorectal cancer, pancreatic cancer, breast cancer, ovarian cancer, squamous cell carcinoma, basal cell carcinoma, adenocarcinoma, sweat gland carcinoma, sebaceous gland carcinoma, papillary carcinoma, papillary adenocarcinomas, cystadenocarcinoma, medullary carcinoma, bronchogenic carcinoma, renal cell carcinoma, hepatoma, bile duct carcinoma, liver cancer, choriocarcinoma, seminoma, embryonal carcinoma, Wilms' tumor, cervical cancer, bone cancer, brain tumor, testicular cancer, lung carcinoma, small cell lung carcinoma, bladder carcinoma, epithelial carcinoma, glioma, astrocytoma, medulloblastoma, craniopharyngioma, ependymoma, pinealoma, hemangioblastoma, acoustic neuroma, oligodendroglioma, meningioma, melanoma, neuroblastoma, retinoblastoma; leukemias, *e.g.*, acute lymphocytic leukemia and acute myelocytic leukemia (myeloblastic, promyelocytic, myelomonocytic, monocytic and erythroleukemia); chronic leukemia (chronic myelocytic (granulocytic) leukemia and chronic lymphocytic leukemia); and polycythemia vera, lymphoma (Hodgkin's disease and non-Hodgkin's disease), multiple myeloma, Waldenstrom's macroglobulinemia, and heavy chain disease. In some embodiments, the cancer whose phenotype is determined by the method of the present disclosure is an epithelial cancer such as, but not limited to, bladder cancer, breast cancer, cervical cancer, colon cancer, gynecologic cancers, renal cancer, laryngeal cancer, lung cancer, oral cancer, head and neck cancer, ovarian cancer, pancreatic cancer, prostate cancer, or skin cancer. In other embodiments, the cancer is breast cancer, prostate cancer, lung cancer, or colon cancer. In still other embodiments, the epithelial cancer is non-small-cell lung cancer, nonpapillary renal cell carcinoma, cervical carcinoma, ovarian carcinoma (*e.g.*, serous ovarian carcinoma), or breast carcinoma. The epithelial cancers may be characterized in various other ways including, but not limited to, serous, endometrioid, mucinous, clear cell, brenner, or undifferentiated. In some embodiments, the present disclosure is used in the treatment, diagnosis, and/or prognosis of lymphoma or its subtypes, including, but not limited to, mantle cell lymphoma. Lymphoproliferative disorders are also considered to be proliferative diseases.

[0390] In some embodiments, the combination of an agent described herein and at least one additional therapeutic agent results in additive or synergistic results. In some embodiments, the combination therapy results in an increase in the therapeutic index of the agent. In some embodiments, the combination therapy results in an increase in the therapeutic index of the additional therapeutic agent(s). In some embodiments, the combination therapy results in a decrease in the toxicity and/or side effects of the agent. In some embodiments, the combination therapy results in a decrease in the toxicity and/or side effects of the additional therapeutic agent(s).

[0391] In certain embodiments, in addition to administering a neoantigen therapeutic described herein, the method or treatment further comprises administering at least one additional therapeutic agent. An additional therapeutic agent can be administered prior to, concurrently with, and/or subsequently to, administration of the agent. In some embodiments, the at least one additional therapeutic agent comprises 1, 2, 3, or more additional therapeutic agents.

[0392] Therapeutic agents that can be administered in combination with the neoantigen therapeutic described herein include chemotherapeutic agents. Thus, in some embodiments, the method or treatment involves the administration of an agent described herein in combination with a chemotherapeutic agent or in combination with a cocktail of chemotherapeutic agents. Treatment with an agent can occur prior to, concurrently with, or subsequent to administration of chemotherapies. Combined administration can include co-administration, either in a single pharmaceutical formulation or using separate formulations, or consecutive administration in either order but generally within a time period such that all active agents can exert their biological activities simultaneously. Preparation and dosing schedules for such chemotherapeutic agents can be used according to manufacturers' instructions or as determined empirically by the skilled practitioner. Preparation and dosing schedules for such chemotherapy are also described in *The Chemotherapy Source Book*, 4th Edition, 2008, M. C. Perry, Editor, Lippincott, Williams & Wilkins, Philadelphia, PA.

[0393] Useful classes of chemotherapeutic agents include, for example, anti-tubulin agents, auristatins, DNA minor groove binders, DNA replication inhibitors, alkylating agents (*e.g.*, platinum complexes such as cisplatin, mono(platinum), bis(platinum) and tri-nuclear platinum complexes and carboplatin), anthracyclines, antibiotics, anti-folates, antimetabolites, chemotherapy sensitizers, duocarmycins, etoposides, fluorinated pyrimidines, ionophores, lexitropsins, nitrosoureas, platinols, purine antimetabolites, puromycins, radiation sensitizers, steroids, taxanes, topoisomerase inhibitors, vinca alkaloids, or the like. In certain embodiments, the second therapeutic agent is an alkylating agent, an antimetabolite, an antimetabolic, a topoisomerase inhibitor, or an angiogenesis inhibitor.

[0394] Chemotherapeutic agents useful in the present disclosure include, but are not limited to, alkylating agents such as thiotepa and cyclophosphamide (CYTOXAN); alkyl sulfonates such as busulfan, improsulfan and piposulfan; aziridines such as benzodopa, carboquone, meturedopa, and uredopa; ethylenimines and methylamelamines including altretamine, triethylenemelamine, triethylenephosphoramide, triethylenethiophosphoramide and trimethylolomelamine; nitrogen mustards

such as chlorambucil, chlornaphazine, cholophosphamide, estramustine, ifosfamide, mechlorethamine, mechlorethamine oxide hydrochloride, melphalan, novembichin, phenesterine, prednimustine, trofosfamide, uracil mustard; nitrosureas such as carmustine, chlorozotocin, fotemustine, lomustine, nimustine, ranimustine; antibiotics such as aclacinomysins, actinomycin, authramycin, azaserine, bleomycins, cactinomycin, calicheamicin, carabycin, caminomycin, carzinophilin, chromomycins, dactinomycin, daunorubicin, detorubicin, 6-diazo-5-oxo-L-norleucine, doxorubicin, epirubicin, esorubicin, idarubicin, marcellomycin, mitomycins, mycophenolic acid, nogalamycin, olivomycins, peplomycin, potfiromycin, puromycin, quelamycin, rodorubicin, streptonigrin, streptozocin, tubercidin, ubenimex, zinostatin, zorubicin; anti-metabolites such as methotrexate and 5-fluorouracil (5-FU); folic acid analogues such as denopterin, methotrexate, pteropterin, trimetrexate; purine analogs such as fludarabine, 6-mercaptopurine, thiamiprine, thioguanine; pyrimidine analogs such as ancitabine, azacitidine, 6-azauridine, carmofur, cytosine arabinoside, dideoxyuridine, doxifluridine, enocitabine, floxuridine, 5-FU; androgens such as calusterone, dromostanolone propionate, epitio stanol, mepitio stanol, testolactone; anti-adrenals such as aminoglutethimide, mitotane, trilostane; folic acid replenishers such as folinic acid; aceglatone; aldophosphamide glycoside; aminolevulinic acid; amsacrine; bestrabucil; bisantrene; edatraxate; defofamine; demecolcine; diaziquone; elformithine; elliptinium acetate; etoglucid; gallium nitrate; hydroxyurea; lentinan; lonidamine; mitoguanzone; mitoxantrone; mopidamol; nitracrine; pentostatin; phenamet; pirarubicin; podophyllinic acid; 2-ethylhydrazide; procarbazine; PSK; razoxane; sizofuran; spirogermanium; tenuazonic acid; triaziquone; 2,2',2''-trichlorotriethylamine; urethan; vindesine; dacarbazine; mannomustine; mitobronitol; mitolactol; pipobroman; gacytosine; arabinoside (Ara-C); taxoids, *e.g.* paclitaxel (TAXOL) and docetaxel (TAXOTERE); chlorambucil; gemcitabine; 6-thioguanine; mercaptopurine; platinum analogs such as cisplatin and carboplatin; vinblastine; platinum; etoposide (VP-16); ifosfamide; mitomycin C; mitoxantrone; vincristine; vinorelbine; navelbine; novantrone; teniposide; daunomycin; aminopterin; ibandronate; CPT11; topoisomerase inhibitor RFS 2000; difluoromethylornithine (DMFO); retinoic acid; esperamicins; capecitabine (XELODA); and pharmaceutically acceptable salts, acids or derivatives of any of the above. Chemotherapeutic agents also include anti-hormonal agents that act to regulate or inhibit hormone action on tumors such as anti-estrogens including for example tamoxifen, raloxifene, aromatase inhibiting 4(5)-imidazoles, 4-hydroxytamoxifen, trioxifene, keoxifene, LY117018, onapristone, and toremifene (FARESTON); and anti-androgens such as flutamide, nilutamide, bicalutamide, leuprolide, and goserelin; and pharmaceutically acceptable salts, acids or derivatives of any of the above. In certain embodiments, the additional therapeutic agent is cisplatin. In certain embodiments, the additional therapeutic agent is carboplatin.

[0395] In certain embodiments, the chemotherapeutic agent is a topoisomerase inhibitor. Topoisomerase inhibitors are chemotherapy agents that interfere with the action of a topoisomerase enzyme (*e.g.*, topoisomerase I or II). Topoisomerase inhibitors include, but are not limited to, doxorubicin HCl, daunorubicin citrate, mitoxantrone HCl, actinomycin D, etoposide, topotecan HCl, teniposide (VM-

26), and irinotecan, as well as pharmaceutically acceptable salts, acids, or derivatives of any of these. In some embodiments, the additional therapeutic agent is irinotecan.

[0396] In certain embodiments, the chemotherapeutic agent is an anti-metabolite. An anti-metabolite is a chemical with a structure that is similar to a metabolite required for normal biochemical reactions, yet different enough to interfere with one or more normal functions of cells, such as cell division. Anti-metabolites include, but are not limited to, gemcitabine, fluorouracil, capecitabine, methotrexate sodium, raltitrexed, pemetrexed, tegafur, cytosine arabinoside, thioguanine, 5-azacytidine, 6 mercaptopurine, azathioprine, 6-thioguanine, pentostatin, fludarabine phosphate, and cladribine, as well as pharmaceutically acceptable salts, acids, or derivatives of any of these. In certain embodiments, the additional therapeutic agent is gemcitabine.

[0397] In certain embodiments, the chemotherapeutic agent is an antimetabolic agent, including, but not limited to, agents that bind tubulin. In some embodiments, the agent is a taxane. In certain embodiments, the agent is paclitaxel or docetaxel, or a pharmaceutically acceptable salt, acid, or derivative of paclitaxel or docetaxel. In certain embodiments, the agent is paclitaxel (TAXOL), docetaxel (TAXOTERE), albumin-bound paclitaxel (ABRAXANE), DHA-paclitaxel, or PG-paclitaxel. In certain alternative embodiments, the antimetabolic agent comprises a vinca alkaloid, such as vincristine, vinblastine, vinorelbine, or vindesine, or pharmaceutically acceptable salts, acids, or derivatives thereof. In some embodiments, the antimetabolic agent is an inhibitor of kinesin Eg5 or an inhibitor of a mitotic kinase such as Aurora A or Plk1. In certain embodiments, the additional therapeutic agent is paclitaxel. In some embodiments, the additional therapeutic agent is albumin-bound paclitaxel.

[0398] In some embodiments, an additional therapeutic agent comprises an agent such as a small molecule. For example, treatment can involve the combined administration of an agent of the present disclosure with a small molecule that acts as an inhibitor against tumor-associated antigens including, but not limited to, EGFR, HER2 (ErbB2), and/or VEGF. In some embodiments, an agent of the present disclosure is administered in combination with a protein kinase inhibitor selected from the group consisting of: gefitinib (IRESSA), erlotinib (TARCEVA), sunitinib (SUTENT), lapatanib, vandetanib (ZACTIMA), AEE788, CI-1033, cediranib (RECENTIN), sorafenib (NEXAVAR), and pazopanib (GW786034B). In some embodiments, an additional therapeutic agent comprises an mTOR inhibitor. In another embodiment, the additional therapeutic agent is chemotherapy or other inhibitors that reduce the number of Treg cells. In certain embodiments, the therapeutic agent is cyclophosphamide or an anti-CTLA4 antibody. In another embodiment, the additional therapeutic reduces the presence of myeloid-derived suppressor cells. In a further embodiment, the additional therapeutic is carboplatin. In another embodiment, the additional therapeutic agent shifts cells to a T helper 1 response. In a further embodiment, the additional therapeutic agent is ibrutinib.

[0399] In some embodiments, an additional therapeutic agent comprises a biological molecule, such as an antibody. For example, treatment can involve the combined administration of an agent of the present disclosure with antibodies against tumor-associated antigens including, but not limited to, antibodies that

bind EGFR, HER2/ErbB2, and/or VEGF. In certain embodiments, the additional therapeutic agent is an antibody specific for a cancer stem cell marker. In certain embodiments, the additional therapeutic agent is an antibody that is an angiogenesis inhibitor (*e.g.*, an anti-VEGF or VEGF receptor antibody). In certain embodiments, the additional therapeutic agent is bevacizumab (AVASTIN), ramucirumab, trastuzumab (HERCEPTIN), pertuzumab (OMNITARG), panitumumab (VECTIBIX), nimotuzumab, zalutumumab, or cetuximab (ERBITUX).

[0400] The agents and compositions provided herein may be used alone or in combination with conventional therapeutic regimens such as surgery, irradiation, chemotherapy and/or bone marrow transplantation (autologous, syngeneic, allogeneic or unrelated). A set of tumor antigens can be useful, *e.g.*, in a large fraction of cancer patients.

[0401] In some embodiments, at least one or more chemotherapeutic agents may be administered in addition to the composition comprising an immunogenic vaccine. In some embodiments, the one or more chemotherapeutic agents may belong to different classes of chemotherapeutic agents.

[0402] Examples of chemotherapy agents include, but are not limited to, alkylating agents such as nitrogen mustards (*e.g.* mechlorethamine (nitrogen mustard), chlorambucil, cyclophosphamide (Cytoxan®), ifosfamide, and melphalan); nitrosoureas (*e.g.* N-Nitroso-N-methylurea, streptozocin, carmustine (BCNU), lomustine, and semustine); alkyl sulfonates (*e.g.* busulfan); tetrazines (*e.g.* dacarbazine (DTIC), mitozolomide and temozolomide (Temodar®)); aziridines (*e.g.* thiotepa, mytomycin and diaziquone); and platinum drugs (*e.g.* cisplatin, carboplatin, and oxaliplatin); non-classical alkylating agents such as procarbazine and altretamine (hexamethylmelamine); anti-metabolite agents such as 5-fluorouracil (5-FU), 6-mercaptopurine (6-MP), capecitabine (Xeloda®), cladribine, clofarabine, cytarabine (Ara-C®), decitabine, floxuridine, fludarabine, nelarabine, gemcitabine (Gemzar®), hydroxyurea, methotrexate, pemetrexed (Alimta®), pentostatin, thioguanine, Vidaza; anti-microtubule agents such as vinca alkaloids (*e.g.* vincristine, vinblastine, vinorelbine, vindesine and vinflunine); taxanes (*e.g.* paclitaxel (Taxol®), docetaxel (Taxotere®)); podophyllotoxin (*e.g.* etoposide and teniposide); epothilones (*e.g.* ixabepilone (Ixempra®)); estramustine (Emcyt®); anti-tumor antibiotics such as anthracyclines (*e.g.* daunorubicin, doxorubicin (Adriamycin®, epirubicin, idarubicin); actinomycin-D; and bleomycin; topoisomerase I inhibitors such as topotecan and irinotecan (CPT-11); topoisomerase II inhibitors such as etoposide (VP-16), teniposide, mitoxantrone, novobiocin, merbarone and aclarubicin; corticosteroids such as prednisone, methylprednisolone (Solumedrol®), and dexamethasone (Decadron®); L-asparaginase; bortezomib (Velcade®); immunotherapeutic agents such as rituximab (Rituxan®), alemtuzumab (Campath®), thalidomide, lenalidomide (Revlimid®), BCG, interleukin-2, interferon-alfa and cancer vaccines such as Provenge®; hormone therapeutic agents such as fulvestrant (Faslodex®), tamoxifen, toremifene (Fareston®), anastrozole (Arimidex®), exemestan (Aromasin®), letrozole (Femara®), megestrol acetate (Megace®), estrogens, bicalutamide (Casodex®), flutamide (Eulexin®), nilutamide (Nilandron®), leuprolide (Lupron®) and goserelin (Zoladex®); differentiating agents such as retinoids, tretinoin (ATRA or Atralin®), bexarotene (Targretin®) and

arsenic trioxide (Arsenox®); and targeted therapeutic agents such as imatinib (Gleevec®), gefitinib (Iressa®) and sunitinib (Sutent®). In some embodiments, the chemotherapy is a cocktail therapy. Examples of a cocktail therapy includes, but is not limited to, CHOP/R-CHOP (rituxan, cyclophosphamide, hydroxydoxorubicin, vincristine, and prednisone), EPOCH (etoposide, prednisone, vincristine, cyclophosphamide, hydroxydoxorubicin), Hyper-CVAD (cyclophosphamide, vincristine, hydroxydoxorubicin, dexamethasone), FOLFOX (fluorouracil (5-FU), leucovorin, oxaliplatin), ICE (ifosfamide, carboplatin, etoposide), DHAP (high-dose cytarabine [ara-C], dexamethasone, cisplatin), ESHAP (etoposide, methylprednisolone, cytarabine [ara-C], cisplatin) and CMF (cyclophosphamide, methotrexate, fluorouracil).

[0403] In certain embodiments, an additional therapeutic agent comprises a second immunotherapeutic agent. In some embodiments, the additional immunotherapeutic agent includes, but is not limited to, a colony stimulating factor, an interleukin, an antibody that blocks immunosuppressive functions (*e.g.*, an anti-CTLA-4 antibody, anti-CD28 antibody, anti-CD3 antibody, anti-PD-1 antibody, anti-PD-L1 antibody, anti-TIGIT antibody), an antibody that enhances immune cell functions (*e.g.*, an anti-GITR antibody, an anti-OX-40 antibody, an anti-CD40 antibody, or an anti-4-1BB antibody), a toll-like receptor (*e.g.*, TLR4, TLR7, TLR9), a soluble ligand (*e.g.*, GITRL, GITRL-Fc, OX-40L, OX-40L-Fc, CD40L, CD40L-Fc, 4-1BB ligand, or 4-1BB ligand-Fc), or a member of the B7 family (*e.g.*, CD80, CD86). In some embodiments, the additional immunotherapeutic agent targets CTLA-4, CD28, CD3, PD-1, PD-L1, TIGIT, GITR, OX-40, CD-40, or 4-1BB.

[0404] In some embodiments, the additional therapeutic agent is an immune checkpoint inhibitor. In some embodiments, the immune checkpoint inhibitor is an anti-PD-1 antibody, an anti-PD-L1 antibody, an anti-CTLA-4 antibody, an anti-CD28 antibody, an anti-TIGIT antibody, an anti-LAG3 antibody, an anti-TIM3 antibody, an anti-GITR antibody, an anti-4-1BB antibody, or an anti-OX-40 antibody. In some embodiments, the additional therapeutic agent is an anti-TIGIT antibody. In some embodiments, the additional therapeutic agent is an anti-PD-1 antibody selected from the group consisting of: nivolumab (OPDIVO), pembrolizumab (KEYTRUDA), pidilizumab, MEDI0680, REGN2810, BGB-A317, and PDR001. In some embodiments, the additional therapeutic agent is an anti-PD-L1 antibody selected from the group consisting of: BMS935559 (MDX-1105), atezolizumab (MPDL3280A), durvalumab (MEDI4736), and avelumab (MSB0010718C). In some embodiments, the additional therapeutic agent is an anti-CTLA-4 antibody selected from the group consisting of: ipilimumab (YERVOY) and tremelimumab. In some embodiments, the additional therapeutic agent is an anti-LAG-3 antibody selected from the group consisting of: BMS-986016 and LAG525. In some embodiments, the additional therapeutic agent is an anti-OX-40 antibody selected from the group consisting of: MEDI6469, MEDI0562, and MOXR0916. In some embodiments, the additional therapeutic agent is an anti-4-1BB antibody selected from the group consisting of: PF-05082566.

[0405] In some embodiments, the neoantigen therapeutic can be administered in combination with a biologic molecule selected from the group consisting of: adrenomedullin (AM), angiopoietin (Ang),

BMPs, BDNF, EGF, erythropoietin (EPO), FGF, GDNF, granulocyte colony stimulating factor (G-CSF), granulocyte-macrophage colony stimulating factor (GM-CSF), FLT-3L, macrophage colony stimulating factor (M-CSF), stem cell factor (SCF), GDF9, HGF, HDGF, IGF, migration-stimulating factor, myostatin (GDF-8), NGF, neurotrophins, PDGF, thrombopoietin, TGF- α , TGF- β , TNF- α , VEGF, PIGF, gamma-IFN, IL-1, IL-2, IL-3, IL-4, IL-5, IL-6, IL-7, IL-12, IL-15, and IL-18.

[0406] In some embodiments, treatment with a neoantigen therapeutic described herein can be accompanied by surgical removal of tumors, removal of cancer cells, or any other surgical therapy deemed necessary by a treating physician.

[0407] In certain embodiments, treatment involves the administration of a neoantigen therapeutic described herein in combination with radiation therapy. Treatment with an agent can occur prior to, concurrently with, or subsequent to administration of radiation therapy. Dosing schedules for such radiation therapy can be determined by the skilled medical practitioner.

[0408] Combined administration can include co-administration, either in a single pharmaceutical formulation or using separate formulations, or consecutive administration in either order but generally within a time period such that all active agents can exert their biological activities simultaneously.

[0409] It will be appreciated that the combination of a neoantigen therapeutic described herein and at least one additional therapeutic agent can be administered in any order or concurrently. In some embodiments, the agent will be administered to patients that have previously undergone treatment with a second therapeutic agent. In certain other embodiments, the neoantigen therapeutic and a second therapeutic agent will be administered substantially simultaneously or concurrently. For example, a subject can be given an agent while undergoing a course of treatment with a second therapeutic agent (*e.g.*, chemotherapy). In certain embodiments, a neoantigen therapeutic will be administered within 1 year of the treatment with a second therapeutic agent. It will further be appreciated that the two (or more) agents or treatments can be administered to the subject within a matter of hours or minutes (*i.e.*, substantially simultaneously).

[0410] For the treatment of a disease, the appropriate dosage of a neoantigen therapeutic described herein depends on the type of disease to be treated, the severity and course of the disease, the responsiveness of the disease, whether the agent is administered for therapeutic or preventative purposes, previous therapy, the patient's clinical history, and so on, all at the discretion of the treating physician. The neoantigen therapeutic can be administered one time or over a series of treatments lasting from several days to several months, or until a cure is effected or a diminution of the disease state is achieved (*e.g.*, reduction in tumor size). Optimal dosing schedules can be calculated from measurements of drug accumulation in the body of the patient and will vary depending on the relative potency of an individual agent. The administering physician can determine optimum dosages, dosing methodologies, and repetition rates.

[0411] In some embodiments, a neoantigen therapeutic can be administered at an initial higher "loading" dose, followed by one or more lower doses. In some embodiments, the frequency of

administration can also change. In some embodiments, a dosing regimen can comprise administering an initial dose, followed by additional doses (or “maintenance” doses) once a week, once every two weeks, once every three weeks, or once every month. For example, a dosing regimen can comprise administering an initial loading dose, followed by a weekly maintenance dose of, for example, one-half of the initial dose. Or a dosing regimen can comprise administering an initial loading dose, followed by maintenance doses of, for example one-half of the initial dose every other week. Or a dosing regimen can comprise administering three initial doses for 3 weeks, followed by maintenance doses of, for example, the same amount every other week.

[0412] As is known to those of skill in the art, administration of any therapeutic agent can lead to side effects and/or toxicities. In some cases, the side effects and/or toxicities are so severe as to preclude administration of the particular agent at a therapeutically effective dose. In some cases, therapy must be discontinued, and other agents can be tried. However, many agents in the same therapeutic class display similar side effects and/or toxicities, meaning that the patient either has to stop therapy, or if possible, suffer from the unpleasant side effects associated with the therapeutic agent.

[0413] In some embodiments, the dosing schedule can be limited to a specific number of administrations or “cycles”. In some embodiments, the agent is administered for 3, 4, 5, 6, 7, 8, or more cycles. For example, the agent is administered every 2 weeks for 6 cycles, the agent is administered every 3 weeks for 6 cycles, the agent is administered every 2 weeks for 4 cycles, the agent is administered every 3 weeks for 4 cycles, etc. Dosing schedules can be decided upon and subsequently modified by those skilled in the art.

[0414] The present disclosure provides methods of administering to a subject a neoantigen therapeutic described herein comprising using an intermittent dosing strategy for administering one or more agents, which can reduce side effects and/or toxicities associated with administration of an agent, chemotherapeutic agent, etc. In some embodiments, a method for treating cancer in a human subject comprises administering to the subject a therapeutically effective dose of a neoantigen therapeutic in combination with a therapeutically effective dose of a chemotherapeutic agent, wherein one or both of the agents are administered according to an intermittent dosing strategy. In some embodiments, a method for treating cancer in a human subject comprises administering to the subject a therapeutically effective dose of a neoantigen therapeutic in combination with a therapeutically effective dose of a second immunotherapeutic agent, wherein one or both of the agents are administered according to an intermittent dosing strategy. In some embodiments, the intermittent dosing strategy comprises administering an initial dose of a neoantigen therapeutic to the subject, and administering subsequent doses of the agent about once every 2 weeks. In some embodiments, the intermittent dosing strategy comprises administering an initial dose of a neoantigen therapeutic to the subject, and administering subsequent doses of the agent about once every 3 weeks. In some embodiments, the intermittent dosing strategy comprises administering an initial dose of a neoantigen therapeutic to the subject, and administering subsequent

doses of the agent about once every 4 weeks. In some embodiments, the agent is administered using an intermittent dosing strategy and the additional therapeutic agent is administered weekly.

[0415] The present disclosure provides compositions comprising the neoantigen therapeutic described herein. The present disclosure also provides pharmaceutical compositions comprising a neoantigen therapeutic described herein and a pharmaceutically acceptable vehicle. In some embodiments, the pharmaceutical compositions find use in immunotherapy. In some embodiments, the compositions find use in inhibiting tumor growth. In some embodiments, the pharmaceutical compositions find use in inhibiting tumor growth in a subject (*e.g.*, a human patient). In some embodiments, the compositions find use in treating cancer. In some embodiments, the pharmaceutical compositions find use in treating cancer in a subject (*e.g.*, a human patient).

[0416] Formulations are prepared for storage and use by combining a neoantigen therapeutic of the present disclosure with a pharmaceutically acceptable vehicle (*e.g.*, a carrier or excipient). Those of skill in the art generally consider pharmaceutically acceptable carriers, excipients, and/or stabilizers to be inactive ingredients of a formulation or pharmaceutical composition. Exemplary formulations are listed in WO 2015/095811.

[0417] Suitable pharmaceutically acceptable vehicles include, but are not limited to, nontoxic buffers such as phosphate, citrate, and other organic acids; salts such as sodium chloride; antioxidants including ascorbic acid and methionine; preservatives such as octadecyldimethylbenzyl ammonium chloride, hexamethonium chloride, benzalkonium chloride, benzethonium chloride, phenol, butyl or benzyl alcohol, alkyl parabens, such as methyl or propyl paraben, catechol, resorcinol, cyclohexanol, 3-pentanol, and m-cresol; low molecular weight polypeptides (*e.g.*, less than about 10 amino acid residues); proteins such as serum albumin, gelatin, or immunoglobulins; hydrophilic polymers such as polyvinylpyrrolidone; amino acids such as glycine, glutamine, asparagine, histidine, arginine, or lysine; carbohydrates such as monosaccharides, disaccharides, glucose, mannose, or dextrans; chelating agents such as EDTA; sugars such as sucrose, mannitol, trehalose or sorbitol; salt-forming counter-ions such as sodium; metal complexes such as Zn-protein complexes; and non-ionic surfactants such as TWEEN or polyethylene glycol (PEG). (Remington: The Science and Practice of Pharmacy, 22nd Edition, 2012, Pharmaceutical Press, London.). In some embodiments, the vehicle is 5% dextrose in water.

[0418] The pharmaceutical compositions described herein can be administered in any number of ways for either local or systemic treatment. Administration can be topical by epidermal or transdermal patches, ointments, lotions, creams, gels, drops, suppositories, sprays, liquids and powders; pulmonary by inhalation or insufflation of powders or aerosols, including by nebulizer, intratracheal, and intranasal; oral; or parenteral including intravenous, intra-arterial, intratumoral, subcutaneous, intraperitoneal, intramuscular (*e.g.*, injection or infusion), or intracranial (*e.g.*, intrathecal or intraventricular).

[0419] The therapeutic formulation can be in unit dosage form. Such formulations include tablets, pills, capsules, powders, granules, solutions or suspensions in water or non-aqueous media, or suppositories.

[0420] The neoantigenic peptides described herein can also be entrapped in microcapsules. Such microcapsules are prepared, for example, by coacervation techniques or by interfacial polymerization, for example, hydroxymethylcellulose or gelatin-microcapsules and poly-(methylmethacrylate) microcapsules, respectively, in colloidal drug delivery systems (for example, liposomes, albumin microspheres, microemulsions, nanoparticles and nanocapsules) or in macroemulsions as described in Remington: The Science and Practice of Pharmacy, 22nd Edition, 2012, Pharmaceutical Press, London.

[0421] In certain embodiments, pharmaceutical formulations include a neoantigen therapeutic described herein complexed with liposomes. Methods to produce liposomes are known to those of skill in the art. For example, some liposomes can be generated by reverse phase evaporation with a lipid composition comprising phosphatidylcholine, cholesterol, and PEG-derivatized phosphatidylethanolamine (PEG-PE). Liposomes can be extruded through filters of defined pore size to yield liposomes with the desired diameter.

[0422] In certain embodiments, sustained-release preparations comprising the neoantigenic peptides described herein can be produced. Suitable examples of sustained-release preparations include semi-permeable matrices of solid hydrophobic polymers containing an agent, where the matrices are in the form of shaped articles (*e.g.*, films or microcapsules). Examples of sustained-release matrices include polyesters, hydrogels such as poly(2-hydroxyethyl-methacrylate) or poly(vinyl alcohol), polylactides, copolymers of L-glutamic acid and 7 ethyl-L-glutamate, non-degradable ethylene-vinyl acetate, degradable lactic acid-glycolic acid copolymers such as the LUPRON DEPOT™ (injectable microspheres composed of lactic acid-glycolic acid copolymer and leuprolide acetate), sucrose acetate isobutyrate, and poly-D-(-)-3-hydroxybutyric acid.

[0423] The present disclosure provides methods of treatment comprising an immunogenic vaccine. Methods of treatment for a disease (such as cancer or a viral infection) are provided. A method can comprise administering to a subject an effective amount of a composition comprising an immunogenic antigen. In some embodiments, the antigen comprises a viral antigen. In some embodiments, the antigen comprises a tumor antigen.

[0424] Non-limiting examples of vaccines that can be prepared include a peptide-based vaccine, a nucleic acid-based vaccine, an antibody based vaccine, a T cell based vaccine, and an antigen-presenting cell based vaccine.

[0425] Vaccine compositions can be formulated using one or more physiologically acceptable carriers including excipients and auxiliaries which facilitate processing of the active agents into preparations which can be used pharmaceutically. Proper formulation can be dependent upon the route of administration chosen. Any of the well-known techniques, carriers, and excipients can be used as suitable and as understood in the art.

[0426] In some cases, the vaccine composition is formulated as a peptide-based vaccine, a nucleic acid-based vaccine, an antibody based vaccine, or a cell based vaccine. For example, a vaccine composition can include naked cDNA in cationic lipid formulations; lipopeptides (*e.g.*, Vitiello, A. et al.,

J. Clin. Invest. 95:341, 1995), naked cDNA or peptides, encapsulated *e.g.*, in poly(DL-lactide-co-glycolide) ("PLG") microspheres (see, *e.g.*, Eldridge, et al., Molec. Immunol. 28:287-294, 1991; Alonso et al, Vaccine 12:299-306, 1994; Jones et al, Vaccine 13:675-681, 1995); peptide composition contained in immune stimulating complexes (ISCOMS) (*e.g.*, Takahashi et al, Nature 344:873-875, 1990; Hu et al, Clin. Exp. Immunol. 113:235-243, 1998); or multiple antigen peptide systems (MAPs) (see *e.g.*, Tam, J. P., Proc. Natl Acad. Sci. U.S.A. 85:5409-5413, 1988; Tam, J.P., J. Immunol. Methods 196:17-32, 1996). Sometimes, a vaccine is formulated as a peptide-based vaccine, or nucleic acid based vaccine in which the nucleic acid encodes the polypeptides. Sometimes, a vaccine is formulated as an antibody based vaccine. Sometimes, a vaccine is formulated as a cell based vaccine.

[0427] The amino acid sequence of an identified disease-specific immunogenic neoantigen peptide can be used develop a pharmaceutically acceptable composition. The source of antigen can be, but is not limited to, natural or synthetic proteins, including glycoproteins, peptides, and superantigens; antibody/antigen complexes; lipoproteins; RNA or a translation product thereof; and DNA or a polypeptide encoded by the DNA. The source of antigen may also comprise non-transformed, transformed, transfected, or transduced cells or cell lines. Cells may be transformed, transfected, or transduced using any of a variety of expression or retroviral vectors known to those of ordinary skill in the art that may be employed to express recombinant antigens. Expression may also be achieved in any appropriate host cell that has been transformed, transfected, or transduced with an expression or retroviral vector containing a DNA molecule encoding recombinant antigen(s). Any number of transfection, transformation, and transduction protocols known to those in the art may be used. Recombinant vaccinia vectors and cells infected with the vaccinia vector, may be used as a source of antigen.

[0428] A composition can comprise a synthetic disease-specific immunogenic neoantigen peptide. A composition can comprise two or more disease-specific immunogenic neoantigen peptides. A composition may comprise a precursor to a disease-specific immunogenic peptide (such as a protein, peptide, DNA and RNA). A precursor to a disease-specific immunogenic peptide can generate or be generated to the identified disease-specific immunogenic neoantigen peptide. In some embodiments, a therapeutic composition comprises a precursor of an immunogenic peptide. The precursor to a disease-specific immunogenic peptide can be a pro-drug. In some embodiments, the composition comprising a disease-specific immunogenic neoantigen peptide may further comprise an adjuvant. For example, the neoantigen peptide can be utilized as a vaccine. In some embodiments, an immunogenic vaccine may comprise a pharmaceutically acceptable immunogenic neoantigen peptide. In some embodiments, an immunogenic vaccine may comprise a pharmaceutically acceptable precursor to an immunogenic neoantigen peptide (such as a protein, peptide, DNA and RNA). In some embodiments, a method of treatment comprises administering to a subject an effective amount of an antibody specifically recognizing an immunogenic neoantigen peptide. In some embodiments, a method of treatment comprises administering to a subject an effective amount of a soluble TCR or TCR analog specifically recognizing an immunogenic neoantigen peptide.

[0429] The methods described herein are particularly useful in the personalized medicine context, where immunogenic neoantigen peptides are used to develop therapeutics (such as vaccines or therapeutic antibodies) for the same individual. Thus, a method of treating a disease in a subject can comprise identifying an immunogenic neoantigen peptide in a subject according to the methods described herein; and synthesizing the peptide (or a precursor thereof); and administering the peptide or an antibody specifically recognizing the peptide to the subject. In some embodiments, an expression pattern of an immunogenic neoantigen can serve as the essential basis for the generation of patient specific vaccines. In some embodiments, an expression pattern of an immunogenic neoantigen can serve as the essential basis for the generation of a vaccine for a group of patients with a particular disease. Thus, particular diseases, *e.g.*, particular types of tumors, can be selectively treated in a patient group.

[0430] In some embodiments, the peptides described herein are structurally normal antigens that can be recognized by autologous anti-disease T cells in a large patient group. In some embodiments, an antigen-expression pattern of a group of diseased subjects whose disease expresses structurally normal neoantigens is determined.

[0431] In some embodiments, the peptides described herein comprises a first peptide comprising a first neoepitope of a protein and a second peptide comprising a second neoepitope of the same protein, wherein the first peptide is different from the second peptide, and wherein the first neoepitope comprises a mutation and the second neoepitope comprises the same mutation. In some embodiments, the peptides described herein comprises a first peptide comprising a first neoepitope of a first region of a protein and a second peptide comprising a second neoepitope of a second region of the same protein, wherein the first region comprises at least one amino acid of the second region, wherein the first peptide is different from the second peptide and wherein the first neoepitope comprises a first mutation and the second neoepitope comprises a second mutation. In some embodiments, the first mutation and the second mutation are the same. In some embodiments, the mutation is selected from the group consisting of a point mutation, a splice-site mutation, a frameshift mutation, a read-through mutation, a gene fusion mutation and any combination thereof.

[0432] There are a variety of ways in which to produce immunogenic neoantigens. Proteins or peptides may be made by any technique known to those of skill in the art, including the expression of proteins, polypeptides or peptides through standard molecular biological techniques, the isolation of proteins or peptides from natural sources, *in vitro* translation, or the chemical synthesis of proteins or peptides. In general, such disease specific neoantigens may be produced either *in vitro* or *in vivo*. Immunogenic neoantigens may be produced *in vitro* as peptides or polypeptides, which may then be formulated into a personalized vaccine or immunogenic composition and administered to a subject. *In vitro* production of immunogenic neoantigens can comprise peptide synthesis or expression of a peptide/polypeptide from a DNA or RNA molecule in any of a variety of bacterial, eukaryotic, or viral recombinant expression systems, followed by purification of the expressed peptide/polypeptide. Alternatively, immunogenic neoantigens can be produced *in vivo* by introducing molecules (*e.g.*, DNA, RNA, and viral expression

systems) that encode an immunogenic neoantigen into a subject, whereupon the encoded immunogenic neoantigens are expressed. In some embodiments, a polynucleotide encoding an immunogenic neoantigen peptide can be used to produce the neoantigen peptide *in vitro*.

[0433] In some embodiments, a polynucleotide comprises a sequence with at least 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%, 96%, 97%, 98%, 99% or 100% sequence identity to a polynucleotide encoding an immunogenic neoantigen.

[0434] The polynucleotide may be, *e.g.*, DNA, cDNA, PNA, CNA, RNA, single- and/or double-stranded, native or stabilized forms of polynucleotides, or combinations thereof. A nucleic acid encoding an immunogenic neoantigen peptide may or may not contain introns so long as it codes for the peptide. In some embodiments *in vitro* translation is used to produce the peptide.

[0435] Expression vectors comprising sequences encoding the neoantigen, as well as host cells containing the expression vectors, are also contemplated. Expression vectors suitable for use in the present disclosure can comprise at least one expression control element operationally linked to the nucleic acid sequence. The expression control elements are inserted in the vector to control and regulate the expression of the nucleic acid sequence. Examples of expression control elements are well known in the art and include, for example, the lac system, operator and promoter regions of phage lambda, yeast promoters and promoters derived from polyoma, adenovirus, retrovirus or SV40. Additional operational elements include, but are not limited to, leader sequences, termination codons, polyadenylation signals and any other sequences necessary or preferred for the appropriate transcription and subsequent translation of the nucleic acid sequence in the host system. It will be understood by one skilled in the art the correct combination of expression control elements will depend on the host system chosen. It will further be understood that the expression vector should contain additional elements necessary for the transfer and subsequent replication of the expression vector containing the nucleic acid sequence in the host system. Examples of such elements include, but are not limited to, origins of replication and selectable markers.

[0436] The neoantigen peptides may be provided in the form of RNA or cDNA molecules encoding the desired neoantigen peptides. One or more neoantigen peptides of the present disclosure may be encoded by a single expression vector. Generally, the DNA is inserted into an expression vector, such as a plasmid, in proper orientation and correct reading frame for expression, if necessary, the DNA may be linked to the appropriate transcriptional and translational regulatory control nucleotide sequences recognized by the desired host (*e.g.*, bacteria), although such controls are generally available in the expression vector. The vector is then introduced into the host bacteria for cloning using standard techniques. Useful expression vectors for eukaryotic hosts, especially mammals or humans include, for example, vectors comprising expression control sequences from SV40, bovine papilloma virus, adenovirus and cytomegalovirus. Useful expression vectors for bacterial hosts include known bacterial

plasmids, such as plasmids from *E. coli*, including pCR 1, pBR322, pMB9 and their derivatives, wider host range plasmids, such as M13 and filamentous single-stranded DNA phages.

[0437] In embodiments, a DNA sequence encoding a polypeptide of interest can be constructed by chemical synthesis using an oligonucleotide synthesizer. Such oligonucleotides can be designed based on the amino acid sequence of the desired polypeptide and selecting those codons that are favored in the host cell in which the recombinant polypeptide of interest is produced. Standard methods can be applied to synthesize an isolated polynucleotide sequence encoding an isolated polypeptide of interest.

[0438] Suitable host cells for expression of a polypeptide include prokaryotes, yeast, insect or higher eukaryotic cells under the control of appropriate promoters. Prokaryotes include gram negative or gram positive organisms, for example *E. coli* or bacilli. Higher eukaryotic cells include established cell lines of mammalian origin. Cell-free translation systems can also be employed. Appropriate cloning and expression vectors for use with bacterial, fungal, yeast, and mammalian cellular hosts are well known in the art. Various mammalian or insect cell culture systems can be employed to express recombinant protein. Exemplary mammalian host cell lines include, but are not limited to COS-7, L cells, C127, 3T3, Chinese hamster ovary (CHO), 293, HeLa and BHK cell lines. Mammalian expression vectors can comprise nontranscribed elements such as an origin of replication, a suitable promoter and enhancer linked to the gene to be expressed, and other 5' or 3' flanking nontranscribed sequences, and 5' or 3' untranslated sequences, such as necessary ribosome binding sites, a polyadenylation site, splice donor and acceptor sites, and transcriptional termination sequences.

[0439] The proteins produced by a transformed host can be purified according to any suitable method. Such standard methods include chromatography (*e.g.*, ion exchange, affinity and sizing column chromatography, and the like), centrifugation, differential solubility, or by any other standard technique for protein purification. Affinity tags such as hexahistidine, maltose binding domain, influenza coat sequence, glutathione-S-transferase, and the like can be attached to the protein to allow easy purification by passage over an appropriate affinity column. Isolated proteins can also be physically characterized using such techniques as proteolysis, nuclear magnetic resonance and x-ray crystallography.

[0440] A vaccine can comprise an entity that binds a polypeptide sequence described herein. The entity can be an antibody. Antibody-based vaccine can be formulated using any of the well-known techniques, carriers, and excipients as suitable and as understood in the art. In some embodiments, the peptides described herein can be used for making neoantigen specific therapeutics such as antibody therapeutics. For example, neoantigens can be used to raise and/or identify antibodies specifically recognizing the neoantigens. These antibodies can be used as therapeutics. The antibody can be a natural antibody, a chimeric antibody, a humanized antibody, or can be an antibody fragment. The antibody may recognize one or more of the polypeptides described herein. In some embodiments, the antibody can recognize a polypeptide that has a sequence with at most 40%, 50%, 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%, 96%, 97%, 98%, or 99% sequence

identity to a polypeptide described herein. In some embodiments, the antibody can recognize a polypeptide that has a sequence with at least 40%, 50%, 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%, 96%, 97%, 98%, 99%, or 100% sequence identity to a polypeptide described herein. In some embodiments, the antibody can recognize a polypeptide sequence that is at least 30%, 40%, 50%, 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%, 96%, 97%, 98%, 99%, or 100% of a length of a polypeptide described herein. In some embodiments, the antibody can recognize a polypeptide sequence that is at most 30%, 40%, 50%, 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%, 96%, 97%, 98%, 99%, or 100% of a length of a polypeptide described herein.

[0441] The present disclosure also contemplates the use of nucleic acid molecules as vehicles for delivering neoantigen peptides/polypeptides to the subject in need thereof, *in vivo*, in the form of, *e.g.*, DNA/RNA vaccines.

[0442] In some embodiments, the vaccine is a nucleic acid vaccine. In some embodiments, neoantigens can be administered to a subject by use of a plasmid. Plasmids may be introduced into animal tissues by a number of different methods, *e.g.*, injection or aerosol instillation of naked DNA on mucosal surfaces, such as the nasal and lung mucosa. In some embodiments, physical delivery, such as with a “gene-gun” may be used. The exact choice of expression vectors can depend upon the peptide/polypeptides to be expressed, and is well within the skill of the ordinary artisan.

[0443] In some embodiments, the nucleic acid encodes an immunogenic peptide or peptide precursor. In some embodiments, the nucleic acid vaccine comprises sequences flanking the sequence coding the immunogenic peptide or peptide precursor. In some embodiments, the nucleic acid vaccine comprises more than one immunogenic epitope. In some embodiments, the nucleic acid vaccine is a DNA-based vaccine. In some embodiments, the nucleic acid vaccine is a RNA-based vaccine. In some embodiments, the RNA-based vaccine comprises mRNA. In some embodiments, the RNA-based vaccine comprises naked mRNA. In some embodiments, the RNA-based vaccine comprises modified mRNA (*e.g.*, mRNA protected from degradation using protamine. mRNA containing modified 5' CAP structure or mRNA containing modified nucleotides). In some embodiments, the RNA-based vaccine comprises single-stranded mRNA.

[0444] The polynucleotide may be substantially pure, or contained in a suitable vector or delivery system. Suitable vectors and delivery systems include viral, such as systems based on adenovirus, vaccinia virus, retroviruses, herpes virus, adeno-associated virus or hybrids containing elements of more than one virus. Non-viral delivery systems include cationic lipids and cationic polymers (*e.g.*, cationic liposomes).

[0445] One or more neoantigen peptides can be encoded and expressed *in vivo* using a viral based system. Viral vectors may be used as recombinant vectors in the present disclosure, wherein a portion of the viral genome is deleted to introduce new genes without destroying infectivity of the virus. The viral vector of the present disclosure is a nonpathogenic virus. In some embodiments the viral vector has a tropism for a specific cell type in the mammal. In another embodiment, the viral vector of the present disclosure is able to infect professional antigen presenting cells such as dendritic cells and macrophages. In yet another embodiment of the present disclosure, the viral vector is able to infect any cell in the mammal. The viral vector may also infect tumor cells. Viral vectors used in the present disclosure include but is not limited to Poxvirus such as vaccinia virus, avipox virus, fowlpox virus and a highly attenuated vaccinia virus (Ankara or MVA), retrovirus, adenovirus, baculovirus and the like.

[0446] A vaccine can be delivered via a variety of routes. Delivery routes can include oral (including buccal and sub-lingual), rectal, nasal, topical, transdermal patch, pulmonary, vaginal, suppository, or parenteral (including intramuscular, intra-arterial, intrathecal, intradermal, intraperitoneal, subcutaneous and intravenous) administration or in a form suitable for administration by aerosolization, inhalation or insufflation. General information on drug delivery systems can be found in Ansel et al., *Pharmaceutical Dosage Forms and Drug Delivery Systems* (Lippencott Williams & Wilkins, Baltimore Md. (1999)). The vaccine described herein can be administered to muscle, or can be administered via intradermal or subcutaneous injections, or transdermally, such as by iontophoresis. Epidermal administration of the vaccine can be employed.

[0447] In some instances, the vaccine can also be formulated for administration via the nasal passages. Formulations suitable for nasal administration, wherein the carrier is a solid, can include a coarse powder having a particle size, for example, in the range of about 10 to about 500 microns which is administered in the manner in which snuff is taken, *i.e.*, by rapid inhalation through the nasal passage from a container of the powder held close up to the nose. The formulation can be a nasal spray, nasal drops, or by aerosol administration by nebulizer. The formulation can include aqueous or oily solutions of the vaccine.

[0448] The vaccine can be a liquid preparation such as a suspension, syrup or elixir. The vaccine can also be a preparation for parenteral, subcutaneous, intradermal, intramuscular or intravenous administration (*e.g.*, injectable administration), such as a sterile suspension or emulsion.

[0449] The vaccine can include material for a single immunization, or may include material for multiple immunizations (*i.e.* a 'multidose' kit). The inclusion of a preservative is preferred in multidose arrangements. As an alternative (or in addition) to including a preservative in multidose compositions, the compositions can be contained in a container having an aseptic adaptor for removal of material.

[0450] The vaccine can be administered in a dosage volume of about 0.5 mL, although a half dose (*i.e.* about 0.25 mL) can be administered to children. Sometimes the vaccine can be administered in a higher dose *e.g.* about 1 ml.

[0451] The vaccine can be administered as a 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or more dose-course regimen. Sometimes, the vaccine is administered as a 1, 2, 3, or 4 dose-course regimen. Sometimes the vaccine is

administered as a 1 dose-course regimen. Sometimes the vaccine is administered as a 2 dose-course regimen.

[0452] The administration of the first dose and second dose can be separated by about 0 day, 1 day, 2 days, 5 days, 7 days, 14 days, 21 days, 30 days, 2 months, 4 months, 6 months, 9 months, 1 year, 1.5 years, 2 years, 3 years, 4 years, or more.

[0453] The vaccine described herein can be administered every 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, or more years. Sometimes, the vaccine described herein is administered every 2, 3, 4, 5, 6, 7, or more years. Sometimes, the vaccine described herein is administered every 4, 5, 6, 7, or more years. Sometimes, the vaccine described herein is administered once.

[0454] The dosage examples are not limiting and are only used to exemplify particular dosing regimens for administering a vaccine described herein. The effective amount for use in humans can be determined from animal models. For example, a dose for humans can be formulated to achieve circulating, liver, topical and/or gastrointestinal concentrations that have been found to be effective in animals. Based on animal data, and other types of similar data, those skilled in the art can determine the effective amounts of a vaccine composition appropriate for humans.

[0455] The effective amount when referring to an agent or combination of agents will generally mean the dose ranges, modes of administration, formulations, etc., that have been recommended or approved by any of the various regulatory or advisory organizations in the medical or pharmaceutical arts (*e.g.*, FDA, AMA) or by the manufacturer or supplier.

[0456] In some aspects, the vaccine and kit described herein can be stored at between 2°C and 8°C. In some instances, the vaccine is not stored frozen. In some instances, the vaccine is stored in temperatures of such as at -20°C or -80°C. In some instances, the vaccine is stored away from sunlight.

IX. Kits

[0457] The neoantigen therapeutic described herein can be provided in kit form together with instructions for administration. Typically the kit would include the desired neoantigen therapeutic in a container, in unit dosage form and instructions for administration. Additional therapeutics, for example, cytokines, lymphokines, checkpoint inhibitors, antibodies, can also be included in the kit. Other kit components that can also be desirable include, for example, a sterile syringe, booster dosages, and other desired excipients.

[0458] Kits and articles of manufacture are also provided herein for use with one or more methods described herein. The kits can contain one or more neoantigenic polypeptides comprising one or more neoepitopes. The kits can also contain nucleic acids that encode one or more of the peptides or proteins described herein, antibodies that recognize one or more of the peptides described herein, or APC-based cells activated with one or more of the peptides described herein. The kits can further contain adjuvants, reagents, and buffers necessary for the makeup and delivery of the vaccines.

[0459] The kits can also include a carrier, package, or container that is compartmentalized to receive one or more containers such as vials, tubes, and the like, each of the container(s) comprising one of the

separate elements, such as the peptides and adjuvants, to be used in a method described herein. Suitable containers include, for example, bottles, vials, syringes, and test tubes. The containers can be formed from a variety of materials such as glass or plastic.

[0460] The articles of manufacture provided herein contain packaging materials. Examples of pharmaceutical packaging materials include, but are not limited to, blister packs, bottles, tubes, bags, containers, bottles, and any packaging material suitable for a selected formulation and intended mode of administration and treatment. A kit typically includes labels listing contents and/or instructions for use, and package inserts with instructions for use. A set of instructions will also typically be included.

[0461] The present disclosure will be described in greater detail by way of specific examples. The following examples are offered for illustrative purposes, and are not intended to limit the present disclosure in any manner. Those of skill in the art will readily recognize a variety of non-critical parameters that can be changed or modified to yield alternative embodiments according to the present disclosure. All patents, patent applications, and printed publications listed herein are incorporated herein by reference in their entirety.

EXAMPLES

[0462] These examples are provided for illustrative purposes only and not to limit the scope of the claims provided herein.

Example 1 - Induction of CD4⁺ and CD8⁺ T cell responses

[0463] *In vitro* T cell inductions are used to expand neo-antigen specific T cells. Mature professional APCs are prepared for these assays in the following way. Monocytes are enriched from healthy human donor PBMCs using a bead-based kit (Miltenyi). Enriched cells are plated in GM-CSF and IL-4 to induce immature DCs. Enriched cells may also be plated using FLT-3L and IL-4 to induce immature DCs. After 5 days, immature DCs are incubated at 37 °C with pools of peptides for 1 hour before addition of a cytokine maturation cocktail (GM-CSF, IL-1 β , IL-4, IL-6, TNF α , PGE1 β). The maturation cocktail may in some cases include FLT-3L, IL-1 β , IL-4, IL-6, TNF α , PGE1 β . The pools of peptides can include multiple mutations, with both shortmers and longmers to expand CD8⁺ and CD4⁺ T cells, respectively. Long peptides were also used to demonstrate the possibility to stimulate CD8⁺ cells in this setting, also shown in FIG. 3C. Cells are incubated at 37 °C to mature DCs.

[0464] After maturation of DCs, PBMCs (either bulk or enriched for T cells) are added to mature dendritic cells with proliferation cytokines. Cultures are monitored for peptide-specific T cells using a combination of functional assays and/or tetramer staining. Parallel immunogenicity assays with the modified and parent peptides allowed for comparisons of the relative efficiency with which the peptides expanded peptide-specific T cells.

Example 2 - Tetramer Staining Assay

[0465] MHC tetramers are purchased or manufactured on-site, and are used to measure peptide-specific T cell expansion in the immunogenicity assays. For the assessment, tetramer is added to 1 x 10⁵ cells in PBS containing 1% FCS and 0.1% sodium azide (FACS buffer) according to manufacturer's

instructions. Cells are incubated in the dark for 20 minutes at room temperature. Antibodies specific for T cell markers, such as CD8, are then added to a final concentration suggested by the manufacturer, and the cells are incubated in the dark at 4 °C for 20 minutes. Cells are washed with cold FACS buffer and resuspended in buffer containing 1% formaldehyde. Cells are acquired on a FACS Calibur (Becton Dickinson) instrument, and are analyzed by use of Cellquest software (Becton Dickinson). For analysis of tetramer positive cells, the lymphocyte gate is taken from the forward and side-scatter plots. Data are reported as the percentage of cells that were CD8⁺/tetramer⁺.

Example 3 - Intracellular Cytokine Staining Assay

[0466] In the absence of well-established tetramer staining to identify antigen-specific T cell populations, antigen-specificity can be estimated using assessment of cytokine production using well-established flow cytometry assays. Briefly, T cells are stimulated with the peptide of interest and compared to a control. After stimulation, production of cytokines by CD4⁺ T cells (e.g., IFN γ and TNF α) are assessed by intracellular staining. These cytokines, especially IFN γ , can be used to identify stimulated cells. FACS analysis of antigen-specific induction of IFN γ and TNF α levels of CD4⁺ cells from a healthy donor stimulated with APCs loaded with or without a mutant RAS peptide was performed.

Example 4 - ELISPOT Assay

[0467] Peptide-specific T cells are functionally enumerated using the ELISPOT assay (BD Biosciences), which measures the release of IFN γ from T cells on a single cell basis. Target cells (T2 or HLA-A0201 transfected C1R) were pulsed with 10 μ M peptide for 1 hour at 37 °C, and washed three times. 1 x 10⁵ peptide-pulsed targets are co-cultured in the ELISPOT plate wells with varying concentrations of T cells (5 x 10² to 2 x 10³) taken from the immunogenicity culture. Plates are developed according to the manufacturer's protocol, and analyzed on an ELISPOT reader (Cellular Technology Ltd.) with accompanying software. Spots corresponding to the number of IFN γ -producing T cells are reported as the absolute number of spots per number of T cells plated. T cells expanded on modified peptides are tested not only for their ability to recognize targets pulsed with the modified peptide, but also for their ability to recognize targets pulsed with the parent peptide. The IFN γ levels of samples mock transduced or transduced with a lentiviral expression vector encoding a mutant RAS peptide were determined.

Example 5 - CD107 Staining Assay

[0468] CD107a and b are expressed on the cell surface of CD8⁺ T cells following activation with cognate peptide. The lytic granules of T cells have a lipid bilayer that contains lysosomal-associated membrane glycoproteins ("LAMPs"), which include the molecules CD107a and b. When cytotoxic T cells are activated through the T cell receptor, the membranes of these lytic granules mobilize and fuse with the plasma membrane of the T cell. The granule contents are released, and this leads to the death of the target cell. As the granule membrane fuses with the plasma membrane, CD107a and b are exposed on the cell surface, and therefore are markers of degranulation. Because degranulation as measured by CD107a and b staining is reported on a single cell basis, the assay is used to functionally enumerate peptide-specific T cells. To perform the assay, peptide is added to HLA-A02:01-transfected cells C1R to

a final concentration of 20 μM , the cells were incubated for 1 hour at 37 °C, and washed three times. 1×10^5 of the peptide-pulsed C1R cells were aliquoted into tubes, and antibodies specific for CD107a and b are added to a final concentration suggested by the manufacturer (Becton Dickinson). Antibodies are added prior to the addition of T cells in order to “capture” the CD107 molecules as they transiently appear on the surface during the course of the assay. 1×10^5 T cells from the immunogenicity culture are added next, and the samples were incubated for 4 hours at 37 °C. The T cells are further stained for additional cell surface molecules such as CD8 and acquired on a FACS Calibur instrument (Becton Dickinson). Data is analyzed using the accompanying Cellquest software, and results are reported as the percentage of CD8⁺ / CD107a and b⁺ cells.

Example 6 - Cytotoxicity Assays

[0469] Cytotoxic activity is measured using a chromium release assay. Target T2 cells are labeled for 1 hour at 37 °C with Na⁵¹Cr and washed. 5×10^3 target T2 cells were then added to varying numbers of T cells from the immunogenicity culture. Chromium release is measured in supernatant harvested after 4 hours of incubation at 37 °C. The percentage of specific lysis is calculated as: Experimental release-spontaneous release/Total release-spontaneous release \times 100.

[0470] Cytotoxicity activity is measured with the detection of cleaved Caspase 3 in target cells by Flow cytometry. Target cancer cells are engineered to express the mutant peptide along with the proper MHC-I allele. Mock-transduced target cells (i.e. not expressing the mutant peptide) are used as a negative control. The cells are labeled with CFSE to distinguish them from the stimulated PBMCs used as effector cells. The target and effector cells are co-cultured for 6 hours before being harvested. Intracellular staining is performed to detect the cleaved form of Caspase 3 in the CFSE-positive target cancer cells. The percentage of specific lysis is calculated as: Experimental cleavage of Caspase 3/spontaneous cleavage of Caspase 3 (measured in the absence of mutant peptide expression) \times 100.

[0471] In some examples, cytotoxicity activity is assessed by co-culturing T cells expressing a TCR specific to a mutant RAS peptide on a specific HLA, with mutant RAS peptide-transduced target cancer cells expressing the corresponding HLA, and by determining the relative growth of the target cells, along with measuring the apoptotic marker Annexin V in the target cancer cells specifically. Target cancer cells are engineered to express the mutant peptide along with the proper MHC-I allele. Mock-transduced target cells (i.e. not expressing the mutant peptide) are used as a negative control. The cells are also transduced to stably express GFP allowing the tracking of target cell growth. PBMCs from healthy donors, used as effector cells, are transduced to express a TCR specific to a mutant RAS peptide. Mock-transduced cells are used as a negative control. The target cells are cocultured with different amount of effector cells for 72h in media containing Annexin V-detection reagent. The GFP signal and Annexin-V signal are measured over time with an IncuCyte S3 apparatus. Annexin V signal originating from effector cells is filtered out by size exclusion. Target cell growth and death is expressed as GFP and Annexin-V area (mm^2) over time, respectively.

Example 7- Enhanced CD8⁺ T cell responses *in vivo* using longmers and shortmers sequentially

[0472] Vaccination with longmer peptides can induce both CD4⁺ and CD8⁺ T cell responses, depending on the processing and presentation of the peptides. Vaccination with minimal shortmer epitopes focuses on generating CD8⁺ T cell responses, but does not require peptide processing before antigen presentation. As such, any cell can present the epitope readily, not just professional antigen-presenting cells (APCs). This may lead to tolerance of T cells that come in contact with healthy cells presenting antigens as part of peripheral tolerance. To circumvent this, initial immunization with longmers allows priming of CD8⁺ T cells only by APCs that can process and present the peptides. Subsequent immunizations boosts the initial CD8⁺ T cell responses.

In vivo immunogenicity assays

[0473] Nineteen 8-12 week old female C57BL/6 mice (Taconic Biosciences) were randomly and prospectively assigned to treatment groups on arrival. Animals were acclimated for three (3) days prior to study commencement. Animals were maintained on LabDiet™ 5053 sterile rodent chow and sterile water provided *ad libitum*. Animals in Group 1 served as vaccination adjuvant-only controls and were administered polyinosinic:polycytidylic acid (polyI:C) alone at 100 µg in a volume of 0.1 mL administered via subcutaneous injection (s.c.) on day 0, 7, and 14. Animals in Group 2 were administered 50 µg each of six longmer peptides (described below) along with polyI:C at 100 µg s.c. in a volume of 0.1 mL on day 0, 7 and 14. Animals in Group 3 were administered 50 µg each of six longmer peptides (described below) along with polyI:C at 100 µg s.c. in a volume of 0.1 mL on day 0 and molar-matched equivalents of corresponding shortmer peptides (described below) along with polyI:C at 100 µg s.c. in a volume of 0.1 mL on day 7 and 14. Animals were weighed and monitored for general health daily. Animals were euthanized by CO₂ overdose at study completion Day 21, if an animal lost > 30% of its body weight compared to weight at Day 0; or if an animal was found moribund. At sacrifice, spleens were harvested and processed into single-cell suspensions using standard protocols. Briefly, spleens were mechanically degraded through a 70 µm filter, pelleted, and lysed with ACK lysis buffer (Sigma) before resuspension in cell culture media.

Peptides

[0474] Six previously identified murine neoantigens were used based on their demonstrated ability to induce CD8⁺ T cell responses. For each neoantigen, shortmers (8-11 amino acids) corresponding to the minimal epitope have been defined. Longmers corresponding to 20-27 amino acids surrounding the mutation were used.

ELISPOT

[0475] ELISPOT analysis (Mouse IFN γ ELISPOT Reasy-SET-Go; EBioscience) was performed according to the kit protocol. Briefly, one day prior to day of analysis, 96-well filter plates (0.45 µm pore size hydrophobic PVDF membrane; EMD Millipore) were activated (35% EtOH), washed (PBS) and coated with capture antibody (1:250; 4 °C O/N). On the day of analysis, wells were washed and blocked (media; 2 hours at 37 °C). Approximately 2 x 10⁵ cells in 100 µL was added to the wells along with 100 µL of 10 mM test peptide pool (shortmers), or PMA/ionomycin positive control antigen, or vehicle. Cells

incubated with antigen overnight (16-18 hours) at 37 °C. The next day, the cell suspension was discarded, and wells were washed once with PBS, and twice with deionized water. For all wash steps in the remainder of the assay, wells were allowed to soak for 3 minutes at each wash step. Wells were then washed three times with wash buffer (PBS + 0.05% Tween-20), and detection antibody (1:250) was added to all wells. Plates were incubated for two hours at room temperature. The detection antibody solution was discarded, and wells were washed three times with wash buffer. Avidin-HRP (1:250) was added to all wells, and plates were incubated for one hour at room temperature. Conjugate solution was discarded, and wells washed three times with wash buffer, then once with PBS. Substrate (3-amino-9-ethyl-carbazole, 0.1 M Acetate buffer, H₂O₂) was added to all wells, and spot development monitored (approximately 10 minutes). Substrate reaction was stopped by washing wells with water, and plates were allowed to air-dry overnight. The plates were analyzed on an ELISPOT reader (Cellular Technology Ltd.) with accompanying software. Spots corresponding to the number of IFN γ -producing T cells are reported as the absolute number of spots per number of T cells plated.

Example 8 - Detection of mutant RAS peptides by mass spectrometry

[0476] 293T cells were transduced with a lentiviral vector encoding various regions of a mutant RAS peptide. 43 million of the transduced cells expressing peptides encoded by the a mutant RAS peptide were cultured and peptides were eluted from HLA-peptide complexes using an acid wash. Eluted peptides were then analyzed by MS/MS. For 293T cells expressing an HLA-A11:01 protein, the peptide VVVGACGVGK, was detected by mass spectrometry (FIG. 2). For 293T cells expressing an HLA-A11:01 protein, the peptides VVVGAVGVGK and VVGAVGVGK, was detected by mass spectrometry (FIG. 2).

Example 9 – Mutant KRAS peptides produce strong epitopes on multiple alleles.

[0477] Multiple peptides containing the neoepitopes in the table below were expressed or loaded onto antigen presenting cells (APCs). Mass spectrometry was then performed and the affinity of the neoepitopes for the indicated HLA alleles and stability of the neoepitopes with the HLA alleles was determined.

Example 10 - Multiple Neoepitopes Elicit CD8⁺ T cell Responses

[0478] PBMC samples from a human donor were used to perform antigen specific T cell induction. CD8⁺ T cell inductions were analyzed after manufacturing T cells. Cell samples can be taken out at different time points for analysis. pMHC multimers were used to monitor the fraction of antigen specific CD8⁺ T cells in the induction cultures. FIGs. 3A-C depict exemplary results showing the fraction of antigen specific CD8⁺ T cells induced with a RAS G12V, a RAS G12 C and a RAS G12D mutant peptide. Long peptides were also used to demonstrate the possibility to stimulate CD8⁺ cells, as shown in FIG. 3C.

Gene	HLA Allele	Peptide Sequence	Peptide Length	Measured Affinity (nM)	Measured stability (hr)
KRAS, G12C	A02.01	LVVVGACGV	9	667.1	0.6

KRAS, G12C	A02.01	KLVVVGACGV	10	70.3	1.0
KRAS, G12D	A02.01	LVVVGADGV	9	977.4	0.0
KRAS, G12D	A02.01	KLVVVGADGV	10	137.7	0.9
KRAS, G12V	A02.01	LVVVGAVGV	9	682.5	0.6
KRAS, G12V	A02.01	KLVVVGAVGV	10	57.6	0.9
KRAS, G12C	A03.01	VVGACGVGK	9	4.1	5.0
KRAS, G12C	A03.01	VVVGACGVGK	10	1.6	2.5
KRAS, G12D	A03.01	VVGADGVGK	9	518.7	NB
KRAS, G12D	A03.01	VVVGADGVGK	10	314.9	2.3
KRAS, G12V	A03.01	VVGAVGVGK	9	1.9	1.2
KRAS, G12V	A03.01	VVVGAVGVGK	10	44.2	6.7
KRAS, G12C	A11.01	VVGACGVGK	9	43.2	10.0
KRAS, G12C	A11.01	VVVGACGVGK	10	69.3	15.7
KRAS, G12D	A11.01	VVGADGVGK	9	203.9	3.4
KRAS, G12D	A11.01	VVVGADGVGK	10	33.1	13.0
KRAS, G12V	A11.01	VVGAVGVGK	9	7.7	16.9
KRAS, G12V	A11.01	VVVGAVGVGK	10	26.1	24.3

Example 11 – Cytotoxicity assay of induced T cells

[0479] A cytotoxicity assay was used to assess whether the induced T cell cultures can kill antigen expressing tumor lines. In this example, expression of active caspase 3 on alive and dead tumor cells was measured to quantify early cell death and dead tumor cells. In FIG. 4B, the induced CD8⁺ responses were capable of killing antigen expressing tumor targets. The percent live caspase-A positive target cells of samples mock transduced or transduced with a lentiviral expression vector encoding a mutant RAS peptide is shown.

Example 12 – Mutant KRAS peptide stablemers produce strong epitopes on multiple alleles

[0480] Multiple peptides containing the neoepitopes in the table below were expressed or loaded onto antigen presenting cells (APCs). Mass spectrometry was then performed and the affinity of the neoepitopes for the indicated HLA alleles and stability of the neoepitopes with the HLA alleles was determined.

Gene	Class	HLA Allele	Peptide Sequence	Predicted affinity (nM)	Measured Affinity (nM)	Measured stability (hr)
KRAS, G12C	Neoepitope	A02.01	KLVVVGACGV	203.6	70.3	1.0
KRAS, G12C	Affinity Enh.	A02.01	FLVVVGACGL	181.8	69.4	1.4

KRAS, G12C	Affinity Enh.	A02.01	FMVVVGACGI	173.8	17.0	1.0
KRAS, G12C	Affinity Enh.	A02.01	FLVVVGACGI	194.9	27.8	1.4
KRAS, G12C	Affinity Enh.	A02.01	FMVVVGACGV	53.2	1.1	5.4
KRAS, G12C	Affinity Enh.	A02.01	FLVVVGACGV	61.6	4.2	7.4
KRAS, G12C	Affinity Enh.	A02.01	MLVVVGACGV	117.7	18.2	1.7
KRAS, G12C	Affinity Enh.	A02.01	FMVVVGACGL	167.3	85.3	0.9
KRAS, G12C	Affinity Enh.	A02.01	YLVVVGACGV	80.7	3.9	9.3
KRAS, G12C	Affinity Enh.	A02.01	KMVVVGACGV	189.3	11.9	3.8
KRAS, G12C	Affinity Enh.	A02.01	YMVVVGACGV	70.1	7.0	6.4
KRAS, G12C	Affinity Enh.	A02.01	MMVVVGACGV	95.8	18.9	2.1

CLAIMS

1. A composition comprising T cells specific to an HLA-peptide complex comprising a mutant RAS peptide, wherein the HLA-peptide complex comprises:
 - (a) a protein encoded by an HLA-C03:04 allele and the mutant RAS peptide consisting of the sequence GAVGVGKSA;
 - (b) a protein encoded by an HLA-C01:02 allele and the mutant RAS peptide consisting of the sequence AVGVGKSAL; or
 - (c) a protein encoded by an HLA-C08:02 allele and the mutant RAS peptide consisting of the sequence GADGVGKSAL or GADGVGKSA.
2. The composition of claim 1, wherein the HLA-peptide complex comprises the protein encoded by the HLA-C03:04 allele and the mutant RAS peptide consisting of the sequence GAVGVGKSA.
3. A method of preparing the composition of claim 1 or 2, comprising priming T cells with antigen presenting cells (APCs) comprising the HLA-peptide complex; wherein the APCs comprise (i) a polypeptide comprising the mutant RAS peptide or (ii) a polynucleotide encoding the polypeptide comprising the mutant RAS peptide.
4. The method of claim 3, wherein the polypeptide is of the formula:

$$(Xaa_N)_N-(Xaa_{RAS})_P-(Xaa_C)_C$$
 wherein P is an integer greater than 7;
 $(Xaa_{RAS})_P$ comprises the mutant RAS peptide;
 $(Xaa_N)_N$ is a polylysine sequence;
 wherein N is 2, 3, 4, 5, or 6;
 C is 0;
 and
 the polypeptide is not KLVVVGAVGVGKSALTIQL.
5. The method of claim 3, wherein the polynucleotide encoding the polypeptide is RNA.
6. The method of claim 3, wherein the T cells are from a human subject with a cancer that expresses the at least one mutant RAS peptide sequence, and wherein the human subject's genome comprises an HLA-allele encoding the HLA of the HLA-peptide complex.

7. The method of claim 3, wherein the APCs express a protein encoded by an HLA-C01:02 allele, an HLA-C03:04 allele or an HLA-C08:02 allele.
8. A composition, comprising the polypeptide comprising the mutant RAS peptide or the polynucleotide encoding the polypeptide of any one of claims 3-5.
9. The composition of claim 8, wherein the polypeptide comprising the mutant RAS peptide further comprises an amino acid sequence of TEY.
10. The composition of claim 8, wherein the polypeptide comprising the mutant RAS peptide further comprises an amino acid sequence of GKSALTIQL or GKSALTI.
11. A pharmaceutical composition comprising:
 - (a) the mutant RAS peptide as recited in any one of claims 1-2;
 - (b) the polypeptide comprising the mutant RAS peptide as recited in any one of claims 3-10;
 - (c) the polynucleotide encoding the polypeptide as recited in (b);
 - (d) an antigen presenting cell comprising (a), (b) or (c); or
 - (e) the T cells specific to an HLA-peptide complex comprising the mutant RAS peptide as recited in any one of claims 1-2, and a pharmaceutically acceptable excipient.
12. Use of the composition of any one of claims 1-2, or 8-10, or the pharmaceutical composition of claim 11 in the manufacture of a medicament for treating a mutant RAS cancer.
13. A method of treating a human subject with a mutant RAS cancer comprising: administering to the subject a therapeutically effective amount of the pharmaceutical composition of claim 11, or the composition of the any one of claims 1-2, or 8-10.
14. A method of treating a subject with a mutant RAS cancer, comprising:
 - administering to the subject a therapeutically effective amount of the T cells of claim 1, wherein, the T cells are from the subject with cancer, and wherein, the subject expresses:
 - (a) a protein encoded by an HLA-C03:04 allele and the T cells are specific to the mutant RAS peptide consisting of the sequence GAVGVGKSA;

(b) a protein encoded by an HLA-C01:02 allele and the T cells are specific to the mutant RAS peptide consisting of the sequence AVGVGKSAL; or

(c) a protein encoded by an HLA-C08:02 allele and the T cells are specific to the mutant RAS peptide consisting of the sequence GADGVGKSAL or GADGVGKSA.

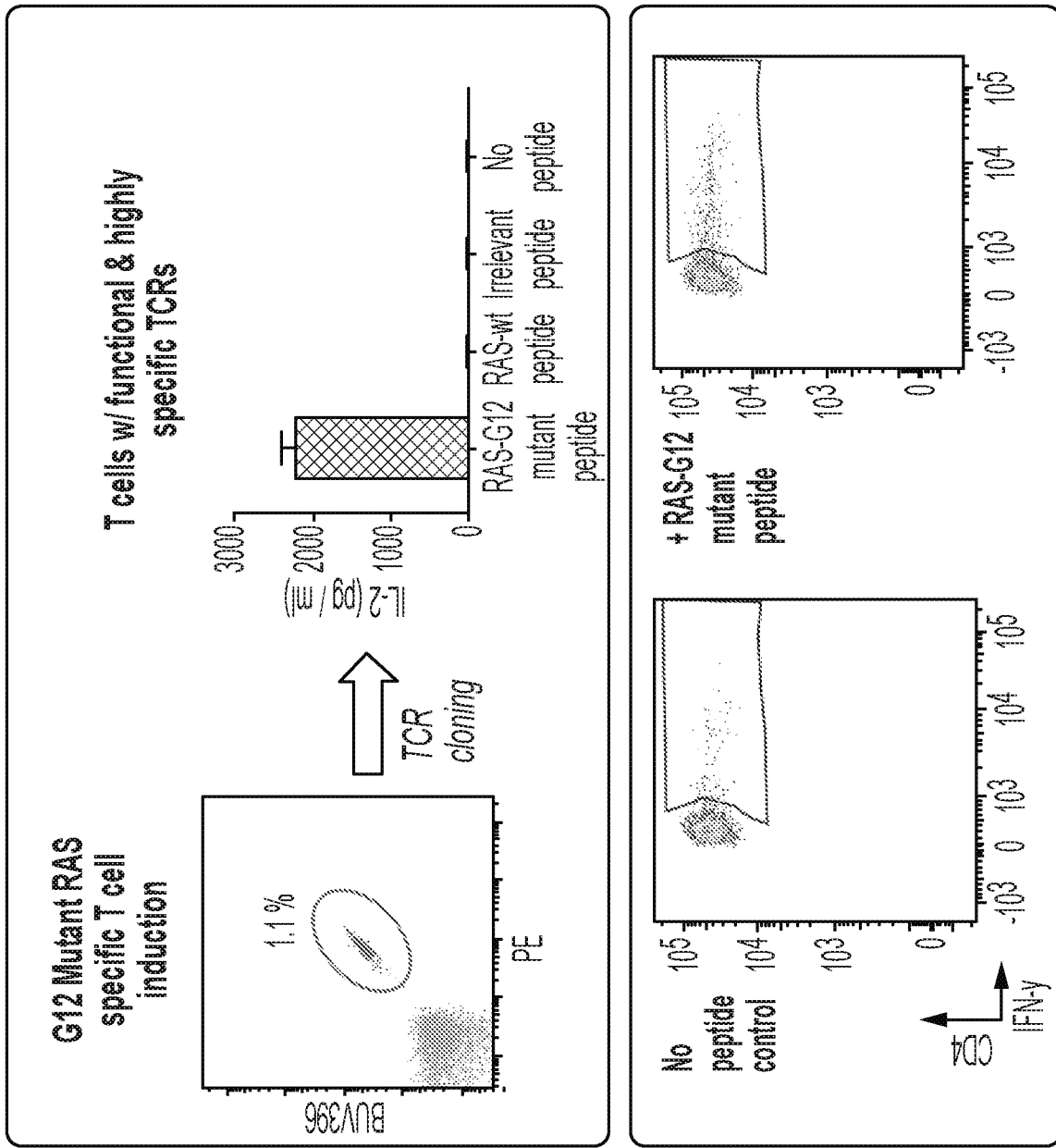
15. The method of claim 14, wherein the subject expresses the protein encoded by the HLA-C03:04 allele and the T cells are specific to the mutant RAS peptide consisting of the sequence GAVGVGKSA.
16. A method of preparing T cells specific to an HLA-peptide complex comprising at least one mutant RAS peptide sequence, the method comprising priming T cells with antigen presenting cells (APCs) comprising (i) at least one polypeptide comprising the at least one mutant RAS peptide sequence or (ii) at least one polynucleotide encoding the at least one polypeptide; wherein:
 - a) the APCs express a protein encoded by an HLA-A30:01 allele and the at least one mutant RAS peptide consists of the sequence VVVGAVGVGK;
 - b) the APCs express a protein encoded by an HLA-A30:01 or HLA-A68:01 allele and the at least one mutant RAS peptide consists of the sequence VVVGAVGVGK;
 - c) the APCs express a protein encoded by an HLA-C03:03, or HLA-C03:04 allele and the at least one mutant RAS peptide consists of the sequence GAVGVGKSAL;
 - d) the APCs express a protein encoded by an HLA-A03:01 or HLA-A68:01 allele and the at least one mutant RAS peptide consists of the sequence VVVGADGVGK;
 - e) the APCs express a protein encoded by an HLA-A03:01, HLA-A30:01 or HLA-A68:01 allele and the at least one mutant RAS peptide consists of the sequence VVVGARGVGK; or
 - f) the APCs express a protein encoded by an HLA-A68:01 allele and the at least one mutant RAS peptide consists of the sequence VVVGACGVGK.
17. The method of claim 16, wherein the at least one polynucleotide encoding the at least one polypeptide is RNA.

18. The use of claim 12 or the method of any one of claims 6 or 13-17, wherein the cancer is selected from the group consisting of lung cancer, non-small cell lung cancer, pancreatic cancer, colorectal cancer, uterine cancer and liver cancer.
19. The composition of claim 1, wherein the HLA-peptide complex comprises the protein encoded by the HLA-C01:02 allele and the mutant RAS peptide consisting of the sequence AVGVGKSAL.
20. The composition of claim 1, wherein the HLA-peptide complex comprises the protein encoded by the HLA-C08:02 allele and the mutant RAS peptide consisting of the sequence GADGVGKSAL or GADGVGKSA.

BioNTech US Inc.

Patent Attorneys for the Applicant/Nominated Person

SPRUSON & FERGUSON



Extensive characterization of MHC affinity & stability across class I alleles

Detected multiple mutant RAS epitopes presented on class I MHC by mass spec

- Class I pull-down of transduced cell line

FIG. 1

KRAS G12C (HLA-A*11)		
Approach	Cell Input	Peptides Detected in Construct
Lentiviral transduced 293T cells	43 Million	VWGACGVGK

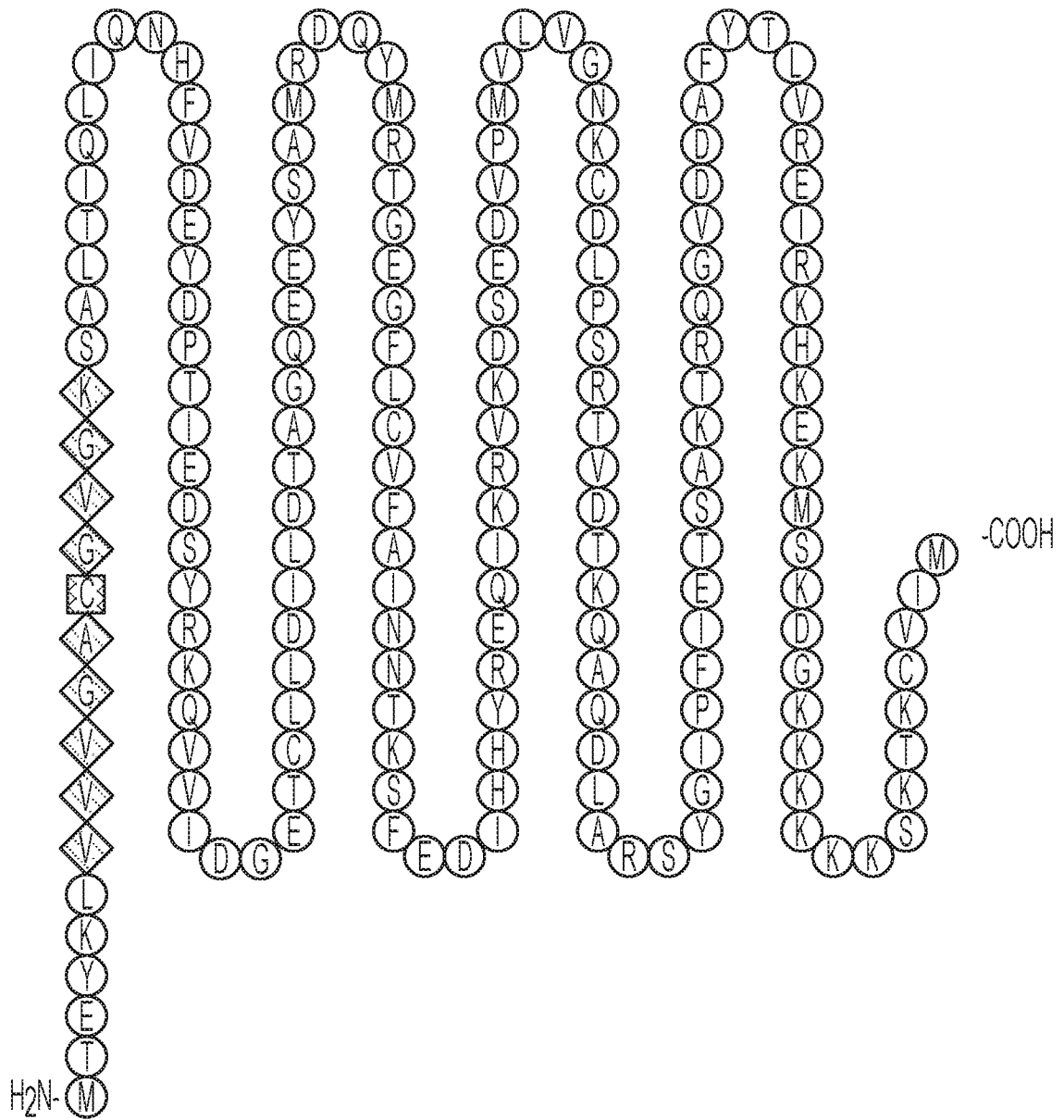


FIG. 2A

KRAS G12V (HLA-A*11)

Approach	Cell Input	Peptides Detected in Construct
Lentiviral transduced 293T cells	39-200 million	VWGAVGVGK VWGAVGVGK

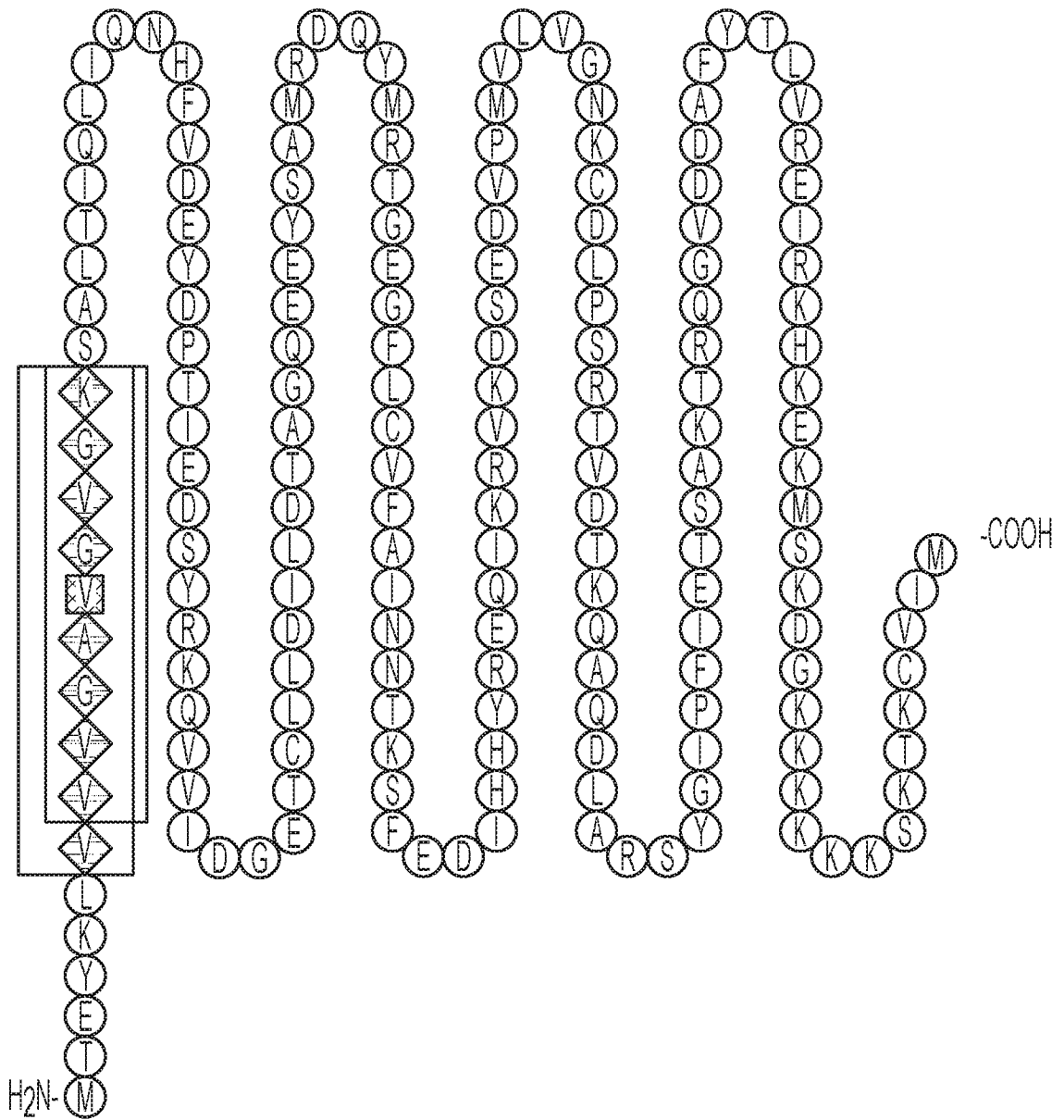


FIG. 2A
CONTINUED

Allele	Mutation	Epitope	Detected by MS?
A*02:01	G12C	L <u>V</u> WG <u>A</u> CGV	-
	G12C	KL <u>V</u> WG <u>A</u> CGV	-
	G12D	L <u>V</u> WG <u>A</u> DGV	-
	G12D	KL <u>V</u> WG <u>A</u> DGV	-
	G12V	L <u>V</u> WG <u>A</u> VGV	-
	G12V	KL <u>V</u> WG <u>A</u> VGV	-
A*03:01	G12C	WG <u>A</u> CGVGK	-
	G12C	<u>V</u> WG <u>A</u> CGVGK	✓
	G12D	WG <u>A</u> DVGK	-
	G12D	<u>V</u> WG <u>A</u> DVGK	-
	G12V	WG <u>A</u> VVGK	✓
	G12V	<u>V</u> WG <u>A</u> VVGK	✓
A*11:01	G12C	WG <u>A</u> CGVGK	-
	G12C	<u>V</u> WG <u>A</u> CGVGK	✓
	G12D	WG <u>A</u> DVGK	-
	G12D	<u>V</u> WG <u>A</u> DVGK	✓
	G12V	WG <u>A</u> VVGK	✓
	G12V	<u>V</u> WG <u>A</u> VVGK	✓
B*08:01	G12D	<u>D</u> GVGKSAL	-
	G12D	<u>D</u> GVGKSALT	-
	G12D	<u>D</u> GVGKSALTI	-

✓ Detected
 - Assayed for, but not detected

FIG. 2B

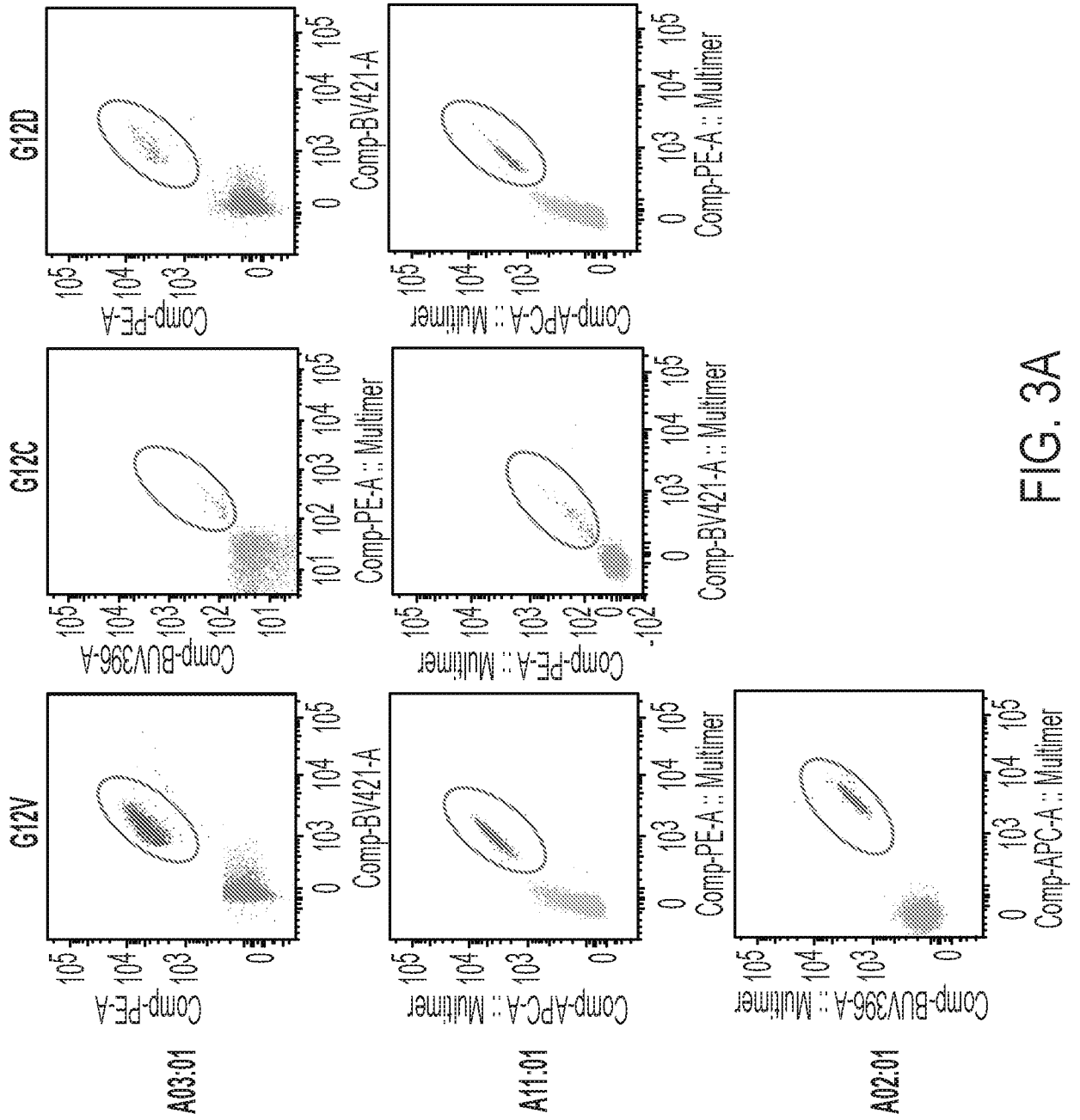


FIG. 3A

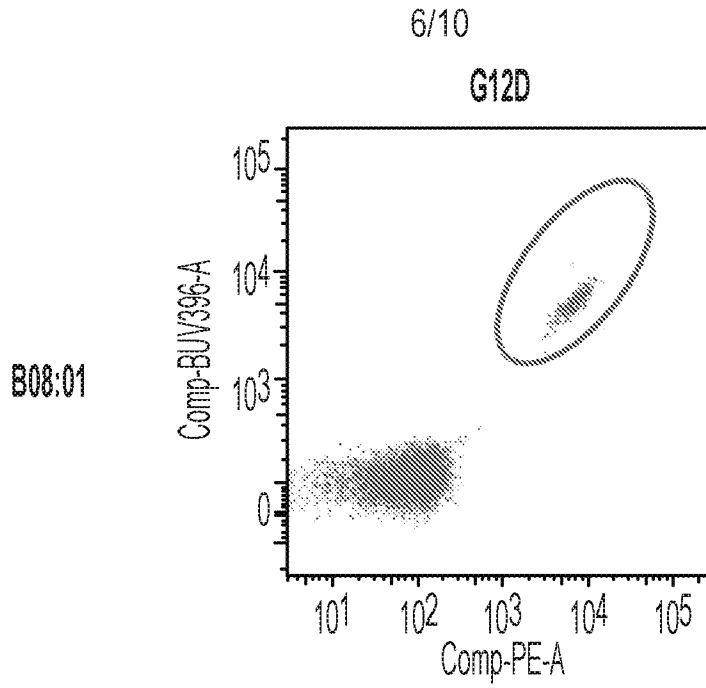


FIG. 3B

Stimulating peptide: TEYKLVVGVAVGVGKSALTI
Minimal epitope used for multimer detection: (V)VGVAVGVGK

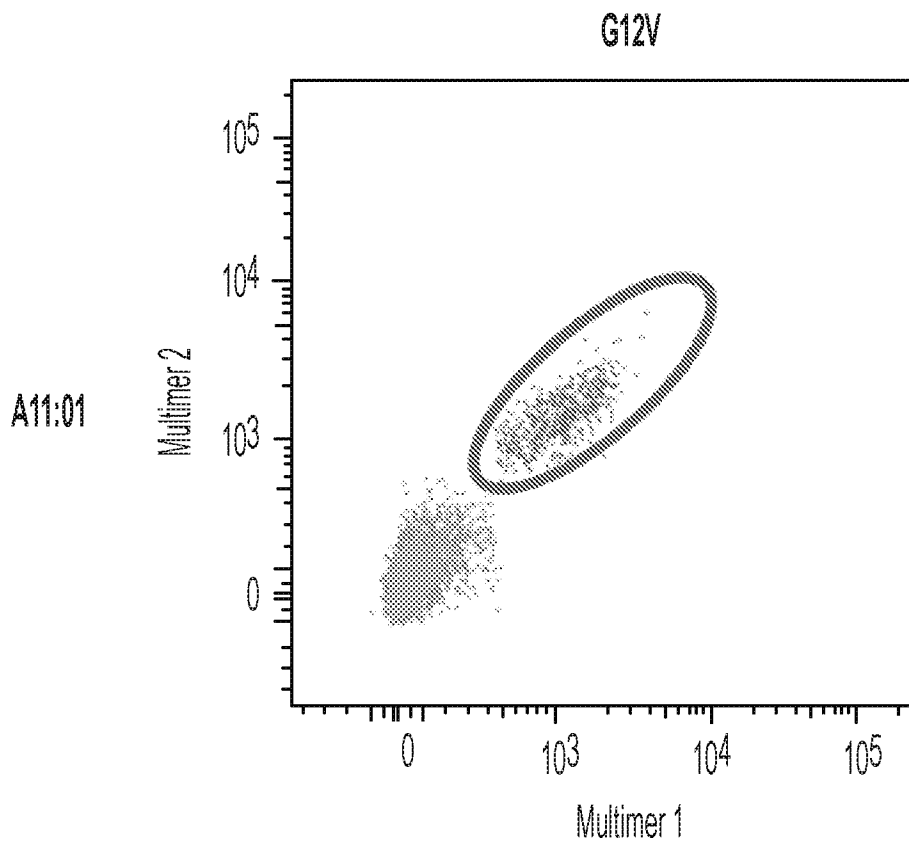


FIG. 3C

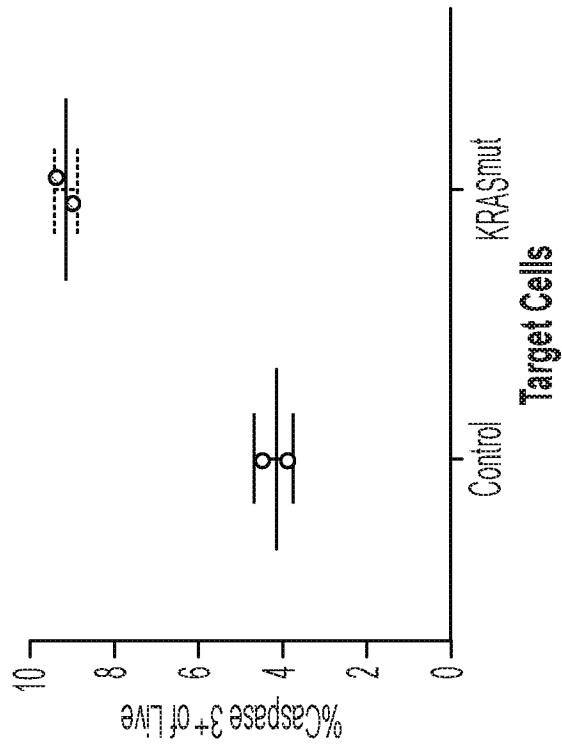


FIG. 4B

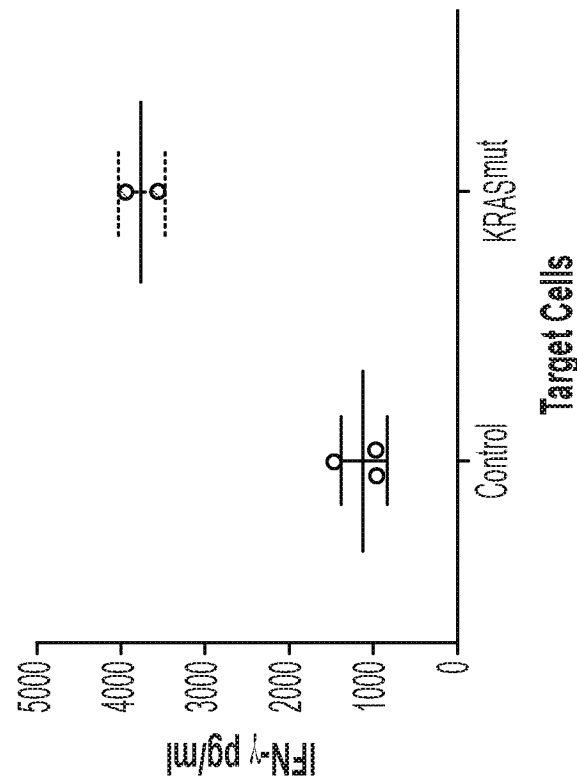


FIG. 4A

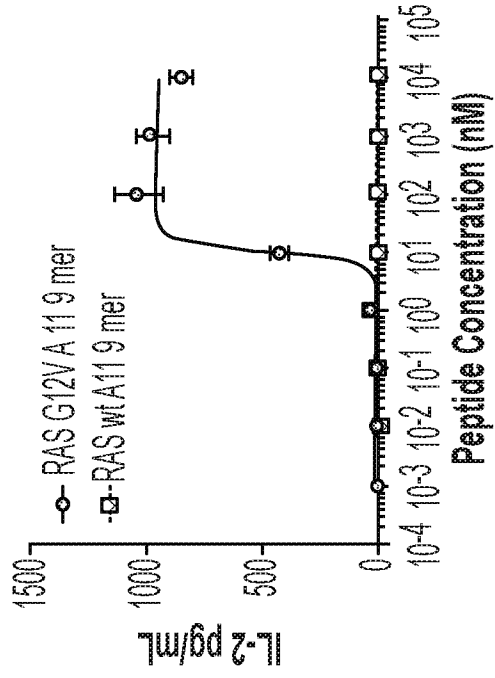


FIG. 5B

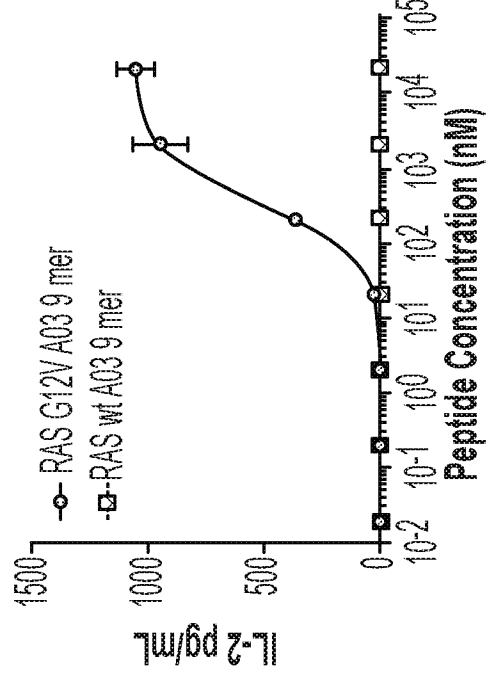


FIG. 5D

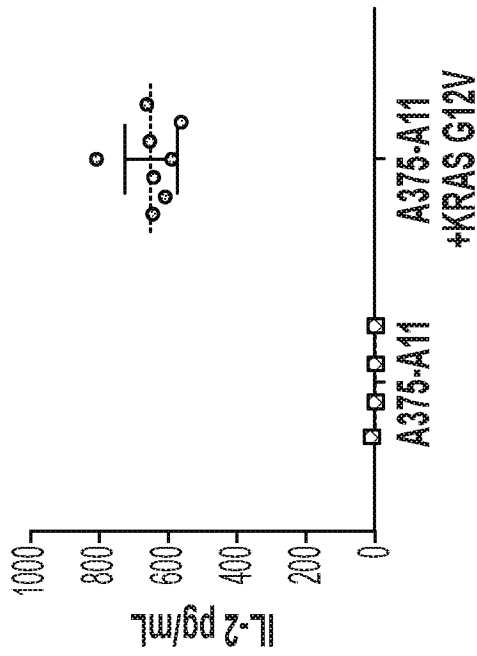


FIG. 5A

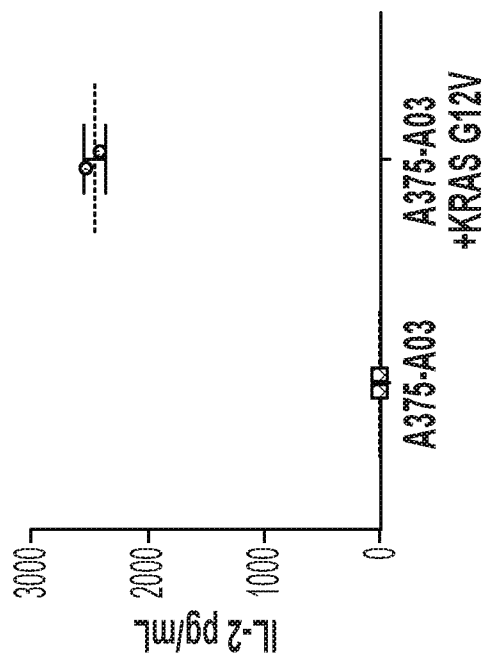


FIG. 5C

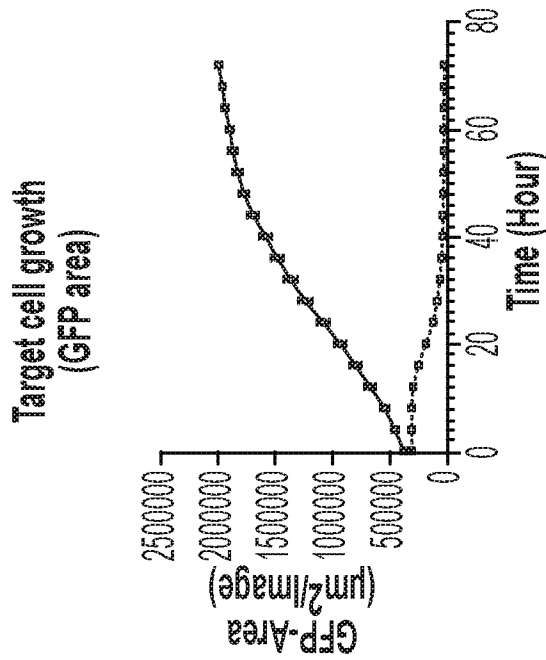


FIG. 5E

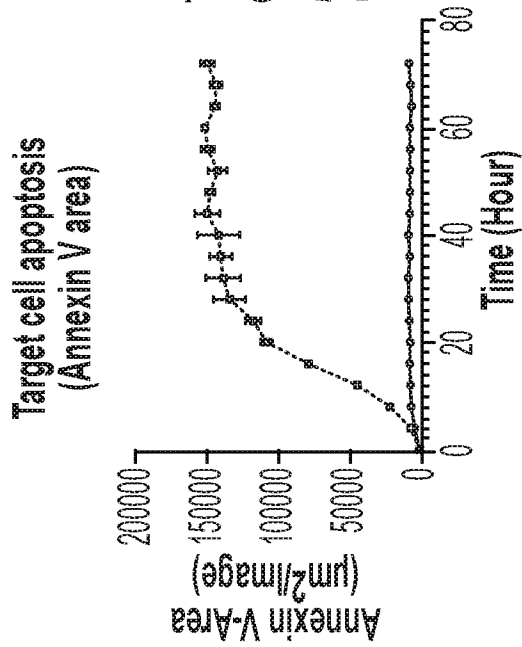


FIG. 5F

Target cell: A375-A11-G12V (GFP+)
effector cell: transduced PBMCs
No TCR (mock transduction)
G12V/A11.01 TCR

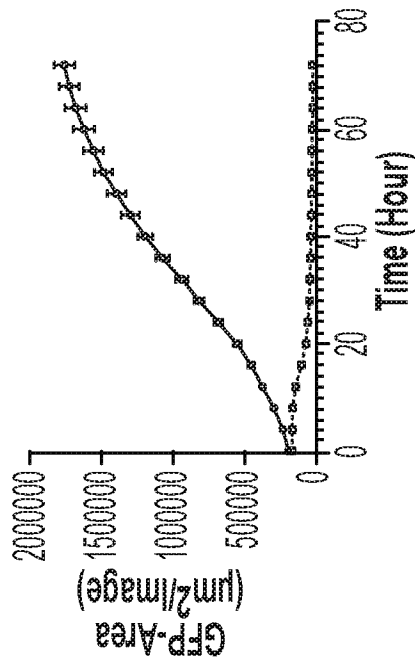


FIG. 5G

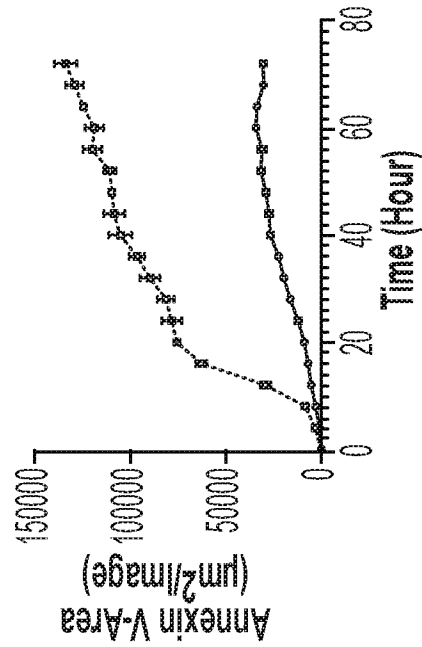


FIG. 5H

Target cell: A375-A03-G12V (GFP+)
effector cell: transduced PBMCs
No TCR (mock transduction)
G12V/A03.01 TCR

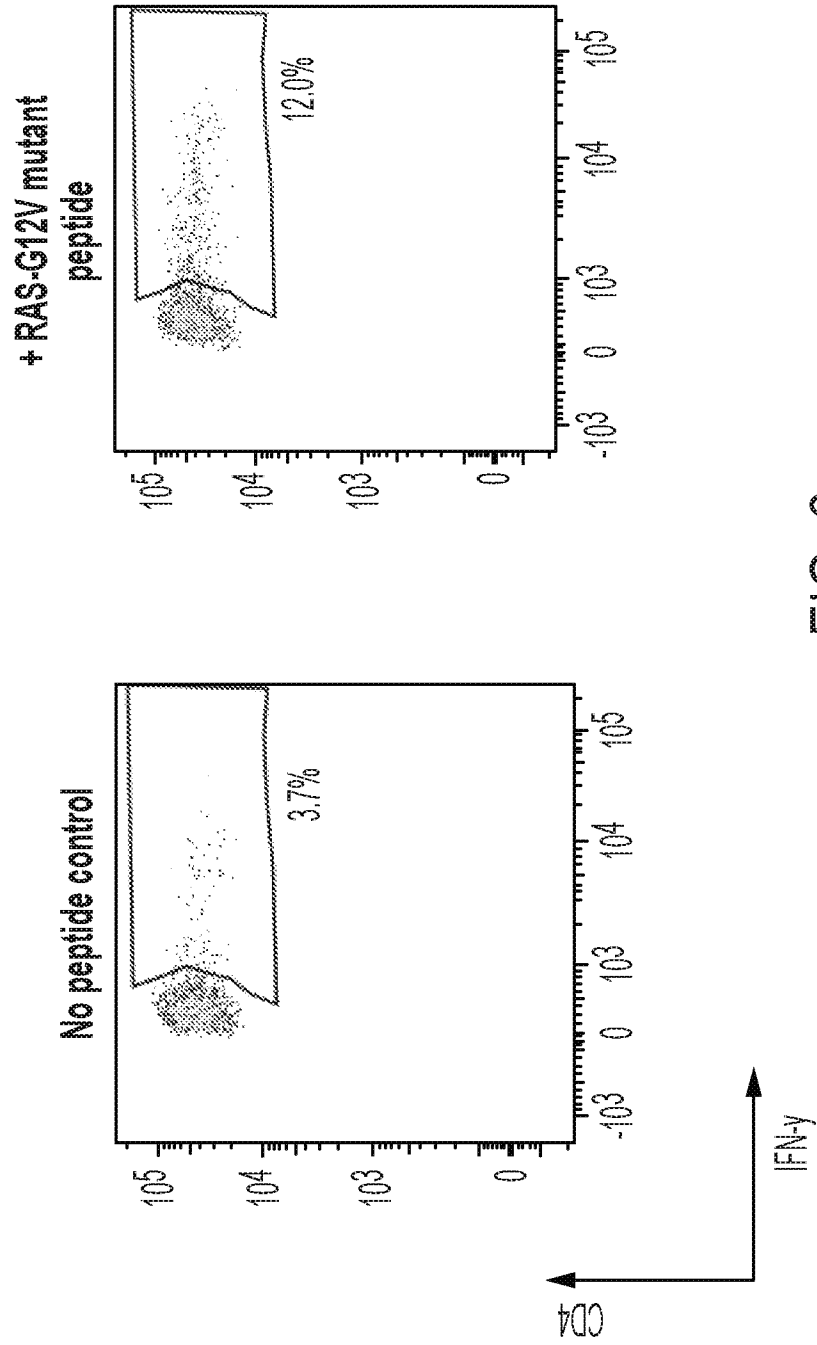


FIG. 6

SEQUENCE LISTING

<110> NEON THERAPEUTICS, INC.

<120> NEOANTIGENS AND USES THEREOF

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<140>PCT/US2019/038019

<141>2019-06-19

<150> 62/800,735

<151> 2019-02-04

<150> 62/687,188

<151> 2018-06-19

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<210> 109

<211> 9

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<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 109

Gly Leu Glu Glu Tyr Ser Ala Met Arg

1 5

<210> 110

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 110

Gly Arg Glu Glu Tyr Ser Ala Met

1 5

<210> 111

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 111

Gly Arg Glu Glu Tyr Ser Ala Met Arg

1 5

<210> 112

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 112

His Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 113
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peptide

<400> 113
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1 5

<210> 114
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peptide

<400> 114
Lys Leu Val Val Val Gly Ala Ser Gly
1 5

<210> 115
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peptide

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Leu Asp Ile Leu Asp Thr Ala Gly Arg
1 5

<210> 116
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<400> 116
Leu Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 117
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Leu Val Val Val Gly Ala Arg Gly Val
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<210> 118
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Leu Val Val Val Gly Ala Ser Gly Val
1 5

<210> 119
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<212> PRT
<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

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Arg Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr
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<210> 120

<211> 8

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<223> Description of Artificial Sequence: Synthetic peptide

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Arg Gly Val Gly Lys Ser Ala Leu
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<210> 121

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

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Thr Ala Gly Leu Glu Glu Tyr Ser Ala
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<210> 122

<211> 11

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 122

Thr Glu Tyr Lys Leu Val Val Val Gly Ala Ala
1 5 10

<210> 123

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

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Val Gly Ala Ala Gly Val Gly Lys Ser Ala
1 5 10

<210> 124

<211> 8

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<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 124

Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 125

<211> 10

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

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Val Gly Ala Ser Gly Val Gly Lys Ser Ala
1 5 10

<210> 126
<211> 10
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<220>
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peptide

<400> 126
Val Gly Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 127
<211> 8
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peptide

<400> 127
Val Val Val Gly Ala Ala Gly Val
1 5

<210> 128
<211> 8
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peptide

<400> 128
Val Val Val Gly Ala Val Gly Val

1

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<210> 129

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

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Tyr Lys Leu Val Val Val Gly Ala Cys

1

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<210> 130

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 130

Tyr Lys Leu Val Val Val Gly Ala Asp

1

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<210> 131

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 131

Tyr Lys Leu Val Val Val Gly Ala Arg

1

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<210> 132
<211> 9
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<400> 132
Asp Ile Leu Asp Thr Ala Gly Lys Glu
1 5

<210> 133
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<400> 133
Leu Val Val Val Gly Ala Cys Gly Val
1 5

<210> 134
<211> 10
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<400> 134
Lys Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 135
<211> 9
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 135

Leu Val Val Val Gly Ala Asp Gly Val
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<210> 136

<211> 10

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 136

Lys Leu Val Val Val Gly Ala Asp Gly Val
1 5 10

<210> 137

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 137

Leu Val Val Val Gly Ala Val Gly Val
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<210> 138

<211> 10

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 138

Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 139

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 139

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 140

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 140

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 141

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 141

Val Val Gly Ala Asp Gly Val Gly Lys

1 5

<210> 142

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 142

Val Val Val Gly Ala Asp Gly Val Gly Lys

1 5 10

<210> 143

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 143

Val Val Gly Ala Val Gly Val Gly Lys

1 5

<210> 144

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 144

Val Val Val Gly Ala Val Gly Val Gly Lys

1 5 10

<210> 145
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<400> 145
Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 146
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<400> 146
Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 147
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
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<400> 147
Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 148

<211> 9
<212> PRT
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<400> 148
Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 149
<211> 10
<212> PRT
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<400> 149
Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 150
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
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<400> 150
Lys Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 151
<211> 10
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 151

Phe Leu Val Val Val Gly Ala Cys Gly Leu
1 5 10

<210> 152

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 152

Phe Met Val Val Val Gly Ala Cys Gly Ile
1 5 10

<210> 153

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 153

Phe Leu Val Val Val Gly Ala Cys Gly Ile
1 5 10

<210> 154

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 154
Phe Met Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 155
<211> 10
<212> PRT
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<220>
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peptide

<400> 155
Phe Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 156
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 156
Met Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 157
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
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peptide

<400> 157

Phe Met Val Val Val Gly Ala Cys Gly Leu
1 5 10

<210> 158
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 158
Tyr Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 159
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 159
Lys Met Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 160
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 160
Tyr Met Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 161
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 161
Met Met Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 162
<211> 13
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 162
Thr Glu Tyr Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 163
<211> 26
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 163
Trp Gln Ala Gly Ile Leu Ala Arg Lys Leu Val Val Val Gly Ala Val
1 5 10 15

Gly Val Gln Gly Gln Asn Leu Lys Tyr Gln
20 25

<210> 164
<211> 25
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 164
His Ser Tyr Thr Thr Ala Glu Lys Leu Val Val Val Gly Ala Val Gly
1 5 10 15

Val Ile Leu Gly Val Leu Leu Leu Ile
20 25

<210> 165
<211> 26
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 165
Pro Leu Thr Glu Glu Lys Ile Lys Lys Leu Val Val Val Gly Ala Val
1 5 10 15

Gly Val Glu Lys Glu Gly Lys Ile Ser Lys
20 25

<210> 166
<211> 30
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic

polypeptide

<400> 166

Gly Ala Leu His Phe Lys Pro Gly Ser Arg Lys Leu Val Val Val Gly
1 5 10 15

Ala Val Gly Val Ala Ala Ser Asp Phe Ile Phe Leu Val Thr
 20 25 30

<210> 167

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 167

Arg Arg Ala Asn Lys Asp Ala Thr Ala Glu Lys Leu Val Val Val Gly
1 5 10 15

Ala Val Gly Val Lys Glu Leu Lys Gln Val Ala Ser Pro Phe
 20 25 30

<210> 168

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 168

Lys Ala Phe Ile Ser His Glu Glu Lys Arg Lys Leu Val Val Val Gly
1 5 10 15

Ala Val Gly Val Lys Lys Lys Leu Ile Asn Glu Lys Lys Glu
 20 25 30

<210> 169
<211> 30
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 169
Thr Asp Leu Ser Ser Arg Phe Ser Lys Ser Lys Leu Val Val Val Gly
1 5 10 15

Ala Val Gly Val Lys Lys Cys Asp Ile Ser Leu Gln Phe Phe
20 25 30

<210> 170
<211> 30
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 170
Phe Asp Leu Gly Gly Gly Thr Phe Asp Val Lys Leu Val Val Val Gly
1 5 10 15

Ala Val Gly Val Lys Ser Thr Ala Gly Asp Thr His Leu Gly
20 25 30

<210> 171
<211> 30
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic

polypeptide

<400> 171

Cys Leu Leu Leu His Tyr Ser Val Ser Lys Lys Leu Val Val Val Gly
1 5 10 15

Ala Val Gly Val Ala Thr Phe Tyr Val Ala Val Thr Val Pro
20 25 30

<210> 172

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 172

Ile Asp Ile Ile Met Lys Ile Arg Asn Ala
1 5 10

<210> 173

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 173

Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe
1 5 10 15

Phe Phe Phe Phe Ile Ile Phe Phe Ile Phe Phe Trp Met Cys
20 25 30

<210> 174

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 174

Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe
1 5 10 15

Phe Phe Phe Phe Phe Phe Phe Phe Ala Ala Phe Trp Phe Trp
20 25 30

<210> 175

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 175

Ile Phe Phe Ile Phe Phe Ile Ile Phe Phe Phe Phe Phe Phe Phe
1 5 10 15

Phe Phe Phe Phe Ile Ile Ile Ile Ile Ile Ile Trp Glu Cys
20 25 30

<210> 176

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 176

Phe Ile Phe Phe Phe Ile Ile Phe Phe Phe Phe Phe Ile Phe Phe Phe

1

5

10

15

Phe Phe Ile Phe Ile Ile Ile Ile Ile Ile Phe Trp Glu Cys
20 25 30

<210> 177

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 177

Trp Gln Ala Gly Ile Leu Ala Arg
1 5

<210> 178

<211> 7

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 178

His Ser Tyr Thr Thr Ala Glu
1 5

<210> 179

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 179

Pro Leu Thr Glu Glu Lys Ile Lys
1 5

<210> 180
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
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<400> 180
Gly Ala Leu His Phe Lys Pro Gly Ser Arg
1 5 10

<210> 181
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
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<400> 181
Arg Arg Ala Asn Lys Asp Ala Thr Ala Glu
1 5 10

<210> 182
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 182
Lys Ala Phe Ile Ser His Glu Glu Lys Arg
1 5 10

<210> 183
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 183
Thr Asp Leu Ser Ser Arg Phe Ser Lys Ser
1 5 10

<210> 184
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 184
Phe Asp Leu Gly Gly Gly Thr Phe Asp Val
1 5 10

<210> 185
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 185
Cys Leu Leu Leu His Tyr Ser Val Ser Lys
1 5 10

<210> 186
<211> 9

<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 186
Met Thr Glu Tyr Lys Leu Val Val Val
1 5

<210> 187
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 187
Lys Lys Asn Lys Lys Asp Asp Ile Lys Asp
1 5 10

<210> 188
<211> 30
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 188
Ala Gly Asn Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp
1 5 10 15

Asp Asp Asp Asp Lys Lys Asp Lys Asp Asp Asp Asp Asp Asp
20 25 30

<210> 189

<211> 30
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 189
Ala Gly Asn Lys Lys Lys Lys Lys Lys Lys Asn Asn Asn Asn Asn Asn
1 5 10 15

Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn Asn
20 25 30

<210> 190
<211> 30
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 190
Ala Gly Arg Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp
1 5 10 15

Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp Asp
20 25 30

<210> 191
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 191

Gly Lys Ser Ala Leu Thr Ile Gln Leu

1 5

<210> 192

<211> 7

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 192

Gly Lys Ser Ala Leu Thr Ile

1 5

<210> 193

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 193

Gln Gly Gln Asn Leu Lys Tyr Gln

1 5

<210> 194

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 194

Ile Leu Gly Val Leu Leu Ile

1 5

<210> 195
<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 195
Glu Lys Glu Gly Lys Ile Ser Lys
1 5

<210> 196
<211> 10
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<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 196
Ala Ala Ser Asp Phe Ile Phe Leu Val Thr
1 5 10

<210> 197
<211> 10
<212> PRT
<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 197
Lys Glu Leu Lys Gln Val Ala Ser Pro Phe
1 5 10

<210> 198
<211> 10

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 198

Lys Lys Lys Leu Ile Asn Glu Lys Lys Glu
1 5 10

<210> 199

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 199

Lys Lys Cys Asp Ile Ser Leu Gln Phe Phe
1 5 10

<210> 200

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 200

Lys Ser Thr Ala Gly Asp Thr His Leu Gly
1 5 10

<210> 201

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 201

Ala Thr Phe Tyr Val Ala Val Thr Val Pro
1 5 10

<210> 202

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 202

Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr Asp Pro
1 5 10 15

Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
20 25 30

<210> 203

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 203

Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr Asp Pro Thr
1 5 10 15

Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly Glu
20 25 30

<210> 204
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 204
Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 205
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 205
Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 206
<211> 9
<212> PRT
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<400> 206
Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 207
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<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 207

Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 208

<211> 10

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<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 208

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 209

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 209

Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 210

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 210

Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 211

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 211

Gly Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 212

<211> 10

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 212

Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 213

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 213

Gly Ala Asp Gly Val Gly Lys Ser Ala
1 5

<210> 214

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 214

Gly Ala Cys Gly Val Gly Lys Ser Ala
1 5

<210> 215

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 215

Gly Ala Val Gly Val Gly Lys Ser Ala
1 5

<210> 216

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 216

Lys Leu Val Val Val Gly Ala Asp Gly Val
1 5 10

<210> 217
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 217
Lys Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 218
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 218
Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 219
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 219
Leu Val Val Val Gly Ala Asp Gly Val
1 5

<210> 220

<211> 9
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 220

Leu Val Val Val Gly Ala Cys Gly Val
1 5

<210> 221

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 221

Leu Val Val Val Gly Ala Val Gly Val
1 5

<210> 222

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 222

Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 223

<211> 10

<212> PRT

<213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic peptide

<400> 223
 Gly Ala Cys Gly Val Gly Lys Ser Ala Leu
 1 5 10

<210> 224
 <211> 10
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic peptide

<400> 224
 Gly Ala Val Gly Val Gly Lys Ser Ala Leu
 1 5 10

<210> 225
 <211> 9
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic peptide

<400> 225
 Gly Ala Asp Gly Val Gly Lys Ser Ala
 1 5

<210> 226
 <211> 9
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic

peptide

<400> 226

Gly Ala Cys Gly Val Gly Lys Ser Ala

1 5

<210> 227

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 227

Gly Ala Val Gly Val Gly Lys Ser Ala

1 5

<210> 228

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 228

Val Val Gly Ala Asp Gly Val Gly Lys

1 5

<210> 229

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 229

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 230

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 230

Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 231

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 231

Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 232

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 232

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 233
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 233
Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 234
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 234
Val Val Gly Ala Ser Gly Val Gly Lys
1 5

<210> 235
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 235
Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Lys
1 5 10

<210> 236
<211> 10

<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 236
Val Val Val Gly Ala Ser Gly Val Gly Lys
1 5 10

<210> 237
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 237
Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 238
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 238
Val Ala Asp Gly Leu Ile Thr Thr Leu His Tyr Pro Ala Pro Lys Arg
1 5 10 15

Asn Lys Pro Thr Val Tyr Gly Val Ser Pro Asn Tyr Asp Lys Trp Glu
20 25 30

Met Glu Arg Thr Asp Ile Thr Met Lys His Lys Leu Gly Gly Gly Gln

35

40

45

Tyr Gly Lys Val Tyr Glu Gly Val Trp Lys Lys Tyr Ser Leu Thr Val
50 55 60

Ala Val Lys Thr Leu Lys Glu Asp Thr Met Glu Val Glu Glu Phe Leu
65 70 75 80

Lys Glu Ala Ala Val Met Lys Glu Ile Lys His Pro Asn Leu Val Gln
85 90 95

Leu Leu Gly Val Cys
100

<210> 239

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 239

Val Ala Asp Gly Leu Ile Thr Thr Leu His Tyr Pro Ala Pro Lys Arg
1 5 10 15

Asn Lys Pro Thr Val Tyr Gly Val Ser Pro Asn Tyr Asp Lys Trp Glu
20 25 30

Met Glu Arg Thr Asp Ile Thr Met Lys His Lys Leu Gly Gly Gly Gln
35 40 45

Tyr Gly Val Val Tyr Glu Gly Val Trp Lys Lys Tyr Ser Leu Thr Val
50 55 60

Ala Val Lys Thr Leu Lys Glu Asp Thr Met Glu Val Glu Glu Phe Leu
65 70 75 80

Lys Glu Ala Ala Val Met Lys Glu Ile Lys His Pro Asn Leu Val Gln
85 90 95

Leu Leu Gly Val Cys
100

<210> 240

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 240

Leu Leu Gly Val Cys Thr Arg Glu Pro Pro Phe Tyr Ile Ile Thr Glu
1 5 10 15

Phe Met Thr Tyr Gly Asn Leu Leu Asp Tyr Leu Arg Glu Cys Asn Arg
20 25 30

Gln Glu Val Asn Ala Val Val Leu Leu Tyr Met Ala Thr Gln Ile Ser
35 40 45

Ser Ala Thr Glu Tyr Leu Glu Lys Lys Asn Phe Ile His Arg Asp Leu
50 55 60

Ala Ala Arg Asn Cys Leu Val Gly Glu Asn His Leu Val Lys Val Ala
65 70 75 80

Asp Phe Gly Leu Ser Arg Leu Met Thr Gly Asp Thr Tyr Thr Ala His
85 90 95

Ala Gly Ala Lys Phe
100

<210> 241
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 241
Ser Leu Thr Val Ala Val Lys Thr Leu Lys Glu Asp Thr Met Glu Val
1 5 10 15

Glu Glu Phe Leu Lys Glu Ala Ala Val Met Lys Glu Ile Lys His Pro
20 25 30

Asn Leu Val Gln Leu Leu Gly Val Cys Thr Arg Glu Pro Pro Phe Tyr
35 40 45

Ile Ile Ile Glu Phe Met Thr Tyr Gly Asn Leu Leu Asp Tyr Leu Arg
50 55 60

Glu Cys Asn Arg Gln Glu Val Asn Ala Val Val Leu Leu Tyr Met Ala
65 70 75 80

Thr Gln Ile Ser Ser Ala Met Glu Tyr Leu Glu Lys Lys Asn Phe Ile
85 90 95

His Arg Asp Leu Ala
100

<210> 242
<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 242

Ser Thr Val Ala Asp Gly Leu Ile Thr Thr Leu His Tyr Pro Ala Pro
1 5 10 15

Lys Arg Asn Lys Pro Thr Val Tyr Gly Val Ser Pro Asn Tyr Asp Lys
20 25 30

Trp Glu Met Glu Arg Thr Asp Ile Thr Met Lys His Lys Leu Gly Gly
35 40 45

Gly Gln His Gly Glu Val Tyr Glu Gly Val Trp Lys Lys Tyr Ser Leu
50 55 60

Thr Val Ala Val Lys Thr Leu Lys Glu Asp Thr Met Glu Val Glu Glu
65 70 75 80

Phe Leu Lys Glu Ala Ala Val Met Lys Glu Ile Lys His Pro Asn Leu
85 90 95

Val Gln Leu Leu Gly
100

<210> 243

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 243

Ser Ser Leu Ala Met Leu Asp Leu Leu His Val Ala Arg Asp Ile Ala
1 5 10 15

Cys Gly Cys Gln Tyr Leu Glu Glu Asn His Phe Ile His Arg Asp Ile
20 25 30

Ala Ala Arg Asn Cys Leu Leu Thr Cys Pro Gly Pro Gly Arg Val Ala
35 40 45

Lys Ile Ala Asp Phe Gly Met Ala Arg Asp Ile Tyr Arg Ala Ser Tyr
50 55 60

Tyr Arg Lys Gly Gly Cys Ala Met Leu Pro Val Lys Trp Met Pro Pro
65 70 75 80

Glu Ala Phe Met Glu Gly Ile Phe Thr Ser Lys Thr Asp Thr Trp Ser
85 90 95

Phe Gly Val Leu Leu
100

<210> 244

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 244

Gln Val Ala Val Lys Thr Leu Pro Glu Val Cys Ser Glu Gln Asp Glu
1 5 10 15

Leu Asp Phe Leu Met Glu Ala Leu Ile Ile Ser Lys Phe Asn His Gln
20 25 30

Asn Ile Val Arg Cys Ile Gly Val Ser Leu Gln Ser Leu Pro Arg Phe
35 40 45

Ile Leu Met Glu Leu Met Ala Gly Gly Asp Leu Lys Ser Phe Leu Arg
50 55 60

Glu Thr Arg Pro Arg Pro Ser Gln Pro Ser Ser Leu Ala Met Leu Asp
65 70 75 80

Leu Leu His Val Ala Arg Asp Ile Ala Cys Gly Cys Gln Tyr Leu Glu
85 90 95

Glu Asn His Phe Ile
100

<210> 245

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 245

Met Ile Lys Leu Ile Asp Ile Ala Arg Gln Thr Ala Gln Gly Met Asp
1 5 10 15

Tyr Leu His Ala Lys Ser Ile Ile His Arg Asp Leu Lys Ser Asn Asn
20 25 30

Ile Phe Leu His Glu Asp Leu Thr Val Lys Ile Gly Asp Phe Gly Leu
35 40 45

Ala Thr Glu Lys Ser Arg Trp Ser Gly Ser His Gln Phe Glu Gln Leu

50

55

60

Ser Gly Ser Ile Leu Trp Met Ala Pro Glu Val Ile Arg Met Gln Asp
65 70 75 80

Lys Asn Pro Tyr Ser Phe Gln Ser Asp Val Tyr Ala Phe Gly Ile Val
85 90 95

Leu Tyr Glu Leu Met
100

<210> 246

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 246

Met Ile Lys Glu Gly Ser Met Ser Glu Asp Glu Phe Ile Glu Glu Ala
1 5 10 15

Lys Val Met Met Asn Leu Ser His Glu Lys Leu Val Gln Leu Tyr Gly
20 25 30

Val Cys Thr Lys Gln Arg Pro Ile Phe Ile Ile Thr Glu Tyr Met Ala
35 40 45

Asn Gly Ser Leu Leu Asn Tyr Leu Arg Glu Met Arg His Arg Phe Gln
50 55 60

Thr Gln Gln Leu Leu Glu Met Cys Lys Asp Val Cys Glu Ala Met Glu
65 70 75 80

Tyr Leu Glu Ser Lys Gln Phe Leu His Arg Asp Leu Ala Ala Arg Asn
85 90 95

Cys Leu Val Asn Asp
100

<210> 247

<211> 93

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 247

Met Gly Phe Gly Asp Leu Lys Ser Pro Ala Gly Leu Gln Val Leu Asn
1 5 10 15

Asp Tyr Leu Ala Asp Lys Ser Tyr Ile Glu Gly Tyr Val Pro Ser Gln
20 25 30

Ala Asp Val Ala Val Phe Glu Ala Val Ser Gly Pro Pro Pro Ala Asp
35 40 45

Leu Cys His Ala Leu Arg Trp Tyr Asn His Ile Lys Ser Tyr Glu Lys
50 55 60

Glu Lys Ala Ser Leu Pro Gly Val Lys Lys Ala Leu Gly Lys Tyr Gly
65 70 75 80

Pro Ala Asp Val Glu Asp Thr Thr Gly Ser Gly Ala Thr
85 90

<210> 248

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 248

Ser Leu Asn Ile Thr Ser Leu Gly Leu Arg Ser Leu Lys Glu Ile Ser
1 5 10 15

Asp Gly Asp Val Ile Ile Ser Gly Asn Lys Asn Leu Cys Tyr Ala Asn
20 25 30

Thr Ile Asn Trp Lys Lys Leu Phe Gly Thr Ser Gly Gln Lys Thr Lys
35 40 45

Ile Ile Arg Asn Arg Gly Glu Asn Ser Cys Lys Ala Thr Gly Gln Val
50 55 60

Cys His Ala Leu Cys Ser Pro Glu Gly Cys Trp Gly Pro Glu Pro Arg
65 70 75 80

Asp Cys Val Ser Cys Arg Asn Val Ser Arg Gly Arg Glu Cys Val Asp
85 90 95

Lys Cys Asn Leu Leu
100

<210> 249

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 249

Ile Pro Val Ala Ile Lys Glu Leu Arg Glu Ala Thr Ser Pro Lys Ala
 1 5 10 15

Asn Lys Glu Ile Leu Asp Glu Ala Tyr Val Met Ala Ser Val Asp Asn
 20 25 30

Pro His Val Cys Arg Leu Leu Gly Ile Cys Leu Thr Ser Thr Val Gln
 35 40 45

Leu Ile Met Gln Leu Met Pro Phe Gly Cys Leu Leu Asp Tyr Val Arg
 50 55 60

Glu His Lys Asp Asn Ile Gly Ser Gln Tyr Leu Leu Asn Trp Cys Val
 65 70 75 80

Gln Ile Ala Lys Gly Met Asn Tyr Leu Glu Asp Arg Arg Leu Val His
 85 90 95

Arg Asp Leu Ala Ala
 100

<210> 250
 <211> 101
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic
 polypeptide

<400> 250
 Glu Arg Cys Glu Val Val Met Gly Asn Leu Glu Ile Val Leu Thr Gly
 1 5 10 15

His Asn Ala Asp Leu Ser Phe Leu Gln Trp Ile Arg Glu Val Thr Gly
 20 25 30

Tyr Val Leu Val Ala Met Asn Glu Phe Ser Thr Leu Pro Leu Pro Asn
35 40 45

Leu Arg Met Val Arg Gly Thr Gln Val Tyr Asp Gly Lys Phe Ala Ile
50 55 60

Phe Val Met Leu Asn Tyr Asn Thr Asn Ser Ser His Ala Leu Arg Gln
65 70 75 80

Leu Arg Leu Thr Gln Leu Thr Glu Ile Leu Ser Gly Gly Val Tyr Ile
85 90 95

Glu Lys Asn Asp Lys
100

<210> 251

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 251

His Leu Met Ala Lys Ala Gly Leu Thr Leu Gln Gln Gln His Gln Arg
1 5 10 15

Leu Ala Gln Leu Leu Leu Ile Leu Ser His Ile Arg His Met Ser Asn
20 25 30

Lys Gly Met Glu His Leu Tyr Ser Met Lys Cys Lys Asn Val Val Pro
35 40 45

Leu Tyr Gly Leu Leu Leu Glu Met Leu Asp Ala His Arg Leu His Ala
50 55 60

Pro Thr Ser Arg Gly Gly Ala Ser Val Glu Glu Thr Asp Gln Ser His
65 70 75 80

Leu Ala Thr Ala Gly Ser Thr Ser Ser His Ser Leu Gln Lys Tyr Tyr
85 90 95

Ile Thr Gly Glu Ala
100

<210> 252

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 252

Asn Gln Gly Lys Cys Val Glu Gly Met Val Glu Ile Phe Asp Met Leu
1 5 10 15

Leu Ala Thr Ser Ser Arg Phe Arg Met Met Asn Leu Gln Gly Glu Glu
20 25 30

Phe Val Cys Leu Lys Ser Ile Ile Leu Leu Asn Ser Gly Val Tyr Thr
35 40 45

Phe Leu Pro Ser Thr Leu Lys Ser Leu Glu Glu Lys Asp His Ile His
50 55 60

Arg Val Leu Asp Lys Ile Thr Asp Thr Leu Ile His Leu Met Ala Lys
65 70 75 80

Ala Gly Leu Thr Leu Gln Gln Gln His Gln Arg Leu Ala Gln Leu Leu

85

90

95

Leu Ile Leu Ser His
100

<210> 253

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 253

Ile His Leu Met Ala Lys Ala Gly Leu Thr Leu Gln Gln Gln His Gln
1 5 10 15

Arg Leu Ala Gln Leu Leu Leu Ile Leu Ser His Ile Arg His Met Ser
20 25 30

Asn Lys Gly Met Glu His Leu Tyr Ser Met Lys Cys Lys Asn Val Val
35 40 45

Pro Leu Cys Asp Leu Leu Leu Glu Met Leu Asp Ala His Arg Leu His
50 55 60

Ala Pro Thr Ser Arg Gly Gly Ala Ser Val Glu Glu Thr Asp Gln Ser
65 70 75 80

His Leu Ala Thr Ala Gly Ser Thr Ser Ser His Ser Leu Gln Lys Tyr
85 90 95

Tyr Ile Thr Gly Glu
100

<210> 254
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 254
Ile His Leu Met Ala Lys Ala Gly Leu Thr Leu Gln Gln Gln His Gln
1 5 10 15

Arg Leu Ala Gln Leu Leu Leu Ile Leu Ser His Ile Arg His Met Ser
20 25 30

Asn Lys Gly Met Glu His Leu Tyr Ser Met Lys Cys Lys Asn Val Val
35 40 45

Pro Leu Asn Asp Leu Leu Leu Glu Met Leu Asp Ala His Arg Leu His
50 55 60

Ala Pro Thr Ser Arg Gly Gly Ala Ser Val Glu Glu Thr Asp Gln Ser
65 70 75 80

His Leu Ala Thr Ala Gly Ser Thr Ser Ser His Ser Leu Gln Lys Tyr
85 90 95

Tyr Ile Thr Gly Glu
100

<210> 255
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic

polypeptide

<400> 255

Ile His Leu Met Ala Lys Ala Gly Leu Thr Leu Gln Gln Gln His Gln
1 5 10 15

Arg Leu Ala Gln Leu Leu Leu Ile Leu Ser His Ile Arg His Met Ser
20 25 30

Asn Lys Gly Met Glu His Leu Tyr Ser Met Lys Cys Lys Asn Val Val
35 40 45

Pro Leu Ser Asp Leu Leu Leu Glu Met Leu Asp Ala His Arg Leu His
50 55 60

Ala Pro Thr Ser Arg Gly Gly Ala Ser Val Glu Glu Thr Asp Gln Ser
65 70 75 80

His Leu Ala Thr Ala Gly Ser Thr Ser Ser His Ser Leu Gln Lys Tyr
85 90 95

Tyr Ile Thr Gly Glu
100

<210> 256

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 256

His Arg Ile Gly Gly Ile Lys Leu Arg His Gln Gln Trp Ser Leu Val
1 5 10 15

Met Glu Ser Val Val Pro Ser Asp Arg Gly Asn Tyr Thr Cys Val Val
20 25 30

Glu Asn Lys Phe Gly Ser Ile Arg Gln Thr Tyr Thr Leu Asp Val Leu
35 40 45

Glu Arg Cys Pro His Arg Pro Ile Leu Gln Ala Gly Leu Pro Ala Asn
50 55 60

Gln Thr Ala Val Leu Gly Ser Asp Val Glu Phe His Cys Lys Val Tyr
65 70 75 80

Ser Asp Ala Gln Pro His Ile Gln Trp Leu Lys His Val Glu Val Asn
85 90 95

Gly Ser Lys Val Gly
100

<210> 257

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 257

Ala Val Lys Leu Ser Asp Ser Arg Ile Ala Leu Lys Ser Gly Tyr Gly
1 5 10 15

Lys Tyr Leu Gly Ile Asn Ser Asp Glu Leu Val Gly His Ser Asp Ala
20 25 30

Ile Gly Pro Arg Glu Gln Trp Glu Pro Val Phe Gln Asn Gly Lys Met
35 40 45

Ala Leu Ser Ala Ser Asn Ser Cys Phe Ile Arg Cys Asn Glu Ala Gly
50 55 60

Asp Ile Glu Ala Lys Ser Lys Thr Ala Gly Glu Glu Glu Met Ile Lys
65 70 75 80

Ile Arg Ser Cys Ala Glu Lys Glu Thr Lys Lys Lys Asp Asp Ile Pro
85 90 95

Glu Glu Asp Lys Gly
100

<210> 258

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 258

Gly Ser Gly Ala Phe Gly Thr Val Tyr Lys Gly Ile Trp Ile Pro Asp
1 5 10 15

Gly Glu Asn Val Lys Ile Pro Val Ala Ile Lys Val Leu Arg Glu Asn
20 25 30

Thr Ser Pro Lys Ala Asn Lys Glu Ile Leu Asp Glu Ala Tyr Val Met
35 40 45

Ala Gly Leu Gly Ser Pro Tyr Val Ser Arg Leu Leu Gly Ile Cys Leu
50 55 60

Thr Ser Thr Val Gln Leu Val Thr Gln Leu Met Pro Tyr Gly Cys Leu
65 70 75 80

Leu Asp His Val Arg Glu Asn Arg Gly Arg Leu Gly Ser Gln Asp Leu
85 90 95

Leu Asn Trp Cys Met
100

<210> 259

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 259

Arg Val Glu Glu Phe Lys Leu Lys Gln Met Trp Lys Ser Pro Asn Gly
1 5 10 15

Thr Ile Arg Asn Ile Leu Gly Gly Thr Val Phe Arg Glu Ala Ile Ile
20 25 30

Cys Lys Asn Ile Pro Arg Leu Val Ser Gly Trp Val Lys Pro Ile Ile
35 40 45

Ile Gly His His Ala Tyr Gly Asp Gln Tyr Arg Ala Thr Asp Phe Val
50 55 60

Val Pro Gly Pro Gly Lys Val Glu Ile Thr Tyr Thr Pro Ser Asp Gly
65 70 75 80

Thr Gln Lys Val Thr Tyr Leu Val His Asn Phe Glu Glu Gly Gly Gly
85 90 95

Val Ala Met Gly Met

<210> 260

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 260

Arg Val Glu Glu Phe Lys Leu Lys Gln Met Trp Lys Ser Pro Asn Gly
1 5 10 15

Thr Ile Arg Asn Ile Leu Gly Gly Thr Val Phe Arg Glu Ala Ile Ile
20 25 30

Cys Lys Asn Ile Pro Arg Leu Val Ser Gly Trp Val Lys Pro Ile Ile
35 40 45

Ile Gly Cys His Ala Tyr Gly Asp Gln Tyr Arg Ala Thr Asp Phe Val
50 55 60

Val Pro Gly Pro Gly Lys Val Glu Ile Thr Tyr Thr Pro Ser Asp Gly
65 70 75 80

Thr Gln Lys Val Thr Tyr Leu Val His Asn Phe Glu Glu Gly Gly Gly
85 90 95

Val Ala Met Gly Met
100

<210> 261

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 261

Arg Val Glu Glu Phe Lys Leu Lys Gln Met Trp Lys Ser Pro Asn Gly
1 5 10 15

Thr Ile Arg Asn Ile Leu Gly Gly Thr Val Phe Arg Glu Ala Ile Ile
20 25 30

Cys Lys Asn Ile Pro Arg Leu Val Ser Gly Trp Val Lys Pro Ile Ile
35 40 45

Ile Gly Gly His Ala Tyr Gly Asp Gln Tyr Arg Ala Thr Asp Phe Val
50 55 60

Val Pro Gly Pro Gly Lys Val Glu Ile Thr Tyr Thr Pro Ser Asp Gly
65 70 75 80

Thr Gln Lys Val Thr Tyr Leu Val His Asn Phe Glu Glu Gly Gly Gly
85 90 95

Val Ala Met Gly Met
100

<210> 262

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 262

Arg Val Glu Glu Phe Lys Leu Lys Gln Met Trp Lys Ser Pro Asn Gly

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Thr	Ile	Arg	Asn	Ile	Leu	Gly	Gly	Thr	Val	Phe	Arg	Glu	Ala	Ile	Ile
			20					25					30		
Cys	Lys	Asn	Ile	Pro	Arg	Leu	Val	Ser	Gly	Trp	Val	Lys	Pro	Ile	Ile
		35					40					45			
Ile	Gly	Ser	His	Ala	Tyr	Gly	Asp	Gln	Tyr	Arg	Ala	Thr	Asp	Phe	Val
	50					55					60				
Val	Pro	Gly	Pro	Gly	Lys	Val	Glu	Ile	Thr	Tyr	Thr	Pro	Ser	Asp	Gly
65					70					75					80
Thr	Gln	Lys	Val	Thr	Tyr	Leu	Val	His	Asn	Phe	Glu	Glu	Gly	Gly	Gly
			85						90					95	
Val	Ala	Met	Gly	Met											
			100												

<210> 263
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 263
Val Ala Val Lys Met Leu Lys Pro Ser Ala His Leu Thr Glu Arg Glu
1 5 10 15

Ala Leu Met Ser Glu Leu Lys Val Leu Ser Tyr Leu Gly Asn His Met
20 25 30

Asn Ile Val Asn Leu Leu Gly Ala Cys Thr Ile Gly Gly Pro Thr Leu
35 40 45

Val Ile Ile Glu Tyr Cys Cys Tyr Gly Asp Leu Leu Asn Phe Leu Arg
50 55 60

Arg Lys Arg Asp Ser Phe Ile Cys Ser Lys Gln Glu Asp His Ala Glu
65 70 75 80

Ala Ala Leu Tyr Lys Asn Leu Leu His Ser Lys Glu Ser Ser Cys Ser
85 90 95

Asp Ser Thr Asn Glu
100

<210> 264

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 264

Val Glu Ala Thr Ala Tyr Gly Leu Ile Lys Ser Asp Ala Ala Met Thr
1 5 10 15

Val Ala Val Lys Met Leu Lys Pro Ser Ala His Leu Thr Glu Arg Glu
20 25 30

Ala Leu Met Ser Glu Leu Lys Val Leu Ser Tyr Leu Gly Asn His Met
35 40 45

Asn Ile Ala Asn Leu Leu Gly Ala Cys Thr Ile Gly Gly Pro Thr Leu
50 55 60

Val Ile Thr Glu Tyr Cys Cys Tyr Gly Asp Leu Leu Asn Phe Leu Arg
65 70 75 80

Arg Lys Arg Asp Ser Phe Ile Cys Ser Lys Gln Glu Asp His Ala Glu
85 90 95

Ala Ala Leu Tyr Lys
100

<210> 265

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 265

Ile Ser Glu Leu Gly Ala Gly Asn Gly Gly Val Val Phe Lys Val Ser
1 5 10 15

His Lys Pro Ser Gly Leu Val Met Ala Arg Lys Leu Ile His Leu Glu
20 25 30

Ile Lys Pro Ala Ile Arg Asn Gln Ile Ile Arg Glu Leu Gln Val Leu
35 40 45

His Glu Ser Asn Ser Pro Tyr Ile Val Gly Phe Tyr Gly Ala Phe Tyr
50 55 60

Ser Asp Gly Glu Ile Ser Ile Cys Met Glu His Met Asp Gly Gly Ser
65 70 75 80

Leu Asp Gln Val Leu Lys Lys Ala Gly Arg Ile Pro Glu Gln Ile Leu
85 90 95

Gly Lys Val Ser Ile
100

<210> 266

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 266

Leu Gly Ala Gly Asn Gly Gly Val Val Phe Lys Val Ser His Lys Pro
1 5 10 15

Ser Gly Leu Val Met Ala Arg Lys Leu Ile His Leu Glu Ile Lys Pro
20 25 30

Ala Ile Arg Asn Gln Ile Ile Arg Glu Leu Gln Val Leu His Glu Cys
35 40 45

Asn Ser Leu Tyr Ile Val Gly Phe Tyr Gly Ala Phe Tyr Ser Asp Gly
50 55 60

Glu Ile Ser Ile Cys Met Glu His Met Asp Gly Gly Ser Leu Asp Gln
65 70 75 80

Val Leu Lys Lys Ala Gly Arg Ile Pro Glu Gln Ile Leu Gly Lys Val
85 90 95

Ser Ile Ala Val Ile
100

<210> 267

<211> 89
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 267

Met Pro Leu Asn Val Ser Phe Thr Asn Arg Asn Tyr Asp Leu Asp Tyr
1 5 10 15

Asp Ser Val Gln Pro Tyr Phe Tyr Cys Asp Glu Glu Glu Asn Phe Tyr
20 25 30

Gln Gln Gln Gln Gln Ser Asp Leu Gln Pro Pro Ala Pro Ser Glu Asp
35 40 45

Ile Trp Lys Lys Phe Glu Leu Leu Pro Thr Pro Pro Leu Ser Pro Ser
50 55 60

Arg Arg Ser Gly Leu Cys Ser Pro Ser Tyr Val Ala Val Thr Pro Phe
65 70 75 80

Ser Leu Arg Gly Asp Asn Asp Gly Gly
85

<210> 268

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 268

Phe Thr Asn Arg Asn Tyr Asp Leu Asp Tyr Asp Ser Val Gln Pro Tyr
1 5 10 15

Phe Tyr Cys Asp Glu Glu Glu Asn Phe Tyr Gln Gln Gln Gln Gln Ser
20 25 30

Glu Leu Gln Pro Pro Ala Pro Ser Glu Asp Ile Trp Lys Lys Phe Glu
35 40 45

Leu Leu Ser Thr Pro Pro Leu Ser Pro Ser Arg Arg Ser Gly Leu Cys
50 55 60

Ser Pro Ser Tyr Val Ala Val Thr Pro Phe Ser Leu Arg Gly Asp Asn
65 70 75 80

Asp Gly Gly Gly Gly Ser Phe Ser Thr Ala Asp Gln Leu Glu Met Val
85 90 95

Thr Glu Leu Leu Gly
100

<210> 269

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 269

Thr Asn Arg Asn Tyr Asp Leu Asp Tyr Asp Ser Val Gln Pro Tyr Phe
1 5 10 15

Tyr Cys Asp Glu Glu Glu Asn Phe Tyr Gln Gln Gln Gln Gln Ser Glu
20 25 30

Leu Gln Pro Pro Ala Pro Ser Glu Asp Ile Trp Lys Lys Phe Glu Leu

35

40

45

Leu Pro Ile Pro Pro Leu Ser Pro Ser Arg Arg Ser Gly Leu Cys Ser
50 55 60

Pro Ser Tyr Val Ala Val Thr Pro Phe Ser Leu Arg Gly Asp Asn Asp
65 70 75 80

Gly Gly Gly Gly Ser Phe Ser Thr Ala Asp Gln Leu Glu Met Val Thr
85 90 95

Glu Leu Leu Gly Gly
100

<210> 270

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 270

Val Ala Val Lys Met Leu Lys Pro Thr Ala Arg Ser Ser Glu Lys Gln
1 5 10 15

Ala Leu Met Ser Glu Leu Lys Ile Met Thr His Leu Gly Pro His Leu
20 25 30

Asn Ile Val Asn Leu Leu Gly Ala Cys Thr Lys Ser Gly Pro Ile Tyr
35 40 45

Ile Ile Ile Glu Tyr Cys Phe Tyr Gly Asp Leu Val Asn Tyr Leu His
50 55 60

Lys Asn Arg Asp Ser Phe Leu Ser His His Pro Glu Lys Pro Lys Lys
65 70 75 80

Glu Leu Asp Ile Phe Gly Leu Asn Pro Ala Asp Glu Ser Thr Arg Ser
85 90 95

Tyr Val Ile Leu Ser
100

<210> 271

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 271

Ile Glu Glu His Ala Asn Trp Ser Val Ser Arg Glu Ala Gly Phe Ser
1 5 10 15

Tyr Ser His Ala Gly Leu Ser Asn Arg Leu Ala Arg Asp Asn Glu Leu
20 25 30

Arg Glu Asn Asp Lys Glu Gln Leu Lys Ala Ile Ser Thr Arg Asp Pro
35 40 45

Leu Ser Lys Ile Thr Glu Gln Glu Lys Asp Phe Leu Trp Ser His Arg
50 55 60

His Tyr Cys Val Thr Ile Pro Glu Ile Leu Pro Lys Leu Leu Leu Ser
65 70 75 80

Val Lys Trp Asn Ser Arg Asp Glu Val Ala Gln Met Tyr Cys Leu Val
85 90 95

Lys Asp Trp Pro Pro
100

<210> 272

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 272

His Ala Asn Trp Ser Val Ser Arg Glu Ala Gly Phe Ser Tyr Ser His
1 5 10 15

Ala Gly Leu Ser Asn Arg Leu Ala Arg Asp Asn Glu Leu Arg Glu Asn
20 25 30

Asp Lys Glu Gln Leu Lys Ala Ile Ser Thr Arg Asp Pro Leu Ser Glu
35 40 45

Ile Thr Lys Gln Glu Lys Asp Phe Leu Trp Ser His Arg His Tyr Cys
50 55 60

Val Thr Ile Pro Glu Ile Leu Pro Lys Leu Leu Leu Ser Val Lys Trp
65 70 75 80

Asn Ser Arg Asp Glu Val Ala Gln Met Tyr Cys Leu Val Lys Asp Trp
85 90 95

Pro Pro Ile Lys Pro
100

<210> 273

<211> 72

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 273

Leu Phe Ile Asn Leu Phe Ser Met Met Leu Gly Ser Gly Met Pro Glu
1 5 10 15

Leu Gln Ser Phe Asp Asp Ile Ala Tyr Ile Arg Lys Thr Leu Ala Leu
20 25 30

Asp Lys Thr Glu Gln Glu Ala Leu Glu Tyr Phe Met Lys Gln Met Asn
35 40 45

Asp Ala Arg His Gly Gly Trp Thr Thr Lys Met Asp Trp Ile Phe His
50 55 60

Thr Ile Lys Gln His Ala Leu Asn
65 70

<210> 274

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 274

Gln Arg Gly Gly Val Ile Thr Asp Glu Glu Glu Thr Ser Lys Lys Ile
1 5 10 15

Ala Asp Gln Leu Asp Asn Ile Val Asp Met Arg Glu Tyr Asp Val Pro
20 25 30

Tyr His Ile Arg Leu Ser Ile Asp Ile Glu Thr Thr Lys Leu Pro Leu
35 40 45

Lys Phe Arg Asp Ala Glu Thr Asp Gln Ile Met Met Ile Ser Tyr Met
50 55 60

Ile Asp Gly Gln Gly Tyr Leu Ile Thr Asn Arg Glu Ile Val Ser Glu
65 70 75 80

Asp Ile Glu Asp Phe Glu Phe Thr Pro Lys Pro Glu Tyr Glu Gly Pro
85 90 95

Phe Cys Val Phe Asn
100

<210> 275

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 275

Lys Phe Asn Cys Arg Val Ala Gln Tyr Pro Phe Glu Asp His Asn Pro
1 5 10 15

Pro Gln Leu Glu Leu Ile Lys Pro Phe Cys Glu Asp Leu Asp Gln Trp
20 25 30

Leu Ser Glu Asp Asp Asn His Val Ala Ala Ile His Cys Lys Ala Gly
35 40 45

Lys Gly Gln Thr Gly Val Met Ile Cys Ala Tyr Leu Leu His Arg Gly
50 55 60

Lys Phe Leu Lys Ala Gln Glu Ala Leu Asp Phe Tyr Gly Glu Val Arg
65 70 75 80

Thr Arg Asp Lys Lys Gly Val Thr Ile Pro Ser Gln Arg Arg Tyr Val
85 90 95

Tyr Tyr Tyr Ser Tyr
100

<210> 276

<211> 79

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 276

Met Gln Ala Ile Lys Cys Val Val Val Gly Asp Gly Ala Val Gly Lys
1 5 10 15

Thr Cys Leu Leu Ile Ser Tyr Thr Thr Asn Ala Phe Ser Gly Glu Tyr
20 25 30

Ile Pro Thr Val Phe Asp Asn Tyr Ser Ala Asn Val Met Val Asp Gly
35 40 45

Lys Pro Val Asn Leu Gly Leu Trp Asp Thr Ala Gly Gln Glu Asp Tyr
50 55 60

Asp Arg Leu Arg Pro Leu Ser Tyr Pro Gln Thr Val Gly Glu Thr
65 70 75

<210> 277

<211> 101
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 277

Ile Arg Val Glu Gly Asn Leu Arg Val Glu Tyr Leu Asp Asp Arg Asn
1 5 10 15

Thr Phe Arg His Ser Val Val Val Pro Tyr Glu Pro Pro Glu Val Gly
20 25 30

Ser Asp Cys Thr Thr Ile His Tyr Asn Tyr Met Cys Asn Ser Ser Cys
35 40 45

Met Gly Ser Met Asn Arg Arg Pro Ile Leu Thr Ile Ile Thr Leu Glu
50 55 60

Asp Ser Ser Gly Asn Leu Leu Gly Arg Asn Ser Phe Glu Val Arg Val
65 70 75 80

Cys Ala Cys Pro Gly Arg Asp Arg Arg Thr Glu Glu Glu Asn Leu Arg
85 90 95

Lys Lys Gly Glu Pro
100

<210> 278
<211> 101
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 278

Thr Tyr Ser Pro Ala Leu Asn Lys Met Phe Cys Gln Leu Ala Lys Thr
1 5 10 15

Cys Pro Val Gln Leu Trp Val Asp Ser Thr Pro Pro Pro Gly Thr Arg
20 25 30

Val Arg Ala Met Ala Ile Tyr Lys Gln Ser Gln His Met Thr Glu Val
35 40 45

Val Arg His Cys Pro His His Glu Arg Cys Ser Asp Ser Asp Gly Leu
50 55 60

Ala Pro Pro Gln His Leu Ile Arg Val Glu Gly Asn Leu Arg Val Glu
65 70 75 80

Tyr Leu Asp Asp Arg Asn Thr Phe Arg His Ser Val Val Val Pro Tyr
85 90 95

Glu Pro Pro Glu Val
100

<210> 279

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 279

Glu Gly Asn Leu Arg Val Glu Tyr Leu Asp Asp Arg Asn Thr Phe Arg
1 5 10 15

His Ser Val Val Val Pro Tyr Glu Pro Pro Glu Val Gly Ser Asp Cys

20

25

30

Thr Thr Ile His Tyr Asn Tyr Met Cys Asn Ser Ser Cys Met Gly Gly
35 40 45

Met Asn Gln Arg Pro Ile Leu Thr Ile Ile Thr Leu Glu Asp Ser Ser
50 55 60

Gly Asn Leu Leu Gly Arg Asn Ser Phe Glu Val Arg Val Cys Ala Cys
65 70 75 80

Pro Gly Arg Asp Arg Arg Thr Glu Glu Glu Asn Leu Arg Lys Lys Gly
85 90 95

Glu Pro His His Glu
100

<210> 280

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 280

Glu Gly Asn Leu Arg Val Glu Tyr Leu Asp Asp Arg Asn Thr Phe Arg
1 5 10 15

His Ser Val Val Val Pro Tyr Glu Pro Pro Glu Val Gly Ser Asp Cys
20 25 30

Thr Thr Ile His Tyr Asn Tyr Met Cys Asn Ser Ser Cys Met Gly Gly
35 40 45

Met Asn Trp Arg Pro Ile Leu Thr Ile Ile Thr Leu Glu Asp Ser Ser
50 55 60

Gly Asn Leu Leu Gly Arg Asn Ser Phe Glu Val Arg Val Cys Ala Cys
65 70 75 80

Pro Gly Arg Asp Arg Arg Thr Glu Glu Glu Asn Leu Arg Lys Lys Gly
85 90 95

Glu Pro His His Glu
100

<210> 281
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 281
Pro Glu Val Gly Ser Asp Cys Thr Thr Ile His Tyr Asn Tyr Met Cys
1 5 10 15

Asn Ser Ser Cys Met Gly Gly Met Asn Arg Arg Pro Ile Leu Thr Ile
20 25 30

Ile Thr Leu Glu Asp Ser Ser Gly Asn Leu Leu Gly Arg Asn Ser Phe
35 40 45

Glu Val Cys Val Cys Ala Cys Pro Gly Arg Asp Arg Arg Thr Glu Glu
50 55 60

Glu Asn Leu Arg Lys Lys Gly Glu Pro His His Glu Leu Pro Pro Gly
65 70 75 80

Ser Thr Lys Arg Ala Leu Pro Asn Asn Thr Ser Ser Ser Pro Gln Pro
85 90 95

Lys Lys Lys Pro Leu
100

<210> 282

<211> 53

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 282

Gly Val Glu Pro Cys Tyr Gly Asp Lys Asp Lys Arg Arg His Cys Phe
1 5 10 15

Ala Thr Trp Lys Asn Ile Ser Gly Ser Ile Glu Ile Val Lys Gln Gly
20 25 30

Cys Trp Leu Asp Asp Ile Asn Cys Tyr Asp Arg Thr Asp Cys Val Glu
35 40 45

Lys Lys Arg Gln Pro
50

<210> 283

<211> 103

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 283

Gly Val Glu Pro Cys Tyr Gly Asp Lys Asp Lys Arg Arg His Cys Phe
1 5 10 15

Ala Thr Trp Lys Asn Ile Ser Gly Ser Ile Glu Ile Val Lys Gln Gly
20 25 30

Cys Trp Leu Asp Asp Ile Asn Cys Tyr Asp Arg Thr Asp Cys Val Glu
35 40 45

Lys Lys Thr Ala Leu Lys Tyr Ile Phe Val Ala Val Arg Ala Ile Cys
50 55 60

Val Met Lys Ser Phe Leu Ile Phe Arg Arg Trp Lys Ser His Ser Pro
65 70 75 80

Leu Gln Ile Gln Leu His Leu Ser His Pro Ile Thr Thr Ser Cys Ser
85 90 95

Ile Pro Trp Cys His Leu Cys
100

<210> 284

<211> 118

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 284

Thr Ala Glu Ala Val Asn Val Ala Ile Ala Ala Pro Pro Ser Glu Gly
1 5 10 15

Glu Ala Asn Ala Glu Leu Cys Arg Tyr Leu Ser Lys Val Leu Glu Leu
20 25 30

Arg Lys Ser Asp Val Val Leu Asp Lys Val Gly Leu Ala Leu Phe Phe
35 40 45

Phe Phe Phe Glu Thr Lys Ser Cys Ser Val Ala Gln Ala Gly Val Gln
50 55 60

Trp Arg Ser Leu Gly Ser Leu Gln Pro Pro Pro Pro Gly Phe Lys Leu
65 70 75 80

Phe Ser Cys Leu Ser Phe Leu Ser Ser Trp Asp Tyr Arg Arg Met Pro
85 90 95

Pro Cys Leu Ala Asn Phe Cys Ile Phe Asn Arg Asp Gly Val Ser Pro
100 105 110

Cys Trp Ser Gly Trp Ser
115

<210> 285

<211> 71

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 285

Leu Ser Val Ile Ile Phe Phe Phe Val Tyr Ile Trp His Trp Ala Leu
1 5 10 15

Pro Leu Ile Leu Asn Asn His His Ile Cys Leu Met Ser Ser Ile Ile
20 25 30

Leu Asp Cys Asn Ser Val Arg Gln Ser Ile Met Ser Val Cys Phe Phe
35 40 45

Phe Phe Ser Val Ile Phe Ser Thr Arg Cys Leu Thr Asp Ser Arg Tyr
50 55 60

Pro Asn Ile Cys Trp Phe Lys
65 70

<210> 286
<211> 60
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 286
Leu Ser Val Ile Ile Phe Phe Phe Val Tyr Ile Trp His Trp Ala Leu
1 5 10 15

Pro Leu Ile Leu Asn Asn His His Ile Cys Leu Met Ser Ser Ile Ile
20 25 30

Leu Asp Cys Asn Ser Val Arg Gln Ser Ile Met Ser Val Cys Phe Phe
35 40 45

Phe Phe Cys Tyr Ile Leu Asn Thr Met Phe Asp Arg
50 55 60

<210> 287
<211> 106
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 287

Val Leu Val Leu Ser Cys Asp Leu Ile Thr Asp Val Ala Leu His Glu
1 5 10 15

Val Val Asp Leu Phe Arg Ala Tyr Asp Ala Ser Leu Ala Met Leu Met
20 25 30

Arg Lys Gly Gln Asp Ser Ile Glu Pro Val Pro Gly Gln Lys Gly Lys
35 40 45

Lys Lys Gln Trp Ser Ser Val Thr Ser Leu Glu Trp Thr Ala Gln Glu
50 55 60

Arg Gly Cys Ser Ser Trp Leu Met Lys Gln Thr Trp Met Lys Ser Trp
65 70 75 80

Ser Leu Arg Asp Pro Ser Tyr Arg Ser Ile Leu Glu Tyr Val Ser Thr
85 90 95

Arg Val Leu Trp Met Pro Thr Ser Thr Val
100 105

<210> 288

<211> 112

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 288

Ser Ile Gln Val Met Arg Ala Gln Met Asn Gln Ile Gln Ser Val Glu
1 5 10 15

Gly Gln Pro Leu Ala Arg Arg Pro Arg Ala Thr Gly Arg Thr Lys Arg
20 25 30

Cys Gln Pro Arg Asp Val Thr Lys Lys Thr Cys Asn Ser Asn Asp Gly
35 40 45

Lys Lys Arg Glu Trp Glu Lys Arg Lys Gln Ile Leu Gly Gly Gly Gly
50 55 60

Lys Tyr Lys Glu Tyr Phe Leu Lys Arg Ile Leu Ile Arg Lys Ala Met
65 70 75 80

Thr Val Leu Ala Gly Asp Lys Lys Gly Leu Gly Arg Phe Met Arg Cys
85 90 95

Val Gln Ser Glu Thr Lys Ala Val Ser Leu Gln Leu Pro Leu Gly Arg
100 105 110

<210> 289

<211> 57

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 289

Leu Asp Phe Leu Gly Glu Phe Ala Thr Asp Ile Arg Thr His Gly Val
1 5 10 15

His Met Val Leu Asn His Gln Gly Arg Pro Ser Gly Asp Ala Phe Ile
20 25 30

Gln Met Lys Ser Ala Asp Arg Ala Phe Met Ala Ala Gln Lys Cys His
35 40 45

Lys Lys Lys His Glu Gly Gln Ile Cys

<210> 290

<211> 51

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 290

Leu Asp Phe Leu Gly Glu Phe Ala Thr Asp Ile Arg Thr His Gly Val
1 5 10 15

His Met Val Leu Asn His Gln Gly Arg Pro Ser Gly Asp Ala Phe Ile
 20 25 30

Gln Met Lys Ser Ala Asp Arg Ala Phe Met Ala Ala Gln Lys Cys His
 35 40 45

Lys Lys Thr
 50

<210> 291

<211> 75

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 291

Gly Ala Leu Cys Lys Asp Gly Arg Phe Arg Ser Asp Ile Gly Glu Phe
1 5 10 15

Glu Trp Lys Leu Lys Glu Gly His Lys Lys Ile Tyr Gly Lys Gln Ser
 20 25 30

Met Val Asp Glu Val Ser Gly Lys Val Leu Glu Met Asp Ile Ser Lys
35 40 45

Lys Lys His Tyr Asn Arg Lys Ile Ser Ile Lys Lys Leu Asn Arg Met
50 55 60

Lys Val Pro Leu Met Lys Leu Ile Thr Arg Val
65 70 75

<210> 292

<211> 58

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 292

Arg Glu Arg Ala Gln Leu Leu Glu Glu Gln Glu Lys Thr Leu Thr Ser
1 5 10 15

Lys Leu Gln Glu Gln Ala Arg Val Leu Lys Glu Arg Cys Gln Gly Glu
20 25 30

Ser Thr Gln Leu Gln Asn Glu Ile Gln Lys Leu Gln Lys Thr Leu Lys
35 40 45

Lys Lys Pro Arg Asp Ile Cys Arg Ile Ser
50 55

<210> 293

<211> 53

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 293

Val Asn Thr Leu Lys Glu Gly Lys Arg Leu Pro Cys Pro Pro Asn Cys
1 5 10 15

Pro Asp Glu Val Tyr Gln Leu Met Arg Lys Cys Trp Glu Phe Gln Pro
20 25 30

Ser Asn Arg Thr Ser Phe Gln Asn Leu Ile Glu Gly Phe Glu Ala Leu
35 40 45

Leu Lys Thr Ser Asn
50

<210> 294

<211> 65

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 294

Cys Arg Pro Val Thr Pro Ser Cys Lys Glu Leu Ala Asp Leu Met Thr
1 5 10 15

Arg Cys Met Asn Tyr Asp Pro Asn Gln Arg Pro Phe Phe Arg Ala Ile
20 25 30

Met Arg Asp Ile Asn Lys Leu Glu Glu Gln Asn Pro Asp Ile Val Ser
35 40 45

Glu Lys Asn Gln Gln Leu Lys Trp Thr Pro His Ile Leu Lys Ser Ala
50 55 60

Ser
65

<210> 295
<211> 69
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 295
Asp Asp His Asp Val Leu Ser Phe Leu Thr Phe Gln Leu Thr Glu Pro
1 5 10 15

Gly Lys Glu Pro Pro Thr Pro Asp Lys Glu Ile Ser Glu Lys Glu Lys
 20 25 30

Glu Lys Tyr Gln Glu Glu Phe Glu His Phe Gln Gln Glu Leu Asp Lys
 35 40 45

Lys Lys Arg Gly Ile Pro Glu Gly Pro Pro Arg Pro Pro Arg Ala Ala
 50 55 60

Cys Gly Gly Asn Ile
65

<210> 296
<211> 71
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 296

Asp Asp His Asp Val Leu Ser Phe Leu Thr Phe Gln Leu Thr Glu Pro
1 5 10 15

Gly Lys Glu Pro Pro Thr Pro Asp Lys Glu Ile Ser Glu Lys Glu Lys
20 25 30

Glu Lys Tyr Gln Glu Glu Phe Glu His Phe Gln Gln Glu Leu Asp Lys
35 40 45

Lys Lys Arg Asn Ser Arg Arg Ala Thr Pro Thr Ser Lys Gly Ser Leu
50 55 60

Arg Arg Lys Tyr Leu Arg Val
65 70

<210> 297

<211> 68

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 297

Thr Lys Ser Thr Leu Ile Gly Glu Asp Val Asn Pro Leu Ile Lys Leu
1 5 10 15

Asp Asp Ala Val Asn Val Asp Glu Ile Met Thr Asp Thr Ser Thr Ser
20 25 30

Tyr Leu Leu Cys Ile Ser Glu Asn Lys Glu Asn Val Arg Asp Lys Lys
35 40 45

Lys Gly Gln His Phe Tyr Trp His Cys Gly Ser Ala Ala Cys His Arg
50 55 60

Arg Gly Cys Val

65

<210> 298

<211> 81

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 298

Leu Tyr Thr Lys Ser Thr Leu Ile Gly Glu Asp Val Asn Pro Leu Ile
1 5 10 15

Lys Leu Asp Asp Ala Val Asn Val Asp Glu Ile Met Thr Asp Thr Ser
 20 25 30

Thr Ser Tyr Leu Leu Cys Ile Ser Glu Asn Lys Glu Asn Val Arg Asp
 35 40 45

Lys Lys Arg Ala Thr Phe Leu Leu Ala Leu Trp Glu Cys Ser Leu Pro
 50 55 60

Gln Ala Arg Leu Cys Leu Ile Val Ser Arg Thr Leu Leu Leu Val Gln
65 70 75 80

Ser

<210> 299

<211> 58

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 299

Leu Pro Pro Pro Lys Leu Thr Asp Pro Arg Leu Leu Tyr Ile Gly Phe
1 5 10 15

Leu Gly Tyr Cys Ser Gly Leu Ile Asp Asn Leu Ile Arg Arg Arg Pro
20 25 30

Ile Ala Thr Ala Gly Leu His Arg Gln Leu Leu Tyr Ile Thr Ala Phe
35 40 45

Phe Phe Cys Trp Ile Leu Ser Cys Lys Thr
50 55

<210> 300

<211> 56

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 300

Ser Leu Pro Pro Pro Lys Leu Thr Asp Pro Arg Leu Leu Tyr Ile Gly
1 5 10 15

Phe Leu Gly Tyr Cys Ser Gly Leu Ile Asp Asn Leu Ile Arg Arg Arg
20 25 30

Pro Ile Ala Thr Ala Gly Leu His Arg Gln Leu Leu Tyr Ile Thr Ala
35 40 45

Phe Phe Leu Leu Asp Ile Ile Leu
50 55

<210> 301
<211> 112
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 301
Asn Gln Ser Gly Gly Ala Gly Glu Asp Cys Gln Ile Phe Ser Thr Pro
1 5 10 15

Gly His Pro Lys Met Ile Tyr Ser Ser Ser Asn Leu Lys Thr Pro Ser
 20 25 30

Lys Leu Cys Ser Gly Ser Lys Ser His Asp Val Gln Glu Val Leu Lys
 35 40 45

Lys Lys Thr Gly Ser Asn Glu Val Thr Thr Arg Tyr Glu Glu Lys Lys
 50 55 60

Thr Gly Ser Val Arg Lys Ala Asn Arg Met Pro Lys Asp Val Asn Ile
65 70 75 80

Gln Val Arg Lys Lys Gln Lys His Glu Thr Arg Arg Lys Ser Lys Tyr
 85 90 95

Asn Glu Asp Phe Glu Arg Ala Trp Arg Glu Asp Leu Thr Ile Lys Arg
 100 105 110

<210> 302
<211> 23
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 302

Met Ala Pro Val Lys Lys Leu Val Val Lys Gly Gly Lys Lys Lys Glu
1 5 10 15

Ala Ser Ser Glu Val His Ser
20

<210> 303

<211> 18

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 303

Met Ala Pro Val Lys Lys Leu Val Val Lys Gly Gly Lys Lys Arg Ser
1 5 10 15

Lys Phe

<210> 304

<211> 51

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 304

Met Pro Ser His Gln Gly Ala Glu Gln Gln Gln Gln His His Val
1 5 10 15

Phe Ile Ser Gln Val Val Thr Glu Lys Glu Phe Leu Ser Arg Ser Asp
20 25 30

Gln Leu Gln Gln Ala Val Gln Ser Gln Gly Phe Ile Asn Tyr Cys Gln
35 40 45

Lys Lys Asn
50

<210> 305
<211> 65
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 305
Met Pro Ser His Gln Gly Ala Glu Gln Gln Gln Gln His His Val
1 5 10 15

Phe Ile Ser Gln Val Val Thr Glu Lys Glu Phe Leu Ser Arg Ser Asp
20 25 30

Gln Leu Gln Gln Ala Val Gln Ser Gln Gly Phe Ile Asn Tyr Cys Gln
35 40 45

Lys Lys Leu Met Leu Leu Arg Leu Asn Leu Arg Lys Met Cys Gly Pro
50 55 60

Phe
65

<210> 306
<211> 79
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 306

Ala Glu Val Phe Glu Lys Glu Gln Ser Ile Cys Ala Ala Glu Glu Gln
1 5 10 15

Pro Ala Glu Asp Gly Gln Gly Glu Thr Asn Lys Asn Arg Thr Lys Gly
20 25 30

Gly Trp Gln Gln Lys Ser Lys Gly Pro Lys Lys Thr Ala Lys Ser Lys
35 40 45

Lys Lys Glu Thr Phe Lys Lys Lys Thr Tyr Thr Cys Ala Ile Thr Thr
50 55 60

Val Lys Ala Thr Glu Thr Lys Ala Gly Lys Trp Ser Arg Trp Glu
65 70 75

<210> 307

<211> 53

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 307

Met Ala Glu Val Phe Glu Lys Glu Gln Ser Ile Cys Ala Ala Glu Glu
1 5 10 15

Gln Pro Ala Glu Asp Gly Gln Gly Glu Thr Asn Lys Asn Arg Thr Lys
20 25 30

Gly Gly Trp Gln Gln Lys Ser Lys Gly Pro Lys Lys Thr Ala Lys Ser
35 40 45

Lys Lys Arg Asn Leu
50

<210> 308
<211> 71
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 308
Asn Ile Met Glu Ile Arg Gln Leu Pro Ser Ser His Ala Leu Glu Ala
1 5 10 15

Lys Leu Ser Arg Met Ser Tyr Pro Val Lys Glu Gln Glu Ser Ile Leu
20 25 30

Lys Thr Val Gly Lys Leu Thr Ala Thr Gln Val Ala Lys Ile Ser Phe
35 40 45

Phe Phe Ala Leu Cys Gly Phe Trp Gln Ile Cys His Ile Lys Lys His
50 55 60

Phe Gln Thr His Lys Leu Leu
65 70

<210> 309
<211> 68
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic

polypeptide

<400> 309

Tyr Glu Lys Lys Lys Tyr Tyr Asp Lys Asn Ala Ile Ala Ile Thr Asn
1 5 10 15

Ile Ser Ser Ser Asp Ala Pro Leu Gln Pro Leu Val Ser Ser Pro Ser
20 25 30

Leu Gln Ala Ala Val Asp Lys Asn Lys Leu Glu Lys Glu Lys Glu Lys
35 40 45

Lys Lys Gly Arg Glu Lys Glu Arg Lys Gly Ala Arg Lys Ala Gly Lys
50 55 60

Thr Thr Tyr Ser
65

<210> 310

<211> 97

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 310

Lys Tyr Glu Lys Lys Lys Tyr Tyr Asp Lys Asn Ala Ile Ala Ile Thr
1 5 10 15

Asn Ile Ser Ser Ser Asp Ala Pro Leu Gln Pro Leu Val Ser Ser Pro
20 25 30

Ser Leu Gln Ala Ala Val Asp Lys Asn Lys Leu Glu Lys Glu Lys Glu
35 40 45

Lys Lys Arg Lys Arg Lys Arg Glu Lys Arg Ser Gln Lys Ser Arg Gln
50 55 60

Asn His Leu Gln Leu Lys Ser Cys Arg Arg Lys Ile Ser Asn Trp Ser
65 70 75 80

Leu Lys Lys Val Pro Ala Leu Lys Lys Leu Arg Ser Pro Leu Trp Ile
85 90 95

Phe

<210> 311

<211> 65

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 311

Ile Tyr Gln Asp Ala Tyr Arg Ala Glu Trp Gln Val Tyr Lys Glu Glu
1 5 10 15

Ile Ser Arg Phe Lys Glu Gln Leu Thr Pro Ser Gln Ile Met Ser Leu
20 25 30

Glu Lys Glu Ile Met Asp Lys His Leu Lys Arg Lys Ala Met Thr Lys
35 40 45

Lys Lys Arg Val Asn Thr Ala Trp Lys Thr Lys Lys Thr Ser Phe Ser
50 55 60

Leu

65

<210> 312
<211> 51
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 312
Ile Tyr Gln Asp Ala Tyr Arg Ala Glu Trp Gln Val Tyr Lys Glu Glu
1 5 10 15

Ile Ser Arg Phe Lys Glu Gln Leu Thr Pro Ser Gln Ile Met Ser Leu
 20 25 30

Glu Lys Glu Ile Met Asp Lys His Leu Lys Arg Lys Ala Met Thr Lys
 35 40 45

Lys Lys Ser
 50

<210> 313
<211> 52
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 313
Lys Pro Gln Glu Val Cys Val Ala Val Trp Arg Lys Asn Asp Glu Asn
1 5 10 15

Ile Thr Leu Glu Thr Val Cys His Asp Pro Lys Leu Pro Tyr His Asp
 20 25 30

Phe Ile Leu Glu Asp Ala Ala Ser Pro Lys Cys Ile Met Lys Glu Lys
35 40 45

Lys Lys Ala Trp
50

<210> 314

<211> 84

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 314

Glu Lys Pro Gln Glu Val Cys Val Ala Val Trp Arg Lys Asn Asp Glu
1 5 10 15

Asn Ile Thr Leu Glu Thr Val Cys His Asp Pro Lys Leu Pro Tyr His
20 25 30

Asp Phe Ile Leu Glu Asp Ala Ala Ser Pro Lys Cys Ile Met Lys Glu
35 40 45

Lys Lys Ser Leu Val Arg Leu Ser Ser Cys Val Pro Val Ala Leu Met
50 55 60

Ser Ala Met Thr Thr Ser Ser Ser Gln Lys Asn Ile Thr Pro Ala Ile
65 70 75 80

Leu Thr Cys Cys

<210> 315

<211> 74

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 315

Val Pro Ser Lys Tyr Gln Phe Leu Cys Ser Asp His Phe Thr Pro Asp
1 5 10 15

Ser Leu Asp Ile Arg Trp Gly Ile Arg Tyr Leu Lys Gln Thr Ala Val
20 25 30

Pro Thr Ile Phe Ser Leu Pro Glu Asp Asn Gln Gly Lys Asp Pro Ser
35 40 45

Lys Lys Asn Pro Arg Arg Lys Thr Trp Lys Met Arg Lys Lys Tyr Ala
50 55 60

Gln Lys Pro Ser Gln Lys Asn His Leu Tyr
65 70

<210> 316

<211> 88

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 316

Gly Thr Thr Glu Glu Met Lys Tyr Val Leu Gly Gln Leu Val Gly Leu
1 5 10 15

Asn Ser Pro Asn Ser Ile Leu Lys Ala Ala Lys Thr Leu Tyr Glu His
20 25 30

Tyr Ser Gly Gly Glu Ser His Asn Ser Ser Ser Ser Lys Thr Phe Glu
35 40 45

Lys Lys Gly Glu Lys Asn Asp Leu Gln Leu Phe Val Met Ser Asp Thr
50 55 60

Thr Tyr Lys Ile Tyr Trp Thr Val Ile Leu Leu Asn Pro Cys Gly Asn
65 70 75 80

Leu His Leu Lys Thr Thr Ser Leu
85

<210> 317

<211> 55

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 317

Gln Gln Leu Ile Arg Glu Thr Leu Ile Ser Trp Leu Gln Ala Gln Met
1 5 10 15

Leu Asn Pro Gln Pro Glu Lys Thr Phe Ile Arg Asn Lys Ala Ala Gln
20 25 30

Val Phe Ala Leu Leu Phe Val Thr Glu Tyr Leu Thr Lys Trp Pro Lys
35 40 45

Phe Phe Leu Thr Phe Ser Gln
50 55

<210> 318

<211> 93

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 318

Ala Lys Phe Gln Gln Cys His Ser Thr Leu Glu Pro Asn Pro Ala Asp
1 5 10 15

Cys Arg Val Leu Val Tyr Leu Gln Asn Gln Pro Gly Thr Lys Leu Leu
20 25 30

Asn Phe Leu Gln Glu Arg Asn Leu Pro Pro Lys Val Val Leu Arg His
35 40 45

Pro Lys Val His Leu Asn Thr Met Phe Arg Arg Pro His Ser Cys Leu
50 55 60

Ala Asp Val Leu Leu Ser Val His Leu Ile Val Leu Arg Val Val Arg
65 70 75 80

Leu Pro Ala Pro Phe Arg Val Asn His Ala Val Glu Trp
85 90

<210> 319

<211> 53

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 319

Ala Pro Val Ile Phe Gln Ile Ala Leu Asp Lys Pro Cys His Gln Ala
1 5 10 15

Glu Val Lys His Leu His His Leu Leu Lys Gln Leu Lys Pro Ser Glu
20 25 30

Lys Tyr Leu Lys Ile Lys His Leu Leu Leu Lys Arg Glu Arg Val Asp
35 40 45

Leu Ser Lys Leu Gln
50

<210> 320
<211> 33
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 320
Met Leu Gln Phe Arg Gly Ser Arg Phe Phe Gln Met Leu Ile Leu Tyr
1 5 10 15

Tyr Ile Leu Pro Arg Lys Val Leu Gln Met Asp Phe Leu Val His Pro
20 25 30

Ala

<210> 321
<211> 179
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 321
Ala Leu Gly Pro His Ser Arg Ile Ser Cys Leu Pro Thr Gln Thr Arg

<210> 322
<211> 79
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 322
Ala His Gln Gly Phe Pro Ala Ala Lys Glu Ser Arg Val Ile Gln Leu
1 5 10 15

Ser Leu Leu Ser Leu Leu Ile Pro Pro Leu Thr Cys Leu Ala Ser Glu
20 25 30

Ala Leu Pro Arg Pro Leu Leu Ala Leu Pro Pro Val Leu Leu Ser Leu
35 40 45

Ala Gln Asp His Ser Arg Leu Leu Gln Cys Gln Ala Thr Arg Cys His
50 55 60

Leu Gly His Pro Val Ala Ser Arg Thr Ala Ser Cys Ile Leu Pro
65 70 75

<210> 323
<211> 222
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 323
Pro Ile Leu Ala Ala Thr Gly Thr Ser Val Arg Thr Ala Ala Arg Thr
1 5 10 15

Trp Val Pro Arg Ala Ala Ile Arg Val Pro Asp Pro Ala Ala Val Pro
20 25 30

Asp Asp His Ala Gly Pro Gly Ala Glu Cys His Gly Arg Pro Leu Leu
35 40 45

Tyr Thr Ala Asp Ser Ser Leu Trp Thr Thr Arg Pro Gln Arg Val Trp
50 55 60

Ser Thr Gly Pro Asp Ser Ile Leu Gln Pro Ala Lys Ser Ser Pro Ser
65 70 75 80

Ala Ala Ala Ala Thr Leu Leu Pro Ala Thr Thr Val Pro Asp Pro Ser
85 90 95

Cys Pro Thr Phe Val Ser Ala Ala Ala Thr Val Ser Thr Thr Thr Ala
100 105 110

Pro Val Leu Ser Ala Ser Ile Leu Pro Ala Ala Ile Pro Ala Ser Thr
115 120 125

Ser Ala Val Pro Gly Ser Ile Pro Leu Pro Ala Val Asp Asp Thr Ala
130 135 140

Ala Pro Pro Glu Pro Ala Pro Leu Leu Thr Ala Thr Gly Ser Val Ser
145 150 155 160

Leu Pro Ala Ala Ala Thr Ser Ala Ala Ser Thr Leu Asp Ala Leu Pro
165 170 175

Ala Gly Cys Val Ser Ser Ala Pro Val Ser Ala Val Pro Ala Asn Cys
180 185 190

Leu Phe Pro Ala Ala Leu Pro Ser Thr Ala Gly Ala Ile Ser Arg Phe
 195 200 205

Ile Trp Val Ser Gly Ile Leu Ser Pro Leu Asn Asp Leu Gln
 210 215 220

<210> 324
 <211> 185
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic polypeptide

<400> 324
 Pro Cys Arg Ala Gly Arg Arg Val Pro Trp Ala Ala Ser Leu Ile His
 1 5 10 15
 Ser Arg Phe Leu Leu Met Asp Asn Lys Ala Pro Ala Gly Met Val Asn
 20 25 30
 Arg Ala Arg Leu His Ile Thr Thr Ser Lys Val Leu Thr Leu Ser Ser
 35 40 45
 Ser Ser His Pro Thr Pro Ser Asn His Arg Pro Arg Pro Leu Met Pro
 50 55 60
 Asn Leu Arg Ile Ser Ser Ser His Ser Leu Asn His His Ser Ser Ser
 65 70 75 80
 Pro Leu Ser Leu His Thr Pro Ser Ser His Pro Ser Leu His Ile Ser
 85 90 95
 Ser Pro Arg Leu His Thr Pro Pro Ser Ser Arg Arg His Ser Ser Thr
 100 105 110

Pro Arg Ala Ser Pro Pro Thr His Ser His Arg Leu Ser Leu Leu Thr
115 120 125

Ser Ser Ser Asn Leu Ser Ser Gln His Pro Arg Arg Ser Pro Ser Arg
130 135 140

Leu Arg Ile Leu Ser Pro Ser Leu Ser Ser Pro Ser Lys Leu Pro Ile
145 150 155 160

Pro Ser Ser Ala Ser Leu His Arg Arg Ser Tyr Leu Lys Ile His Leu
165 170 175

Gly Leu Arg His Pro Gln Pro Pro Gln
180 185

<210> 325

<211> 58

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 325

Arg Thr Asn Pro Thr Val Arg Met Arg Pro His Cys Val Pro Phe Trp
1 5 10 15

Thr Gly Arg Ile Leu Leu Pro Ser Ala Ala Ser Val Cys Pro Ile Pro
20 25 30

Phe Glu Ala Cys His Leu Cys Gln Ala Met Thr Leu Arg Cys Pro Asn
35 40 45

Thr Gln Gly Cys Cys Ser Ser Trp Ala Ser
50 55

<210> 326
<211> 90
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 326
Thr Asn Gln Ala Leu Pro Lys Ile Glu Val Ile Cys Arg Gly Thr Pro
1 5 10 15

Arg Cys Pro Ser Thr Val Pro Pro Ser Pro Ala Gln Pro Tyr Leu Arg
 20 25 30

Val Ser Leu Pro Glu Asp Arg Tyr Thr Gln Ala Trp Ala Pro Thr Ser
 35 40 45

Arg Thr Pro Trp Gly Ala Met Val Pro Arg Gly Val Ser Met Ala His
 50 55 60

Lys Val Ala Thr Pro Gly Ser Gln Thr Ile Met Pro Cys Pro Met Pro
65 70 75 80

Thr Thr Pro Val Gln Ala Trp Leu Glu Ala
 85 90

<210> 327
<211> 41
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 327

Arg Met Glu Arg Glu Leu Lys Lys Trp Ser Ile Gln Thr Cys Leu Ser
1 5 10 15

Ala Arg Thr Gly Leu Ser Ile Ser Cys Thr Thr Leu Asn Ser Pro Pro
 20 25 30

Leu Lys Lys Met Ser Met Pro Ala Val
 35 40

<210> 328

<211> 35

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
 polypeptide

<400> 328

Leu Cys Ser Arg Tyr Ser Leu Phe Leu Ala Trp Arg Leu Ser Ser Val
1 5 10 15

Leu Gln Arg Phe Arg Phe Thr His Val Ile Gln Gln Arg Met Glu Ser
 20 25 30

Gln Ile Ser
 35

<210> 329

<211> 39

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
 polypeptide

<400> 329

Arg Ser Ala Cys Val Thr Val Lys Gly Pro Leu Ala Ser Val Gly Arg
 1 5 10 15

His Ser Leu Ser Lys Gln Asp Cys Lys Phe Leu Pro Phe Trp Gly Phe
 20 25 30

Leu Glu Glu Phe Leu Leu Cys
 35

<210> 330
 <211> 97
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic polypeptide

<400> 330
 Ile Gln Trp Gly Thr Thr Thr Ala Pro Arg Pro Ile Arg Pro Pro Phe
 1 5 10 15

Leu Glu Ser Lys Gln Asn Cys Ser His Phe Pro Thr Pro Leu Leu Ala
 20 25 30

Ser Glu Asp Arg Arg Glu Thr Gly Leu Phe Leu Pro Ser Ala Ala Gln
 35 40 45

Lys Met Lys Lys Ala His Phe Leu Lys Thr Trp Phe Arg Ser Asn Pro
 50 55 60

Thr Lys Thr Lys Lys Ala Arg Phe Ser Thr Ala Ser Leu Ala Lys Glu
 65 70 75 80

Leu Thr His Pro Leu Leu Val Ser Leu Leu Leu Lys Glu Lys Gln Asp
 85 90 95

Gly

<210> 331

<211> 73

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 331

Pro Thr Asp Pro Phe Leu Gly Leu Arg Leu Gly Leu His Leu Gln Lys
1 5 10 15

Val Phe His Gln Ser His Ala Glu Tyr Ser Gly Ala Pro Pro Pro Pro
20 25 30

Pro Ala Pro Ser Gly Leu Arg Phe Trp Asn Pro Ser Arg Ile Ala His
35 40 45

Ile Ser Gln Leu Leu Ser Trp Pro Gln Lys Thr Glu Glu Arg Leu Gly
50 55 60

Tyr Ser Ser His Gln Leu Pro Arg Lys
65 70

<210> 332

<211> 45

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 332

Phe Cys Cys Ser Cys Cys Phe Phe Gly Gly Glu Arg Trp Ser Lys Ser
1 5 10 15

Pro Tyr Cys Pro Gln Arg Met Thr Pro Gly Thr Thr Phe Ile Thr Met
20 25 30

Met Lys Lys Glu Ala Glu Lys Arg Thr Arg Thr Leu Thr
35 40 45

<210> 333
<211> 95
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 333
Trp Arg Arg Asn Cys Lys Ala Pro Val Ser Leu Arg Lys Ser Val Gln
1 5 10 15

Thr Pro Ala Arg Ser Ser Pro Ala Arg Pro Asp Arg Thr Arg Arg Leu
20 25 30

Pro Ser Leu Gly Val Pro Gly Gln Pro Trp Ala Leu Gly Ala Ala Ala
35 40 45

Ser Arg Arg Cys Cys Cys Cys Cys Arg Ser Pro Leu Gly Ser Ala Arg
50 55 60

Ser Arg Ser Pro Ala Thr Leu Ala Leu Thr Pro Arg Ala Thr Arg Ser
65 70 75 80

Arg Cys Pro Gly Ala Thr Trp Arg Glu Ala Ala Ser Trp Ala Glu
85 90 95

<210> 334
<211> 113
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 334
Pro Gly Arg Pro Leu Gln Thr His Val Leu Pro Glu Pro His Leu Ala
1 5 10 15

Leu Gln Pro Leu Gln Pro His Ala Asp His Ala His Ala Asp Ala Pro
20 25 30

Ala Ile Gln Pro Val Leu Trp Thr Thr Pro Pro Leu Gln His Gly His
35 40 45

Arg His Gly Leu Glu Pro Cys Ser Met Leu Thr Gly Pro Pro Ala Arg
50 55 60

Val Pro Ala Val Pro Phe Asp Leu His Phe Cys Arg Ser Ser Ile Met
65 70 75 80

Lys Pro Lys Arg Asp Gly Tyr Met Phe Leu Lys Ala Glu Ser Lys Ile
85 90 95

Met Phe Ala Thr Leu Gln Arg Ser Ser Leu Trp Cys Leu Cys Ser Asn
100 105 110

His

<210> 335
<211> 57

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 335

Pro Arg Pro Arg Arg Cys Thr Arg His Pro Ala Cys Pro Leu Asp His
1 5 10 15

Thr Thr Pro Pro Ala Trp Ser Pro Pro Trp Val Arg Ala Leu Leu Asp
20 25 30

Ala His Arg Ala Pro Ser Glu Ser Pro Cys Ser Pro Phe Arg Leu Ala
35 40 45

Phe Leu Gln Glu Gln Tyr His Glu Ala
50 55

<210> 336

<211> 494

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 336

Thr Arg Arg Cys His Cys Cys Pro His Leu Arg Ser His Pro Cys Pro
1 5 10 15

His His Leu Arg Asn His Pro Arg Pro His His Leu Arg His His Ala
20 25 30

Cys His His His Leu Arg Asn Cys Pro His Pro His Phe Leu Arg His
35 40 45

Cys Thr Cys Pro Gly Arg Trp Arg Asn Arg Pro Ser Leu Arg Arg Leu
50 55 60

Arg Ser Leu Leu Cys Leu Pro His Leu Asn His His Leu Phe Leu His
65 70 75 80

Trp Arg Ser Arg Pro Cys Leu His Arg Lys Ser His Pro His Leu Leu
85 90 95

His Leu Arg Arg Leu Tyr Pro His His Leu Lys His Arg Pro Cys Pro
100 105 110

His His Leu Lys Asn Leu Leu Cys Pro Arg His Leu Arg Asn Cys Pro
115 120 125

Leu Pro Arg His Leu Lys His Leu Ala Cys Leu His His Leu Arg Ser
130 135 140

His Pro Cys Pro Leu His Leu Lys Ser His Pro Cys Leu His His Arg
145 150 155 160

Arg His Leu Val Cys Ser His His Leu Lys Ser Leu Leu Cys Pro Leu
165 170 175

His Leu Arg Ser Leu Pro Phe Pro His His Leu Arg His His Ala Cys
180 185 190

Pro His His Leu Arg Thr Arg Leu Cys Pro His His Leu Lys Asn His
195 200 205

Leu Cys Pro Pro His Leu Arg Tyr Arg Ala Tyr Pro Pro Cys Leu Trp
210 215 220

Cys His Ala Cys Leu His Arg Leu Arg Asn Leu Pro Cys Pro His Arg
 225 230 235 240

Leu Arg Ser Leu Pro Arg Pro Leu His Leu Arg Leu His Ala Ser Pro
 245 250 255

His His Leu Arg Thr Pro Pro His Pro His His Leu Arg Thr His Leu
 260 265 270

Leu Pro His His Arg Arg Thr Arg Ser Cys Pro Cys Arg Trp Arg Ser
 275 280 285

His Pro Cys Cys His Tyr Leu Arg Ser Arg Asn Ser Ala Pro Gly Pro
 290 295 300

Arg Gly Arg Thr Cys His Pro Gly Leu Arg Ser Arg Thr Cys Pro Pro
 305 310 315 320

Gly Leu Arg Ser His Thr Tyr Leu Arg Arg Leu Arg Ser His Thr Cys
 325 330 335

Pro Pro Ser Leu Arg Ser His Ala Tyr Ala Leu Cys Leu Arg Ser His
 340 345 350

Thr Cys Pro Pro Arg Leu Arg Asp His Ile Cys Pro Leu Ser Leu Arg
 355 360 365

Asn Cys Thr Cys Pro Pro Arg Leu Arg Ser Arg Thr Cys Leu Leu Cys
 370 375 380

Leu Arg Ser His Ala Cys Pro Pro Asn Leu Arg Asn His Thr Cys Pro
 385 390 395 400

Pro Ser Leu Arg Ser His Ala Cys Pro Pro Gly Leu Arg Asn Arg Ile

405

410

415

Cys Pro Leu Ser Leu Arg Ser His Pro Cys Pro Leu Gly Leu Lys Ser
420 425 430

Pro Leu Arg Ser Gln Ala Asn Ala Leu His Leu Arg Ser Cys Pro Cys
435 440 445

Ser Leu Pro Leu Gly Asn His Pro Tyr Leu Pro Cys Leu Glu Ser Gln
450 455 460

Pro Cys Leu Ser Leu Gly Asn His Leu Cys Pro Leu Cys Pro Arg Ser
465 470 475 480

Cys Arg Cys Pro His Leu Gly Ser His Pro Cys Arg Leu Ser
485 490

<210> 337

<211> 53

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 337

Ser Trp Lys Gly Thr Asn Trp Cys Asn Asp Met Cys Ile Phe Ile Thr
1 5 10 15

Ser Gly Gln Ile Phe Lys Gly Thr Arg Gly Pro Arg Phe Leu Trp Gly
20 25 30

Ser Lys Asp Gln Arg Gln Lys Gly Ser Asn Tyr Ser Gln Ser Glu Ala
35 40 45

Leu Cys Val Leu Leu

50

<210> 338

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 338

Lys Arg Thr Lys Cys Phe Thr Phe Gly

1

5

<210> 339

<211> 27

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 339

Pro Ile Phe Ile Gln Thr Leu Leu Leu Trp Asp Phe Leu Gln Lys Asp

1

5

10

15

Leu Lys Ala Tyr Thr Gly Thr Ile Leu Met Met

20

25

<210> 340

<211> 22

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 340

Gln Lys Met Ile Leu Thr Lys Gln Ile Lys Thr Lys Pro Thr Asp Thr
1 5 10 15

Phe Leu Gln Ile Leu Arg
 20

<210> 341

<211> 43

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 341

Gly Phe Trp Ile Gln Ser Ile Lys Thr Ile Thr Arg Tyr Thr Ile Phe
1 5 10 15

Val Leu Lys Asp Ile Met Thr Pro Pro Asn Leu Ile Ala Glu Leu His
 20 25 30

Asn Ile Leu Leu Lys Thr Ile Thr His His Ser
 35 40

<210> 342

<211> 40

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 342

Asn Tyr Ser Asn Val Gln Trp Arg Asn Leu Gln Ser Ser Val Cys Gly
1 5 10 15

Leu Pro Ala Lys Gly Glu Asp Ile Phe Leu Gln Phe Arg Thr His Thr
20 25 30

Thr Gly Arg Gln Val His Val Leu
35 40

<210> 343

<211> 44

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 343

Tyr Gln Ser Arg Val Leu Pro Gln Thr Glu Gln Asp Ala Lys Lys Gly
1 5 10 15

Gln Asn Val Ser Leu Leu Gly Lys Tyr Ile Leu His Thr Arg Thr Arg
20 25 30

Gly Asn Leu Arg Lys Ser Arg Lys Trp Lys Ser Met
35 40

<210> 344

<211> 85

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 344

Ser Ser Gln Asn Ala Arg Gly Cys Ser Pro Arg Gly Pro Cys Thr Ser
1 5 10 15

Ser Ser Tyr Thr Gly Gly Pro Cys Thr Ser Pro Leu Leu Ala Pro Val

20

25

30

Ile	Phe	Cys	Pro	Phe	Pro	Glu	Asn	Leu	Pro	Gly	Gln	Leu	Arg	Phe	Pro
		35					40					45			

Ser	Gly	Leu	Leu	Ala	Phe	Trp	Asp	Ser	Gln	Val	Cys	Asp	Leu	His	Val
	50					55					60				

Leu	Pro	Cys	Pro	Gln	Gln	Asp	Val	Leu	Pro	Thr	Gly	Gln	Asp	Leu	Pro
65					70					75					80

Cys	Ala	Ala	Val	Gly
				85

<210> 345

<211> 72

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 345

Gly	Ala	Ala	Pro	Thr	Met	Ser	Ala	Ala	Gln	Ile	Ala	Met	Val	Trp	Pro
1				5					10					15	

Leu	Leu	Ser	Ile	Leu	Ser	Glu	Trp	Lys	Glu	Ile	Cys	Val	Trp	Ser	Ile
			20					25					30		

Trp	Met	Thr	Glu	Thr	Leu	Phe	Asp	Ile	Val	Trp	Trp	Cys	Pro	Met	Ser
		35					40					45			

Arg	Leu	Arg	Leu	Ala	Leu	Thr	Val	Pro	Pro	Ser	Thr	Thr	Thr	Thr	Cys
	50					55					60				

Val Thr Val Pro Ala Trp Ala Ala
65 70

<210> 346

<211> 97

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 346

Thr Gly Gly Pro Ser Ser Pro Ser Ser His Trp Lys Thr Pro Val Val
1 5 10 15

Ile Tyr Trp Asp Gly Thr Ala Leu Arg Cys Val Phe Val Pro Val Leu
20 25 30

Gly Glu Thr Gly Ala Gln Arg Lys Arg Ile Ser Ala Arg Lys Gly Ser
35 40 45

Leu Thr Thr Ser Cys Pro Gln Gly Ala Leu Ser Glu His Cys Pro Thr
50 55 60

Thr Pro Ala Pro Leu Pro Ser Gln Arg Arg Asn His Trp Met Glu Asn
65 70 75 80

Ile Ser Pro Phe Arg Ser Val Gly Val Ser Ala Ser Arg Cys Ser Glu
85 90 95

Ser

<210> 347

<211> 31

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 347

Phe His Thr Pro Ala Arg His Pro Arg Pro Arg His Gly His Leu Gln
1 5 10 15

Ala Val Thr Ala His Asp Gly Gly Cys Glu Ala Leu Pro Pro Pro
20 25 30

<210> 348

<211> 78

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 348

Cys Cys Pro Arg Thr Ile Leu Asn Asn Gly Ser Leu Lys Thr Gln Val
1 5 10 15

Gln Met Lys Leu Pro Glu Cys Gln Arg Leu Leu Pro Pro Trp Pro Leu
20 25 30

His Gln Gln Leu Leu His Arg Arg Pro Leu His Gln Pro Pro Pro Gly
35 40 45

Pro Cys His Leu Leu Ser Leu Pro Arg Lys Pro Thr Arg Ala Ala Thr
50 55 60

Val Ser Val Trp Ala Ser Cys Ile Leu Gly Gln Pro Ser Leu
65 70 75

<210> 349
<211> 28
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 349
Val Arg Lys His Phe Gln Thr Tyr Gly Asn Tyr Phe Leu Lys Thr Thr
1 5 10 15

Phe Cys Pro Pro Cys Arg Pro Lys Gln Trp Met Ile
20 25

<210> 350
<211> 46
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 350
Leu Ala Arg Thr Pro Leu Pro Ser Thr Arg Cys Phe Ala Asn Trp Pro
1 5 10 15

Arg Pro Ala Leu Cys Ser Cys Gly Leu Ile Pro His Pro Arg Pro Ala
20 25 30

Pro Ala Ser Ala Pro Trp Pro Ser Thr Ser Ser His Ser Thr
35 40 45

<210> 351
<211> 81
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 351

Glu Leu Gln Glu Thr Gly His Arg Gln Val Ala Leu Arg Arg Ser Gly
1 5 10 15

Arg Pro Pro Lys Cys Ala Glu Arg Pro Gly Ala Ala Asp Thr Gly Ala
20 25 30

His Cys Thr Ser Thr Asp Gly Arg Leu Lys Ile Ser Val Glu Thr Tyr
35 40 45

Thr Val Ser Ser Gln Leu Leu Met Val Leu Met Ser Leu Asp Leu Asp
50 55 60

Thr Gly Leu Val Pro Ser Leu Val Ser Lys Cys Leu Ile Leu Arg Val
65 70 75 80

Lys

<210> 352

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 352

Lys Ser Asp Ala Ser Arg Leu Ser Gly Ala
1 5 10

<210> 353

<211> 29

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 353

Arg Thr Ala Tyr Phe Cys Gln Tyr His Thr Ala Ser Val Tyr Ser Glu
1 5 10 15

Arg Ala Met Pro Pro Gly Cys Pro Glu Pro Ser Gln Ala
20 25

<210> 354

<211> 91

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 354

Thr Arg Ala Ser Pro Pro Arg Ser Ser Ser Ala Ile Ala Val Arg Ala
1 5 10 15

Ser Cys Cys Pro Tyr Gly Ser Thr Ser Thr Ala Ser Arg Ser Pro Thr
20 25 30

Gln Arg Cys Arg Leu Ala Arg Ala Ala Ala Ser Thr Ala Thr Glu Val
35 40 45

Thr Phe Gly Ser Ser Glu Met Gln Gly His Thr Met Gly Phe Trp Leu
50 55 60

Thr Lys Leu Asn Tyr Leu Cys His Leu Ser Met Leu Thr Asp Ser Leu
65 70 75 80

Phe Leu Pro Ile Ser His Cys Gln Cys Ile Leu
85 90

<210> 355

<211> 31

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 355

Ser Ser Leu Arg Ile Thr Gly Asp Trp Thr Ser Ser Gly Arg Ser Thr
1 5 10 15

Lys Ile Trp Lys Thr Thr Gln Met Cys Arg Lys Thr Trp Ser Gly
20 25 30

<210> 356

<211> 104

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 356

Arg Arg Arg Arg Gly Gly Val Gly Arg Arg Gly Val Arg Pro Gly Arg
1 5 10 15

Val Arg Pro Gly Gly Thr Gly Arg Arg Gly Gly Asp Gly Gly Arg Ala
20 25 30

Ala Ala Ala Arg Ala Ala Leu Gly Glu Leu Ala Arg Ala Leu Pro Gly
35 40 45

His Leu Leu Gln Ser Gln Ser Ala Arg Arg Ala Ala Arg Met Ala Gln
50 55 60

Leu Arg Arg Arg Ala Ala Ala Leu Pro Asn Ala Ala Ala Trp His Gly
65 70 75 80

Pro Pro His Pro Gln Leu Pro Arg Ser Pro Leu Ala Leu Gln Arg Cys
85 90 95

Arg Asp Thr Arg Trp Ala Ser Gly
100

<210> 357
<211> 66
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 357
Ser Cys Lys Val Phe Phe Lys Arg Ala Ala Glu Gly Lys Gln Lys Tyr
1 5 10 15

Leu Cys Ala Ser Arg Asn Asp Cys Thr Ile Asp Lys Phe Arg Arg Lys
20 25 30

Asn Cys Pro Ser Cys Arg Leu Arg Lys Cys Tyr Glu Ala Gly Met Thr
35 40 45

Leu Gly Glu Lys Phe Arg Val Gly Asn Cys Lys His Leu Lys Met Thr
50 55 60

Arg Pro
65

<210> 358
<211> 49
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 358
Met Ala Gly Ala Pro Pro Pro Ala Ser Leu Pro Pro Cys Ser Leu Ile
1 5 10 15

Ser Asp Cys Cys Ala Ser Asn Gln Arg Asp Ser Val Gly Val Gly Pro
20 25 30

Ser Glu Pro Gly Asn Asn Ile Lys Ile Cys Asn Glu Ser Ala Ser Arg
35 40 45

Lys

<210> 359
<211> 61
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 359
His Gly Trp Arg Pro Phe Leu Pro Val Arg Ala Arg Ser Arg Trp Asn
1 5 10 15

Arg Arg Leu Asp Val Thr Val Ala Asn Gly Arg Ser Trp Lys Tyr Gly
20 25 30

Trp Ser Leu Leu Arg Val Pro Gln Val Asn Gly Ile Gln Val Leu Asn
35 40 45

Val Ser Leu Lys Ser Ser Ser Asn Val Ile Ser Tyr Glu
50 55 60

<210> 360

<211> 65

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 360

Arg Leu Lys Glu Val Phe Gln Thr Lys Ile Gln Glu Phe Arg Lys Ala
1 5 10 15

Cys Tyr Thr Leu Thr Gly Tyr Gln Ile Asp Ile Thr Thr Glu Asn Gln
20 25 30

Tyr Arg Leu Thr Ser Leu Tyr Ala Glu His Pro Gly Asp Cys Leu Ile
35 40 45

Phe Lys Leu Arg Val Pro Gly Ser Ser Val Leu Val Thr Val Pro Gly
50 55 60

Leu

65

<210> 361

<211> 107

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

polypeptide

<400> 361

Ala Glu Val Leu Lys Val Ile Arg Gln Ser Ala Gly Gln Lys Thr Thr
1 5 10 15

Cys Gly Gln Gly Leu Glu Gly Pro Trp Glu Arg Pro Pro Pro Leu Asp
20 25 30

Glu Ser Glu Arg Asp Gly Gly Ser Glu Asp Gln Val Glu Asp Pro Ala
35 40 45

Leu Ser Ala Leu Leu Leu Arg Pro Arg Pro Pro Arg Pro Glu Val Gly
50 55 60

Ala His Gln Asp Glu Gln Ala Ala Gln Gly Ala Asp Pro Arg Leu Gly
65 70 75 80

Ala Gln Pro Ala Cys Arg Gly Leu Pro Gly Leu Leu Thr Val Pro Gln
85 90 95

Pro Glu Pro Leu Leu Ala Pro Pro Ser Ala Ala
100 105

<210> 362

<211> 100

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 362

Glu Arg Ala Glu Trp Arg Glu Asn Ile Arg Glu Gln Gln Lys Lys Cys
1 5 10 15

Phe Arg Ser Phe Ser Leu Thr Ser Val Glu Leu Gln Met Leu Thr Asn
20 25 30
Ser Cys Val Lys Leu Gln Thr Val His Ser Ile Pro Leu Thr Ile Asn
35 40 45
Lys Glu Glu Ala Leu Gln Arg Pro Val Ala Ser Asp Phe Glu Pro Gln
50 55 60
Gly Leu Ser Glu Ala Ala Arg Trp Asn Ser Lys Glu Asn Leu Leu Ala
65 70 75 80
Gly Pro Ser Glu Asn Asp Pro Asn Leu Phe Val Ala Leu Tyr Asp Phe
85 90 95
Val Ala Ser Gly
100

<210> 363
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 363
Glu Leu Gln Met Leu Thr Asn Ser Cys Val Lys Leu Gln Thr Val His
1 5 10 15
Ser Ile Pro Leu Thr Ile Asn Lys Glu Asp Asp Glu Ser Pro Gly Leu
20 25 30
Tyr Gly Phe Leu Asn Val Ile Val His Ser Ala Thr Gly Phe Lys Gln
35 40 45

Ser Ser Lys Ala Leu Gln Arg Pro Val Ala Ser Asp Phe Glu Pro Gln
50 55 60

Gly Leu Ser Glu Ala Ala Arg Trp Asn Ser Lys Glu Asn Leu Leu Ala
65 70 75 80

Gly Pro Ser Glu Asn Asp Pro Asn Leu Phe Val Ala Leu Tyr Asp Phe
85 90 95

Val Ala Ser Gly Asp
100

<210> 364

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 364

Ile Ser Asn Ser Trp Asp Ala His Leu Gly Leu Gly Ala Cys Gly Glu
1 5 10 15

Ala Glu Gly Leu Gly Val Gln Gly Ala Glu Glu Glu Glu Glu Glu
20 25 30

Glu Glu Glu Glu Glu Glu Gly Ala Gly Val Pro Ala Cys Pro Pro Lys
35 40 45

Gly Pro Glu Leu Phe Pro Leu Ile Phe Pro Ala Glu Pro Ala Gln Ala
50 55 60

Ser Gly Pro Tyr Val Glu Ile Ile Glu Gln Pro Lys Gln Arg Gly Met
65 70 75 80

Arg Phe Arg Tyr Lys Cys Glu Gly Arg Ser Ala Gly Ser Ile Pro Gly
85 90 95

Glu Arg Ser Thr Asp
100

<210> 365
<211> 100
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 365
Leu Gln Arg Leu Asp Gly Met Gly Cys Leu Glu Phe Asp Glu Glu Arg
1 5 10 15

Ala Gln Gln Glu Asp Ala Leu Ala Gln Gln Ala Phe Glu Glu Ala Arg
20 25 30

Arg Arg Thr Arg Glu Phe Glu Asp Arg Asp Arg Ser His Arg Glu Glu
35 40 45

Met Glu Val His Glu Leu Glu Lys Ser Lys Arg Ala Leu Glu Thr Gln
50 55 60

Met Glu Glu Met Lys Thr Gln Leu Glu Glu Leu Glu Asp Glu Leu Gln
65 70 75 80

Ala Thr Glu Asp Ala Lys Leu Arg Leu Glu Val Asn Met Gln Ala Leu
85 90 95

Lys Gly Gln Phe

<210> 366

<211> 100

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 366

Lys Gly Ser Phe Pro Glu Asn Leu Arg His Leu Lys Asn Thr Met Glu
1 5 10 15

Thr Ile Asp Trp Lys Val Phe Glu Ser Trp Met His His Trp Leu Leu
20 25 30

Phe Glu Met Ser Arg His Ser Leu Glu Gln Lys Pro Thr Asp Ala Pro
35 40 45

Pro Lys Ala Gly Val Pro Asn Lys Pro Gly Ile Pro Lys Leu Leu Glu
50 55 60

Gly Ser Lys Asn Ser Ile Gln Trp Glu Lys Ala Glu Asp Asn Gly Cys
65 70 75 80

Arg Ile Thr Tyr Tyr Ile Leu Glu Ile Arg Lys Ser Thr Ser Asn Asn
85 90 95

Leu Gln Asn Gln
100

<210> 367

<211> 80

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 367

Met Arg Pro Ser Gly Thr Ala Gly Ala Ala Leu Leu Ala Leu Leu Ala
1 5 10 15

Ala Leu Cys Pro Ala Ser Arg Ala Leu Glu Glu Lys Lys Gly Asn Tyr
20 25 30

Val Val Thr Asp His Gly Ser Cys Val Arg Ala Cys Gly Ala Asp Ser
35 40 45

Tyr Glu Met Glu Glu Asp Gly Val Arg Lys Cys Lys Lys Cys Glu Gly
50 55 60

Pro Cys Arg Lys Val Cys Asn Gly Ile Gly Ile Gly Glu Phe Lys Asp
65 70 75 80

<210> 368

<211> 100

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 368

Leu Pro Gln Pro Pro Ile Cys Thr Ile Asp Val Tyr Met Ile Met Val
1 5 10 15

Lys Cys Trp Met Ile Asp Ala Asp Ser Arg Pro Lys Phe Arg Glu Leu
20 25 30

Ile Ile Glu Phe Ser Lys Met Ala Arg Asp Pro Gln Arg Tyr Leu Val

35

40

45

Ile Gln Leu Gln Asp Lys Phe Glu His Leu Lys Met Ile Gln Gln Glu
50 55 60

Glu Ile Arg Lys Leu Glu Glu Glu Lys Lys Gln Leu Glu Gly Glu Ile
65 70 75 80

Ile Asp Phe Tyr Lys Met Lys Ala Ala Ser Glu Ala Leu Gln Thr Gln
85 90 95

Leu Ser Thr Asp
100

<210> 369

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 369

Ser Trp Glu Asn Ser Asp Asp Ser Arg Asn Lys Leu Ser Lys Ile Pro
1 5 10 15

Ser Thr Pro Lys Leu Ile Pro Lys Val Thr Lys Thr Ala Asp Lys His
20 25 30

Lys Asp Val Ile Ile Asn Gln Ala Lys Met Ser Thr Arg Glu Lys Asn
35 40 45

Ser Gln Val Tyr Arg Arg Lys His Gln Glu Leu Gln Ala Met Gln Met
50 55 60

Glu Leu Gln Ser Pro Glu Tyr Lys Leu Ser Lys Leu Arg Thr Ser Thr
65 70 75 80

Ile Met Thr Asp Tyr Asn Pro Asn Tyr Cys Phe Ala Gly Lys Thr Ser
85 90 95

Ser Ile Ser Asp Leu
100

<210> 370

<211> 100

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 370

Glu Gly His Arg Met Asp Lys Pro Ala Asn Cys Thr His Asp Leu Tyr
1 5 10 15

Met Ile Met Arg Glu Cys Trp His Ala Ala Pro Ser Gln Arg Pro Thr
20 25 30

Phe Lys Gln Leu Val Glu Asp Leu Asp Arg Val Leu Thr Val Thr Ser
35 40 45

Thr Asp Val Lys Ala Thr Gln Glu Glu Asn Arg Glu Leu Arg Ser Arg
50 55 60

Cys Glu Glu Leu His Gly Lys Asn Leu Glu Leu Gly Lys Ile Met Asp
65 70 75 80

Arg Phe Glu Glu Val Val Tyr Gln Ala Met Glu Glu Val Gln Lys Gln
85 90 95

Lys Glu Leu Ser
100

<210> 371

<211> 107

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 371

Arg Asp Asn Thr Leu Leu Leu Arg Arg Val Glu Leu Phe Ser Leu Ser
1 5 10 15

Arg Gln Val Ala Arg Glu Ser Thr Tyr Leu Ser Ser Leu Lys Gly Ser
20 25 30

Arg Leu His Pro Glu Glu Leu Gly Gly Pro Pro Leu Lys Lys Leu Lys
35 40 45

Gln Glu Ala Thr Ser Lys Ser Gln Ile Met Ser Leu Trp Gly Leu Val
50 55 60

Ser Lys Met Pro Pro Glu Lys Val Gln Arg Leu Tyr Val Asp Phe Pro
65 70 75 80

Gln His Leu Arg His Leu Leu Gly Asp Trp Leu Glu Ser Gln Pro Trp
85 90 95

Glu Phe Leu Val Gly Ser Asp Ala Phe Cys Cys
100 105

<210> 372

<211> 83

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 372

Met Ser Arg Glu Met Gln Asp Val Asp Leu Ala Glu Val Lys Pro Leu
1 5 10 15

Val Glu Lys Gly Glu Thr Ile Thr Gly Leu Leu Gln Glu Phe Asp Val
20 25 30

Gln Glu Ala Leu Ser Val Val Ser Glu Asp Gln Ser Leu Phe Glu Cys
35 40 45

Ala Tyr Gly Thr Pro His Leu Ala Lys Thr Glu Met Thr Ala Ser Ser
50 55 60

Ser Ser Asp Tyr Gly Gln Thr Ser Lys Met Ser Pro Arg Val Pro Gln
65 70 75 80

Gln Asp Trp

<210> 373

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 373

Val Leu Asp Met His Gly Phe Leu Arg Gln Ala Leu Cys Arg Leu Arg
1 5 10 15

Gln Glu Glu Pro Gln Ser Leu Gln Ala Ala Val Arg Thr Asp Gly Phe
20 25 30

Asp Glu Phe Lys Val Arg Leu Gln Asp Leu Ser Ser Cys Ile Thr Gln
35 40 45

Gly Lys Ala Ile Glu Thr Gln Ser Ser Ser Ser Glu Glu Ile Val Pro
50 55 60

Ser Pro Pro Ser Pro Pro Pro Leu Pro Arg Ile Tyr Lys Pro Cys Phe
65 70 75 80

Val Cys Gln Asp Lys Ser Ser Gly Tyr His Tyr Gly Val Ser Ala Cys
85 90 95

Glu Gly Cys Lys Gly
100

<210> 374

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 374

Arg Ser Ser Pro Glu Gln Pro Arg Pro Ser Thr Ser Lys Ala Val Ser
1 5 10 15

Pro Pro His Leu Asp Gly Pro Pro Ser Pro Arg Ser Pro Val Ile Gly
20 25 30

Ser Glu Val Phe Leu Pro Asn Ser Asn His Val Ala Ser Gly Ala Gly
35 40 45

Glu Ala Ala Ile Glu Thr Gln Ser Ser Ser Ser Glu Glu Ile Val Pro
50 55 60

Ser Pro Pro Ser Pro Pro Pro Leu Pro Arg Ile Tyr Lys Pro Cys Phe
65 70 75 80

Val Cys Gln Asp Lys Ser Ser Gly Tyr His Tyr Gly Val Ser Ala Cys
85 90 95

Glu Gly Cys Lys Gly
100

<210> 375

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 375

Val Ala Arg Phe Asn Asp Leu Arg Phe Val Gly Arg Ser Gly Arg Gly
1 5 10 15

Lys Ser Phe Thr Leu Thr Ile Thr Val Phe Thr Asn Pro Pro Gln Val
20 25 30

Ala Thr Tyr His Arg Ala Ile Lys Ile Thr Val Asp Gly Pro Arg Glu
35 40 45

Pro Arg Asn Arg Thr Glu Lys His Ser Thr Met Pro Asp Ser Pro Val
50 55 60

Asp Val Lys Thr Gln Ser Arg Leu Thr Pro Pro Thr Met Pro Pro Pro

65

70

75

80

Pro	Thr	Thr	Gln	Gly	Ala	Pro	Arg	Thr	Ser	Ser	Phe	Thr	Pro	Thr	Thr
			85						90					95	

Leu	Thr	Asn	Gly	Thr
			100	

<210> 376
 <211> 55
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic polypeptide

<400> 376															
Met	Ala	Leu	Asn	Ser	Glu	Ala	Leu	Ser	Val	Val	Ser	Glu	Asp	Gln	Ser
1				5					10					15	

Leu	Phe	Glu	Cys	Ala	Tyr	Gly	Thr	Pro	His	Leu	Ala	Lys	Thr	Glu	Met
			20					25					30		

Thr	Ala	Ser	Ser	Ser	Ser	Asp	Tyr	Gly	Gln	Thr	Ser	Lys	Met	Ser	Pro
		35					40					45			

Arg	Val	Pro	Gln	Gln	Asp	Trp
	50					55

<210> 377
 <211> 9
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic peptide

<400> 377
Gly Gln Tyr Gly Lys Val Tyr Glu Gly
1 5

<210> 378
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 378
Gly Gln Tyr Gly Lys Val Tyr Glu Gly Val
1 5 10

<210> 379
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 379
Lys Leu Gly Gly Gly Gln Tyr Gly Lys
1 5

<210> 380
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 380
Lys Leu Gly Gly Gly Gln Tyr Gly Lys Val

1

5

10

<210> 381
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 381
Lys Val Tyr Glu Gly Val Trp Lys Lys
1 5

<210> 382
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 382
Lys Val Tyr Glu Gly Val Trp Lys Lys Tyr
1 5 10

<210> 383
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 383
Gln Tyr Gly Lys Val Tyr Glu Gly Val
1 5

<210> 384
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 384
Gln Tyr Gly Lys Val Tyr Glu Gly Val Trp
1 5 10

<210> 385
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 385
Gly Gln Tyr Gly Val Val Tyr Glu Gly
1 5

<210> 386
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 386
Gly Gln Tyr Gly Val Val Tyr Glu Gly Val
1 5 10

<210> 387
<211> 9
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 387

Lys Leu Gly Gly Gly Gln Tyr Gly Val
1 5

<210> 388

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 388

Lys Leu Gly Gly Gly Gln Tyr Gly Val Val
1 5 10

<210> 389

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 389

Gln Tyr Gly Val Val Tyr Glu Gly Val
1 5

<210> 390

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 390

Gln Tyr Gly Val Val Tyr Glu Gly Val Trp
1 5 10

<210> 391

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 391

Val Val Tyr Glu Gly Val Trp Lys Lys
1 5

<210> 392

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 392

Val Val Tyr Glu Gly Val Trp Lys Lys Tyr
1 5 10

<210> 393

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 393

Ala Thr Gln Ile Ser Ser Ala Thr Glu Tyr
1 5 10

<210> 394

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 394

Ile Ser Ser Ala Thr Glu Tyr Leu Glu Lys
1 5 10

<210> 395

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 395

Ser Ser Ala Thr Glu Tyr Leu Glu Lys
1 5

<210> 396

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 396

Thr Gln Ile Ser Ser Ala Thr Glu Tyr Leu
1 5 10

<210> 397
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 397
Tyr Met Ala Thr Gln Ile Ser Ser Ala Thr
1 5 10

<210> 398
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 398
Phe Tyr Ile Ile Ile Glu Phe Met Thr Tyr
1 5 10

<210> 399
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 399
Ile Ile Glu Phe Met Thr Tyr Gly Asn Leu
1 5 10

<210> 400

<211> 9
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 400

Ile Ile Ile Glu Phe Met Thr Tyr Gly
1 5

<210> 401

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 401

Ile Ile Ile Glu Phe Met Thr Tyr Gly Asn
1 5 10

<210> 402

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 402

Tyr Ile Ile Ile Glu Phe Met Thr Tyr Gly
1 5 10

<210> 403

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 403

Gly Gln His Gly Glu Val Tyr Glu Gly Val
1 5 10

<210> 404

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 404

Lys Leu Gly Gly Gly Gln His Gly Glu Val
1 5 10

<210> 405

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 405

Lys Ile Ala Asp Phe Gly Met Ala Arg
1 5

<210> 406

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 406

Arg Val Ala Lys Ile Ala Asp Phe Gly Met
1 5 10

<210> 407

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 407

Phe Ile Leu Met Glu Leu Met Ala Gly Gly
1 5 10

<210> 408

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 408

Ile Leu Met Glu Leu Met Ala Gly Gly
1 5

<210> 409

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 409

Ile Leu Met Glu Leu Met Ala Gly Gly Asp
1 5 10

<210> 410

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 410

Leu Met Glu Leu Met Ala Gly Gly Asp Leu
1 5 10

<210> 411

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 411

Leu Pro Arg Phe Ile Leu Met Glu Leu
1 5

<210> 412

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 412

Leu Pro Arg Phe Ile Leu Met Glu Leu Met
1 5 10

<210> 413
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 413
Leu Gln Ser Leu Pro Arg Phe Ile Leu Met
1 5 10

<210> 414
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 414
Ser Leu Pro Arg Phe Ile Leu Met Glu Leu
1 5 10

<210> 415
<211> 9
<212> PRT
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Ser Ala Ala Cys His Arg Arg Gly Cys Val
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Cys Leu Ile Val Ser Arg Thr Leu Leu
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Cys Leu Ile Val Ser Arg Thr Leu Leu Leu
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1 5 10

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peptide

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peptide

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Thr Gly Ser Asn Glu Val Thr Thr Arg Tyr
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Leu Met Leu Leu Arg Leu Asn Leu
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Phe Lys Lys Lys Thr Tyr Thr Cys Ala Ile
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Lys Ser Lys Lys Lys Glu Thr Phe Lys
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<210> 628

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Lys Ser Lys Lys Lys Glu Thr Phe Lys Lys
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Lys Thr Tyr Thr Cys Ala Ile Thr Thr Val
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peptide

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<210> 637
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Ser Leu Lys Lys Val Pro Ala Leu
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<210> 638
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Arg Lys Ile Ser Asn Trp Ser Leu Lys Lys
1 5 10

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<400> 639
Val Pro Ala Leu Lys Lys Leu Arg Ser Pro Leu
1 5 10

<210> 640
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
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<400> 640
Lys Arg Val Asn Thr Ala Trp Lys Thr Lys
1 5 10

<210> 641
<211> 10

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 641

Met Thr Lys Lys Lys Arg Val Asn Thr Ala
1 5 10

<210> 642

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 642

Arg Val Asn Thr Ala Trp Lys Thr Lys
1 5

<210> 643

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 643

Arg Val Asn Thr Ala Trp Lys Thr Lys Lys
1 5 10

<210> 644

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 644

Thr Lys Lys Lys Arg Val Asn Thr Ala
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<210> 645

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 645

Trp Lys Thr Lys Lys Thr Ser Phe Ser Leu
1 5 10

<210> 646

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 646

Ala Leu Met Ser Ala Met Thr Thr Ser
1 5

<210> 647

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 647

Ala Met Thr Thr Ser Ser Ser Gln Lys
1 5

<210> 648

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 648

Ala Met Thr Thr Ser Ser Ser Gln Lys Asn
1 5 10

<210> 649

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 649

Cys Ile Met Lys Glu Lys Lys Ser Leu
1 5

<210> 650

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 650

Cys Ile Met Lys Glu Lys Lys Ser Leu Val

1

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<210> 651

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 651

Ile Met Lys Glu Lys Lys Ser Leu

1

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<210> 652

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 652

Ile Met Lys Glu Lys Lys Ser Leu Val

1

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<210> 653

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 653

Lys Ser Leu Val Arg Leu Ser Ser Cys Val

1

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<210> 654
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<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 654
Leu Val Arg Leu Ser Ser Cys Val Pro Val
1 5 10

<210> 655
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 655
Arg Leu Ser Ser Cys Val Pro Val Ala
1 5

<210> 656
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 656
Arg Leu Ser Ser Cys Val Pro Val Ala Leu
1 5 10

<210> 657
<211> 10
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 657

Ser Ala Met Thr Thr Ser Ser Ser Gln Lys
1 5 10

<210> 658

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 658

Ser Leu Val Arg Leu Ser Ser Cys Val
1 5

<210> 659

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 659

Val Pro Val Ala Leu Met Ser Ala Met
1 5

<210> 660

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 660

Val Arg Leu Ser Ser Cys Val Pro Val Ala
1 5 10

<210> 661

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 661

Lys Met Arg Lys Lys Tyr Ala Gln Lys
1 5

<210> 662

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 662

Phe Val Met Ser Asp Thr Thr Tyr Lys
1 5

<210> 663

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 663

Phe Val Met Ser Asp Thr Thr Tyr Lys Ile
1 5 10

<210> 664

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 664

Lys Thr Phe Glu Lys Lys Gly Glu Lys
1 5

<210> 665

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 665

Leu Phe Val Met Ser Asp Thr Thr Tyr Lys
1 5 10

<210> 666

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 666

Met Ser Asp Thr Thr Tyr Lys Ile Tyr
1 5

<210> 667
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 667
Val Met Ser Asp Thr Thr Tyr Lys Ile
1 5

<210> 668
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 668
Val Met Ser Asp Thr Thr Tyr Lys Ile Tyr
1 5 10

<210> 669
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 669
Tyr Leu Thr Lys Trp Pro Lys Phe Phe Leu
1 5 10

<210> 670

<211> 9
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 670

Phe Leu Gln Glu Arg Asn Leu Pro Pro
1 5

<210> 671

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 671

Phe Arg Arg Pro His Ser Cys Leu Ala
1 5

<210> 672

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 672

Leu Ile Val Leu Arg Val Val Arg Leu
1 5

<210> 673

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 673

Leu Leu Ser Val His Leu Ile Val Leu
1 5

<210> 674

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 674

Glu Val Lys His Leu His His Leu Leu
1 5

<210> 675

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 675

His Leu His His Leu Leu Lys Gln Leu Lys
1 5 10

<210> 676

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 676

His Leu Leu Leu Lys Arg Glu Arg Val

1 5

<210> 677

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 677

Lys Ile Lys His Leu Leu Lys Arg

1 5

<210> 678

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 678

Lys Pro Ser Glu Lys Tyr Leu Lys Ile

1 5

<210> 679

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 679

Lys Tyr Leu Lys Ile Lys His Leu Leu
1 5

<210> 680
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 680
Lys Tyr Leu Lys Ile Lys His Leu Leu Leu
1 5 10

<210> 681
<211> 10
<212> PRT
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<220>
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<400> 681
Leu Leu Lys Gln Leu Lys Pro Ser Glu Lys
1 5 10

<210> 682
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 682
Leu Leu Lys Arg Glu Arg Val Asp Leu
1 5

<210> 683
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 683
Leu Leu Leu Lys Arg Glu Arg Val Asp Leu
1 5 10

<210> 684
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 684
Gln Leu Lys Pro Ser Glu Lys Tyr Leu Lys
1 5 10

<210> 685
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 685
Tyr Leu Lys Ile Lys His Leu Leu Leu
1 5

<210> 686
<211> 10

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 686

Tyr Leu Lys Ile Lys His Leu Leu Leu Lys
1 5 10

<210> 687

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 687

Ile Leu Pro Arg Lys Val Leu Gln Met
1 5

<210> 688

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 688

Lys Val Leu Gln Met Asp Phe Leu Val
1 5

<210> 689

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 689

Leu Pro Arg Lys Val Leu Gln Met Asp Phe
1 5 10

<210> 690

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 690

Leu Gln Met Asp Phe Leu Val His Pro Ala
1 5 10

<210> 691

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 691

Gln Met Asp Phe Leu Val His Pro Ala
1 5

<210> 692

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 692

Tyr Ile Leu Pro Arg Lys Val Leu Gln Met
1 5 10

<210> 693

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 693

Ala Pro Ser Pro Ala Ser Arg Leu Gln Cys
1 5 10

<210> 694

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 694

His Pro Leu Ala Pro Met Pro Ser Lys Thr
1 5 10

<210> 695

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 695

Ile Leu Pro Leu Pro Gln Leu Leu Leu

1

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<210> 696

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 696

Leu Leu Leu Ser Ala Asp Gln Gln Ala

1

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<210> 697

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 697

Leu Pro Thr Gln Thr Arg Gly Cys Ile

1

5

<210> 698

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 698

Leu Pro Thr Gln Thr Arg Gly Cys Ile Leu

1

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10

<210> 699
<211> 10
<212> PRT
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<220>
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<400> 699
Arg Ile Ser Cys Leu Pro Thr Gln Thr Arg
1 5 10

<210> 700
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 700
Ser Leu Ala Glu Thr Val Ser Leu His
1 5

<210> 701
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 701
Thr Pro Arg Ser Ser Ser Ser Ser Ser
1 5

<210> 702
<211> 10
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 702

Thr Pro Arg Ser Ser Ser Ser Ser Ser Ser
1 5 10

<210> 703

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 703

Ala Leu Pro Pro Val Leu Leu Ser Leu
1 5

<210> 704

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 704

Ala Leu Pro Pro Val Leu Leu Ser Leu Ala
1 5 10

<210> 705

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 705

Ala Leu Pro Arg Pro Leu Leu Ala Leu
1 5

<210> 706

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 706

Ala Ser Arg Thr Ala Ser Cys Ile Leu
1 5

<210> 707

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 707

Glu Ala Leu Pro Arg Pro Leu Leu Ala Leu
1 5 10

<210> 708

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 708

His Leu Gly His Pro Val Ala Ser Arg

1 5

<210> 709

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 709

His Pro Val Ala Ser Arg Thr Ala Ser

1 5

<210> 710

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 710

His Pro Val Ala Ser Arg Thr Ala Ser Cys

1 5 10

<210> 711

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 711

Ile Ile Gln Leu Ser Leu Leu Ser Leu Leu

1 5 10

<210> 712
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 712
Ile Gln Leu Ser Leu Leu Ser Leu Leu
1 5

<210> 713
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
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<400> 713
Ile Gln Leu Ser Leu Leu Ser Leu Leu Ile
1 5 10

<210> 714
<211> 9
<212> PRT
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<220>
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<400> 714
Leu Leu Ala Leu Pro Pro Val Leu Leu
1 5

<210> 715

<211> 9
<212> PRT
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<220>
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<400> 715
Leu Leu Ile Pro Pro Leu Thr Cys Leu
1 5

<210> 716
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 716
Leu Leu Ile Pro Pro Leu Thr Cys Leu Ala
1 5 10

<210> 717
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 717
Leu Leu Ser Leu Leu Ile Pro Pro Leu
1 5

<210> 718
<211> 10
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 718

Leu Leu Ser Leu Leu Ile Pro Pro Leu Thr
1 5 10

<210> 719

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 719

Leu Pro Arg Pro Leu Leu Ala Leu Pro Pro
1 5 10

<210> 720

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 720

Gln Leu Ser Leu Leu Ser Leu Leu Ile
1 5

<210> 721

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 721

Arg Leu Leu Gln Cys Gln Ala Thr Arg

1 5

<210> 722

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 722

Arg Pro Leu Leu Ala Leu Pro Pro Val

1 5

<210> 723

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 723

Arg Pro Leu Leu Ala Leu Pro Pro Val Leu

1 5 10

<210> 724

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 724

Ser Leu Ala Gln Asp His Ser Arg Leu
1 5

<210> 725

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 725

Ser Leu Ala Gln Asp His Ser Arg Leu Leu
1 5 10

<210> 726

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 726

Ser Leu Leu Ile Pro Pro Leu Thr Cys Leu
1 5 10

<210> 727

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 727

Ser Leu Leu Ser Leu Leu Ile Pro Pro
1 5

<210> 728
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 728
Ser Leu Leu Ser Leu Leu Ile Pro Pro Leu
1 5 10

<210> 729
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 729
Ala Ala Ala Thr Ser Ala Ala Ser Thr Leu
1 5 10

<210> 730
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 730
Ala Ala Ile Pro Ala Ser Thr Ser Ala Val
1 5 10

<210> 731
<211> 9

<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 731
Ala Ile Pro Ala Ser Thr Ser Ala Val
1 5

<210> 732
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 732
Ala Leu Pro Ala Gly Cys Val Ser Ser Ala
1 5 10

<210> 733
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 733
Ala Pro Leu Leu Thr Ala Thr Gly Ser Val
1 5 10

<210> 734
<211> 9
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 734

Ala Pro Val Leu Ser Ala Ser Ile Leu
1 5

<210> 735

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 735

Ala Thr Leu Leu Pro Ala Thr Thr Val
1 5

<210> 736

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 736

Ala Thr Val Ser Thr Thr Thr Ala Pro Val
1 5 10

<210> 737

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 737
Ala Val Pro Ala Asn Cys Leu Phe Pro Ala
1 5 10

<210> 738
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 738
Cys Leu Phe Pro Ala Ala Leu Pro Ser Thr
1 5 10

<210> 739
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 739
Cys Pro Thr Phe Val Ser Ala Ala Ala
1 5

<210> 740
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 740
Phe Pro Ala Ala Leu Pro Ser Thr Ala

1

5

<210> 741
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 741
Phe Pro Ala Ala Leu Pro Ser Thr Ala Gly
1 5 10

<210> 742
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 742
Gly Ala Glu Cys His Gly Arg Pro Leu
1 5

<210> 743
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 743
Gly Ala Ile Ser Arg Phe Ile Trp Val
1 5

<210> 744
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 744
Ile Leu Pro Ala Ala Ile Pro Ala Ser Thr
1 5 10

<210> 745
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 745
Ile Trp Val Ser Gly Ile Leu Ser Pro Leu
1 5 10

<210> 746
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 746
Leu Leu Thr Ala Thr Gly Ser Val Ser Leu
1 5 10

<210> 747
<211> 9
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 747

Leu Leu Tyr Thr Ala Asp Ser Ser Leu
1 5

<210> 748

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 748

Leu Pro Ala Ala Ala Thr Ser Ala Ala
1 5

<210> 749

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 749

Leu Pro Ala Ala Ala Thr Ser Ala Ala Ser
1 5 10

<210> 750

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 750

Leu Pro Ala Ala Ile Pro Ala Ser Thr
1 5

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Leu Pro Ala Gly Cys Val Ser Ser Ala
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<210> 752

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<212> PRT

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Leu Pro Ala Gly Cys Val Ser Ser Ala Pro
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<210> 753

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<212> PRT

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Leu Tyr Thr Ala Asp Ser Ser Leu Trp
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Gln Pro Ala Lys Ser Ser Pro Ser Ala
1 5

<210> 755

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Gln Pro Ala Lys Ser Ser Pro Ser Ala Ala
1 5 10

<210> 756

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Arg Val Trp Ser Thr Gly Pro Asp Ser Ile
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1 5

<210> 760

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1 5

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1 5

<210> 762
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1 5 10

<210> 763
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Ser Leu Trp Thr Thr Arg Pro Gln Arg
1 5

<210> 764

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Ser Leu Trp Thr Thr Arg Pro Gln Arg Val
1 5 10

<210> 765

<211> 9

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Ser Pro Ser Ala Ala Ala Ala Thr Leu
1 5

<210> 766

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<213> Artificial Sequence

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peptide

<400> 766

Ser Pro Ser Ala Ala Ala Ala Thr Leu Leu
1 5 10

<210> 767

<211> 10

<212> PRT

<213> Artificial Sequence

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peptide

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Thr Leu Asp Ala Leu Pro Ala Gly Cys Val
1 5 10

<210> 768

<211> 9

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Thr Val Ser Thr Thr Thr Ala Pro Val
1 5

<210> 769

<211> 9

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Val Leu Ser Ala Ser Ile Leu Pro Ala
1 5

<210> 770
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1 5 10

<210> 771
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1 5

<210> 772
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1 5 10

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1 5

<210> 774
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1 5

<210> 775
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1 5 10

<210> 776
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Trp Val Ser Gly Ile Leu Ser Pro Leu
1 5

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Tyr Thr Ala Asp Ser Ser Leu Trp Thr Thr
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<210> 778

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Ala Pro Ala Gly Met Val Asn Arg Ala
1 5

<210> 779

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 779

Ala Ser Leu His Arg Arg Ser Tyr Leu
1 5

<210> 780

<211> 10

<212> PRT

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<400> 780

Ala Ser Leu His Arg Arg Ser Tyr Leu Lys
1 5 10

<210> 781

<211> 10

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<400> 781

Phe Leu Leu Met Asp Asn Lys Ala Pro Ala
1 5 10

<210> 782

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 782
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1 5

<210> 783
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peptide

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1 5

<210> 784
<211> 10
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peptide

<400> 784
His Arg Arg Ser Tyr Leu Lys Ile His Leu
1 5 10

<210> 785
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peptide

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His Ser Arg Phe Leu Leu Met Asp Asn Lys

1

5

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<210> 786

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

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Lys Leu Pro Ile Pro Ser Ser Ala Ser Leu

1 5 10

<210> 787

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 787

Lys Val Leu Thr Leu Ser Ser Ser Ser His

1 5 10

<210> 788

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 788

Leu Ile His Ser Arg Phe Leu Leu Met

1 5

<210> 789
<211> 9
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Leu Leu Met Asp Asn Lys Ala Pro Ala
1 5

<210> 790
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Leu Met Asp Asn Lys Ala Pro Ala Gly Met
1 5 10

<210> 791
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Leu Pro Ile Pro Ser Ser Ala Ser Leu
1 5

<210> 792
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Met Pro Asn Leu Arg Ile Ser Ser Ser
1 5

<210> 793

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 793

Met Pro Asn Leu Arg Ile Ser Ser Ser His
1 5 10

<210> 794

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 794

Asn Leu Arg Ile Ser Ser Ser His Ser Leu
1 5 10

<210> 795

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 795

Pro Pro Thr His Ser His Arg Leu Ser Leu
1 5 10

<210> 796

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 796

Arg Ala Gly Arg Arg Val Pro Trp Ala Ala
1 5 10

<210> 797

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 797

Arg Ala Arg Leu His Ile Thr Thr Ser Lys
1 5 10

<210> 798

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 798

Arg Ile Ser Ser Ser His Ser Leu Asn His
1 5 10

<210> 799

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 799

Arg Leu His Thr Pro Pro Ser Ser Arg
1 5

<210> 800

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 800

Arg Leu His Thr Pro Pro Ser Ser Arg Arg
1 5 10

<210> 801

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 801

Arg Leu Arg Ile Leu Ser Pro Ser Leu
1 5

<210> 802
<211> 9
<212> PRT
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<400> 802
Arg Pro Leu Met Pro Asn Leu Arg Ile
1 5

<210> 803
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<212> PRT
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<400> 803
Arg Pro Arg Pro Leu Met Pro Asn Leu
1 5

<210> 804
<211> 10
<212> PRT
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<400> 804
Ser Ala Ser Leu His Arg Arg Ser Tyr Leu
1 5 10

<210> 805

<211> 9
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 805

Ser Leu His Ile Ser Ser Pro Arg Leu
1 5

<210> 806

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 806

Ser Leu His Arg Arg Ser Tyr Leu Lys
1 5

<210> 807

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 807

Ser Leu His Arg Arg Ser Tyr Leu Lys Ile
1 5 10

<210> 808

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 808

Ser Leu Ile His Ser Arg Phe Leu Leu
1 5

<210> 809

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 809

Ser Leu Ile His Ser Arg Phe Leu Leu Met
1 5 10

<210> 810

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 810

Ser Leu Leu Thr Ser Ser Ser Asn Leu
1 5

<210> 811

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 811

Ser Leu Asn His His Ser Ser Ser Pro Leu
1 5 10

<210> 812

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 812

Ser Leu Ser Ser Pro Ser Lys Leu Pro Ile
1 5 10

<210> 813

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 813

Ser Pro Leu Ser Leu His Thr Pro Ser
1 5

<210> 814

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 814

Ser Pro Leu Ser Leu His Thr Pro Ser Ser
1 5 10

<210> 815

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 815

Ser Pro Pro Thr His Ser His Arg Leu
1 5

<210> 816

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 816

Ser Pro Arg Leu His Thr Pro Pro Ser
1 5

<210> 817

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 817

Ser Pro Arg Leu His Thr Pro Pro Ser Ser
1 5 10

<210> 818
<211> 10
<212> PRT
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<400> 818
Ser Pro Ser Leu Ser Ser Pro Ser Lys Leu
1 5 10

<210> 819
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<400> 819
Ser Tyr Leu Lys Ile His Leu Gly Leu
1 5

<210> 820
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<212> PRT
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Thr Pro Ser Asn His Arg Pro Arg Pro Leu
1 5 10

<210> 821
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<400> 821

Thr Pro Ser Ser His Pro Ser Leu His Ile
1 5 10

<210> 822

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 822

Cys Val Pro Phe Trp Thr Gly Arg Ile Leu
1 5 10

<210> 823

<211> 11

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 823

His Cys Val Pro Phe Trp Thr Gly Arg Ile Leu
1 5 10

<210> 824

<211> 9

<212> PRT

<213> Artificial Sequence

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<400> 824

Ile Leu Leu Pro Ser Ala Ala Ser Val
1 5

<210> 825

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 825

Ile Leu Leu Pro Ser Ala Ala Ser Val Cys
1 5 10

<210> 826

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 826

Leu Leu Pro Ser Ala Ala Ser Val Cys Pro Ile
1 5 10

<210> 827

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

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<400> 827
Leu Pro Ser Ala Ala Ser Val Cys Pro Ile
1 5 10

<210> 828
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Met Arg Pro His Cys Val Pro Phe
1 5

<210> 829
<211> 10
<212> PRT
<213> Artificial Sequence

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<400> 829
Arg Ile Leu Leu Pro Ser Ala Ala Ser Val
1 5 10

<210> 830
<211> 9
<212> PRT
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<400> 830
Arg Met Arg Pro His Cys Val Pro Phe

<210> 831
<211> 10
<212> PRT
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<220>
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<400> 831
Arg Met Arg Pro His Cys Val Pro Phe Trp
1 5 10

<210> 832
<211> 9
<212> PRT
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<400> 832
Arg Thr Asn Pro Thr Val Arg Met Arg
1 5

<210> 833
<211> 9
<212> PRT
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<400> 833
Ser Val Cys Pro Ile Pro Phe Glu Ala
1 5

<210> 834
<211> 9
<212> PRT
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<400> 834
Thr Val Arg Met Arg Pro His Cys Val
1 5

<210> 835
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<212> PRT
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<400> 835
Thr Val Arg Met Arg Pro His Cys Val Pro Phe
1 5 10

<210> 836
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<212> PRT
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Val Pro Phe Trp Thr Gly Arg Ile Leu
1 5

<210> 837
<211> 10
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 837

Val Pro Phe Trp Thr Gly Arg Ile Leu Leu
1 5 10

<210> 838

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 838

Val Arg Met Arg Pro His Cys Val Pro Phe
1 5 10

<210> 839

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 839

Ala Met Val Pro Arg Gly Val Ser Met
1 5

<210> 840

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 840

Ala Met Val Pro Arg Gly Val Ser Met Ala
1 5 10

<210> 841

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 841

Ala Trp Ala Pro Thr Ser Arg Thr Pro Trp
1 5 10

<210> 842

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 842

Cys Pro Met Pro Thr Thr Pro Val Gln Ala
1 5 10

<210> 843

<211> 10

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 843

Cys Pro Ser Thr Val Pro Pro Ser Pro Ala
1 5 10

<210> 844

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<212> PRT

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 844

Gly Ala Met Val Pro Arg Gly Val Ser Met
1 5 10

<210> 845

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 845

Met Pro Cys Pro Met Pro Thr Thr Pro Val
1 5 10

<210> 846

<211> 9

<212> PRT

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peptide

<400> 846

Met Pro Thr Thr Pro Val Gln Ala Trp
1 5

<210> 847
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<220>
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<400> 847
Met Pro Thr Thr Pro Val Gln Ala Trp Leu
1 5 10

<210> 848
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Ser Leu Pro Glu Asp Arg Tyr Thr Gln Ala
1 5 10

<210> 849
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Ser Pro Ala Gln Pro Tyr Leu Arg Val
1 5

<210> 850

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<400> 850

Ser Pro Ala Gln Pro Tyr Leu Arg Val Ser
1 5 10

<210> 851

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 851

Thr Ile Met Pro Cys Pro Met Pro Thr
1 5

<210> 852

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 852

Thr Pro Val Gln Ala Trp Leu Glu Ala
1 5

<210> 853

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 853

Thr Ser Arg Thr Pro Trp Gly Ala Met
1 5

<210> 854

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<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 854

Val Pro Pro Ser Pro Ala Gln Pro Tyr Leu
1 5 10

<210> 855

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<223> Description of Artificial Sequence: Synthetic peptide

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Val Pro Arg Gly Val Ser Met Ala His
1 5

<210> 856

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<212> PRT

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<223> Description of Artificial Sequence: Synthetic

peptide

<400> 856

Cys Leu Ser Ala Arg Thr Gly Leu Ser Ile
1 5 10

<210> 857

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 857

Cys Thr Thr Leu Asn Ser Pro Pro Leu Lys
1 5 10

<210> 858

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 858

Gly Leu Ser Ile Ser Cys Thr Thr Leu
1 5

<210> 859

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 859

Ser Pro Pro Leu Lys Lys Met Ser Met
1 5

<210> 860

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<212> PRT

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 860

Thr Leu Asn Ser Pro Pro Leu Lys Lys
1 5

<210> 861

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 861

Thr Thr Leu Asn Ser Pro Pro Leu Lys
1 5

<210> 862

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 862

Thr Thr Leu Asn Ser Pro Pro Leu Lys Lys
1 5 10

<210> 863
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1 5

<210> 864
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Leu Gln Arg Phe Arg Phe Thr His Val Ile
1 5 10

<210> 865
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1 5

<210> 866
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Arg Leu Ser Ser Val Leu Gln Arg Phe Arg
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<210> 867

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

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Val Leu Gln Arg Phe Arg Phe Thr His Val
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<210> 868

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

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Ala Ser Val Gly Arg His Ser Leu Ser Lys
1 5 10

<210> 869

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

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Lys Phe Leu Pro Phe Trp Gly Phe Leu
1 5

<210> 870

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

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Leu Ala Ser Val Gly Arg His Ser Leu
1 5

<210> 871

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<223> Description of Artificial Sequence: Synthetic peptide

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Leu Pro Phe Trp Gly Phe Leu Glu Glu Phe
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<210> 872

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

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1 5

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1 5

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1 5

<210> 875
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1

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<210> 876

<211> 10

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Ala Gln Lys Met Lys Lys Ala His Phe Leu

1 5 10

<210> 877

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

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Phe Leu Pro Ser Ala Ala Gln Lys Met

1 5

<210> 878

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 878

Gly Leu Phe Leu Pro Ser Ala Ala Gln Lys

1 5 10

<210> 879
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His Pro Leu Leu Val Ser Leu Leu Leu
1 5

<210> 880
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<210> 881
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1 5

<210> 882
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Lys Met Lys Lys Ala His Phe Leu Lys
1 5

<210> 883

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

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Lys Thr Trp Phe Arg Ser Asn Pro Thr Lys
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<210> 884

<211> 9

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Leu Ala Lys Glu Leu Thr His Pro Leu
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<210> 885

<211> 10

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<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

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Leu Ala Lys Glu Leu Thr His Pro Leu Leu
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<210> 886

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

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Asn Pro Thr Lys Thr Lys Lys Ala Arg Phe
1 5 10

<210> 887

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 887

Gln Lys Met Lys Lys Ala His Phe Leu
1 5

<210> 888

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 888

Arg Phe Ser Thr Ala Ser Leu Ala Lys

1 5

<210> 889

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 889

Arg Pro Ile Arg Pro Pro Phe Leu Glu Ser

1 5 10

<210> 890

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 890

Arg Ser Asn Pro Thr Lys Thr Lys Lys

1 5

<210> 891

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 891

Ser Leu Ala Lys Glu Leu Thr His Pro Leu

1 5 10

<210> 892
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1 5

<210> 893
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1 5

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Ile Ser Gln Leu Leu Ser Trp Pro Gln Lys
1 5 10

<210> 895

<211> 9
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<400> 895
Arg Ile Ala His Ile Ser Gln Leu Leu
1 5

<210> 896
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<212> PRT
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<400> 896
Arg Leu Gly Tyr Ser Ser His Gln Leu
1 5

<210> 897
<211> 9
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<400> 897
Ser Gln Leu Leu Ser Trp Pro Gln Lys
1 5

<210> 898
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<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 898

Ser Arg Ile Ala His Ile Ser Gln Leu
1 5

<210> 899

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 899

Trp Pro Gln Lys Thr Glu Glu Arg Leu
1 5

<210> 900

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 900

Tyr Ser Ser His Gln Leu Pro Arg Lys
1 5

<210> 901

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 901

Cys Pro Gln Arg Met Thr Pro Gly Thr Thr
1 5 10

<210> 902

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 902

Glu Ala Glu Lys Arg Thr Arg Thr Leu
1 5

<210> 903

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 903

Gly Thr Thr Phe Ile Thr Met Met Lys
1 5

<210> 904

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 904

Gly Thr Thr Phe Ile Thr Met Met Lys Lys
1 5 10

<210> 905

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 905

Ile Thr Met Met Lys Lys Glu Ala Glu Lys
1 5 10

<210> 906

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 906

Arg Met Thr Pro Gly Thr Thr Phe Ile
1 5

<210> 907

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 907

Ser Pro Tyr Cys Pro Gln Arg Met Thr
1 5

<210> 908
<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 908
Thr Met Met Lys Lys Glu Ala Glu Lys
1 5

<210> 909
<211> 9
<212> PRT
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<220>
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<400> 909
Thr Pro Gly Thr Thr Phe Ile Thr Met
1 5

<210> 910
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 910
Thr Pro Gly Thr Thr Phe Ile Thr Met Met
1 5 10

<210> 911
<211> 9

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 911

Thr Thr Phe Ile Thr Met Met Lys Lys
1 5

<210> 912

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 912

Cys Pro Gly Ala Thr Trp Arg Glu Ala
1 5

<210> 913

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 913

Cys Pro Gly Ala Thr Trp Arg Glu Ala Ala
1 5 10

<210> 914

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 914

Arg Ser Arg Cys Pro Gly Ala Thr Trp Arg
1 5 10

<210> 915

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 915

Thr Pro Arg Ala Thr Arg Ser Arg Cys
1 5

<210> 916

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 916

His Val Leu Pro Glu Pro His Leu Ala Leu
1 5 10

<210> 917

<211> 10

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 917
Arg Pro Leu Gln Thr His Val Leu Pro Glu
1 5 10

<210> 918
<211> 10
<212> PRT
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peptide

<400> 918
Val Leu Trp Thr Thr Pro Pro Leu Gln His
1 5 10

<210> 919
<211> 10
<212> PRT
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peptide

<400> 919
Ala Pro Ser Glu Ser Pro Cys Ser Pro Phe
1 5 10

<210> 920
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<212> PRT
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peptide

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1

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<210> 921

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 921

Phe Leu Gln Glu Gln Tyr His Glu Ala

1

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<210> 922

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 922

Arg Leu Ala Phe Leu Gln Glu Gln Tyr His

1

5

10

<210> 923

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 923

Ser Pro Cys Ser Pro Phe Arg Leu Ala Phe

1

5

10

<210> 924
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Ser Pro Pro Trp Val Arg Ala Leu Leu
1 5

<210> 925
<211> 10
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Tyr Pro Ala Cys Pro Leu Asp His Thr Thr
1 5 10

<210> 926
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<400> 926
Ala Leu His Leu Arg Ser Cys Pro Cys
1 5

<210> 927
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 927

Cys Leu His His Arg Arg His Leu Val
1 5

<210> 928

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 928

Cys Leu His His Arg Arg His Leu Val Cys
1 5 10

<210> 929

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 929

Cys Leu His Arg Lys Ser His Pro His Leu
1 5 10

<210> 930

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 930

Cys Leu Arg Ser His Ala Cys Pro Pro
1 5

<210> 931

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 931

Cys Leu Arg Ser His Thr Cys Pro Pro
1 5

<210> 932

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 932

Cys Leu Trp Cys His Ala Cys Leu His
1 5

<210> 933

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 933

Cys Pro His His Leu Lys Asn His Leu
1 5

<210> 934

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 934

Cys Pro His His Leu Lys Asn Leu Leu
1 5

<210> 935

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 935

Cys Pro His His Leu Arg Thr Arg Leu
1 5

<210> 936

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 936

Cys Pro Leu His Leu Arg Ser Leu Pro Phe
1 5 10

<210> 937
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<400> 937
Cys Pro Leu Pro Arg His Leu Lys His Leu
1 5 10

<210> 938
<211> 10
<212> PRT
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Cys Pro Leu Ser Leu Arg Ser His Pro Cys
1 5 10

<210> 939
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<400> 939
Cys Pro Arg His Leu Arg Asn Cys Pro Leu
1 5 10

<210> 940

<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

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Phe Pro His His Leu Arg His His Ala
1 5

<210> 941

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 941

Phe Pro His His Leu Arg His His Ala Cys
1 5 10

<210> 942

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 942

Gly Leu Arg Ser Arg Thr Cys Pro Pro
1 5

<210> 943

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 943

His Ala Cys Leu His Arg Leu Arg Asn Leu
1 5 10

<210> 944

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 944

His Leu Ala Cys Leu His His Leu Arg
1 5

<210> 945

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 945

His Leu Cys Pro Pro His Leu Arg Tyr
1 5

<210> 946

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 946

His Leu Cys Pro Pro His Leu Arg Tyr Arg
1 5 10

<210> 947

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 947

His Leu Lys His Leu Ala Cys Leu His
1 5

<210> 948

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 948

His Leu Lys His Arg Pro Cys Pro His
1 5

<210> 949

<211> 9

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peptide

<400> 949

His Leu Lys Asn His Leu Cys Pro Pro
1 5

<210> 950
<211> 9
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His Leu Lys Ser His Pro Cys Leu His
1 5

<210> 951
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His Leu Lys Ser Leu Leu Cys Pro Leu
1 5

<210> 952
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His Leu Leu His Leu Arg Arg Leu Tyr
1 5

<210> 953
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His Leu Arg Asn Cys Pro Leu Pro Arg
1 5

<210> 954
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<400> 954
His Leu Arg Asn Cys Pro Leu Pro Arg His
1 5 10

<210> 955
<211> 10
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<220>
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<400> 955
His Leu Arg Arg Leu Tyr Pro His His Leu
1 5 10

<210> 956
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<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 956

His Leu Arg Ser His Pro Cys Pro Leu
1 5

<210> 957

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 957

His Leu Arg Ser His Pro Cys Pro Leu His
1 5 10

<210> 958

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 958

His Leu Arg Ser Leu Pro Phe Pro His
1 5

<210> 959

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 959

His Leu Arg Thr Arg Leu Cys Pro His
1 5

<210> 960

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 960

His Leu Val Cys Ser His His Leu Lys
1 5

<210> 961

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 961

His Pro Cys Leu His His Arg Arg His Leu
1 5 10

<210> 962

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 962
His Pro Gly Leu Arg Ser Arg Thr Cys
1 5

<210> 963
<211> 10
<212> PRT
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peptide

<400> 963
His Pro His Leu Leu His Leu Arg Arg Leu
1 5 10

<210> 964
<211> 9
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peptide

<400> 964
His Arg Lys Ser His Pro His Leu Leu
1 5

<210> 965
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<220>
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peptide

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His Arg Arg Thr Arg Ser Cys Pro Cys

1

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<210> 966
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Lys Ser His Pro His Leu Leu His Leu Arg
1 5 10

<210> 967
<211> 10
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<400> 967
Lys Ser Leu Leu Cys Pro Leu His Leu Arg
1 5 10

<210> 968
<211> 10
<212> PRT
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<400> 968
Leu Leu Cys Pro Leu His Leu Arg Ser Leu
1 5 10

<210> 969
<211> 10
<212> PRT
<213> Artificial Sequence

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<400> 969
Leu Leu His Leu Arg Arg Leu Tyr Pro His
1 5 10

<210> 970
<211> 9
<212> PRT
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Leu Pro Arg His Leu Lys His Leu Ala
1 5

<210> 971
<211> 10
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<400> 971
Leu Pro Arg His Leu Lys His Leu Ala Cys
1 5 10

<210> 972
<211> 9
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 972

Leu Arg Arg Leu Arg Ser His Thr Cys
1 5

<210> 973

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 973

Leu Arg Arg Leu Tyr Pro His His Leu
1 5

<210> 974

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 974

Leu Val Cys Ser His His Leu Lys Ser Leu
1 5 10

<210> 975

<211> 10

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 975

Asn Leu Arg Asn His Thr Cys Pro Pro Ser
1 5 10

<210> 976

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 976

Pro Leu His Leu Arg Ser Leu Pro Phe
1 5

<210> 977

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

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Arg Leu Cys Pro His His Leu Lys Asn His
1 5 10

<210> 978

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 978

Arg Leu Tyr Pro His His Leu Lys His
1 5

<210> 979

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

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Arg Leu Tyr Pro His His Leu Lys His Arg
1 5 10

<210> 980

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
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Arg Pro Cys Pro His His Leu Lys Asn Leu
1 5 10

<210> 981

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
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<400> 981

Arg Ser His Pro Cys Pro Leu His Leu Lys
1 5 10

<210> 982
<211> 10
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<220>
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Arg Ser Leu Pro Phe Pro His His Leu Arg
1 5 10

<210> 983
<211> 9
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<213> Artificial Sequence

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Arg Thr Arg Leu Cys Pro His His Leu
1 5

<210> 984
<211> 10
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<220>
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Arg Thr Arg Leu Cys Pro His His Leu Lys
1 5 10

<210> 985

<211> 9
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Ser Leu Leu Cys Pro Leu His Leu Arg
1 5

<210> 986
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<220>
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Ser Leu Arg Ser His Ala Cys Pro Pro
1 5

<210> 987
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<220>
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Ser Pro Leu Arg Ser Gln Ala Asn Ala
1 5

<210> 988
<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

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Tyr Leu Arg Arg Leu Arg Ser His Thr
1 5

<210> 989

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 989

Tyr Pro His His Leu Lys His Arg Pro Cys
1 5 10

<210> 990

<211> 9

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 990

Phe Ile Thr Ser Gly Gln Ile Phe Lys
1 5

<210> 991

<211> 9

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<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic

peptide

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Ile Phe Ile Thr Ser Gly Gln Ile Phe
1 5

<210> 992

<211> 9

<212> PRT

<213> Artificial Sequence

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peptide

<400> 992

Ser Gln Ser Glu Ala Leu Cys Val Leu
1 5

<210> 993

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 993

Ser Gln Ser Glu Ala Leu Cys Val Leu Leu
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<210> 994

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 994

Ala Tyr Thr Gly Thr Ile Leu Met Met
1 5

<210> 995

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 995

Asp Leu Lys Ala Tyr Thr Gly Thr Ile Leu
1 5 10

<210> 996

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 996

Ile Leu Thr Lys Gln Ile Lys Thr Lys
1 5

<210> 997

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 997

Lys Met Ile Leu Thr Lys Gln Ile Lys
1 5

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1 5

<210> 999
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<210> 1000
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Met Ile Leu Thr Lys Gln Ile Lys Thr Lys
1 5 10

<210> 1001
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<212> PRT
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Ile Thr Arg Tyr Thr Ile Phe Val Leu Lys
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<210> 1002

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1002

Leu Ile Ala Glu Leu His Asn Ile Leu
1 5

<210> 1003

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1003

Leu Ile Ala Glu Leu His Asn Ile Leu Leu
1 5 10

<210> 1004

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1004

Met Thr Pro Pro Asn Leu Ile Ala Glu Leu
1 5 10

<210> 1005

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1005

Asn Leu Ile Ala Glu Leu His Asn Ile
1 5

<210> 1006

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1006

Asn Leu Ile Ala Glu Leu His Asn Ile Leu
1 5 10

<210> 1007

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1007
Arg Tyr Thr Ile Phe Val Leu Lys Asp Ile
1 5 10

<210> 1008
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<212> PRT
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<220>
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peptide

<400> 1008
Thr Ile Thr Arg Tyr Thr Ile Phe Val Leu
1 5 10

<210> 1009
<211> 9
<212> PRT
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<220>
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peptide

<400> 1009
Thr Pro Pro Asn Leu Ile Ala Glu Leu
1 5

<210> 1010
<211> 9
<212> PRT
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<220>
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peptide

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Phe Leu Gln Phe Arg Thr His Thr Thr

1

5

<210> 1011

<211> 10

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1011

Leu Pro Ala Lys Gly Glu Asp Ile Phe Leu

1 5 10

<210> 1012

<211> 10

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1012

Leu Gln Phe Arg Thr His Thr Thr Gly Arg

1 5 10

<210> 1013

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1013

Asn Leu Gln Ser Ser Val Cys Gly Leu

1 5

<210> 1014
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Ser Ser Val Cys Gly Leu Pro Ala Lys
1 5

<210> 1015
<211> 10
<212> PRT
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<220>
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<400> 1015
Val Gln Trp Arg Asn Leu Gln Ser Ser Val
1 5 10

<210> 1016
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1016
Gly Gln Asn Val Ser Leu Leu Gly Lys
1 5

<210> 1017
<211> 10
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1017

His Thr Arg Thr Arg Gly Asn Leu Arg Lys
1 5 10

<210> 1018

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1018

Ile Leu His Thr Arg Thr Arg Gly Asn Leu
1 5 10

<210> 1019

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1019

Lys Gly Gln Asn Val Ser Leu Leu Gly Lys
1 5 10

<210> 1020

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1020

Leu Leu Gly Lys Tyr Ile Leu His Thr
1 5

<210> 1021

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1021

Leu Arg Lys Ser Arg Lys Trp Lys Ser Met
1 5 10

<210> 1022

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1022

Ser Leu Leu Gly Lys Tyr Ile Leu His
1 5

<210> 1023

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1023

Ser Leu Leu Gly Lys Tyr Ile Leu His Thr
1 5 10

<210> 1024

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1024

Cys Thr Ser Pro Leu Leu Ala Pro Val
1 5

<210> 1025

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1025

Phe Pro Glu Asn Leu Pro Gly Gln Leu
1 5

<210> 1026

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1026

Gly Leu Leu Ala Phe Trp Asp Ser Gln Val
1 5 10

<210> 1027

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1027

Ile Phe Cys Pro Phe Pro Glu Asn Leu

1 5

<210> 1028

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1028

Leu Leu Ala Phe Trp Asp Ser Gln Val

1 5

<210> 1029

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1029

Leu Leu Ala Pro Val Ile Phe Cys Pro

1 5

<210> 1030

<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1030
Leu Leu Ala Pro Val Ile Phe Cys Pro Phe
1 5 10

<210> 1031
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<212> PRT
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<400> 1031
Leu Pro Cys Pro Gln Gln Asp Val Leu
1 5

<210> 1032
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1032
Arg Phe Pro Ser Gly Leu Leu Ala Phe
1 5

<210> 1033
<211> 10
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1033

Arg Phe Pro Ser Gly Leu Leu Ala Phe Trp
1 5 10

<210> 1034

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1034

Ser Pro Leu Leu Ala Pro Val Ile Phe
1 5

<210> 1035

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1035

Ser Pro Arg Gly Pro Cys Thr Ser Ser
1 5

<210> 1036

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1036

Ser Pro Arg Gly Pro Cys Thr Ser Ser Ser
1 5 10

<210> 1037

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1037

Ser Gln Val Cys Asp Leu His Val Leu
1 5

<210> 1038

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1038

Val Ile Phe Cys Pro Phe Pro Glu Asn Leu
1 5 10

<210> 1039

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1039

Ala Met Val Trp Pro Leu Leu Ser Ile

1 5

<210> 1040

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1040

Ala Met Val Trp Pro Leu Leu Ser Ile Leu

1 5 10

<210> 1041

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1041

Ala Gln Ile Ala Met Val Trp Pro Leu

1 5

<210> 1042

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1042

Ala Gln Ile Ala Met Val Trp Pro Leu Leu

1 5 10

<210> 1043
<211> 9
<212> PRT
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<220>
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<400> 1043
Cys Pro Met Ser Arg Leu Arg Leu Ala
1 5

<210> 1044
<211> 10
<212> PRT
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<220>
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<400> 1044
Cys Pro Met Ser Arg Leu Arg Leu Ala Leu
1 5 10

<210> 1045
<211> 10
<212> PRT
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<220>
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<400> 1045
Ile Ala Met Val Trp Pro Leu Leu Ser Ile
1 5 10

<210> 1046
<211> 10

<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1046

Ile Leu Ser Glu Trp Lys Glu Ile Cys Val
1 5 10

<210> 1047

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1047

Ile Val Trp Trp Cys Pro Met Ser Arg
1 5

<210> 1048

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1048

Ile Val Trp Trp Cys Pro Met Ser Arg Leu
1 5 10

<210> 1049

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1049

Ile Trp Met Thr Glu Thr Leu Phe Asp Ile
1 5 10

<210> 1050

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1050

Leu Leu Ser Ile Leu Ser Glu Trp Lys
1 5

<210> 1051

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1051

Met Ser Ala Ala Gln Ile Ala Met Val
1 5

<210> 1052

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1052

Met Ser Arg Leu Arg Leu Ala Leu Thr
1 5

<210> 1053

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1053

Met Ser Arg Leu Arg Leu Ala Leu Thr Val
1 5 10

<210> 1054

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1054

Met Val Trp Pro Leu Leu Ser Ile Leu
1 5

<210> 1055

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1055

Arg Leu Ala Leu Thr Val Pro Pro Ser Thr

1

5

10

<210> 1056

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1056

Thr Leu Phe Asp Ile Val Trp Trp Cys

1

5

<210> 1057

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1057

Thr Leu Phe Asp Ile Val Trp Trp Cys Pro

1

5

10

<210> 1058

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1058

Thr Met Ser Ala Ala Gln Ile Ala Met Val

1

5

10

<210> 1059
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1059
Val Trp Ser Ile Trp Met Thr Glu Thr Leu
1 5 10

<210> 1060
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
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<400> 1060
Trp Met Thr Glu Thr Leu Phe Asp Ile
1 5

<210> 1061
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
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<400> 1061
Trp Met Thr Glu Thr Leu Phe Asp Ile Val
1 5 10

<210> 1062
<211> 9
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1062

Ala Leu Arg Cys Val Phe Val Pro Val
1 5

<210> 1063

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1063

Ala Leu Arg Cys Val Phe Val Pro Val Leu
1 5 10

<210> 1064

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1064

Ala Leu Ser Glu His Cys Pro Thr Thr
1 5

<210> 1065

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1065

Ala Gln Arg Lys Arg Ile Ser Ala Arg Lys
1 5 10

<210> 1066

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1066

Gly Ala Gln Arg Lys Arg Ile Ser Ala
1 5

<210> 1067

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1067

His Trp Met Glu Asn Ile Ser Pro Phe
1 5

<210> 1068

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1068

Leu Pro Ser Gln Arg Arg Asn His Trp
1 5

<210> 1069

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1069

Leu Pro Ser Gln Arg Arg Asn His Trp Met
1 5 10

<210> 1070

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1070

Asn Ile Ser Pro Phe Arg Ser Val Gly Val
1 5 10

<210> 1071

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1071

Arg Ile Ser Ala Arg Lys Gly Ser Leu
1 5

<210> 1072
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1072
Ser Pro Phe Arg Ser Val Gly Val Ser Ala
1 5 10

<210> 1073
<211> 10
<212> PRT
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<220>
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<400> 1073
Ser Pro Ser Ser His Trp Lys Thr Pro Val
1 5 10

<210> 1074
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1074
Thr Ala Leu Arg Cys Val Phe Val Pro Val
1 5 10

<210> 1075

<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1075
Val Ile Tyr Trp Asp Gly Thr Ala Leu
1 5

<210> 1076
<211> 10
<212> PRT
<213> Artificial Sequence

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<400> 1076
Val Ile Tyr Trp Asp Gly Thr Ala Leu Arg
1 5 10

<210> 1077
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1077
Val Leu Gly Glu Thr Gly Ala Gln Arg Lys
1 5 10

<210> 1078
<211> 9
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1078

His Pro Arg Pro Arg His Gly His Leu
1 5

<210> 1079

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1079

His Pro Arg Pro Arg His Gly His Leu Gln
1 5 10

<210> 1080

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1080

Arg Pro Arg His Gly His Leu Gln Ala
1 5

<210> 1081

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1081

Arg Pro Arg His Gly His Leu Gln Ala Val
1 5 10

<210> 1082

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1082

Gly Ser Leu Lys Thr Gln Val Gln Met Lys
1 5 10

<210> 1083

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1083

Pro Pro Gly Pro Cys His Leu Leu Ser Leu
1 5 10

<210> 1084

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1084

Arg Thr Ile Leu Asn Asn Gly Ser Leu Lys
1 5 10

<210> 1085

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1085

Ser Leu Lys Thr Gln Val Gln Met Lys
1 5

<210> 1086

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1086

Ser Leu Lys Thr Gln Val Gln Met Lys Leu
1 5 10

<210> 1087

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1087

Thr Ile Leu Asn Asn Gly Ser Leu Lys
1 5

<210> 1088
<211> 10
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

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Cys Pro Pro Cys Arg Pro Lys Gln Trp Met
1 5 10

<210> 1089
<211> 10
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Thr Thr Phe Cys Pro Pro Cys Arg Pro Lys
1 5 10

<210> 1090
<211> 10
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

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Cys Phe Ala Asn Trp Pro Arg Pro Ala Leu
1 5 10

<210> 1091
<211> 9

<212> PRT
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<220>
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Phe Ala Asn Trp Pro Arg Pro Ala Leu
1 5

<210> 1092
<211> 9
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Gly Leu Ile Pro His Pro Arg Pro Ala
1 5

<210> 1093
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<220>
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His Pro Arg Pro Ala Pro Ala Ser Ala
1 5

<210> 1094
<211> 10
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<223> Description of Artificial Sequence: Synthetic peptide

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His Pro Arg Pro Ala Pro Ala Ser Ala Pro
1 5 10

<210> 1095

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1095

Ile Pro His Pro Arg Pro Ala Pro Ala
1 5

<210> 1096

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1096

Ile Pro His Pro Arg Pro Ala Pro Ala Ser
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<210> 1097

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1097
Arg Pro Ala Leu Cys Ser Cys Gly Leu
1 5

<210> 1098
<211> 10
<212> PRT
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<220>
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peptide

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Arg Pro Ala Leu Cys Ser Cys Gly Leu Ile
1 5 10

<210> 1099
<211> 9
<212> PRT
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<220>
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peptide

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Thr Pro Leu Pro Ser Thr Arg Cys Phe
1 5

<210> 1100
<211> 9
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<220>
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peptide

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Trp Pro Arg Pro Ala Leu Cys Ser Cys

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<210> 1101
<211> 10
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<220>
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Trp Pro Arg Pro Ala Leu Cys Ser Cys Gly
1 5 10

<210> 1102
<211> 10
<212> PRT
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<220>
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Ala Leu Arg Arg Ser Gly Arg Pro Pro Lys
1 5 10

<210> 1103
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
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<400> 1103
Gly Leu Val Pro Ser Leu Val Ser Lys
1 5

<210> 1104
<211> 9
<212> PRT
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<400> 1104
Lys Ile Ser Val Glu Thr Tyr Thr Val
1 5

<210> 1105
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1105
Leu Leu Met Val Leu Met Ser Leu Asp Leu
1 5 10

<210> 1106
<211> 10
<212> PRT
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<220>
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<400> 1106
Leu Met Ser Leu Asp Leu Asp Thr Gly Leu
1 5 10

<210> 1107
<211> 9
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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1107

Leu Met Val Leu Met Ser Leu Asp Leu
1 5

<210> 1108

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1108

Leu Val Ser Lys Cys Leu Ile Leu Arg Val
1 5 10

<210> 1109

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1109

Gln Leu Leu Met Val Leu Met Ser Leu
1 5

<210> 1110

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1110

Arg Pro Gly Ala Ala Asp Thr Gly Ala
1 5

<210> 1111

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1111

Arg Pro Gly Ala Ala Asp Thr Gly Ala His
1 5 10

<210> 1112

<211> 9

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<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1112

Ser Leu Asp Leu Asp Thr Gly Leu Val
1 5

<210> 1113

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1113

Ser Leu Val Ser Lys Cys Leu Ile Leu
1 5

<210> 1114

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1114

Ser Gln Leu Leu Met Val Leu Met Ser Leu
1 5 10

<210> 1115

<211> 9

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1115

Thr Val Ser Ser Gln Leu Leu Met Val
1 5

<210> 1116

<211> 9

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1116

Thr Tyr Thr Val Ser Ser Gln Leu Leu
1 5

<210> 1117
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<220>
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<400> 1117
Thr Tyr Thr Val Ser Ser Gln Leu Leu Met
1 5 10

<210> 1118
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<220>
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<400> 1118
Val Leu Met Ser Leu Asp Leu Asp Thr
1 5

<210> 1119
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<223> Description of Artificial Sequence: Synthetic peptide

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Val Pro Ser Leu Val Ser Lys Cys Leu
1 5

<210> 1120

<211> 10
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1120

Val Ser Lys Cys Leu Ile Leu Arg Val Lys
1 5 10

<210> 1121

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1121

Tyr Thr Val Ser Ser Gln Leu Leu Met
1 5

<210> 1122

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1122

Tyr Thr Val Ser Ser Gln Leu Leu Met Val
1 5 10

<210> 1123

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1123

Phe Cys Gln Tyr His Thr Ala Ser Val
1 5

<210> 1124

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1124

Cys Pro Tyr Gly Ser Thr Ser Thr Ala
1 5

<210> 1125

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1125

Cys Pro Tyr Gly Ser Thr Ser Thr Ala Ser
1 5 10

<210> 1126

<211> 10

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1126

Leu Ala Arg Ala Ala Ala Ser Thr Ala Thr
1 5 10

<210> 1127

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1127

Met Leu Thr Asp Ser Leu Phe Leu Pro
1 5

<210> 1128

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1128

Pro Pro Arg Ser Ser Ser Ala Ile Ala Val
1 5 10

<210> 1129

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1129

Arg Ala Ala Ala Ser Thr Ala Thr Glu Val
1 5 10

<210> 1130

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1130

Ser Pro Pro Arg Ser Ser Ser Ala Ile
1 5

<210> 1131

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1131

Ser Pro Pro Arg Ser Ser Ser Ala Ile Ala
1 5 10

<210> 1132

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1132

Ser Pro Thr Gln Arg Cys Arg Leu Ala
1 5

<210> 1133
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1133
Thr Gln Arg Cys Arg Leu Ala Arg Ala
1 5

<210> 1134
<211> 10
<212> PRT
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<220>
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<400> 1134
Thr Gln Arg Cys Arg Leu Ala Arg Ala Ala
1 5 10

<210> 1135
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1135
Lys Ile Trp Lys Thr Thr Gln Met Cys Arg
1 5 10

<210> 1136
<211> 9

<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1136

Trp Thr Ser Ser Gly Arg Ser Thr Lys
1 5

<210> 1137

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1137

Ala Leu Gly Glu Leu Ala Arg Ala Leu
1 5

<210> 1138

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1138

Ala Gln Leu Arg Arg Arg Ala Ala Ala
1 5

<210> 1139

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1139

Ala Gln Leu Arg Arg Arg Ala Ala Ala Leu
1 5 10

<210> 1140

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1140

Ala Arg Arg Ala Ala Arg Met Ala Gln Leu
1 5 10

<210> 1141

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1141

His Pro Gln Leu Pro Arg Ser Pro Leu
1 5

<210> 1142

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1142
His Pro Gln Leu Pro Arg Ser Pro Leu Ala
1 5 10

<210> 1143
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1143
Leu Ala Arg Ala Leu Pro Gly His Leu
1 5

<210> 1144
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1144
Leu Ala Arg Ala Leu Pro Gly His Leu Leu
1 5 10

<210> 1145
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1145
Met Ala Gln Leu Arg Arg Arg Ala Ala

1

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<210> 1146

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1146

Met Ala Gln Leu Arg Arg Arg Ala Ala Ala

1 5 10

<210> 1147

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1147

Gln Leu Arg Arg Ala Ala Ala Leu

1 5

<210> 1148

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1148

Arg Ala Ala Ala Leu Pro Asn Ala Ala Ala

1 5 10

<210> 1149

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1149

Arg Met Ala Gln Leu Arg Arg Arg Ala Ala
1 5 10

<210> 1150

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1150

Ser Gln Ser Ala Arg Arg Ala Ala Arg Met
1 5 10

<210> 1151

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1151

Gly Met Thr Leu Gly Glu Lys Phe Arg Val
1 5 10

<210> 1152

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1152

Arg Val Gly Asn Cys Lys His Leu Lys
1 5

<210> 1153

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1153

Gly Pro Ser Glu Pro Gly Asn Asn Ile
1 5

<210> 1154

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1154

Lys Ile Cys Asn Glu Ser Ala Ser Arg Lys
1 5 10

<210> 1155

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1155

Gly Ile Gln Val Leu Asn Val Ser Leu Lys
1 5 10

<210> 1156

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1156

Ile Gln Val Leu Asn Val Ser Leu Lys
1 5

<210> 1157

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

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Lys Ser Ser Ser Asn Val Ile Ser Tyr
1 5

<210> 1158

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1158

Lys Tyr Gly Trp Ser Leu Leu Arg Val

1 5

<210> 1159

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1159

Arg Ser Trp Lys Tyr Gly Trp Ser Leu

1 5

<210> 1160

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1160

Ser Leu Lys Ser Ser Ser Asn Val Ile

1 5

<210> 1161

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1161

Ser Trp Lys Tyr Gly Trp Ser Leu Leu

1 5

<210> 1162
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<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1162
Thr Val Ala Asn Gly Arg Ser Trp Lys
1 5

<210> 1163
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1163
Val Pro Gln Val Asn Gly Ile Gln Val
1 5

<210> 1164
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1164
Val Pro Gln Val Asn Gly Ile Gln Val Leu
1 5 10

<210> 1165

<211> 10
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1165

Val Thr Val Ala Asn Gly Arg Ser Trp Lys
1 5 10

<210> 1166

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1166

Trp Ser Leu Leu Arg Val Pro Gln Val
1 5

<210> 1167

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1167

His Pro Gly Asp Cys Leu Ile Phe Lys Leu
1 5 10

<210> 1168

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1168

Lys Leu Arg Val Pro Gly Ser Ser Val
1 5

<210> 1169

<211> 10

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1169

Lys Leu Arg Val Pro Gly Ser Ser Val Leu
1 5 10

<210> 1170

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1170

Arg Val Pro Gly Ser Ser Val Leu Val
1 5

<210> 1171

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1171

Ser Val Leu Val Thr Val Pro Gly Leu

1 5

<210> 1172

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1172

Val Pro Gly Ser Ser Val Leu Val Thr Val

1 5 10

<210> 1173

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1173

Ala Leu Leu Leu Arg Pro Arg Pro Pro Arg

1 5 10

<210> 1174

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1174

Ala Leu Ser Ala Leu Leu Leu Arg Pro Arg
1 5 10

<210> 1175

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1175

Leu Thr Ile Asn Lys Glu Glu Ala Leu
1 5

<210> 1176

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1176

Ile Val His Ser Ala Thr Gly Phe Lys
1 5

<210> 1177

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1177

Ala Thr Gly Phe Lys Gln Ser Ser Lys
1 5

<210> 1178
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1178
Glu Leu Phe Pro Leu Ile Phe Pro Ala
1 5

<210> 1179
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1179
Lys Gly Pro Glu Leu Phe Pro Leu Ile
1 5

<210> 1180
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1180
Lys Gly Pro Glu Leu Phe Pro Leu Ile Phe
1 5 10

<210> 1181
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<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1181

Lys Pro Thr Asp Ala Pro Pro Lys Ala Gly Val
1 5 10

<210> 1182

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1182

Ala Leu Glu Glu Lys Lys Gly Asn Tyr Val
1 5 10

<210> 1183

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1183

Ile Gln Leu Gln Asp Lys Phe Glu His Leu
1 5 10

<210> 1184

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1184

Gln Leu Gln Asp Lys Phe Glu His Leu
1 5

<210> 1185

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1185

Gln Leu Gln Asp Lys Phe Glu His Leu Lys
1 5 10

<210> 1186

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1186

Tyr Leu Val Ile Gln Leu Gln Asp Lys Phe
1 5 10

<210> 1187

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1187
Gln Val Tyr Arg Arg Lys His Gln Glu Leu
1 5 10

<210> 1188
<211> 9
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1188
Ser Thr Arg Glu Lys Asn Ser Gln Val
1 5

<210> 1189
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1189
Val Tyr Arg Arg Lys His Gln Glu Leu
1 5

<210> 1190
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1190
Val Leu Thr Val Thr Ser Thr Asp Val

1

5

<210> 1191
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1191
Val Leu Thr Val Thr Ser Thr Asp Val Lys
1 5 10

<210> 1192
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1192
Ile Met Ser Leu Trp Gly Leu Val Ser
1 5

<210> 1193
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1193
Ile Met Ser Leu Trp Gly Leu Val Ser Lys
1 5 10

<210> 1194
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1194
Lys Leu Lys Gln Glu Ala Thr Ser Lys
1 5

<210> 1195
<211> 9
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<220>
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<400> 1195
Gln Ile Met Ser Leu Trp Gly Leu Val
1 5

<210> 1196
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1196
Ser Gln Ile Met Ser Leu Trp Gly Leu
1 5

<210> 1197
<211> 10
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1197

Ser Gln Ile Met Ser Leu Trp Gly Leu Val
1 5 10

<210> 1198

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1198

Thr Ser Lys Ser Gln Ile Met Ser Leu
1 5

<210> 1199

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1199

Leu Leu Gln Glu Phe Asp Val Gln Glu Ala
1 5 10

<210> 1200

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1200

Leu Gln Glu Phe Asp Val Gln Glu Ala Leu
1 5 10

<210> 1201

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1201

Gly Pro Arg Glu Pro Arg Asn Arg Thr
1 5

<210> 1202

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1202

Arg Asn Arg Thr Glu Lys His Ser Thr Met
1 5 10

<210> 1203

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1203

Ala Leu Asn Ser Glu Ala Leu Ser Val
1 5

<210> 1204

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1204

Ala Leu Asn Ser Glu Ala Leu Ser Val Val
1 5 10

<210> 1205

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1205

Met Ala Leu Asn Ser Glu Ala Leu Ser Val
1 5 10

<210> 1206

<211> 67

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1206

Met Ser Asp Val Ala Ile Val Lys Glu Gly Trp Leu His Lys Arg Gly
1 5 10 15

Lys Tyr Ile Lys Thr Trp Arg Pro Arg Tyr Phe Leu Leu Lys Asn Asp
20 25 30

Gly Thr Phe Ile Gly Tyr Lys Glu Arg Pro Gln Asp Val Asp Gln Arg
35 40 45

Glu Ala Pro Leu Asn Asn Phe Ser Val Ala Gln Cys Gln Leu Met Lys
50 55 60

Thr Glu Arg
65

<210> 1207

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1207

Thr Met Leu Val Leu Glu Gly Ser Gly Asn Leu Val Leu Tyr Thr Gly
1 5 10 15

Val Val Arg Val Gly Lys Val Phe Ile Pro Gly Leu Pro Ala Pro Ser
20 25 30

Leu Thr Met Ser Asn Thr Met Pro Arg Pro Ser Thr Pro Leu Asp Gly
35 40 45

Val Ser Ala Pro Lys Pro Leu Ser Lys Leu Leu Gly Ser Leu Asp Glu
50 55 60

Val Val Leu Leu Ser Pro Val Pro Glu Leu Arg Asp Ser Ser Lys Leu

65 70 75 80

His Asp Ser Leu Tyr Asn Glu Asp Cys Thr Phe Gln Gln Leu Gly Thr
85 90 95

Tyr Ile His Ser Ile
100

<210> 1208
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1208
His Arg Ile Gly Gly Ile Lys Leu Arg His Gln Gln Trp Ser Leu Val
1 5 10 15

Met Glu Ser Val Val Pro Ser Asp Arg Gly Asn Tyr Thr Cys Val Val
20 25 30

Glu Asn Lys Phe Gly Ser Ile Arg Gln Thr Tyr Thr Leu Asp Val Leu
35 40 45

Glu Arg Cys Pro His Arg Pro Ile Leu Gln Ala Gly Leu Pro Ala Asn
50 55 60

Gln Thr Ala Val Leu Gly Ser Asp Val Glu Phe His Cys Lys Val Tyr
65 70 75 80

Ser Asp Ala Gln Pro His Ile Gln Trp Leu Lys His Val Glu Val Asn
85 90 95

Gly Ser Lys Val Gly
100

<210> 1209

<211> 90

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1209

Met Arg Glu Pro Ile Tyr Met His Ser Thr Met Val Phe Leu Pro Trp
1 5 10 15

Glu Leu His Thr Lys Lys Gly Pro Ser Pro Pro Glu Gln Phe Met Ala
20 25 30

Val Lys Leu Ser Asp Ser Arg Thr Ala Leu Lys Ser Gly Tyr Gly Lys
35 40 45

Tyr Leu Gly Ile Asn Ser Asp Glu Leu Val Gly His Ser Asp Ala Ile
50 55 60

Gly Pro Arg Glu Gln Trp Glu Pro Val Phe Gln Asn Gly Lys Met Ala
65 70 75 80

Leu Leu Ala Ser Asn Ser Cys Phe Ile Arg
85 90

<210> 1210

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

polypeptide

<400> 1210

Ala Val Lys Leu Ser Asp Ser Arg Ile Ala Leu Lys Ser Gly Tyr Gly
1 5 10 15

Lys Tyr Leu Gly Ile Asn Ser Asp Glu Leu Val Gly His Ser Asp Ala
20 25 30

Ile Gly Pro Arg Glu Gln Trp Glu Pro Val Phe Gln Asn Gly Lys Met
35 40 45

Ala Leu Ser Ala Ser Asn Ser Cys Phe Ile Arg Cys Asn Glu Ala Gly
50 55 60

Asp Ile Glu Ala Lys Ser Lys Thr Ala Gly Glu Glu Glu Met Ile Lys
65 70 75 80

Ile Arg Ser Cys Ala Glu Lys Glu Thr Lys Lys Lys Asp Asp Ile Pro
85 90 95

Glu Glu Asp Lys Gly
100

<210> 1211

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1211

Ala Met Pro Asn Gln Ala Gln Met Arg Ile Leu Lys Glu Thr Glu Leu
1 5 10 15

Arg Lys Val Lys Val Leu Gly Ser Gly Ala Phe Gly Thr Val Tyr Lys
20 25 30

Gly Ile Trp Ile Pro Asp Gly Glu Asn Val Lys Ile Pro Val Ala Ile
35 40 45

Lys Val Ser Arg Glu Asn Thr Ser Pro Lys Ala Asn Lys Glu Ile Leu
50 55 60

Asp Glu Ala Tyr Val Met Ala Gly Val Gly Ser Pro Tyr Val Ser Arg
65 70 75 80

Leu Leu Gly Ile Cys Leu Thr Ser Thr Val Gln Leu Val Thr Gln Leu
85 90 95

Met Pro Tyr Gly Cys
100

<210> 1212

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1212

Arg Val Glu Glu Phe Lys Leu Lys Gln Met Trp Lys Ser Pro Asn Gly
1 5 10 15

Thr Ile Arg Asn Ile Leu Gly Gly Thr Val Phe Arg Glu Ala Ile Ile
20 25 30

Cys Lys Asn Ile Pro Arg Leu Val Ser Gly Trp Val Lys Pro Ile Ile
35 40 45

Ile Gly Gly His Ala Tyr Gly Asp Gln Tyr Arg Ala Thr Asp Phe Val
50 55 60

Val Pro Gly Pro Gly Lys Val Glu Ile Thr Tyr Thr Pro Ser Asp Gly
65 70 75 80

Thr Gln Lys Val Thr Tyr Leu Val His Asn Phe Glu Glu Gly Gly Gly
85 90 95

Val Ala Met Gly Met
100

<210> 1213

<211> 62

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1213

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr
20 25 30

Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
35 40 45

Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Gln Glu
50 55 60

<210> 1214

<211> 62

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1214

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr
20 25 30

Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
35 40 45

Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Gln Glu
50 55 60

<210> 1215

<211> 62

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1215

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr
20 25 30

Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
35 40 45

Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Gln Glu
50 55 60

<210> 1216

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1216

Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn
1 5 10 15

His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
35 40 45

Ala Gly His Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr
50 55 60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Thr Lys Ser Phe
65 70 75 80

Glu Asp Ile His His Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
85 90 95

Glu Asp Val Pro Met
100

<210> 1217

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1217

Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn
1 5 10 15

His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
35 40 45

Ala Gly Leu Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr
50 55 60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Thr Lys Ser Phe
65 70 75 80

Glu Asp Ile His His Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
85 90 95

Glu Asp Val Pro Met
100

<210> 1218

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1218

Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn
1 5 10 15

His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
35 40 45

Ala Gly Lys Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr
50 55 60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Ser Lys Ser Phe
65 70 75 80

Ala Asp Ile Asn Leu Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
85 90 95

Asp Asp Val Pro Met
100

<210> 1219

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1219

Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn
1 5 10 15

His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
35 40 45

Ala Gly Arg Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr
50 55 60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Ser Lys Ser Phe
65 70 75 80

Ala Asp Ile Asn Leu Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
85 90 95

Asp Asp Val Pro Met
100

<210> 1220
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1220
Ile Glu Glu His Ala Asn Trp Ser Val Ser Arg Glu Ala Gly Phe Ser
1 5 10 15

Tyr Ser His Ala Gly Leu Ser Asn Arg Leu Ala Arg Asp Asn Glu Leu
20 25 30

Arg Glu Asn Asp Lys Glu Gln Leu Lys Ala Ile Ser Thr Arg Asp Pro
35 40 45

Leu Ser Lys Ile Thr Glu Gln Glu Lys Asp Phe Leu Trp Ser His Arg

50

55

60

His	Tyr	Cys	Val	Thr	Ile	Pro	Glu	Ile	Leu	Pro	Lys	Leu	Leu	Leu	Ser
65					70					75					80

Val	Lys	Trp	Asn	Ser	Arg	Asp	Glu	Val	Ala	Gln	Met	Tyr	Cys	Leu	Val
				85					90					95	

Lys	Asp	Trp	Pro	Pro
			100	

<210> 1221

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1221

Lys	Phe	Asn	Cys	Arg	Val	Ala	Gln	Tyr	Pro	Phe	Glu	Asp	His	Asn	Pro
1				5					10					15	

Pro	Gln	Leu	Glu	Leu	Ile	Lys	Pro	Phe	Cys	Glu	Asp	Leu	Asp	Gln	Trp
			20					25						30	

Leu	Ser	Glu	Asp	Asp	Asn	His	Val	Ala	Ala	Ile	His	Cys	Lys	Ala	Gly
		35					40					45			

Lys	Gly	Gln	Thr	Gly	Val	Met	Ile	Cys	Ala	Tyr	Leu	Leu	His	Arg	Gly
	50					55					60				

Lys	Phe	Leu	Lys	Ala	Gln	Glu	Ala	Leu	Asp	Phe	Tyr	Gly	Glu	Val	Arg
65					70					75					80

Thr Arg Asp Lys Lys Gly Val Thr Ile Pro Ser Gln Arg Arg Tyr Val
85 90 95

Tyr Tyr Tyr Ser Tyr
100

<210> 1222

<211> 79

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1222

Met Gln Ala Ile Lys Cys Val Val Val Gly Asp Gly Ala Val Gly Lys
1 5 10 15

Thr Cys Leu Leu Ile Ser Tyr Thr Thr Asn Ala Phe Ser Gly Glu Tyr
20 25 30

Ile Pro Thr Val Phe Asp Asn Tyr Ser Ala Asn Val Met Val Asp Gly
35 40 45

Lys Pro Val Asn Leu Gly Leu Trp Asp Thr Ala Gly Gln Glu Asp Tyr
50 55 60

Asp Arg Leu Arg Pro Leu Ser Tyr Pro Gln Thr Val Gly Glu Thr
65 70 75

<210> 1223

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

polypeptide

<400> 1223

Ala Val Cys Lys Ser Lys Lys Ser Trp Gln Ala Arg His Thr Gly Ile
1 5 10 15

Lys Ile Val Gln Gln Ile Ala Ile Leu Met Gly Cys Ala Ile Leu Pro
20 25 30

His Leu Arg Ser Leu Val Glu Ile Ile Glu His Gly Leu Val Asp Glu
35 40 45

Gln Gln Glu Val Arg Thr Ile Ser Ala Leu Ala Ile Ala Ala Leu Ala
50 55 60

Glu Ala Ala Thr Pro Tyr Gly Ile Glu Ser Phe Asp Ser Val Leu Lys
65 70 75 80

Pro Leu Trp Lys Gly Ile Arg Gln His Arg Gly Lys Gly Leu Ala Ala
85 90 95

Phe Leu Lys Ala Ile
100

<210> 1224

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1224

Tyr Leu Ser Leu Tyr Leu Leu Leu Val Ser Cys Pro Lys Ser Glu Val
1 5 10 15

Arg Ala Lys Phe Lys Phe Ser Ile Leu Asn Ala Lys Gly Glu Glu Thr
20 25 30

Lys Ala Met Glu Ser Gln Arg Ala Tyr Arg Phe Val Gln Gly Lys Asp
35 40 45

Trp Gly Leu Lys Lys Phe Ile Arg Arg Asp Phe Leu Leu Asp Glu Ala
50 55 60

Asn Gly Leu Leu Pro Asp Asp Lys Leu Thr Leu Phe Cys Glu Val Ser
65 70 75 80

Val Val Gln Asp Ser Val Asn Ile Ser Gly Gln Asn Thr Met Asn Met
85 90 95

Val Lys Val Pro Glu
100

<210> 1225

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1225

Tyr Leu Ser Leu Tyr Leu Leu Leu Val Ser Cys Pro Lys Ser Glu Val
1 5 10 15

Arg Ala Lys Phe Lys Phe Ser Ile Leu Asn Ala Lys Gly Glu Glu Thr
20 25 30

Lys Ala Met Glu Ser Gln Arg Ala Tyr Arg Phe Val Gln Gly Lys Asp
35 40 45

Trp Gly Val Lys Lys Phe Ile Arg Arg Asp Phe Leu Leu Asp Glu Ala
50 55 60

Asn Gly Leu Leu Pro Asp Asp Lys Leu Thr Leu Phe Cys Glu Val Ser
65 70 75 80

Val Val Gln Asp Ser Val Asn Ile Ser Gly Gln Asn Thr Met Asn Met
85 90 95

Val Lys Val Pro Glu
100

<210> 1226

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1226

Ile Arg Val Glu Gly Asn Leu Arg Val Glu Tyr Leu Asp Asp Arg Asn
1 5 10 15

Thr Phe Arg His Ser Val Val Val Pro Tyr Glu Pro Pro Glu Val Gly
20 25 30

Ser Asp Cys Thr Thr Ile His Tyr Asn Tyr Met Cys Asn Ser Ser Cys
35 40 45

Met Gly Ser Met Asn Arg Arg Pro Ile Leu Thr Ile Ile Thr Leu Glu
50 55 60

Asp Ser Ser Gly Asn Leu Leu Gly Arg Asn Ser Phe Glu Val Arg Val
65 70 75 80

Cys Ala Cys Pro Gly Arg Asp Arg Arg Thr Glu Glu Glu Asn Leu Arg
85 90 95

Lys Lys Gly Glu Pro
100

<210> 1227

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1227

Glu Gly Asn Leu Arg Val Glu Tyr Leu Asp Asp Arg Asn Thr Phe Arg
1 5 10 15

His Ser Val Val Val Pro Tyr Glu Pro Pro Glu Val Gly Ser Asp Cys
20 25 30

Thr Thr Ile His Tyr Asn Tyr Met Cys Asn Ser Ser Cys Met Gly Gly
35 40 45

Met Asn Gln Arg Pro Ile Leu Thr Ile Ile Thr Leu Glu Asp Ser Ser
50 55 60

Gly Asn Leu Leu Gly Arg Asn Ser Phe Glu Val Arg Val Cys Ala Cys
65 70 75 80

Pro Gly Arg Asp Arg Arg Thr Glu Glu Glu Asn Leu Arg Lys Lys Gly
85 90 95

Glu Pro His His Glu

<210> 1228

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1228

Glu Gly Asn Leu Arg Val Glu Tyr Leu Asp Asp Arg Asn Thr Phe Arg
1 5 10 15

His Ser Val Val Val Pro Tyr Glu Pro Pro Glu Val Gly Ser Asp Cys
20 25 30

Thr Thr Ile His Tyr Asn Tyr Met Cys Asn Ser Ser Cys Met Gly Gly
35 40 45

Met Asn Trp Arg Pro Ile Leu Thr Ile Ile Thr Leu Glu Asp Ser Ser
50 55 60

Gly Asn Leu Leu Gly Arg Asn Ser Phe Glu Val Arg Val Cys Ala Cys
65 70 75 80

Pro Gly Arg Asp Arg Arg Thr Glu Glu Glu Asn Leu Arg Lys Lys Gly
85 90 95

Glu Pro His His Glu
100

<210> 1229

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1229

Pro Glu Val Gly Ser Asp Cys Thr Thr Ile His Tyr Asn Tyr Met Cys
1 5 10 15

Asn Ser Ser Cys Met Gly Gly Met Asn Arg Arg Pro Ile Leu Thr Ile
20 25 30

Ile Thr Leu Glu Asp Ser Ser Gly Asn Leu Leu Gly Arg Asn Ser Phe
35 40 45

Glu Val Cys Val Cys Ala Cys Pro Gly Arg Asp Arg Arg Thr Glu Glu
50 55 60

Glu Asn Leu Arg Lys Lys Gly Glu Pro His His Glu Leu Pro Pro Gly
65 70 75 80

Ser Thr Lys Arg Ala Leu Pro Asn Asn Thr Ser Ser Ser Pro Gln Pro
85 90 95

Lys Lys Lys Pro Leu
100

<210> 1230

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1230

Pro Glu Val Gly Ser Asp Cys Thr Thr Ile His Tyr Asn Tyr Met Cys

1 5 10 15
 Asn Ser Ser Cys Met Gly Gly Met Asn Arg Arg Pro Ile Leu Thr Ile
 20 25 30
 Ile Thr Leu Glu Asp Ser Ser Gly Asn Leu Leu Gly Arg Asn Ser Phe
 35 40 45
 Glu Val His Val Cys Ala Cys Pro Gly Arg Asp Arg Arg Thr Glu Glu
 50 55 60
 Glu Asn Leu Arg Lys Lys Gly Glu Pro His His Glu Leu Pro Pro Gly
 65 70 75 80
 Ser Thr Lys Arg Ala Leu Pro Asn Asn Thr Ser Ser Ser Pro Gln Pro
 85 90 95

 Lys Lys Lys Pro Leu
 100

<210> 1231
 <211> 101
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1231
 Thr Glu Val Val Arg Arg Cys Pro His His Glu Arg Cys Ser Asp Ser
 1 5 10 15

Asp Gly Leu Ala Pro Pro Gln His Leu Ile Arg Val Glu Gly Asn Leu
 20 25 30

Arg Val Glu Tyr Leu Asp Asp Arg Asn Thr Phe Arg His Ser Val Val
35 40 45

Val Pro Cys Glu Pro Pro Glu Val Gly Ser Asp Cys Thr Thr Ile His
50 55 60

Tyr Asn Tyr Met Cys Asn Ser Ser Cys Met Gly Gly Met Asn Arg Arg
65 70 75 80

Pro Ile Leu Thr Ile Ile Thr Leu Glu Asp Ser Ser Gly Asn Leu Leu
85 90 95

Gly Arg Asn Ser Phe
100

<210> 1232

<211> 54

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1232

Tyr Asn Phe Asp Lys Asn Tyr Lys Asp Trp Gln Ser Ala Val Glu Cys
1 5 10 15

Ile Ala Val Leu Asp Val Leu Leu Cys Leu Ala Asn Tyr Ser Arg Gly
20 25 30

Gly Asp Gly Pro Met Cys Arg Pro Val Ile Leu Leu Pro Glu Asp Thr
35 40 45

Pro Pro Leu Leu Arg Ala
50

<210> 1233
<211> 93
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1233
Ala Lys Phe Gln Gln Cys His Ser Thr Leu Glu Pro Asn Pro Ala Asp
1 5 10 15

Cys Arg Val Leu Val Tyr Leu Gln Asn Gln Pro Gly Thr Lys Leu Leu
20 25 30

Asn Phe Leu Gln Glu Arg Asn Leu Pro Pro Lys Val Val Leu Arg His
35 40 45

Pro Lys Val His Leu Asn Thr Met Phe Arg Arg Pro His Ser Cys Leu
50 55 60

Ala Asp Val Leu Leu Ser Val His Leu Ile Val Leu Arg Val Val Arg
65 70 75 80

Leu Pro Ala Pro Phe Arg Val Asn His Ala Val Glu Trp
85 90

<210> 1234
<211> 179
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1234

Ala Leu Gly Pro His Ser Arg Ile Ser Cys Leu Pro Thr Gln Thr Arg
 1 5 10 15

Gly Cys Ile Leu Leu Ala Ala Thr Pro Arg Ser Ser Ser Ser Ser Ser
 20 25 30

Ser Asn Asp Met Ile Pro Met Ala Ile Ser Ser Pro Pro Lys Ala Pro
 35 40 45

Leu Leu Ala Ala Pro Ser Pro Ala Ser Arg Leu Gln Cys Ile Asn Ser
 50 55 60

Asn Ser Arg Ile Thr Ser Gly Gln Trp Met Ala His Met Ala Leu Leu
 65 70 75 80

Pro Ser Gly Thr Lys Gly Arg Cys Thr Ala Cys His Thr Ala Leu Gly
 85 90 95

Arg Gly Ser Leu Ser Ser Ser Ser Cys Pro Gln Pro Ser Pro Ser Leu
 100 105 110

Pro Ala Ser Asn Lys Leu Pro Ser Leu Pro Leu Ser Lys Met Tyr Thr
 115 120 125

Thr Ser Met Ala Met Pro Ile Leu Pro Leu Pro Gln Leu Leu Leu Ser
 130 135 140

Ala Asp Gln Gln Ala Ala Pro Arg Thr Asn Phe His Ser Ser Leu Ala
 145 150 155 160

Glu Thr Val Ser Leu His Pro Leu Ala Pro Met Pro Ser Lys Thr Cys
 165 170 175

His His Lys

<210> 1235

<211> 67

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1235

Arg Ser Tyr Arg Arg Met Ile His Leu Trp Trp Thr Ala Gln Ile Ser
1 5 10 15

Leu Gly Val Cys Arg Ser Leu Thr Val Ala Cys Cys Thr Gly Gly Leu
20 25 30

Val Gly Gly Thr Pro Leu Ser Ile Ser Arg Pro Thr Ser Arg Ala Arg
35 40 45

Gln Ser Cys Cys Leu Pro Gly Leu Thr His Pro Ala His Gln Pro Leu
50 55 60

Gly Ser Met
65

<210> 1236

<211> 60

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1236

Gln His Ser Gly Arg Asp Val Ser Leu Arg Gly Leu Ser Cys Ala Arg
1 5 10 15

Ala Thr Leu Ser Phe Trp Pro Gly Gly Tyr Pro Ala Tyr Ser Lys Asp
20 25 30

Ser Gly Leu Leu Thr Ser Ser Ser Arg Glu Trp Lys Val Lys Phe Pro
35 40 45

Glu Leu Leu Cys Val Trp Val Ser Ser Ile Arg His
50 55 60

<210> 1237

<211> 48

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1237

Ala Gln Ala Lys Ala Val Cys Ser Gln Glu Ser Arg Asp Val Leu Cys
1 5 10 15

Glu Leu Ser Asp His His Asn His Thr Leu Glu Glu Glu Cys Gln Trp
20 25 30

Gly Pro Cys Leu Gln Cys Leu Trp Ala Leu Leu Gln Ala Ser Gln Tyr
35 40 45

<210> 1238

<211> 113

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1238

Pro Gly Arg Pro Leu Gln Thr His Val Leu Pro Glu Pro His Leu Ala
1 5 10 15

Leu Gln Pro Leu Gln Pro His Ala Asp His Ala His Ala Asp Ala Pro
20 25 30

Ala Ile Gln Pro Val Leu Trp Thr Thr Pro Pro Leu Gln His Gly His
35 40 45

Arg His Gly Leu Glu Pro Cys Ser Met Leu Thr Gly Pro Pro Ala Arg
50 55 60

Val Pro Ala Val Pro Phe Asp Leu His Phe Cys Arg Ser Ser Ile Met
65 70 75 80

Lys Pro Lys Arg Asp Gly Tyr Met Phe Leu Lys Ala Glu Ser Lys Ile
85 90 95

Met Phe Ala Thr Leu Gln Arg Ser Ser Leu Trp Cys Leu Cys Ser Asn
100 105 110

His

<210> 1239

<211> 494

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1239

Thr Arg Arg Cys His Cys Cys Pro His Leu Arg Ser His Pro Cys Pro
1 5 10 15

His His Leu Arg Asn His Pro Arg Pro His His Leu Arg His His Ala
20 25 30

Cys His His His Leu Arg Asn Cys Pro His Pro His Phe Leu Arg His
35 40 45

Cys Thr Cys Pro Gly Arg Trp Arg Asn Arg Pro Ser Leu Arg Arg Leu
50 55 60

Arg Ser Leu Leu Cys Leu Pro His Leu Asn His His Leu Phe Leu His
65 70 75 80

Trp Arg Ser Arg Pro Cys Leu His Arg Lys Ser His Pro His Leu Leu
85 90 95

His Leu Arg Arg Leu Tyr Pro His His Leu Lys His Arg Pro Cys Pro
100 105 110

His His Leu Lys Asn Leu Leu Cys Pro Arg His Leu Arg Asn Cys Pro
115 120 125

Leu Pro Arg His Leu Lys His Leu Ala Cys Leu His His Leu Arg Ser
130 135 140

His Pro Cys Pro Leu His Leu Lys Ser His Pro Cys Leu His His Arg
145 150 155 160

Arg His Leu Val Cys Ser His His Leu Lys Ser Leu Leu Cys Pro Leu
165 170 175

His Leu Arg Ser Leu Pro Phe Pro His His Leu Arg His His Ala Cys
180 185 190

Pro His His Leu Arg Thr Arg Leu Cys Pro His His Leu Lys Asn His
195 200 205

Leu Cys Pro Pro His Leu Arg Tyr Arg Ala Tyr Pro Pro Cys Leu Trp
210 215 220

Cys His Ala Cys Leu His Arg Leu Arg Asn Leu Pro Cys Pro His Arg
225 230 235 240

Leu Arg Ser Leu Pro Arg Pro Leu His Leu Arg Leu His Ala Ser Pro
245 250 255

His His Leu Arg Thr Pro Pro His Pro His His Leu Arg Thr His Leu
260 265 270

Leu Pro His His Arg Arg Thr Arg Ser Cys Pro Cys Arg Trp Arg Ser
275 280 285

His Pro Cys Cys His Tyr Leu Arg Ser Arg Asn Ser Ala Pro Gly Pro
290 295 300

Arg Gly Arg Thr Cys His Pro Gly Leu Arg Ser Arg Thr Cys Pro Pro
305 310 315 320

Gly Leu Arg Ser His Thr Tyr Leu Arg Arg Leu Arg Ser His Thr Cys
325 330 335

Pro Pro Ser Leu Arg Ser His Ala Tyr Ala Leu Cys Leu Arg Ser His
340 345 350

Thr Cys Pro Pro Arg Leu Arg Asp His Ile Cys Pro Leu Ser Leu Arg
355 360 365

Asn Cys Thr Cys Pro Pro Arg Leu Arg Ser Arg Thr Cys Leu Leu Cys
370 375 380

Leu Arg Ser His Ala Cys Pro Pro Asn Leu Arg Asn His Thr Cys Pro
385 390 395 400

Pro Ser Leu Arg Ser His Ala Cys Pro Pro Gly Leu Arg Asn Arg Ile
405 410 415

Cys Pro Leu Ser Leu Arg Ser His Pro Cys Pro Leu Gly Leu Lys Ser
420 425 430

Pro Leu Arg Ser Gln Ala Asn Ala Leu His Leu Arg Ser Cys Pro Cys
435 440 445

Ser Leu Pro Leu Gly Asn His Pro Tyr Leu Pro Cys Leu Glu Ser Gln
450 455 460

Pro Cys Leu Ser Leu Gly Asn His Leu Cys Pro Leu Cys Pro Arg Ser
465 470 475 480

Cys Arg Cys Pro His Leu Gly Ser His Pro Cys Arg Leu Ser
485 490

<210> 1240

<211> 35

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1240

Gly Pro Arg Ser His Pro Leu Pro Arg Leu Trp His Leu Leu Leu Gln
1 5 10 15

Val Thr Gln Thr Ser Phe Ala Leu Ala Pro Thr Leu Thr His Met Leu
20 25 30

Ser Pro His
35

<210> 1241

<211> 172

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1241

Pro Leu Gly Leu Val Pro Trp Thr Arg Trp Cys Pro Gln Gly Lys Pro
1 5 10 15

Arg Phe Pro Ala Met Ser Thr Thr Thr Ala Thr Gly Thr Thr Thr Thr
20 25 30

Lys Ser Gly Ser Ser Gly Met Ala Gly Ser Leu Ala Gln Lys Pro Glu
35 40 45

Ser Pro Ser Pro Gly Leu Leu Phe Leu Gly His Ser Pro Ser Gln Ser
50 55 60

His Leu Leu Leu Ile Ser Lys Ser Pro Asp Pro Thr Gln Gln Pro Leu
65 70 75 80

Arg Gly Gly Ser Leu Thr His Ser Ala Pro Gly Pro Ser Leu Ser Gln
85 90 95

Pro Leu Ala Gln Leu Thr Pro Pro Ala Ser Ala Pro Val Pro Ala Val
100 105 110

Cys Ser Thr Cys Lys Asn Pro Ala Ser Leu Pro Asp Thr His Arg Gly
115 120 125

Lys Gly Gly Gly Val Pro Pro Ser Pro Pro Leu Ala Leu Gly Pro Arg
130 135 140

Met Gln Leu Cys Thr Gln Leu Ala Arg Phe Phe Pro Ile Thr Pro Pro
145 150 155 160

Val Trp His Ile Leu Gly Pro Gln Arg His Thr Pro
165 170

<210> 1242

<211> 97

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1242

Lys Tyr Glu Lys Lys Lys Tyr Tyr Asp Lys Asn Ala Ile Ala Ile Thr
1 5 10 15

Asn Ile Ser Ser Ser Asp Ala Pro Leu Gln Pro Leu Val Ser Ser Pro
20 25 30

Ser Leu Gln Ala Ala Val Asp Lys Asn Lys Leu Glu Lys Glu Lys Glu
35 40 45

Lys Lys Arg Lys Arg Lys Arg Glu Lys Arg Ser Gln Lys Ser Arg Gln
50 55 60

Asn His Leu Gln Leu Lys Ser Cys Arg Arg Lys Ile Ser Asn Trp Ser

65

70

75

80

Leu Lys Lys Val Pro Ala Leu Lys Lys Leu Arg Ser Pro Leu Trp Ile
85 90 95

Phe

<210> 1243
<211> 78
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1243
Cys Cys Pro Arg Thr Ile Leu Asn Asn Gly Ser Leu Lys Thr Gln Val
1 5 10 15

Gln Met Lys Leu Pro Glu Cys Gln Arg Leu Leu Pro Pro Trp Pro Leu
20 25 30

His Gln Gln Leu Leu His Arg Arg Pro Leu His Gln Pro Pro Pro Gly
35 40 45

Pro Cys His Leu Leu Ser Leu Pro Arg Lys Pro Thr Arg Ala Ala Thr
50 55 60

Val Ser Val Trp Ala Ser Cys Ile Leu Gly Gln Pro Ser Leu
65 70 75

<210> 1244
<211> 46
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1244

Leu Ala Arg Thr Pro Leu Pro Ser Thr Arg Cys Phe Ala Asn Trp Pro
1 5 10 15

Arg Pro Ala Leu Cys Ser Cys Gly Leu Ile Pro His Pro Arg Pro Ala
20 25 30

Pro Ala Ser Ala Pro Trp Pro Ser Thr Ser Ser His Ser Thr
35 40 45

<210> 1245

<211> 77

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1245

Ser Gln Gly Leu Tyr Ser Ser Ser Ala Ser Ser Gly Lys Cys Leu Met
1 5 10 15

Glu Val Thr Val Asp Arg Asn Cys Leu Glu Val Leu Pro Thr Lys Met
20 25 30

Ser Tyr Ala Ala Asn Leu Lys Asn Val Met Asn Met Gln Asn Arg Gln
35 40 45

Lys Lys Lys Gly Lys Asn Ser Pro Cys Cys Gln Lys Lys Leu Arg Val
50 55 60

Gln Asn Gln Gly His Leu Leu Met Ile Leu Leu His Asn

65

70

75

<210> 1246

<211> 91

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1246

Thr Arg Ala Ser Pro Pro Arg Ser Ser Ser Ala Ile Ala Val Arg Ala
1 5 10 15

Ser Cys Cys Pro Tyr Gly Ser Thr Ser Thr Ala Ser Arg Ser Pro Thr
20 25 30

Gln Arg Cys Arg Leu Ala Arg Ala Ala Ala Ser Thr Ala Thr Glu Val
35 40 45

Thr Phe Gly Ser Ser Glu Met Gln Gly His Thr Met Gly Phe Trp Leu
50 55 60

Thr Lys Leu Asn Tyr Leu Cys His Leu Ser Met Leu Thr Asp Ser Leu
65 70 75 80

Phe Leu Pro Ile Ser His Cys Gln Cys Ile Leu
85 90

<210> 1247

<211> 104

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1247

Leu Gly Ser Gly Ala Phe Gly Thr Val Tyr Lys Gly Ile Trp Ile Pro
1 5 10 15

Asp Gly Glu Asn Val Lys Ile Pro Val Ala Ile Lys Val Leu Arg Glu
20 25 30

Asn Thr Ser Pro Lys Ala Asn Lys Glu Ile Leu Asp Glu Ala Tyr Val
35 40 45

Met Ala Tyr Val Met Ala Gly Val Gly Ser Pro Tyr Val Ser Arg Leu
50 55 60

Leu Gly Ile Cys Leu Thr Ser Thr Val Gln Leu Val Thr Gln Leu Met
65 70 75 80

Pro Tyr Gly Cys Leu Leu Asp His Val Arg Glu Asn Arg Gly Arg Leu
85 90 95

Gly Ser Gln Asp Leu Leu Asn Trp
100

<210> 1248

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1248

Lys Tyr Ile Lys Thr Trp Arg Pro Arg Tyr
1 5 10

<210> 1249

<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1249
Trp Leu His Lys Arg Gly Lys Tyr Ile
1 5

<210> 1250
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1250
Trp Leu His Lys Arg Gly Lys Tyr Ile Lys
1 5 10

<210> 1251
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1251
Ala Pro Lys Pro Leu Ser Lys Leu Leu
1 5

<210> 1252
<211> 10
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1252

Gly Val Ser Ala Pro Lys Pro Leu Ser Lys
1 5 10

<210> 1253

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1253

Val Ser Ala Pro Lys Pro Leu Ser Lys
1 5

<210> 1254

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1254

Cys Pro His Arg Pro Ile Leu Gln Ala
1 5

<210> 1255

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1255

Lys Leu Ser Asp Ser Arg Thr Ala Leu
1 5

<210> 1256

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1256

Lys Leu Ser Asp Ser Arg Thr Ala Leu Lys
1 5 10

<210> 1257

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1257

Leu Ser Asp Ser Arg Thr Ala Leu Lys
1 5

<210> 1258

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1258

Arg Thr Ala Leu Lys Ser Gly Tyr Gly Lys
1 5 10

<210> 1259

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1259

Thr Ala Leu Lys Ser Gly Tyr Gly Lys
1 5

<210> 1260

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1260

Ala Leu Ser Ala Ser Asn Ser Cys Phe
1 5

<210> 1261

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1261

Ala Leu Ser Ala Ser Asn Ser Cys Phe Ile
1 5 10

<210> 1262
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1262
Phe Gln Asn Gly Lys Met Ala Leu Ser Ala
1 5 10

<210> 1263
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1263
Lys Val Ser Arg Glu Asn Thr Ser Pro Lys
1 5 10

<210> 1264
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1264
Lys Pro Ile Ile Ile Gly Gly His Ala Tyr
1 5 10

<210> 1265
<211> 10

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1265

Lys Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 1266

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1266

Leu Val Val Val Gly Ala Cys Gly Val
1 5

<210> 1267

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1267

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 1268

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1268

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 1269

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1269

Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 1270

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1270

Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 1271

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1271
Lys Leu Val Val Val Gly Ala Asp Gly Val
1 5 10

<210> 1272
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1272
Leu Val Val Val Gly Ala Asp Gly Val
1 5

<210> 1273
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1273
Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 1274
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1274
Leu Val Val Val Gly Ala Val Gly Val

1

5

<210> 1275

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1275

Val Val Gly Ala Val Gly Val Gly Lys

1

5

<210> 1276

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1276

Val Val Val Gly Ala Val Gly Val Gly Lys

1

5

10

<210> 1277

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1277

Ile Leu Asp Thr Ala Gly His Glu Glu Tyr

1

5

10

<210> 1278
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1278
Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1279
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1279
Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5 10

<210> 1280
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1280
Ile Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5 10

<210> 1281
<211> 10
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1281

Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5 10

<210> 1282

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1282

Ala Ile Ser Thr Arg Asp Pro Leu Ser Lys
1 5 10

<210> 1283

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1283

Gln Thr Gly Val Met Ile Cys Ala Tyr
1 5

<210> 1284

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1284

Phe Ser Gly Glu Tyr Ile Pro Thr Val
1 5

<210> 1285

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1285

Thr Thr Asn Ala Phe Ser Gly Glu Tyr
1 5

<210> 1286

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1286

Tyr Thr Thr Asn Ala Phe Ser Gly Glu Tyr
1 5 10

<210> 1287

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1287

Gly Leu Val Asp Glu Gln Gln Glu Val

1 5

<210> 1288

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1288

Phe Val Gln Gly Lys Asp Trp Gly Leu

1 5

<210> 1289

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1289

Phe Val Gln Gly Lys Asp Trp Gly Val

1 5

<210> 1290

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1290

Cys Met Gly Ser Met Asn Arg Arg Pro Ile

1 5 10

<210> 1291
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1291
Gly Ser Met Asn Arg Arg Pro Ile Leu
1 5

<210> 1292
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1292
Met Gly Ser Met Asn Arg Arg Pro Ile
1 5

<210> 1293
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1293
Met Gly Ser Met Asn Arg Arg Pro Ile Leu
1 5 10

<210> 1294

<211> 10
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1294

Ser Met Asn Arg Arg Pro Ile Leu Thr Ile
1 5 10

<210> 1295

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1295

Cys Met Gly Gly Met Asn Gln Arg Pro Ile
1 5 10

<210> 1296

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1296

Gly Met Asn Gln Arg Pro Ile Leu Thr Ile
1 5 10

<210> 1297

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1297

Asn Gln Arg Pro Ile Leu Thr Ile Ile
1 5

<210> 1298

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1298

Cys Met Gly Gly Met Asn Trp Arg Pro Ile
1 5 10

<210> 1299

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1299

Gly Met Asn Trp Arg Pro Ile Leu Thr Ile
1 5 10

<210> 1300

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1300

Met Asn Trp Arg Pro Ile Leu Thr Ile
1 5

<210> 1301

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1301

Met Asn Trp Arg Pro Ile Leu Thr Ile Ile
1 5 10

<210> 1302

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1302

Asn Ser Phe Glu Val Cys Val Cys Ala
1 5

<210> 1303

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1303

Asn Ser Phe Glu Val His Val Cys Ala
1 5

<210> 1304

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1304

Val Val Pro Cys Glu Pro Pro Glu Val

1 5

<210> 1305

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1305

Val Val Val Pro Cys Glu Pro Pro Glu Val

1 5 10

<210> 1306

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1306

Ile Leu Leu Pro Glu Asp Thr Pro Pro Leu

1 5 10

<210> 1307
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1307
Leu Leu Pro Glu Asp Thr Pro Pro Leu
1 5

<210> 1308
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1308
Ala Pro Phe Arg Val Asn His Ala Val
1 5

<210> 1309
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1309
Cys Leu Ala Asp Val Leu Leu Ser Val
1 5

<210> 1310
<211> 10

<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1310
Phe Leu Gln Glu Arg Asn Leu Pro Pro Lys
1 5 10

<210> 1311
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1311
His Leu Ile Val Leu Arg Val Val Arg Leu
1 5 10

<210> 1312
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1312
His Pro Lys Val His Leu Asn Thr Met
1 5

<210> 1313
<211> 10
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1313

His Pro Lys Val His Leu Asn Thr Met Phe
1 5 10

<210> 1314

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1314

Lys Val His Leu Asn Thr Met Phe Arg
1 5

<210> 1315

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1315

Lys Val His Leu Asn Thr Met Phe Arg Arg
1 5 10

<210> 1316

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1316
Leu Pro Ala Pro Phe Arg Val Asn His Ala
1 5 10

<210> 1317
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1317
Met Phe Arg Arg Pro His Ser Cys Leu
1 5

<210> 1318
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1318
Met Phe Arg Arg Pro His Ser Cys Leu Ala
1 5 10

<210> 1319
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1319
Asn Thr Met Phe Arg Arg Pro His Ser Cys

1

5

10

<210> 1320

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1320

Arg Pro His Ser Cys Leu Ala Asp Val

1

5

<210> 1321

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1321

Arg Pro His Ser Cys Leu Ala Asp Val Leu

1

5

10

<210> 1322

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1322

Arg Val Val Arg Leu Pro Ala Pro Phe Arg

1

5

10

<210> 1323
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1323
Ser Val His Leu Ile Val Leu Arg Val
1 5

<210> 1324
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1324
Thr Met Phe Arg Arg Pro His Ser Cys
1 5

<210> 1325
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1 5 10

<210> 1326
<211> 9
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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

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Val Leu Leu Ser Val His Leu Ile Val
1 5

<210> 1327

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1327

Val Leu Leu Ser Val His Leu Ile Val Leu
1 5 10

<210> 1328

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

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Val Leu Arg Val Val Arg Leu Pro Ala
1 5

<210> 1329

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1329

Val Val Arg Leu Pro Ala Pro Phe Arg
1 5

<210> 1330

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

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Ala Met Pro Ile Leu Pro Leu Pro Gln Leu
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<210> 1331

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1331

Ala Pro Leu Leu Ala Ala Pro Ser Pro Ala
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<210> 1332

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

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Ala Pro Arg Thr Asn Phe His Ser Ser
1 5

<210> 1333

<211> 10

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<220>

<223> Description of Artificial Sequence: Synthetic
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Ala Pro Arg Thr Asn Phe His Ser Ser Leu
1 5 10

<210> 1334

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
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Cys Pro Gln Pro Ser Pro Ser Leu Pro Ala
1 5 10

<210> 1335

<211> 9

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<220>

<223> Description of Artificial Sequence: Synthetic
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Gly Gln Trp Met Ala His Met Ala Leu
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<210> 1336
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<220>
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<400> 1336
Gly Gln Trp Met Ala His Met Ala Leu Leu
1 5 10

<210> 1337
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<220>
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His Met Ala Leu Leu Pro Ser Gly Thr Lys
1 5 10

<210> 1338
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<220>
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1 5

<210> 1339

<211> 9
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<220>
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Ile Pro Met Ala Ile Ser Ser Pro Pro
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<210> 1340
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1 5 10

<210> 1341
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<220>
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Lys Leu Pro Ser Leu Pro Leu Ser Lys
1 5

<210> 1342
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1342

Lys Leu Pro Ser Leu Pro Leu Ser Lys Met
1 5 10

<210> 1343

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1343

Lys Met Tyr Thr Thr Ser Met Ala Met
1 5

<210> 1344

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

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Leu Leu Ala Ala Pro Ser Pro Ala Ser Arg
1 5 10

<210> 1345

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1345

Leu Leu Leu Ser Ala Asp Gln Gln Ala Ala
1 5 10

<210> 1346

<211> 9

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1346

Leu Leu Ser Ala Asp Gln Gln Ala Ala
1 5

<210> 1347

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1347

Leu Pro Ala Ser Asn Lys Leu Pro Ser
1 5

<210> 1348

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1348

Leu Pro Ala Ser Asn Lys Leu Pro Ser Leu
1 5 10

<210> 1349

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1349

Leu Pro Leu Pro Gln Leu Leu Leu Ser Ala
1 5 10

<210> 1350

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
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<400> 1350

Leu Pro Ser Leu Pro Leu Ser Lys Met
1 5

<210> 1351

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1351

Leu Ser Lys Met Tyr Thr Thr Ser Met
1 5

<210> 1352
<211> 9
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<220>
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<400> 1352
Met Ala Leu Leu Pro Ser Gly Thr Lys
1 5

<210> 1353
<211> 9
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<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1353
Met Pro Ile Leu Pro Leu Pro Gln Leu
1 5

<210> 1354
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1354
Met Pro Ile Leu Pro Leu Pro Gln Leu Leu
1 5 10

<210> 1355
<211> 10

<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1355

Met Tyr Thr Thr Ser Met Ala Met Pro Ile
1 5 10

<210> 1356

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1356

Pro Met Ala Ile Ser Ser Pro Pro Lys
1 5

<210> 1357

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1357

Gln Trp Met Ala His Met Ala Leu Leu
1 5

<210> 1358

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1358

Ser Lys Met Tyr Thr Thr Ser Met Ala Met
1 5 10

<210> 1359

<211> 9

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1359

Ser Met Ala Met Pro Ile Leu Pro Leu
1 5

<210> 1360

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1360

Ser Asn Lys Leu Pro Ser Leu Pro Leu
1 5

<210> 1361

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1361
Ser Pro Ala Ser Arg Leu Gln Cys Ile
1 5

<210> 1362
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<220>
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peptide

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Ser Pro Pro Lys Ala Pro Leu Leu Ala Ala
1 5 10

<210> 1363
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Ser Pro Ser Leu Pro Ala Ser Asn Lys Leu
1 5 10

<210> 1364
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<400> 1364
Tyr Thr Thr Ser Met Ala Met Pro Ile

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<210> 1365
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<400> 1365
Tyr Thr Thr Ser Met Ala Met Pro Ile Leu
1 5 10

<210> 1366
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<400> 1366
Cys Leu Pro Gly Leu Thr His Pro Ala
1 5

<210> 1367
<211> 10
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1367
Gly Leu Thr His Pro Ala His Gln Pro Leu
1 5 10

<210> 1368
<211> 10
<212> PRT
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<220>
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<400> 1368
His Pro Ala His Gln Pro Leu Gly Ser Met
1 5 10

<210> 1369
<211> 9
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<220>
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<400> 1369
Leu Thr His Pro Ala His Gln Pro Leu
1 5

<210> 1370
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<220>
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<400> 1370
Arg Pro Thr Ser Arg Ala Arg Gln Ser Cys
1 5 10

<210> 1371
<211> 9
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1371

Arg Gln Ser Cys Cys Leu Pro Gly Leu
1 5

<210> 1372

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1372

Thr Ser Arg Ala Arg Gln Ser Cys Cys Leu
1 5 10

<210> 1373

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1373

Glu Leu Leu Cys Val Trp Val Ser Ser Ile
1 5 10

<210> 1374

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1374

Glu Trp Lys Val Lys Phe Pro Glu Leu
1 5

<210> 1375

<211> 9

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<400> 1375

Lys Phe Pro Glu Leu Leu Cys Val Trp
1 5

<210> 1376

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1376

Leu Leu Cys Val Trp Val Ser Ser Ile
1 5

<210> 1377

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1377

Leu Leu Thr Ser Ser Ser Arg Glu Trp Lys
1 5 10

<210> 1378

<211> 9

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<223> Description of Artificial Sequence: Synthetic
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<400> 1378

Leu Thr Ser Ser Ser Arg Glu Trp Lys
1 5

<210> 1379

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1379

Tyr Pro Ala Tyr Ser Lys Asp Ser Gly Leu
1 5 10

<210> 1380

<211> 9

<212> PRT

<213> Artificial Sequence

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<400> 1380

Cys Leu Gln Cys Leu Trp Ala Leu Leu
1 5

<210> 1381
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Cys Gln Trp Gly Pro Cys Leu Gln Cys Leu
1 5 10

<210> 1382
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<400> 1382
Gln Trp Gly Pro Cys Leu Gln Cys Leu
1 5

<210> 1383
<211> 10
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<400> 1383
Gln Trp Gly Pro Cys Leu Gln Cys Leu Trp
1 5 10

<210> 1384

<211> 9
<212> PRT
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<220>
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<400> 1384
Ala Ile Gln Pro Val Leu Trp Thr Thr
1 5

<210> 1385
<211> 9
<212> PRT
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<400> 1385
Ala Leu Gln Pro Leu Gln Pro His Ala
1 5

<210> 1386
<211> 10
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Asp Leu His Phe Cys Arg Ser Ser Ile Met
1 5 10

<210> 1387
<211> 9
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<220>

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<400> 1387

Glu Pro His Leu Ala Leu Gln Pro Leu
1 5

<210> 1388

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1388

Glu Ser Lys Ile Met Phe Ala Thr Leu
1 5

<210> 1389

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1389

Phe Ala Thr Leu Gln Arg Ser Ser Leu
1 5

<210> 1390

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peptide

<400> 1390

Phe Leu Lys Ala Glu Ser Lys Ile Met

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<400> 1391

Phe Leu Lys Ala Glu Ser Lys Ile Met Phe

1

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10

<210> 1392

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

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Gly Pro Pro Ala Arg Val Pro Ala Val

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<210> 1393

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1393

Ile Met Lys Pro Lys Arg Asp Gly Tyr Met
1 5 10

<210> 1394

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1394

Lys Ile Met Phe Ala Thr Leu Gln Arg

1 5

<210> 1395

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1395

Lys Pro Lys Arg Asp Gly Tyr Met Phe

1 5

<210> 1396

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1396

Lys Pro Lys Arg Asp Gly Tyr Met Phe Leu

1 5 10

<210> 1397
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<400> 1397
Leu His Phe Cys Arg Ser Ser Ile Met
1 5

<210> 1398
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<400> 1398
Leu Gln His Gly His Arg His Gly Leu
1 5

<210> 1399
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<400> 1399
Met Phe Ala Thr Leu Gln Arg Ser Ser Leu
1 5 10

<210> 1400
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<212> PRT
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Met Phe Leu Lys Ala Glu Ser Lys Ile
1 5

<210> 1401
<211> 9
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<400> 1401
Met Leu Thr Gly Pro Pro Ala Arg Val
1 5

<210> 1402
<211> 10
<212> PRT
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<220>
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<400> 1402
Gln Pro Val Leu Trp Thr Thr Pro Pro Leu
1 5 10

<210> 1403
<211> 10
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1403

Ser Met Leu Thr Gly Pro Pro Ala Arg Val
1 5 10

<210> 1404

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1404

Thr Leu Gln Arg Ser Ser Leu Trp Cys Leu
1 5 10

<210> 1405

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1405

Val Leu Pro Glu Pro His Leu Ala Leu
1 5

<210> 1406

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1406
Val Pro Ala Val Pro Phe Asp Leu His Phe
1 5 10

<210> 1407
<211> 9
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peptide

<400> 1407
Tyr Met Phe Leu Lys Ala Glu Ser Lys
1 5

<210> 1408
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peptide

<400> 1408
Tyr Met Phe Leu Lys Ala Glu Ser Lys Ile
1 5 10

<210> 1409
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peptide

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Ala Pro Gly Pro Arg Gly Arg Thr Cys

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<210> 1410

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

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Cys Leu Arg Ser His Thr Cys Pro Pro Arg
1 5 10

<210> 1411

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1411

Cys Leu Trp Cys His Ala Cys Leu His Arg
1 5 10

<210> 1412

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1412

Cys Pro His Leu Gly Ser His Pro Cys
1 5

<210> 1413

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1413

Cys Pro Leu Gly Leu Lys Ser Pro Leu

1 5

<210> 1414

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1414

Cys Pro Arg Ser Cys Arg Cys Pro His

1 5

<210> 1415

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1415

Cys Pro Arg Ser Cys Arg Cys Pro His Leu

1 5 10

<210> 1416

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1416

Cys Ser Leu Pro Leu Gly Asn His Pro Tyr
1 5 10

<210> 1417

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1417

Gly Leu Arg Asn Arg Ile Cys Pro Leu
1 5

<210> 1418

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1418

Gly Leu Arg Ser His Thr Tyr Leu Arg
1 5

<210> 1419

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1419

Gly Leu Arg Ser His Thr Tyr Leu Arg Arg
1 5 10

<210> 1420

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1420

Gly Pro Arg Gly Arg Thr Cys His Pro Gly
1 5 10

<210> 1421

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1421

His Leu Gly Ser His Pro Cys Arg Leu
1 5

<210> 1422

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1422

His Leu Arg Leu His Ala Ser Pro His

1 5

<210> 1423

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1423

His Leu Arg Ser Cys Pro Cys Ser Leu

1 5

<210> 1424

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1424

His Leu Arg Thr His Leu Leu Pro His

1 5

<210> 1425

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1425

His Leu Arg Thr His Leu Leu Pro His His

1 5 10

<210> 1426
<211> 9
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<400> 1426
His Leu Arg Tyr Arg Ala Tyr Pro Pro
1 5

<210> 1427
<211> 10
<212> PRT
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<400> 1427
His Leu Arg Tyr Arg Ala Tyr Pro Pro Cys
1 5 10

<210> 1428
<211> 9
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<400> 1428
His Pro His His Leu Arg Thr His Leu
1 5

<210> 1429

<211> 10
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1429

His Pro His His Leu Arg Thr His Leu Leu
1 5 10

<210> 1430

<211> 10

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1430

His Thr Tyr Leu Arg Arg Leu Arg Ser His
1 5 10

<210> 1431

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1431

Leu Pro Cys Pro His Arg Leu Arg Ser Leu
1 5 10

<210> 1432

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1432

Leu Pro His His Arg Arg Thr Arg Ser Cys
1 5 10

<210> 1433

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1433

Leu Pro Leu Gly Asn His Pro Tyr Leu
1 5

<210> 1434

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1434

Leu Pro Arg Pro Leu His Leu Arg Leu
1 5

<210> 1435

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1435

Asn Leu Arg Asn His Thr Cys Pro Pro
1 5

<210> 1436

<211> 10

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1436

Pro Pro Arg Leu Arg Ser Arg Thr Cys Leu
1 5 10

<210> 1437

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1437

Arg Leu His Ala Ser Pro His His Leu
1 5

<210> 1438

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1438

<210> 1442
<211> 9
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<220>
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<400> 1442
Arg Leu Arg Ser His Thr Cys Pro Pro
1 5

<210> 1443
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Arg Leu Arg Ser Leu Pro Arg Pro Leu
1 5

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<211> 10
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Arg Leu Arg Ser Leu Pro Arg Pro Leu His
1 5 10

<210> 1445
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<400> 1445
Arg Leu Arg Ser Arg Thr Cys Leu Leu
1 5

<210> 1446
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<400> 1446
Arg Asn Arg Ile Cys Pro Leu Ser Leu
1 5

<210> 1447
<211> 9
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<220>
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<400> 1447
Arg Pro Leu His Leu Arg Leu His Ala
1 5

<210> 1448
<211> 10
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1448

Arg Pro Leu His Leu Arg Leu His Ala Ser
1 5 10

<210> 1449

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1449

Arg Ser His Ala Cys Pro Pro Gly Leu Arg
1 5 10

<210> 1450

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1450

Arg Ser His Ala Cys Pro Pro Asn Leu Arg
1 5 10

<210> 1451

<211> 10

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1451
Arg Ser His Ala Tyr Ala Leu Cys Leu Arg
1 5 10

<210> 1452
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1452
Arg Ser His Pro Cys Cys His Tyr Leu Arg
1 5 10

<210> 1453
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
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peptide

<400> 1453
Arg Ser His Pro Cys Pro Leu Gly Leu Lys
1 5 10

<210> 1454
<211> 10
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<213> Artificial Sequence

<220>
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peptide

<400> 1454
Arg Ser His Thr Cys Pro Pro Ser Leu Arg

1

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<210> 1455

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1455

Arg Ser Leu Pro Arg Pro Leu His Leu Arg

1 5 10

<210> 1456

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1456

Arg Ser Arg Thr Cys Leu Leu Cys Leu

1 5

<210> 1457

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1457

Arg Ser Arg Thr Cys Leu Leu Cys Leu Arg

1 5 10

<210> 1458
<211> 9
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1458
Arg Ser Arg Thr Cys Pro Pro Gly Leu
1 5

<210> 1459
<211> 10
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<400> 1459
Arg Ser Arg Thr Cys Pro Pro Gly Leu Arg
1 5 10

<210> 1460
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<212> PRT
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<220>
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1 5 10

<210> 1461
<211> 10
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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1461

Arg Thr Arg Ser Cys Pro Cys Arg Trp Arg
1 5 10

<210> 1462

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1462

Arg Tyr Arg Ala Tyr Pro Pro Cys Leu
1 5

<210> 1463

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1463

Arg Tyr Arg Ala Tyr Pro Pro Cys Leu Trp
1 5 10

<210> 1464

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1464

Ser Leu Gly Asn His Leu Cys Pro Leu
1 5

<210> 1465

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1465

Ser Leu Pro Leu Gly Asn His Pro Tyr Leu
1 5 10

<210> 1466

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1466

Ser Leu Pro Arg Pro Leu His Leu Arg Leu
1 5 10

<210> 1467

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1467

Ser Leu Arg Asn Cys Thr Cys Pro Pro Arg
1 5 10

<210> 1468

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1468

Ser Leu Arg Ser His Ala Tyr Ala Leu
1 5

<210> 1469

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1469

Ser Leu Arg Ser His Pro Cys Pro Leu
1 5

<210> 1470

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1470

Ser Pro His His Leu Arg Thr Pro Pro
1 5

<210> 1471
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1471
Ser Pro His His Leu Arg Thr Pro Pro His
1 5 10

<210> 1472
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1472
Ser Pro Leu Arg Ser Gln Ala Asn Ala Leu
1 5 10

<210> 1473
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1473
Tyr Leu Arg Arg Leu Arg Ser His Thr Cys
1 5 10

<210> 1474

<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1474
Tyr Leu Arg Ser Arg Asn Ser Ala Pro
1 5

<210> 1475
<211> 10
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1475
Tyr Leu Arg Ser Arg Asn Ser Ala Pro Gly
1 5 10

<210> 1476
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1476
Ala Leu Ala Pro Thr Leu Thr His Met
1 5

<210> 1477
<211> 10
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1477

Ala Leu Ala Pro Thr Leu Thr His Met Leu
1 5 10

<210> 1478

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1478

Leu Leu Gln Val Thr Gln Thr Ser Phe Ala
1 5 10

<210> 1479

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1479

Leu Gln Val Thr Gln Thr Ser Phe Ala Leu
1 5 10

<210> 1480

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1480

Arg Leu Trp His Leu Leu Leu Gln Val

1 5

<210> 1481

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1481

Arg Leu Trp His Leu Leu Leu Gln Val Thr

1 5 10

<210> 1482

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1482

Cys Thr Gln Leu Ala Arg Phe Phe Pro Ile

1 5 10

<210> 1483

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1483

Phe Phe Pro Ile Thr Pro Pro Val Trp
1 5

<210> 1484
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1484
Phe Pro Ile Thr Pro Pro Val Trp His Ile
1 5 10

<210> 1485
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1485
Gly Pro Arg Met Gln Leu Cys Thr Gln Leu
1 5 10

<210> 1486
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1486
Ile Thr Pro Pro Val Trp His Ile Leu
1 5

<210> 1487
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1487
Leu Ala Leu Gly Pro Arg Met Gln Leu
1 5

<210> 1488
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1488
Met Gln Leu Cys Thr Gln Leu Ala Arg Phe
1 5 10

<210> 1489
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1489
Arg Phe Phe Pro Ile Thr Pro Pro Val
1 5

<210> 1490
<211> 10

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1490

Arg Phe Phe Pro Ile Thr Pro Pro Val Trp
1 5 10

<210> 1491

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1491

Arg Met Gln Leu Cys Thr Gln Leu Ala
1 5

<210> 1492

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1492

Arg Met Gln Leu Cys Thr Gln Leu Ala Arg
1 5 10

<210> 1493

<211> 10

<212> PRT

<213> Artificial Sequence

<400> 1496

Ala Leu Lys Lys Leu Arg Ser Pro Leu

1 5

<210> 1497

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1497

His Leu Gln Leu Lys Ser Cys Arg Arg Lys

1 5 10

<210> 1498

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1498

Lys Ile Ser Asn Trp Ser Leu Lys Lys

1 5

<210> 1499

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1499

Lys Ile Ser Asn Trp Ser Leu Lys Lys Val

1

5

10

<210> 1500

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1500

Lys Leu Arg Ser Pro Leu Trp Ile Phe

1

5

<210> 1501

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1501

Lys Ser Arg Gln Asn His Leu Gln Leu Lys

1

5

10

<210> 1502

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1502

Asn Trp Ser Leu Lys Lys Val Pro Ala Leu

1

5

10

<210> 1503

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1503

Ser Leu Lys Lys Val Pro Ala Leu Lys

1 5

<210> 1504

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1504

Ser Leu Lys Lys Val Pro Ala Leu Lys Lys

1 5 10

<210> 1505

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1505

Ser Gln Lys Ser Arg Gln Asn His Leu

1 5

<210> 1506

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1506

Trp Ser Leu Lys Lys Val Pro Ala Leu
1 5

<210> 1507

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1507

Trp Ser Leu Lys Lys Val Pro Ala Leu Lys
1 5 10

<210> 1508

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1508

Lys Leu Pro Glu Cys Gln Arg Leu Leu
1 5

<210> 1509

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1509

Lys Pro Thr Arg Ala Ala Thr Val Ser Val
1 5 10

<210> 1510

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1510

Leu Pro Pro Trp Pro Leu His Gln Gln Leu
1 5 10

<210> 1511

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1511

Leu Pro Arg Lys Pro Thr Arg Ala Ala
1 5

<210> 1512

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1512

Leu Pro Arg Lys Pro Thr Arg Ala Ala Thr
1 5 10

<210> 1513

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1513

Gln Gln Leu Leu His Arg Arg Pro Leu
1 5

<210> 1514

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1514

Arg Leu Leu Pro Pro Trp Pro Leu His
1 5

<210> 1515

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1515

Ala Pro Ala Ser Ala Pro Trp Pro Ser Thr
1 5 10

<210> 1516
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1516
Ala Pro Trp Pro Ser Thr Ser Ser His
1 5

<210> 1517
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1517
Arg Pro Ala Pro Ala Ser Ala Pro Trp
1 5

<210> 1518
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1518
Trp Pro Ser Thr Ser Ser His Ser Thr
1 5

<210> 1519

<211> 9
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1519

Arg Val Gln Asn Gln Gly His Leu Leu
1 5

<210> 1520

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1520

Phe Leu Pro Ile Ser His Cys Gln Cys Ile
1 5 10

<210> 1521

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1521

Phe Trp Leu Thr Lys Leu Asn Tyr Leu
1 5

<210> 1522

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1522

His Leu Ser Met Leu Thr Asp Ser Leu
1 5

<210> 1523

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1523

His Thr Met Gly Phe Trp Leu Thr Lys
1 5

<210> 1524

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1524

His Thr Met Gly Phe Trp Leu Thr Lys Leu
1 5 10

<210> 1525

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1525

Lys Leu Asn Tyr Leu Cys His Leu Ser Met
1 5 10

<210> 1526

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1526

Leu Pro Ile Ser His Cys Gln Cys Ile
1 5

<210> 1527

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1527

Leu Pro Ile Ser His Cys Gln Cys Ile Leu
1 5 10

<210> 1528

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1528

Leu Thr Asp Ser Leu Phe Leu Pro Ile
1 5

<210> 1529

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1529

Leu Thr Lys Leu Asn Tyr Leu Cys His Leu
1 5 10

<210> 1530

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1530

Met Leu Thr Asp Ser Leu Phe Leu Pro Ile
1 5 10

<210> 1531

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1531

Met Gln Gly His Thr Met Gly Phe Trp Leu
1 5 10

<210> 1532
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1532
Asn Tyr Leu Cys His Leu Ser Met Leu
1 5

<210> 1533
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1533
Ser Met Leu Thr Asp Ser Leu Phe Leu
1 5

<210> 1534
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1534
Thr Met Gly Phe Trp Leu Thr Lys Leu
1 5

<210> 1535
<211> 9

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1535

Tyr Leu Cys His Leu Ser Met Leu Thr
1 5

<210> 1536

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1536

Ile Leu Asp Glu Ala Tyr Val Met Ala Tyr
1 5 10

<210> 1537

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1537

Val Met Ala Tyr Val Met Ala Gly Val
1 5

<210> 1538

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1538

Tyr Val Met Ala Tyr Val Met Ala Gly
1 5

<210> 1539

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1539

Tyr Val Met Ala Tyr Val Met Ala Gly Val
1 5 10

<210> 1540

<211> 62

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1540

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr
20 25 30

Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
35 40 45

Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Gln Glu
50 55 60

<210> 1541
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1541
Lys Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 1542
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1542
Leu Val Val Val Gly Ala Cys Gly Val
1 5

<210> 1543
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1543
Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 1544
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1544
Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 1545
<211> 62
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1545
Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr
 20 25 30

Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
 35 40 45

Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Gln Glu
 50 55 60

<210> 1546
<211> 9
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1546

Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 1547

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1547

Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 1548

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1548

Lys Leu Val Val Val Gly Ala Asp Gly Val
1 5 10

<210> 1549

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1549

Leu Val Val Val Gly Ala Asp Gly Val
1 5

<210> 1550

<211> 62

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1550

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr
20 25 30

Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
35 40 45

Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Gln Glu
50 55 60

<210> 1551

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1551

Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 1552
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1552
Leu Val Val Val Gly Ala Val Gly Val
1 5

<210> 1553
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1553
Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 1554
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1554
Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 1555

<211> 101
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1555

Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn
1 5 10 15

His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
35 40 45

Ala Gly His Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr
50 55 60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Thr Lys Ser Phe
65 70 75 80

Glu Asp Ile His His Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
85 90 95

Glu Asp Val Pro Met
100

<210> 1556
<211> 10
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1556

Ile Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5 10

<210> 1557

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 1557

Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn
1 5 10 15

His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
 20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
 35 40 45

Ala Gly Leu Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr
 50 55 60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Thr Lys Ser Phe
65 70 75 80

Glu Asp Ile His His Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
 85 90 95

Glu Asp Val Pro Met
 100

<210> 1558

<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1558
Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1559
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1559
Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5 10

<210> 1560
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1560
Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn
1 5 10 15

His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
 35 40 45

Ala Gly Lys Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr
 50 55 60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Ser Lys Ser Phe
 65 70 75 80

Ala Asp Ile Asn Leu Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
 85 90 95

Asp Asp Val Pro Met
 100

<210> 1561
 <211> 10
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic peptide

<400> 1561
 Ile Leu Asp Thr Ala Gly Lys Glu Glu Tyr
 1 5 10

<210> 1562
 <211> 101
 <212> PRT
 <213> Artificial Sequence

<220>
 <223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1562
 Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn

1 5 10 15
His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
 20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
 35 40 45

Ala Gly Arg Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr
 50 55 60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Ser Lys Ser Phe
65 70 75 80

Ala Asp Ile Asn Leu Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
 85 90 95

Asp Asp Val Pro Met
 100

<210> 1563
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1563
Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5 10

<210> 1564
<211> 64
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 1564

Met Ala Leu Asn Ser Glu Ala Leu Ser Val Val Ser Glu Asp Gln Ser
1 5 10 15

Leu Phe Glu Cys Ala Tyr Gly Thr Pro His Leu Ala Lys Thr Glu Met
20 25 30

Thr Ala Ser Ser Ser Ser Asp Tyr Gly Gln Thr Ser Lys Met Ser Pro
35 40 45

Arg Val Pro Gln Gln Asp Trp Ala Leu Asn Ser Glu Ala Leu Ser Val
50 55 60

<210> 1565

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1565

Ala Leu Asn Ser Glu Ala Leu Ser Val Val
1 5 10

<210> 1566

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1566
Met Ala Leu Asn Ser Glu Ala Leu Ser Val
1 5 10

<210> 1567
<211> 23
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1567
Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly His Glu Glu Tyr Ser
1 5 10 15

Ala Met Arg Asp Gln Tyr Met
20

<210> 1568
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1568
Ile Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5 10

<210> 1569
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1569

Ile Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5 10

<210> 1570

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1570

Asp Thr Ala Gly His Glu Glu Tyr Ser Ala Met
1 5 10

<210> 1571

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1571

Asp Thr Ala Gly His Glu Glu Tyr Ser Ala Met
1 5 10

<210> 1572

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1572

Gly His Glu Glu Tyr Ser Ala Met

1

5

<210> 1573

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1573

Asp Thr Ala Gly His Glu Glu Tyr

1

5

<210> 1574

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1574

Ile Leu Asp Thr Ala Gly His Glu Glu

1

5

<210> 1575

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1575

Ala Gly His Glu Glu Tyr Ser Ala Met

1

5

<210> 1576
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1576
Ala Gly His Glu Glu Tyr Ser Ala Met
1 5

<210> 1577
<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1577
Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 1578
<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1578
Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 1579
<211> 8
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1579

Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 1580

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1580

Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 1581

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1581

Ile Leu Asp Thr Ala Gly His Glu Glu
1 5

<210> 1582

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1582

Ile Leu Asp Thr Ala Gly His Glu Glu
1 5

<210> 1583

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1583

Ile Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5 10

<210> 1584

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1584

Ile Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5 10

<210> 1585

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1585

His Glu Glu Tyr Ser Ala Met Arg Asp

1 5

<210> 1586

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1586

Thr Ala Gly His Glu Glu Tyr Ser Ala

1 5

<210> 1587

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1587

Asp Thr Ala Gly His Glu Glu Tyr Ser

1 5

<210> 1588

<211> 12

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1588

Asp Thr Ala Gly His Glu Glu Tyr Ser Ala Met Arg

1 5 10

<210> 1589
<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1589
Gly His Glu Glu Tyr Ser Ala Met
1 5

<210> 1590
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1590
Ile Leu Asp Thr Ala Gly His Glu Glu
1 5

<210> 1591
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1591
Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 1592

<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1592
His Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 1593
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1593
Ile Leu Asp Thr Ala Gly His Glu Glu
1 5

<210> 1594
<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1594
Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 1595
<211> 10
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1595

Leu Leu Asp Ile Leu Asp Thr Ala Gly His
1 5 10

<210> 1596

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1596

Thr Ala Gly His Glu Glu Tyr Ser Ala Met
1 5 10

<210> 1597

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1597

Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 1598

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1598

Asp Ile Leu Asp Thr Ala Gly His Glu

1 5

<210> 1599

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1599

Asp Thr Ala Gly His Glu Glu Tyr

1 5

<210> 1600

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1600

Ile Leu Asp Thr Ala Gly His Glu Glu Tyr

1 5 10

<210> 1601

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1601

Ala Gly His Glu Glu Tyr Ser Ala Met
1 5

<210> 1602
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1602
Asp Ile Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5 10

<210> 1603
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1603
Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 1604
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1604
Ile Leu Asp Thr Ala Gly His Glu Glu
1 5

<210> 1605
<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1605
Asp Ile Leu Asp Thr Ala Gly His
1 5

<210> 1606
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1606
Ile Leu Asp Thr Ala Gly His Glu Glu
1 5

<210> 1607
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1607
Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 1608
<211> 8

<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1608

Ile Leu Asp Thr Ala Gly His Glu
1 5

<210> 1609

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1609

Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 1610

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1610

Ala Gly His Glu Glu Tyr Ser Ala Met
1 5

<210> 1611

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1611

Asp Ile Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5 10

<210> 1612

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1612

Asp Thr Ala Gly His Glu Glu Tyr Ser
1 5

<210> 1613

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1613

Ile Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5 10

<210> 1614

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1614
Asp Thr Ala Gly His Glu Glu Tyr Ser Ala
1 5 10

<210> 1615
<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1615
Ile Leu Asp Thr Ala Gly His Glu
1 5

<210> 1616
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1616
Ile Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5 10

<210> 1617
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1617
Ile Leu Asp Thr Ala Gly His Glu Glu Tyr

<210> 1618
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1618
Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 1619
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1619
Ala Gly His Glu Glu Tyr Ser Ala Met
1 5

<210> 1620
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1620
Ala Gly His Glu Glu Tyr Ser Ala Met
1 5

<210> 1621
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1621
Leu Leu Asp Ile Leu Asp Thr Ala Gly His
1 5 10

<210> 1622
<211> 23
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1622
Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr Ser
1 5 10 15

Ala Met Arg Asp Gln Tyr Met
 20

<210> 1623
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1623
Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5 10

<210> 1624
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1624
Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5 10

<210> 1625
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1625
Asp Thr Ala Gly Arg Glu Glu Tyr Ser Ala Met
1 5 10

<210> 1626
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1626
Asp Ile Leu Asp Thr Ala Gly Arg
1 5

<210> 1627
<211> 8

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1627

Asp Ile Leu Asp Thr Ala Gly Arg
1 5

<210> 1628

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1628

Asp Thr Ala Gly Arg Glu Glu Tyr
1 5

<210> 1629

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1629

Asp Thr Ala Gly Arg Glu Glu Tyr Ser Ala Met
1 5 10

<210> 1630

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1630

Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Arg
1 5 10

<210> 1631

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1631

Asp Thr Ala Gly Arg Glu Glu Tyr
1 5

<210> 1632

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1632

Arg Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 1633

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1633

Gly Arg Glu Glu Tyr Ser Ala Met Arg
1 5

<210> 1634

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1634

Ile Leu Asp Thr Ala Gly Arg Glu Glu
1 5

<210> 1635

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1635

Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5 10

<210> 1636

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1636

Arg Glu Glu Tyr Ser Ala Met Arg Asp

1

5

<210> 1637

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1637

Ala Gly Arg Glu Glu Tyr Ser Ala Met

1

5

<210> 1638

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1638

Asp Thr Ala Gly Arg Glu Glu Tyr

1

5

<210> 1639

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1639

Asp Thr Ala Gly Arg Glu Glu Tyr

1

5

<210> 1640
<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1640
Asp Thr Ala Gly Arg Glu Glu Tyr
1 5

<210> 1641
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1641
Asp Ile Leu Asp Thr Ala Gly Arg
1 5

<210> 1642
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1642
Asp Ile Leu Asp Thr Ala Gly Arg Glu
1 5

<210> 1643
<211> 9
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1643

Ile Leu Asp Thr Ala Gly Arg Glu Glu
1 5

<210> 1644

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1644

Asp Ile Leu Asp Thr Ala Gly Arg
1 5

<210> 1645

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1645

Gly Arg Glu Glu Tyr Ser Ala Met
1 5

<210> 1646

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1646

Ala Gly Arg Glu Glu Tyr Ser Ala Met
1 5

<210> 1647

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1647

Gly Arg Glu Glu Tyr Ser Ala Met
1 5

<210> 1648

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1648

Ile Leu Asp Thr Ala Gly Arg Glu Glu
1 5

<210> 1649

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1649

Thr Ala Gly Arg Glu Glu Tyr Ser Ala
1 5

<210> 1650

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1650

Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5 10

<210> 1651

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1651

Asp Thr Ala Gly Arg Glu Glu Tyr Ser
1 5

<210> 1652

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1652

Ile Leu Asp Thr Ala Gly Arg Glu
1 5

<210> 1653
<211> 11
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1653
Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Arg
1 5 10

<210> 1654
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<400> 1654
Asp Thr Ala Gly Arg Glu Glu Tyr Ser Ala Met Arg
1 5 10

<210> 1655
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<400> 1655
Leu Leu Asp Ile Leu Asp Thr Ala Gly Arg
1 5 10

<210> 1656

<211> 8
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<400> 1656
Asp Thr Ala Gly Arg Glu Glu Tyr
1 5

<210> 1657
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<400> 1657
Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5 10

<210> 1658
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<220>
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<400> 1658
Asp Ile Leu Asp Thr Ala Gly Arg
1 5

<210> 1659
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1659

Ile Leu Asp Thr Ala Gly Arg Glu Glu
1 5

<210> 1660

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1660

Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5 10

<210> 1661

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1661

Leu Leu Asp Ile Leu Asp Thr Ala Gly Arg
1 5 10

<210> 1662

<211> 10

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<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1662

Thr Ala Gly Arg Glu Glu Tyr Ser Ala Met
1 5 10

<210> 1663

<211> 11

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1663

Asp Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5 10

<210> 1664

<211> 8

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<223> Description of Artificial Sequence: Synthetic
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<400> 1664

Ile Leu Asp Thr Ala Gly Arg Glu
1 5

<210> 1665

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1665

Ile Leu Asp Thr Ala Gly Arg Glu Glu
1 5

<210> 1666
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1666
Arg Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 1667
<211> 9
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<220>
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<400> 1667
Ala Gly Arg Glu Glu Tyr Ser Ala Met
1 5

<210> 1668
<211> 10
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<400> 1668
Ala Gly Arg Glu Glu Tyr Ser Ala Met Arg
1 5 10

<210> 1669
<211> 8
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<220>
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<400> 1669
Ile Leu Asp Thr Ala Gly Arg Glu
1 5

<210> 1670
<211> 9
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1670
Leu Asp Ile Leu Asp Thr Ala Gly Arg
1 5

<210> 1671
<211> 9
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<400> 1671
Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5

<210> 1672
<211> 9

<212> PRT
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<400> 1672
Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5

<210> 1673
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<212> PRT
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<400> 1673
Arg Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 1674
<211> 11
<212> PRT
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<220>
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<400> 1674
Arg Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr
1 5 10

<210> 1675
<211> 8
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1675

Asp Thr Ala Gly Arg Glu Glu Tyr
1 5

<210> 1676

<211> 23

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1676

Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Lys Glu Glu Tyr Ser
1 5 10 15

Ala Met Arg Asp Gln Tyr Met
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<210> 1677

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1677

Ile Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5 10

<210> 1678

<211> 10

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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1678

Ile Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5 10

<210> 1679

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1679

Asp Thr Ala Gly Lys Glu Glu Tyr Ser Ala Met
1 5 10

<210> 1680

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1680

Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Lys
1 5 10

<210> 1681

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1681

Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 1682

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1682

Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 1683

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1683

Asp Thr Ala Gly Lys Glu Glu Tyr Ser Ala Met
1 5 10

<210> 1684

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1684

Ala Gly Lys Glu Glu Tyr Ser Ala Met
1 5

<210> 1685

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1685

Asp Ile Leu Asp Thr Ala Gly Lys Glu
1 5

<210> 1686

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1686

Lys Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 1687

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1687

Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 1688
<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1688
Gly Lys Glu Glu Tyr Ser Ala Met
1 5

<210> 1689
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1689
Ile Leu Asp Thr Ala Gly Lys Glu Glu
1 5

<210> 1690
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1690
Ile Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5 10

<210> 1691
<211> 9

<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1691
Asp Thr Ala Gly Lys Glu Glu Tyr Ser
1 5

<210> 1692
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1692
Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 1693
<211> 9
<212> PRT
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<220>
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<400> 1693
Thr Ala Gly Lys Glu Glu Tyr Ser Ala
1 5

<210> 1694
<211> 8
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1694

Asp Ile Leu Asp Thr Ala Gly Lys
1 5

<210> 1695

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1695

Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 1696

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1696

Lys Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 1697

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1697

Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 1698

<211> 12

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1698

Asp Thr Ala Gly Lys Glu Glu Tyr Ser Ala Met Arg
1 5 10

<210> 1699

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1699

Ile Leu Asp Thr Ala Gly Lys Glu Glu
1 5

<210> 1700

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1700

Ile Leu Asp Thr Ala Gly Lys Glu Glu Tyr

1

5

10

<210> 1701

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1701

Leu Leu Asp Ile Leu Asp Thr Ala Gly Lys

1

5

10

<210> 1702

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1702

Ala Gly Lys Glu Glu Tyr Ser Ala Met

1

5

<210> 1703

<211> 8

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1703

Asp Thr Ala Gly Lys Glu Glu Tyr

1

5

<210> 1704

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1704

Asp Thr Ala Gly Lys Glu Glu Tyr Ser
1 5

<210> 1705

<211> 8

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1705

Ile Leu Asp Thr Ala Gly Lys Glu
1 5

<210> 1706

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1706

Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 1707

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1707

Ala	Gly	Lys	Glu	Glu	Tyr	Ser	Ala	Met	Arg
1				5					10

<210> 1708

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1708

Asp	Ile	Leu	Asp	Thr	Ala	Gly	Lys
1				5			

<210> 1709

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1709

Ile	Leu	Asp	Thr	Ala	Gly	Lys	Glu
1				5			

<210> 1710

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1710

Ile Leu Asp Thr Ala Gly Lys Glu Glu
1 5

<210> 1711

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1711

Ile Leu Asp Thr Ala Gly Lys Glu Glu
1 5

<210> 1712

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1712

Thr Ala Gly Lys Glu Glu Tyr Ser Ala Met
1 5 10

<210> 1713

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1713

Ala Gly Lys Glu Glu Tyr Ser Ala Met
1 5

<210> 1714

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1714

Ile Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5 10

<210> 1715

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1715

Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 1716

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1716

Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 1717
<211> 10
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<220>
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peptide

<400> 1717
Ile Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5 10

<210> 1718
<211> 9
<212> PRT
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<220>
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peptide

<400> 1718
Ala Gly Lys Glu Glu Tyr Ser Ala Met
1 5

<210> 1719
<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1719
Ala Gly Lys Glu Glu Tyr Ser Ala Met
1 5

<210> 1720

<211> 8
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<220>
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<400> 1720
Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 1721
<211> 9
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<220>
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<400> 1721
Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 1722
<211> 23
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1722
Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr Ser
1 5 10 15

Ala Met Arg Asp Gln Tyr Met
20

<210> 1723
<211> 10
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<220>
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<400> 1723
Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1724
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1724
Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1725
<211> 10
<212> PRT
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<220>
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<400> 1725
Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5 10

<210> 1726
<211> 12
<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1726

Gly Leu Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr
1 5 10

<210> 1727

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1727

Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1728

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1728

Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1729

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1729

Asp Thr Ala Gly Leu Glu Glu Tyr Ser Ala Met
1 5 10

<210> 1730

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1730

Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1731

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1731

Ile Leu Asp Thr Ala Gly Leu Glu Glu
1 5

<210> 1732

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1732

Ile Leu Asp Thr Ala Gly Leu Glu Glu
1 5

<210> 1733

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1733

Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5 10

<210> 1734

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1734

Ile Leu Asp Thr Ala Gly Leu Glu Glu
1 5

<210> 1735

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1735

Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5 10

<210> 1736
<211> 8
<212> PRT
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<220>
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<400> 1736
Asp Ile Leu Asp Thr Ala Gly Leu
1 5

<210> 1737
<211> 11
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<400> 1737
Asp Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1738
<211> 9
<212> PRT
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<400> 1738
Asp Thr Ala Gly Leu Glu Glu Tyr Ser
1 5

<210> 1739

<211> 11
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1739

Asp Thr Ala Gly Leu Glu Glu Tyr Ser Ala Met
1 5 10

<210> 1740

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1740

Gly Leu Glu Glu Tyr Ser Ala Met Arg
1 5

<210> 1741

<211> 8

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1741

Ile Leu Asp Thr Ala Gly Leu Glu
1 5

<210> 1742

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1742

Asp Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1743

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1743

Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1744

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1744

Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1745

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1745

Asp Ile Leu Asp Thr Ala Gly Leu
1 5

<210> 1746

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1746

Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1747

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1747

Ile Leu Asp Thr Ala Gly Leu Glu Glu
1 5

<210> 1748

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1748

Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1749

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1749

Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5 10

<210> 1750

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1750

Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1751

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1751

Ile Leu Asp Thr Ala Gly Leu Glu Glu
1 5

<210> 1752
<211> 10
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<213> Artificial Sequence

<220>
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<400> 1752
Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1753
<211> 10
<212> PRT
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<220>
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<400> 1753
Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1754
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1754
Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5 10

<210> 1755
<211> 8

<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1755

Asp Ile Leu Asp Thr Ala Gly Leu
1 5

<210> 1756

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1756

Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1757

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1757

Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1758

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1758

Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1759

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1759

Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1760

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1760

Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5 10

<210> 1761

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1761

Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5 10

<210> 1762

<211> 12

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1762

Asp Thr Ala Gly Leu Glu Glu Tyr Ser Ala Met Arg
1 5 10

<210> 1763

<211> 8

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1763

Ile Leu Asp Thr Ala Gly Leu Glu
1 5

<210> 1764

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1764

Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu

1

5

10

<210> 1765

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1765

Ala Gly Leu Glu Glu Tyr Ser Ala Met

1

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<210> 1766

<211> 10

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1766

Asp Thr Ala Gly Leu Glu Glu Tyr Ser Ala

1

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10

<210> 1767

<211> 12

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1767

Gly Leu Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr

1

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10

<210> 1768

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1768

Ile Leu Asp Thr Ala Gly Leu Glu

1 5

<210> 1769

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1769

Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr

1 5 10

<210> 1770

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1770

Leu Asp Ile Leu Asp Thr Ala Gly Leu

1 5

<210> 1771

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1771

Ala Gly Leu Glu Glu Tyr Ser Ala Met
1 5

<210> 1772

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1772

Ala Gly Leu Glu Glu Tyr Ser Ala Met
1 5

<210> 1773

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1773

Ala Gly Leu Glu Glu Tyr Ser Ala Met Arg
1 5 10

<210> 1774

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1774

Ile Leu Asp Thr Ala Gly Leu Glu Glu
1 5

<210> 1775

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1775

Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1776

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1776

Ala Gly Leu Glu Glu Tyr Ser Ala Met
1 5

<210> 1777

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1777

Gly Leu Glu Glu Tyr Ser Ala Met Arg

1 5

<210> 1778

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1778

Leu Glu Glu Tyr Ser Ala Met Arg Asp

1 5

<210> 1779

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1779

Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu Glu

1 5 10

<210> 1780

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1780

Ala Gly Leu Glu Glu Tyr Ser Ala Met

1 5

<210> 1781
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1781
Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5

<210> 1782
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1782
Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1783
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1783
Asp Ile Leu Asp Thr Ala Gly Leu Glu
1 5

<210> 1784

<211> 8
<212> PRT
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<220>
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<400> 1784
Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1785
<211> 10
<212> PRT
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<220>
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<400> 1785
Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1786
<211> 9
<212> PRT
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<220>
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<400> 1786
Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1787
<211> 9
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1787

Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1788

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1788

Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1789

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1789

Asp Thr Ala Gly Leu Glu Glu Tyr
1 5

<210> 1790

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1790

Ile Leu Asp Thr Ala Gly Leu Glu

1 5

<210> 1791

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1791

Leu Asp Thr Ala Gly Leu Glu Glu Tyr

1 5

<210> 1792

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1792

Leu Glu Glu Tyr Ser Ala Met Arg Asp

1 5

<210> 1793

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1793

Thr Ala Gly Leu Glu Glu Tyr Ser Ala
1 5

<210> 1794
<211> 11
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1794
Asp Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 1795
<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1795
Gly Leu Glu Glu Tyr Ser Ala Met
1 5

<210> 1796
<211> 23
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1796
Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Ala Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu
20

<210> 1797
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1797
Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1798
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1798
Val Val Val Gly Ala Ala Gly Val Gly Lys
1 5 10

<210> 1799
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1799
Val Val Gly Ala Ala Gly Val Gly Lys
1 5

<210> 1800
<211> 11
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1800
Thr Glu Tyr Lys Leu Val Val Val Gly Ala Ala
1 5 10

<210> 1801
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1801
Val Val Gly Ala Ala Gly Val Gly Lys
1 5

<210> 1802
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1802
Val Val Val Gly Ala Ala Gly Val Gly Lys
1 5 10

<210> 1803

<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1803
Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1804
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1804
Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1805
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1805
Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1806
<211> 9
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1806

Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1807

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1807

Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1808

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1808

Leu Val Val Val Gly Ala Ala Gly Val
1 5

<210> 1809

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1809

Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1810

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1810

Val Val Val Gly Ala Ala Gly Val Gly Lys
1 5 10

<210> 1811

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1811

Val Val Gly Ala Ala Gly Val Gly Lys
1 5

<210> 1812

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1812

Thr Glu Tyr Lys Leu Val Val Val Gly Ala Ala
1 5 10

<210> 1813

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1813

Val Val Gly Ala Ala Gly Val Gly Lys
1 5

<210> 1814

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1814

Val Val Val Gly Ala Ala Gly Val Gly Lys
1 5 10

<210> 1815

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1815

Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1816
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1816
Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1817
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1817
Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1818
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1818
Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1819
<211> 9

<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1819
Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1820
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1820
Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1821
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1821
Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1822
<211> 9
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1822

Leu Val Val Val Gly Ala Ala Gly Val
1 5

<210> 1823

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1823

Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1824

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1824

Val Val Gly Ala Ala Gly Val Gly Lys
1 5

<210> 1825

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1825

Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1826

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1826

Val Val Val Gly Ala Ala Gly Val Gly Lys
1 5 10

<210> 1827

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1827

Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1828

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1828

Ala Ala Gly Val Gly Lys Ser Ala Leu

1

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<210> 1829

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1829

Gly Ala Ala Gly Val Gly Lys Ser Ala

1

5

<210> 1830

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1830

Val Val Gly Ala Ala Gly Val Gly Lys

1

5

<210> 1831

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1831

Gly Ala Ala Gly Val Gly Lys Ser Ala

1

5

<210> 1832
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1832
Lys Leu Val Val Val Gly Ala Ala Gly Val
1 5 10

<210> 1833
<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1833
Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1834
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1834
Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1835
<211> 9
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1835

Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1836

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1836

Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1837

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1837

Val Val Val Gly Ala Ala Gly Val
1 5

<210> 1838

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1838

Tyr Lys Leu Val Val Val Gly Ala Ala
1 5

<210> 1839

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1839

Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1840

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1840

Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1841

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1841

Ala Gly Val Gly Lys Ser Ala Leu

1 5

<210> 1842

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1842

Val Val Val Gly Ala Ala Gly Val Gly Lys

1 5 10

<210> 1843

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1843

Ala Ala Gly Val Gly Lys Ser Ala

1 5

<210> 1844

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1844

Lys Leu Val Val Val Gly Ala Ala Gly Val

1 5 10

<210> 1845
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1845
Tyr Lys Leu Val Val Val Gly Ala Ala
1 5

<210> 1846
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1846
Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1847
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1847
Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1848

<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1848
Val Val Gly Ala Ala Gly Val Gly Lys
1 5

<210> 1849
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1849
Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1850
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1850
Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1851
<211> 10
<212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1851

Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1852

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1852

Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1853

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1853

Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1854

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1854

Ala Ala Gly Val Gly Lys Ser Ala Leu

1

5

<210> 1855

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1855

Ala Ala Gly Val Gly Lys Ser Ala Leu

1

5

<210> 1856

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1856

Ala Ala Gly Val Gly Lys Ser Ala Leu

1

5

<210> 1857

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1857

Gly Ala Ala Gly Val Gly Lys Ser Ala
1 5

<210> 1858
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1858
Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1859
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1859
Gly Ala Ala Gly Val Gly Lys Ser Ala
1 5

<210> 1860
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1860
Leu Val Val Val Gly Ala Ala Gly Val
1 5

<210> 1861
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1861
Thr Glu Tyr Lys Leu Val Val Val Gly Ala Ala
1 5 10

<210> 1862
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1862
Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1863
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1863
Gly Ala Ala Gly Val Gly Lys Ser Ala
1 5

<210> 1864
<211> 10

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1864

Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1865

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1865

Val Gly Ala Ala Gly Val Gly Lys Ser Ala
1 5 10

<210> 1866

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1866

Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1867

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1867

Ala Gly Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 1868

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1868

Val Val Val Gly Ala Ala Gly Val
1 5

<210> 1869

<211> 23

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1869

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu
20

<210> 1870

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1870

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 1871

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1871

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 1872

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1872

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 1873

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1873

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 1874

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1874

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 1875

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1875

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 1876

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1876

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 1877

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1877

Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1878

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1878

Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1879

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1879

Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1880
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1880
Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1881
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1881
Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 1882
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1882
Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1883
<211> 8

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1883

Cys Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1884

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1884

Lys Leu Val Val Gly Ala Cys Gly Val
1 5 10

<210> 1885

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1885

Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1886

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1886

Gly	Ala	Cys	Gly	Val	Gly	Lys	Ser	Ala	Leu
1			5						10

<210> 1887

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1887

Gly	Ala	Cys	Gly	Val	Gly	Lys	Ser	Ala	Leu
1			5						10

<210> 1888

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1888

Ala	Cys	Gly	Val	Gly	Lys	Ser	Ala	Leu
1			5					

<210> 1889

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1889
Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1890
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1890
Tyr Lys Leu Val Val Val Gly Ala Cys
1 5

<210> 1891
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1891
Tyr Lys Leu Val Val Val Gly Ala Cys
1 5

<210> 1892
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1892
Gly Ala Cys Gly Val Gly Lys Ser Ala

1

5

<210> 1893
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1893
Gly Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1894
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1894
Gly Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1895
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1895
Leu Val Val Val Gly Ala Cys Gly Val
1 5

<210> 1896
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1896
Cys Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1897
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1897
Gly Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1898
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1898
Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 1899
<211> 23
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1899

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu
20

<210> 1900

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1900

Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1901

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1901

Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1902

<211> 10

<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1902
Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 1903
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1903
Asp Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1904
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1904
Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 1905
<211> 9
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1905

Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 1906

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1906

Asp Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1907

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1907

Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 1908

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 1908
Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1909
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1909
Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 1910
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1910
Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1911
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1911
Gly Ala Asp Gly Val Gly Lys Ser Ala Leu

1

5

10

<210> 1912

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1912

Val Val Gly Ala Asp Gly Val Gly Lys

1

5

<210> 1913

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1913

Gly Ala Asp Gly Val Gly Lys Ser Ala

1

5

<210> 1914

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1914

Gly Ala Asp Gly Val Gly Lys Ser Ala Leu

1

5

10

<210> 1915

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1915

Gly Ala Asp Gly Val Gly Lys Ser

1 5

<210> 1916

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1916

Gly Ala Asp Gly Val Gly Lys Ser Ala

1 5

<210> 1917

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1917

Ala Asp Gly Val Gly Lys Ser Ala Leu

1 5

<210> 1918

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1918

Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 1919

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1919

Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1920

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1920

Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1921

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1921

Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1922

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1922

Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1923

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1923

Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1924

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1924

Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 1925

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1925

Gly Ala Asp Gly Val Gly Lys Ser Ala
1 5

<210> 1926

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1926

Gly Ala Asp Gly Val Gly Lys Ser Ala
1 5

<210> 1927

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1927

Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1928
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1928
Lys Leu Val Val Val Gly Ala Asp Gly Val
1 5 10

<210> 1929
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1929
Leu Val Val Val Gly Ala Asp Gly Val
1 5

<210> 1930
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1930
Val Gly Ala Asp Gly Val Gly Lys Ser Ala
1 5 10

<210> 1931

<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1931
Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 1932
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1932
Gly Ala Asp Gly Val Gly Lys Ser Ala
1 5

<210> 1933
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1933
Lys Leu Val Val Val Gly Ala Asp Gly Val
1 5 10

<210> 1934
<211> 8
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1934

Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 1935

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1935

Tyr Lys Leu Val Val Val Gly Ala Asp
1 5

<210> 1936

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1936

Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1937

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1937

Asp Gly Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 1938

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1938

Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 1939

<211> 23

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1939

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Arg Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu
20

<210> 1940

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1940

Val Val Gly Ala Arg Gly Val Gly Lys
1 5

<210> 1941

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1941

Val Val Val Gly Ala Arg Gly Val Gly Lys
1 5 10

<210> 1942

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1942

Gly Ala Arg Gly Val Gly Lys Ser Ala
1 5

<210> 1943

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1943

Ala Arg Gly Val Gly Lys Ser Ala Leu

1 5

<210> 1944

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1944

Gly Ala Arg Gly Val Gly Lys Ser Ala

1 5

<210> 1945

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1945

Arg Gly Val Gly Lys Ser Ala Leu

1 5

<210> 1946

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1946

Val Val Gly Ala Arg Gly Val Gly Lys

1 5

<210> 1947
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1947
Ala Arg Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1948
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1948
Ala Arg Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1949
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1949
Val Val Gly Ala Arg Gly Val Gly Lys
1 5

<210> 1950

<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1950
Val Val Val Gly Ala Arg Gly Val Gly Lys
1 5 10

<210> 1951
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1951
Gly Ala Arg Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1952
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1952
Arg Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1953
<211> 10
<212> PRT
<213> Artificial Sequence

peptide

<400> 1956

Gly Ala Arg Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1957

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1957

Val Val Val Gly Ala Arg Gly Val Gly Lys
1 5 10

<210> 1958

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1958

Gly Ala Arg Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1959

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1959

Leu Val Val Val Gly Ala Arg Gly Val
1 5

<210> 1960

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1960

Arg Gly Val Gly Lys Ser Ala Leu

1 5

<210> 1961

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1961

Val Val Gly Ala Arg Gly Val Gly Lys

1 5

<210> 1962

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1962

Lys Leu Val Val Gly Ala Arg Gly Val

1 5 10

<210> 1963
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1963
Leu Val Val Val Gly Ala Arg Gly Val
1 5

<210> 1964
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1964
Tyr Lys Leu Val Val Val Gly Ala Arg
1 5

<210> 1965
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1965
Lys Leu Val Val Val Gly Ala Arg
1 5

<210> 1966
<211> 10

<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1966
Lys Leu Val Val Val Gly Ala Arg Gly Val
1 5 10

<210> 1967
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1967
Arg Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1968
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1968
Leu Val Val Val Gly Ala Arg Gly Val
1 5

<210> 1969
<211> 8
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1969

Val Val Val Gly Ala Arg Gly Val
1 5

<210> 1970

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1970

Ala Arg Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1971

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1971

Ala Arg Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1972

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1972
Gly Ala Arg Gly Val Gly Lys Ser Ala
1 5

<210> 1973
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1973
Val Val Val Gly Ala Arg Gly Val
1 5

<210> 1974
<211> 23
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1974
Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Ser Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu
20

<210> 1975
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic

peptide

<400> 1975

Val Val Val Gly Ala Ser Gly Val Gly Lys
1 5 10

<210> 1976

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1976

Val Val Gly Ala Ser Gly Val Gly Lys
1 5

<210> 1977

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1977

Val Val Gly Ala Ser Gly Val Gly Lys
1 5

<210> 1978

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1978

<210> 1982
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1982
Val Val Val Gly Ala Ser Gly Val Gly Lys
1 5 10

<210> 1983
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1983
Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1984
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1984
Gly Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1985
<211> 9

<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1985
Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1986
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1986
Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1987
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1987
Gly Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 1988
<211> 8
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1988

Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1989

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1989

Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1990

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1990

Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1991

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1991
Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1992
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1992
Val Val Gly Ala Ser Gly Val Gly Lys
1 5

<210> 1993
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1993
Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 1994
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 1994
Val Val Val Gly Ala Ser Gly Val Gly Lys

1

5

10

<210> 1995

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1995

Gly Ala Ser Gly Val Gly Lys Ser Ala Leu

1

5

10

<210> 1996

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1996

Ser Gly Val Gly Lys Ser Ala Leu

1

5

<210> 1997

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 1997

Ala Ser Gly Val Gly Lys Ser Ala Leu

1

5

<210> 1998
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1998
Gly Ala Ser Gly Val Gly Lys Ser Ala
1 5

<210> 1999
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 1999
Gly Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2000
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2000
Lys Leu Val Val Val Gly Ala Ser Gly Val
1 5 10

<210> 2001
<211> 9
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2001

Leu Val Val Val Gly Ala Ser Gly Val
1 5

<210> 2002

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2002

Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2003

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2003

Ala Ser Gly Val Gly Lys Ser Ala
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<210> 2004

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2004

Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2005

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2005

Gly Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2006

<211> 8

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2006

Ser Gly Val Gly Lys Ser Ala Leu
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<210> 2007

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2007

Ala Ser Gly Val Gly Lys Ser Ala Leu

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<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2008

Gly Ala Ser Gly Val Gly Lys Ser Ala Leu

1 5 10

<210> 2009

<211> 9

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<400> 2009

Val Val Gly Ala Ser Gly Val Gly Lys

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<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2010

Ala Ser Gly Val Gly Lys Ser Ala Leu

1 5

<210> 2011
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Gly Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5 10

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Ser Gly Val Gly Lys Ser Ala Leu
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Ser Gly Val Gly Lys Ser Ala Leu Thr Ile
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Val Gly Ala Ser Gly Val Gly Lys Ser Ala
1 5 10

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<400> 2015
Ala Ser Gly Val Gly Lys Ser Ala Leu
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<210> 2016
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<400> 2016
Ala Ser Gly Val Gly Lys Ser Ala Leu
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<210> 2017
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2017

Lys Leu Val Val Val Gly Ala Ser Gly Val
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<210> 2018

<211> 8

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2018

Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2019

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2019

Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2020

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 2020

Lys Leu Val Val Val Gly Ala Ser Gly
1 5

<210> 2021

<211> 23

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2021

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu
20

<210> 2022

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2022

Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2023

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2023

Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2024

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2024

Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2025

<211> 10

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<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2025

Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2026

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2026

Val Val Gly Ala Val Gly Val Gly Lys
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<210> 2027

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2027

Leu Val Val Val Gly Ala Val Gly Val
1 5

<210> 2028

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2028

Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2029

<211> 9

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2029

Ala Val Gly Val Gly Lys Ser Ala Leu
1 5

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Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 2031
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Ala Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2032
<211> 10
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Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2033

<211> 10
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<400> 2033
Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2034
<211> 10
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<400> 2034
Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2035
<211> 9
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<400> 2035
Ala Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2036
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2036

Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2037

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2037

Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 2038

<211> 8

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<400> 2038

Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2039

<211> 8

<212> PRT

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<223> Description of Artificial Sequence: Synthetic

peptide

<400> 2039

Val Val Val Gly Ala Val Gly Val

1 5

<210> 2040

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2040

Ala Val Gly Val Gly Lys Ser Ala Leu

1 5

<210> 2041

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2041

Ala Val Gly Val Gly Lys Ser Ala Leu

1 5

<210> 2042

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2042

Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2043

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2043

Ala Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2044

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2044

Ala Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2045

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2045

Gly Ala Val Gly Val Gly Lys Ser Ala
1 5

<210> 2046
<211> 10
<212> PRT
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<400> 2046
Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2047
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2047
Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2048
<211> 10
<212> PRT
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<220>
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<400> 2048
Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 2049
<211> 8

<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2049

Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2050

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2050

Ala Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2051

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2051

Gly Ala Val Gly Val Gly Lys Ser Ala
1 5

<210> 2052

<211> 8

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2052

Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2053

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2053

Val Gly Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 2054

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2054

Gly Ala Val Gly Val Gly Lys Ser Ala
1 5

<210> 2055

<211> 8

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2055
Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2056
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peptide

<400> 2056
Ala Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2057
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peptide

<400> 2057
Ala Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2058
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peptide

<400> 2058
Ala Val Gly Val Gly Lys Ser Ala Leu

1

5

<210> 2059

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2059

Leu Val Val Val Gly Ala Val Gly Val

1

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<210> 2060

<211> 8

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2060

Val Gly Val Gly Lys Ser Ala Leu

1

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<210> 2061

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2061

Val Val Gly Ala Val Gly Val Gly Lys

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<210> 2062
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2062
Ala Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2063
<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2063
Ala Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2064
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2064
Gly Ala Val Gly Val Gly Lys Ser Ala
1 5

<210> 2065
<211> 10
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<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2065

Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 2066

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2066

Leu Val Val Val Gly Ala Val Gly Val
1 5

<210> 2067

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2067

Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2068

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2068

Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2069

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2069

Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2070

<211> 8

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2070

Val Val Val Gly Ala Val Gly Val
1 5

<210> 2071

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2071

Ala Val Gly Val Gly Lys Ser Ala Leu

1 5

<210> 2072

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2072

Ala Val Gly Val Gly Lys Ser Ala Leu

1 5

<210> 2073

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2073

Leu Val Val Val Gly Ala Val Gly Val

1 5

<210> 2074

<211> 8

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2074

Ala Val Gly Val Gly Lys Ser Ala

1 5

<210> 2075
<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2075
Ala Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2076
<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2076
Gly Ala Val Gly Val Gly Lys Ser Ala
1 5

<210> 2077
<211> 10
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2077
Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2078

<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2078

Tyr Lys Leu Val Val Val Gly Ala Val
1 5

<210> 2079

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2079

Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2080

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2080

Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2081

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2081

Tyr Lys Leu Val Val Val Gly Ala Val
1 5

<210> 2082

<211> 23

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2082

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Gly Cys Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu
20

<210> 2083

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2083

Val Val Val Gly Ala Gly Cys Val Gly Lys
1 5 10

<210> 2084

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2084

Val Val Gly Ala Gly Cys Val Gly Lys
1 5

<210> 2085

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2085

Ala Gly Cys Val Gly Lys Ser Ala Leu
1 5

<210> 2086

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2086

Val Val Gly Ala Gly Cys Val Gly Lys
1 5

<210> 2087

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2087

Val Val Val Gly Ala Gly Cys Val Gly Lys
1 5 10

<210> 2088

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2088

Cys Val Gly Lys Ser Ala Leu Thr Ile
1 5

<210> 2089

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2089

Val Val Gly Ala Gly Cys Val Gly Lys
1 5

<210> 2090

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2090

Val Val Gly Ala Gly Cys Val Gly Lys
1 5

<210> 2091

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2091

Ala Gly Cys Val Gly Lys Ser Ala Leu
1 5

<210> 2092

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2092

Ala Gly Cys Val Gly Lys Ser Ala Leu
1 5

<210> 2093

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2093

Gly Cys Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 2094
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2094
Ala Gly Cys Val Gly Lys Ser Ala Leu
1 5

<210> 2095
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2095
Val Val Val Gly Ala Gly Cys Val Gly Lys
1 5 10

<210> 2096
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2096
Lys Leu Val Val Val Gly Ala Gly Cys
1 5

<210> 2097

<211> 8
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2097
Gly Cys Val Gly Lys Ser Ala Leu
1 5

<210> 2098
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2098
Val Val Gly Ala Gly Cys Val Gly Lys
1 5

<210> 2099
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2099
Ala Gly Cys Val Gly Lys Ser Ala Leu
1 5

<210> 2100
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2100

Lys Leu Val Val Val Gly Ala Gly Cys
1 5

<210> 2101

<211> 23

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2101

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Gly Asp Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu
20

<210> 2102

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2102

Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2103

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2103

Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2104

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2104

Val Val Gly Ala Gly Asp Val Gly Lys
1 5

<210> 2105

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2105

Val Val Val Gly Ala Gly Asp Val Gly Lys
1 5 10

<210> 2106

<211> 10

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2106

Val Val Val Gly Ala Gly Asp Val Gly Lys
1 5 10

<210> 2107

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2107

Gly Ala Gly Asp Val Gly Lys Ser Ala
1 5

<210> 2108

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2108

Gly Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5 10

<210> 2109

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2109

Val Val Gly Ala Gly Asp Val Gly Lys
1 5

<210> 2110

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<212> PRT

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2110

Val Val Gly Ala Gly Asp Val Gly Lys
1 5

<210> 2111

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2111

Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2112

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2112

Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2113
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<400> 2113
Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2114
<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2114
Asp Val Gly Lys Ser Ala Leu Thr Ile
1 5

<210> 2115
<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2115
Asp Val Gly Lys Ser Ala Leu Thr Ile
1 5

<210> 2116

<211> 8
<212> PRT
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<400> 2116
Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2117
<211> 8
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<400> 2117
Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2118
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2118
Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2119
<211> 9
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2119

Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2120

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2120

Asp Val Gly Lys Ser Ala Leu Thr Ile
1 5

<210> 2121

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2121

Val Val Gly Ala Gly Asp Val Gly Lys
1 5

<210> 2122

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 2122

Gly Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5 10

<210> 2123

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2123

Gly Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5 10

<210> 2124

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2124

Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2125

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2125

Gly Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5 10

<210> 2126
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2126
Asp Val Gly Lys Ser Ala Leu Thr Ile
1 5

<210> 2127
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2127
Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2128
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2128
Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2129
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2129
Asp Val Gly Lys Ser Ala Leu Thr Ile
1 5

<210> 2130
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2130
Val Val Gly Ala Gly Asp Val Gly Lys
1 5

<210> 2131
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2131
Gly Ala Gly Asp Val Gly Lys Ser Ala
1 5

<210> 2132
<211> 9

<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2132
Asp Val Gly Lys Ser Ala Leu Thr Ile
1 5

<210> 2133
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2133
Gly Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5 10

<210> 2134
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2134
Val Val Val Gly Ala Gly Asp Val Gly Lys
1 5 10

<210> 2135
<211> 64
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2135

Met Ala Leu Asn Ser Glu Ala Leu Ser Val Val Ser Glu Asp Gln Ser
1 5 10 15

Leu Phe Glu Cys Ala Tyr Gly Thr Pro His Leu Ala Lys Thr Glu Met
20 25 30

Thr Ala Ser Ser Ser Ser Asp Tyr Gly Gln Thr Ser Lys Met Ser Pro
35 40 45

Arg Val Pro Gln Gln Asp Trp Ala Leu Asn Ser Glu Ala Leu Ser Val
50 55 60

<210> 2136

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2136

Ala Leu Asn Ser Glu Ala Leu Ser Val Val
1 5 10

<210> 2137

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2137

Met Ala Leu Asn Ser Glu Ala Leu Ser Val
1 5 10

<210> 2138

<211> 62

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 2138

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr
20 25 30

Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
35 40 45

Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Gln Glu
50 55 60

<210> 2139

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2139

Lys Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2140

<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2140
Leu Val Val Val Gly Ala Cys Gly Val
1 5

<210> 2141
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2141
Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 2142
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2142
Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 2143
<211> 71
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2143

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr
20 25 30

Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
35 40 45

Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Gln Glu Val Val
50 55 60

Gly Ala Asp Gly Val Gly Lys
65 70

<210> 2144

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2144

Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 2145

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2145

Lys Leu Val Val Val Gly Ala Asp Gly Val
1 5 10

<210> 2146

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2146

Leu Val Val Val Gly Ala Asp Gly Val
1 5

<210> 2147

<211> 62

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2147

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr
20 25 30

Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
35 40 45

Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Gln Glu
50 55 60

<210> 2148
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2148
Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 2149
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2149
Leu Val Val Val Gly Ala Val Gly Val
1 5

<210> 2150
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2150
Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2151
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2151
Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2152
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2152
Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn
1 5 10 15

His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
35 40 45

Ala Gly His Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr
50 55 60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Thr Lys Ser Phe
65 70 75 80

Glu Asp Ile His His Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
85 90 95

Glu Asp Val Pro Met
100

<210> 2153
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2153
Ile Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5 10

<210> 2154
<211> 101
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2154
Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn
1 5 10 15

His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
35 40 45

Ala Gly Leu Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr

50

55

60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Thr Lys Ser Phe
65 70 75 80

Glu Asp Ile His His Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
85 90 95

Glu Asp Val Pro Met
100

<210> 2155

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2155

Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 2156

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2156

Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5 10

<210> 2157

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2157

Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn
1 5 10 15

His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
35 40 45

Ala Gly Lys Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr
50 55 60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Ser Lys Ser Phe
65 70 75 80

Ala Asp Ile Asn Leu Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
85 90 95

Asp Asp Val Pro Met
100

<210> 2158

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2158

Ile Leu Asp Thr Ala Gly Lys Glu Glu Tyr
1 5 10

<210> 2159

<211> 101

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 2159

Ala Gly Gly Val Gly Lys Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn
1 5 10 15

His Phe Val Asp Glu Tyr Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys
20 25 30

Gln Val Val Ile Asp Gly Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr
35 40 45

Ala Gly Arg Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr Met Arg Thr
50 55 60

Gly Glu Gly Phe Leu Cys Val Phe Ala Ile Asn Asn Ser Lys Ser Phe
65 70 75 80

Ala Asp Ile Asn Leu Tyr Arg Glu Gln Ile Lys Arg Val Lys Asp Ser
85 90 95

Asp Asp Val Pro Met
100

<210> 2160

<211> 10

<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2160
Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5 10

<210> 2161
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2161
Asp Thr Ala Gly His Glu Glu Tyr
1 5

<210> 2162
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2162
Thr Ala Gly His Glu Glu Tyr Ser Ala Met
1 5 10

<210> 2163
<211> 9
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2163

Asp Ile Leu Asp Thr Ala Gly His Glu
1 5

<210> 2164

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2164

Asp Ile Leu Asp Thr Ala Gly His
1 5

<210> 2165

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2165

Ile Leu Asp Thr Ala Gly His Glu Glu
1 5

<210> 2166

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2166
Ile Leu Asp Thr Ala Gly His Glu
1 5

<210> 2167
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2167
Asp Ile Leu Asp Thr Ala Gly His Glu Glu Tyr
1 5 10

<210> 2168
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2168
Asp Thr Ala Gly His Glu Glu Tyr Ser
1 5

<210> 2169
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2169
Leu Leu Asp Ile Leu Asp Thr Ala Gly His

<210> 2170
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2170
Asp Ile Leu Asp Thr Ala Gly Arg Glu
1 5

<210> 2171
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2171
Asp Ile Leu Asp Thr Ala Gly Arg
1 5

<210> 2172
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2172
Ile Leu Asp Thr Ala Gly Arg Glu Glu
1 5

<210> 2173
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2173
Ile Leu Asp Thr Ala Gly Arg Glu
1 5

<210> 2174
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2174
Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Arg
1 5 10

<210> 2175
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2175
Thr Ala Gly Arg Glu Glu Tyr Ser Ala Met
1 5 10

<210> 2176
<211> 9
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2176

Arg Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 2177

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2177

Asp Thr Ala Gly Lys Glu Glu Tyr Ser Ala Met
1 5 10

<210> 2178

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2178

Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Lys
1 5 10

<210> 2179

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2179

Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 2180

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2180

Leu Leu Asp Ile Leu Asp Thr Ala Gly Lys
1 5 10

<210> 2181

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2181

Ile Leu Asp Thr Ala Gly Lys Glu
1 5

<210> 2182

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2182

Ile Leu Asp Thr Ala Gly Lys Glu Glu

1 5

<210> 2183

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2183

Asp Thr Ala Gly Leu Glu Glu Tyr

1 5

<210> 2184

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2184

Ile Leu Asp Thr Ala Gly Leu Glu

1 5

<210> 2185

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2185

Asp Ile Leu Asp Thr Ala Gly Leu

1 5

<210> 2186

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2186

Ile Leu Asp Thr Ala Gly Leu Glu Glu
1 5

<210> 2187

<211> 12

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2187

Gly Leu Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr
1 5 10

<210> 2188

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2188

Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu Glu
1 5 10

<210> 2189

<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2189
Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5

<210> 2190
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2190
Asp Ile Leu Asp Thr Ala Gly Leu Glu
1 5

<210> 2191
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2191
Asp Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 2192
<211> 8
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2192

Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2193

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2193

Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2194

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2194

Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2195

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 2195

Cys Gly Val Gly Lys Ser Ala Leu

1 5

<210> 2196

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2196

Ala Cys Gly Val Gly Lys Ser Ala Leu

1 5

<210> 2197

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2197

Asp Gly Val Gly Lys Ser Ala Leu

1 5

<210> 2198

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2198

Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2199
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2199
Asp Gly Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 2200
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2200
Gly Ala Arg Gly Val Gly Lys Ser Ala
1 5

<210> 2201
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2201
Lys Leu Val Val Gly Ala Arg Gly Val
1 5 10

<210> 2202
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2202
Val Val Val Gly Ala Arg Gly Val
1 5

<210> 2203
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2203
Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2204
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2204
Val Val Val Gly Ala Ser Gly Val Gly Lys
1 5 10

<210> 2205
<211> 10

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2205

Gly Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2206

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2206

Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2207

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2207

Val Val Val Gly Ala Gly Cys Val Gly Lys
1 5 10

<210> 2208

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2208

Lys Leu Val Val Val Gly Ala Gly Cys
1 5

<210> 2209

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2209

Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2210

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2210

Asp Val Gly Lys Ser Ala Leu Thr Ile
1 5

<210> 2211

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2211
Val Val Val Gly Ala Gly Asp Val Gly Lys
1 5 10

<210> 2212
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2212
Thr Ala Gly Lys Glu Glu Tyr Ser Ala Met
1 5 10

<210> 2213
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2213
Asp Thr Ala Gly His Glu Glu Tyr Ser Ala Met
1 5 10

<210> 2214
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2214
Thr Ala Gly His Glu Glu Tyr Ser Ala

1

5

<210> 2215
<211> 11
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2215
Asp Thr Ala Gly Arg Glu Glu Tyr Ser Ala Met
1 5 10

<210> 2216
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2216
Thr Ala Gly Lys Glu Glu Tyr Ser Ala
1 5

<210> 2217
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2217
Ala Ala Gly Val Gly Lys Ser Ala
1 5

<210> 2218
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2218
Ala Gly Cys Val Gly Lys Ser Ala Leu
1 5

<210> 2219
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Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2220
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Ala Gly Lys Glu Glu Tyr Ser Ala Met Arg
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<210> 2221
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2224

Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2225

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Ala Val Gly Val Gly Lys Ser Ala
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<400> 2226

Cys Val Gly Lys Ser Ala Leu Thr Ile
1 5

<210> 2227

<211> 8

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2227

Asp Ile Leu Asp Thr Ala Gly Lys

1 5

<210> 2228

<211> 11

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Asp Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr

1 5 10

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<211> 12

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Asp Thr Ala Gly His Glu Glu Tyr Ser Ala Met Arg

1 5 10

<210> 2230

<211> 9

<212> PRT

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Asp Thr Ala Gly Lys Glu Glu Tyr Ser

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<210> 2232
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<400> 2233
Asp Thr Ala Gly Leu Glu Glu Tyr Ser Ala
1 5 10

<210> 2234

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2237

Gly Ala Ala Gly Val Gly Lys Ser Ala
1 5

<210> 2238

<211> 9

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<400> 2238

Gly Ala Cys Gly Val Gly Lys Ser Ala
1 5

<210> 2239

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Gly Ala Cys Gly Val Gly Lys Ser Ala Leu
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<210> 2240

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Gly Ala Asp Gly Val Gly Lys Ser
1 5

<210> 2241

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<400> 2241

Gly Ala Gly Asp Val Gly Lys Ser Ala
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<210> 2242

<211> 10

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Gly Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5 10

<210> 2243

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<213> Artificial Sequence

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Gly Ala Ser Gly Val Gly Lys Ser Ala
1 5

<210> 2244
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<220>
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Gly Cys Val Gly Lys Ser Ala Leu
1 5

<210> 2245
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<400> 2245
Gly Cys Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 2246
<211> 8
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Gly His Glu Glu Tyr Ser Ala Met
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<210> 2247
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<212> PRT
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<220>
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<400> 2247
Gly Lys Glu Glu Tyr Ser Ala Met
1 5

<210> 2248
<211> 9
<212> PRT
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<220>
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<400> 2248
Gly Leu Glu Glu Tyr Ser Ala Met Arg
1 5

<210> 2249
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<212> PRT
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<400> 2249
Gly Arg Glu Glu Tyr Ser Ala Met
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<210> 2250
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<212> PRT
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Gly Arg Glu Glu Tyr Ser Ala Met Arg
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<210> 2251

<211> 9

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<400> 2251

His Glu Glu Tyr Ser Ala Met Arg Asp
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<210> 2252

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2252

Lys Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 2253

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2253

Lys Leu Val Val Val Gly Ala Ser Gly
1 5

<210> 2254

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2254

Leu Asp Ile Leu Asp Thr Ala Gly Arg
1 5

<210> 2255

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2255

Leu Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 2256

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2256

Leu Val Val Val Gly Ala Arg Gly Val
1 5

<210> 2257

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

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Leu Val Val Val Gly Ala Ser Gly Val
1 5

<210> 2258

<211> 11

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2258

Arg Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr
1 5 10

<210> 2259

<211> 8

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<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
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Arg Gly Val Gly Lys Ser Ala Leu

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5

<210> 2260
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<400> 2260
Thr Ala Gly Leu Glu Glu Tyr Ser Ala
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<400> 2261
Thr Glu Tyr Lys Leu Val Val Val Gly Ala Ala
1 5 10

<210> 2262
<211> 10
<212> PRT
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<400> 2262
Val Gly Ala Ala Gly Val Gly Lys Ser Ala
1 5 10

<210> 2263
<211> 8
<212> PRT
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<400> 2263
Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 2264
<211> 10
<212> PRT
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<220>
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<400> 2264
Val Gly Ala Ser Gly Val Gly Lys Ser Ala
1 5 10

<210> 2265
<211> 10
<212> PRT
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<220>
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<400> 2265
Val Gly Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 2266
<211> 8
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<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2266

Val Val Val Gly Ala Ala Gly Val
1 5

<210> 2267

<211> 8

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2267

Val Val Val Gly Ala Val Gly Val
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<210> 2268

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2268

Tyr Lys Leu Val Val Val Gly Ala Cys
1 5

<210> 2269

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2269

Tyr Lys Leu Val Val Val Gly Ala Asp
1 5

<210> 2270

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2270

Tyr Lys Leu Val Val Val Gly Ala Arg
1 5

<210> 2271

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2271

Asp Ile Leu Asp Thr Ala Gly Lys Glu
1 5

<210> 2272

<211> 6

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<400> 2272

His His His His His His

1 5

<210> 2273

<211> 6

<212> PRT

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<400> 2273

His His His His His His

1 5

<210> 2274

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2274

Val Val Val Gly Ala Cys Gly Val Gly Lys

1 5 10

<210> 2275

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

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<400> 2275

Val Val Val Gly Ala Val Gly Val Gly Lys

1 5 10

<210> 2276
<211> 9
<212> PRT
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<400> 2276
Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2277
<211> 9
<212> PRT
<213> Artificial Sequence

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<400> 2277
Leu Val Val Val Gly Ala Cys Gly Val
1 5

<210> 2278
<211> 10
<212> PRT
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<400> 2278
Lys Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2279

<211> 9
<212> PRT
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<400> 2279

Leu Val Val Val Gly Ala Asp Gly Val
1 5

<210> 2280

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2280

Lys Leu Val Val Val Gly Ala Asp Gly Val
1 5 10

<210> 2281

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2281

Leu Val Val Val Gly Ala Val Gly Val
1 5

<210> 2282

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

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<400> 2282

Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 2283

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2283

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 2284

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2284

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 2285

<211> 9

<212> PRT

<213> Artificial Sequence

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peptide

<400> 2285

Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 2286

<211> 10

<212> PRT

<213> Artificial Sequence

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peptide

<400> 2286

Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 2287

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2287

Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2288

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<212> PRT

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peptide

<400> 2288

<210> 2292
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<400> 2292
Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 2293
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<400> 2293
Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2294
<211> 10
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<220>
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<400> 2294
Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2295
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<212> PRT
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<400> 2295

Lys Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2296

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<400> 2296

Phe Leu Val Val Val Gly Ala Cys Gly Leu
1 5 10

<210> 2297

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<400> 2297

Phe Met Val Val Val Gly Ala Cys Gly Ile
1 5 10

<210> 2298

<211> 10

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<400> 2298

Phe Leu Val Val Val Gly Ala Cys Gly Ile
1 5 10

<210> 2299

<211> 10

<212> PRT

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<220>

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<400> 2299

Phe Met Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2300

<211> 10

<212> PRT

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<220>

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<400> 2300

Phe Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2301

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<212> PRT

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Met Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2302
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peptide

<400> 2302
Phe Met Val Val Val Gly Ala Cys Gly Leu
1 5 10

<210> 2303
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<220>
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peptide

<400> 2303
Tyr Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2304
<211> 10
<212> PRT
<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2304
Lys Met Val Val Val Gly Ala Cys Gly Val

<210> 2308
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<220>
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<400> 2308
Lys Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2309
<211> 10
<212> PRT
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<400> 2309
Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 2310
<211> 9
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2310
Leu Val Val Val Gly Ala Asp Gly Val
1 5

<210> 2311
<211> 9
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2311

Leu Val Val Val Gly Ala Cys Gly Val
1 5

<210> 2312

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2312

Leu Val Val Val Gly Ala Val Gly Val
1 5

<210> 2313

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2313

Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2314

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2314

Gly Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2315

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<400> 2315

Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2316

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<400> 2316

Gly Ala Asp Gly Val Gly Lys Ser Ala
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<210> 2317

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<400> 2317

Gly Ala Cys Gly Val Gly Lys Ser Ala
1 5

<210> 2318

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2318

Gly Ala Val Gly Val Gly Lys Ser Ala
1 5

<210> 2319

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<212> PRT

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2319

Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 2320

<211> 9

<212> PRT

<213> Artificial Sequence

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<400> 2320

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 2321
<211> 9
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<400> 2321
Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2322
<211> 10
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<400> 2322
Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 2323
<211> 10
<212> PRT
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<400> 2323
Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 2324

<211> 10
<212> PRT
<213> Artificial Sequence

<220>
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<400> 2324
Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2325
<211> 15
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<223> Asp, Val, Cys, Ala, Arg or Ser

<400> 2325
Lys Leu Val Val Val Gly Ala Xaa Gly Val Gly Lys Ser Ala Leu
1 5 10 15

<210> 2326
<211> 19
<212> PRT
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<400> 2326
Lys Leu Val Val Val Gly Ala Val Gly Val Gly Lys Ser Ala Leu Thr
1 5 10 15

Ile Gln Leu

<210> 2327
<211> 10
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<220>
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<400> 2327
Xaa Xaa Val Val Val Gly Ala Xaa Gly Xaa
1 5 10

<210> 2328

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2328

Asp Thr Ala Gly His Glu Glu Tyr

1 5

<210> 2329

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2329

Thr Ala Gly His Glu Glu Tyr Ser Ala Met

1 5 10

<210> 2330

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2330

Asp Ile Leu Asp Thr Ala Gly His Glu

1 5

<210> 2331

<211> 8

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2331

Asp Ile Leu Asp Thr Ala Gly His
1 5

<210> 2332

<211> 9

<212> PRT

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<400> 2332

Ile Leu Asp Thr Ala Gly His Glu Glu
1 5

<210> 2333

<211> 8

<212> PRT

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<400> 2333

Ile Leu Asp Thr Ala Gly His Glu
1 5

<210> 2334

<211> 11

<212> PRT

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<400> 2337

Asp Ile Leu Asp Thr Ala Gly Arg Glu

1 5

<210> 2338

<211> 8

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2338

Asp Ile Leu Asp Thr Ala Gly Arg

1 5

<210> 2339

<211> 9

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<400> 2339

Ile Leu Asp Thr Ala Gly Arg Glu Glu

1 5

<210> 2340

<211> 8

<212> PRT

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<400> 2340

Ile Leu Asp Thr Ala Gly Arg Glu

1 5

<210> 2341
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<400> 2341
Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Arg
1 5 10

<210> 2342
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<212> PRT
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<400> 2342
Thr Ala Gly Arg Glu Glu Tyr Ser Ala Met
1 5 10

<210> 2343
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<400> 2343
Arg Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 2344

<211> 11
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<400> 2344

Asp Thr Ala Gly Lys Glu Glu Tyr Ser Ala Met
1 5 10

<210> 2345

<211> 11

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<400> 2345

Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Lys
1 5 10

<210> 2346

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2346

Asp Thr Ala Gly Lys Glu Glu Tyr
1 5

<210> 2347

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2347

Leu Leu Asp Ile Leu Asp Thr Ala Gly Lys
1 5 10

<210> 2348

<211> 8

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2348

Ile Leu Asp Thr Ala Gly Lys Glu
1 5

<210> 2349

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2349

Ile Leu Asp Thr Ala Gly Lys Glu Glu
1 5

<210> 2350

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 2350

Asp Thr Ala Gly Leu Glu Glu Tyr

1 5

<210> 2351

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2351

Ile Leu Asp Thr Ala Gly Leu Glu

1 5

<210> 2352

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2352

Asp Ile Leu Asp Thr Ala Gly Leu

1 5

<210> 2353

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2353

Ile Leu Asp Thr Ala Gly Leu Glu Glu
1 5

<210> 2354
<211> 12
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<220>
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Gly Leu Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr
1 5 10

<210> 2355
<211> 11
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<220>
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<400> 2355
Leu Leu Asp Ile Leu Asp Thr Ala Gly Leu Glu
1 5 10

<210> 2356
<211> 9
<212> PRT
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<220>
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<400> 2356
Leu Asp Ile Leu Asp Thr Ala Gly Leu
1 5

<210> 2357
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Asp Ile Leu Asp Thr Ala Gly Leu Glu
1 5

<210> 2358
<211> 11
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Asp Ile Leu Asp Thr Ala Gly Leu Glu Glu Tyr
1 5 10

<210> 2359
<211> 8
<212> PRT
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<220>
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Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2360
<211> 10

<212> PRT
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<220>
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Gly Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2361
<211> 9
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2361
Ala Ala Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2362
<211> 8
<212> PRT
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<220>
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<400> 2362
Cys Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2363
<211> 9
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2363

Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2364

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2364

Asp Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2365

<211> 9

<212> PRT

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<400> 2365

Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2366

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<400> 2366
Asp Gly Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 2367
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<400> 2367
Gly Ala Arg Gly Val Gly Lys Ser Ala
1 5

<210> 2368
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peptide

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Lys Leu Val Val Val Gly Ala Arg Gly Val
1 5 10

<210> 2369
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peptide

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Val Val Val Gly Ala Arg Gly Val

1

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<210> 2370

<211> 8

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2370

Ser Gly Val Gly Lys Ser Ala Leu

1

5

<210> 2371

<211> 10

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<220>

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<400> 2371

Val Val Val Gly Ala Ser Gly Val Gly Lys

1

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<210> 2372

<211> 10

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2372

Gly Ala Ser Gly Val Gly Lys Ser Ala Leu

1

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<210> 2373
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<400> 2373
Val Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2374
<211> 10
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<220>
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<400> 2374
Val Val Val Gly Ala Gly Cys Val Gly Lys
1 5 10

<210> 2375
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<400> 2375
Lys Leu Val Val Val Gly Ala Gly Cys
1 5

<210> 2376
<211> 8
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2376

Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2377

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2377

Asp Val Gly Lys Ser Ala Leu Thr Ile
1 5

<210> 2378

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2378

Val Val Val Gly Ala Gly Asp Val Gly Lys
1 5 10

<210> 2379

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2379

Thr Ala Gly Lys Glu Glu Tyr Ser Ala Met
1 5 10

<210> 2380

<211> 11

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2380

Asp Thr Ala Gly His Glu Glu Tyr Ser Ala Met
1 5 10

<210> 2381

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2381

Thr Ala Gly His Glu Glu Tyr Ser Ala
1 5

<210> 2382

<211> 11

<212> PRT

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<220>

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<210> 2386
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<220>
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<400> 2386
Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5

<210> 2387
<211> 10
<212> PRT
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<400> 2387
Ala Gly Lys Glu Glu Tyr Ser Ala Met Arg
1 5 10

<210> 2388
<211> 10
<212> PRT
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<400> 2388
Ala Gly Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 2389

<211> 9
<212> PRT
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<400> 2389
Ala Arg Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2390
<211> 8
<212> PRT
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<220>
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<400> 2390
Ala Ser Gly Val Gly Lys Ser Ala
1 5

<210> 2391
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<400> 2391
Ala Ser Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2392
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2392

Ala Val Gly Val Gly Lys Ser Ala
1 5

<210> 2393

<211> 9

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2393

Cys Val Gly Lys Ser Ala Leu Thr Ile
1 5

<210> 2394

<211> 8

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2394

Asp Ile Leu Asp Thr Ala Gly Lys
1 5

<210> 2395

<211> 11

<212> PRT

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<223> Description of Artificial Sequence: Synthetic

peptide

<400> 2395

Asp Ile Leu Asp Thr Ala Gly Arg Glu Glu Tyr
1 5 10

<210> 2396

<211> 12

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<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2396

Asp Thr Ala Gly His Glu Glu Tyr Ser Ala Met Arg
1 5 10

<210> 2397

<211> 9

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peptide

<400> 2397

Asp Thr Ala Gly Lys Glu Glu Tyr Ser
1 5

<210> 2398

<211> 12

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2398

Asp Thr Ala Gly Lys Glu Glu Tyr Ser Ala Met Arg
1 5 10

<210> 2399

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2399

Asp Thr Ala Gly Leu Glu Glu Tyr Ser
1 5

<210> 2400

<211> 10

<212> PRT

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<400> 2400

Asp Thr Ala Gly Leu Glu Glu Tyr Ser Ala
1 5 10

<210> 2401

<211> 12

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2401

Asp Thr Ala Gly Leu Glu Glu Tyr Ser Ala Met Arg
1 5 10

<210> 2402
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<220>
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<400> 2402
Asp Thr Ala Gly Arg Glu Glu Tyr Ser
1 5

<210> 2403
<211> 12
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<220>
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<400> 2403
Asp Thr Ala Gly Arg Glu Glu Tyr Ser Ala Met Arg
1 5 10

<210> 2404
<211> 9
<212> PRT
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<220>
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<400> 2404
Gly Ala Ala Gly Val Gly Lys Ser Ala
1 5

<210> 2405
<211> 9

<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2405

Gly Ala Cys Gly Val Gly Lys Ser Ala
1 5

<210> 2406

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2406

Gly Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2407

<211> 8

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2407

Gly Ala Asp Gly Val Gly Lys Ser
1 5

<210> 2408

<211> 9

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2408

Gly Ala Gly Asp Val Gly Lys Ser Ala
1 5

<210> 2409

<211> 10

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2409

Gly Ala Gly Asp Val Gly Lys Ser Ala Leu
1 5 10

<210> 2410

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2410

Gly Ala Ser Gly Val Gly Lys Ser Ala
1 5

<210> 2411

<211> 8

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2411
Gly Cys Val Gly Lys Ser Ala Leu
1 5

<210> 2412
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peptide

<400> 2412
Gly Cys Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 2413
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<212> PRT
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<220>
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peptide

<400> 2413
Gly His Glu Glu Tyr Ser Ala Met
1 5

<210> 2414
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<220>
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peptide

<400> 2414
Gly Lys Glu Glu Tyr Ser Ala Met

1

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<210> 2415

<211> 9

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<400> 2415

Gly Leu Glu Glu Tyr Ser Ala Met Arg

1

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<210> 2416

<211> 8

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2416

Gly Arg Glu Glu Tyr Ser Ala Met

1

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<210> 2417

<211> 9

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<400> 2417

Gly Arg Glu Glu Tyr Ser Ala Met Arg

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<210> 2418
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<400> 2418
His Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 2419
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<400> 2419
Lys Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 2420
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<400> 2420
Lys Leu Val Val Val Gly Ala Ser Gly
1 5

<210> 2421
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<400> 2421

Leu Asp Ile Leu Asp Thr Ala Gly Arg
1 5

<210> 2422

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2422

Leu Glu Glu Tyr Ser Ala Met Arg Asp
1 5

<210> 2423

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2423

Leu Val Val Val Gly Ala Arg Gly Val
1 5

<210> 2424

<211> 9

<212> PRT

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<400> 2424

Leu Val Val Val Gly Ala Ser Gly Val
1 5

<210> 2425

<211> 11

<212> PRT

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<400> 2425

Arg Glu Glu Tyr Ser Ala Met Arg Asp Gln Tyr
1 5 10

<210> 2426

<211> 8

<212> PRT

<213> Artificial Sequence

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<400> 2426

Arg Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2427

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2427

Thr Ala Gly Leu Glu Glu Tyr Ser Ala

1 5

<210> 2428

<211> 11

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2428

Thr Glu Tyr Lys Leu Val Val Val Gly Ala Ala

1 5 10

<210> 2429

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2429

Val Gly Ala Ala Gly Val Gly Lys Ser Ala

1 5 10

<210> 2430

<211> 8

<212> PRT

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<400> 2430

Val Gly Ala Asp Gly Val Gly Lys

1 5

<210> 2431
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<212> PRT
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<400> 2431
Val Gly Ala Ser Gly Val Gly Lys Ser Ala
1 5 10

<210> 2432
<211> 10
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<400> 2432
Val Gly Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 2433
<211> 8
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<400> 2433
Val Val Val Gly Ala Ala Gly Val
1 5

<210> 2434

<211> 8
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2434

Val Val Val Gly Ala Val Gly Val
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<210> 2435

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2435

Tyr Lys Leu Val Val Val Gly Ala Cys
1 5

<210> 2436

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2436

Tyr Lys Leu Val Val Val Gly Ala Asp
1 5

<210> 2437

<211> 9

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2437

Tyr Lys Leu Val Val Val Gly Ala Arg
1 5

<210> 2438

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2438

Asp Ile Leu Asp Thr Ala Gly Lys Glu
1 5

<210> 2439

<211> 9

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2439

Leu Val Val Val Gly Ala Cys Gly Val
1 5

<210> 2440

<211> 10

<212> PRT

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<223> Description of Artificial Sequence: Synthetic

Leu Val Val Val Gly Ala Val Gly Val
1 5

<210> 2444
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<400> 2444
Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 2445
<211> 9
<212> PRT
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<400> 2445
Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 2446
<211> 10
<212> PRT
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<400> 2446
Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 2447
<211> 9
<212> PRT
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<400> 2447
Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 2448
<211> 10
<212> PRT
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<400> 2448
Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 2449
<211> 9
<212> PRT
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<400> 2449
Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2450
<211> 10

<212> PRT
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<400> 2450
Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2451
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<212> PRT
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<400> 2451
Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 2452
<211> 9
<212> PRT
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<220>
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<400> 2452
Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 2453
<211> 10
<212> PRT
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<210> 2463
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<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2463
Phe Met Val Val Val Gly Ala Cys Gly Leu
1 5 10

<210> 2464
<211> 10
<212> PRT
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<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2464
Tyr Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2465
<211> 10
<212> PRT
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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2465
Lys Met Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2466
<211> 10
<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2466

Tyr Met Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2467

<211> 10

<212> PRT

<213> Artificial Sequence

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2467

Met Met Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2468

<211> 13

<212> PRT

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<223> Description of Artificial Sequence: Synthetic peptide

<400> 2468

Thr Glu Tyr Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 2469

<211> 26

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2469

Trp Gln Ala Gly Ile Leu Ala Arg Lys Leu Val Val Val Gly Ala Val
1 5 10 15

Gly Val Gln Gly Gln Asn Leu Lys Tyr Gln
20 25

<210> 2470

<211> 25

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2470

His Ser Tyr Thr Thr Ala Glu Lys Leu Val Val Val Gly Ala Val Gly
1 5 10 15

Val Ile Leu Gly Val Leu Leu Leu Ile
20 25

<210> 2471

<211> 26

<212> PRT

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<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2471

Pro Leu Thr Glu Glu Lys Ile Lys Lys Leu Val Val Val Gly Ala Val
1 5 10 15

Gly Val Glu Lys Glu Gly Lys Ile Ser Lys

<210> 2472
 <211> 30
 <212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2472

Gly Ala Leu His Phe Lys Pro Gly Ser Arg Lys Leu Val Val Val Gly
 1 5 10 15

Ala Val Gly Val Ala Ala Ser Asp Phe Ile Phe Leu Val Thr
 20 25 30

<210> 2473
 <211> 30
 <212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2473

Arg Arg Ala Asn Lys Asp Ala Thr Ala Glu Lys Leu Val Val Val Gly
 1 5 10 15

Ala Val Gly Val Lys Glu Leu Lys Gln Val Ala Ser Pro Phe
 20 25 30

<210> 2474
 <211> 30
 <212> PRT
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<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2474

Lys Ala Phe Ile Ser His Glu Glu Lys Arg Lys Leu Val Val Val Gly
1 5 10 15

Ala Val Gly Val Lys Lys Lys Leu Ile Asn Glu Lys Lys Glu
20 25 30

<210> 2475

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2475

Thr Asp Leu Ser Ser Arg Phe Ser Lys Ser Lys Leu Val Val Val Gly
1 5 10 15

Ala Val Gly Val Lys Lys Cys Asp Ile Ser Leu Gln Phe Phe
20 25 30

<210> 2476

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2476

Phe Asp Leu Gly Gly Gly Thr Phe Asp Val Lys Leu Val Val Val Gly
1 5 10 15

Ala Val Gly Val Lys Ser Thr Ala Gly Asp Thr His Leu Gly

<210> 2477

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2477

Cys Leu Leu Leu His Tyr Ser Val Ser Lys Lys Leu Val Val Val Gly
1 5 10 15

Ala Val Gly Val Ala Thr Phe Tyr Val Ala Val Thr Val Pro
 20 25 30

<210> 2478

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2478

Ile Asp Ile Ile Met Lys Ile Arg Asn Ala
1 5 10

<210> 2479

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2479

Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe
1 5 10 15

Phe Phe Phe Phe Ile Ile Phe Phe Ile Phe Phe Trp Met Cys
20 25 30

<210> 2480
<211> 30
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2480
Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe Phe
1 5 10 15

Phe Phe Phe Phe Phe Phe Phe Phe Ala Ala Phe Trp Phe Trp
20 25 30

<210> 2481
<211> 30
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2481
Ile Phe Phe Ile Phe Phe Ile Ile Phe Phe Phe Phe Phe Phe Phe Phe
1 5 10 15

Phe Phe Phe Phe Ile Ile Ile Ile Ile Ile Ile Trp Glu Cys
20 25 30

<210> 2482

<211> 30
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2482
Phe Ile Phe Phe Phe Ile Ile Phe Phe Phe Phe Phe Ile Phe Phe Phe
1 5 10 15

Phe Phe Ile Phe Ile Ile Ile Ile Ile Ile Phe Trp Glu Cys
20 25 30

<210> 2483
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2483
Trp Gln Ala Gly Ile Leu Ala Arg
1 5

<210> 2484
<211> 7
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2484
His Ser Tyr Thr Thr Ala Glu
1 5

<210> 2485
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2485
Pro Leu Thr Glu Glu Lys Ile Lys
1 5

<210> 2486
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2486
Gly Ala Leu His Phe Lys Pro Gly Ser Arg
1 5 10

<210> 2487
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2487
Arg Arg Ala Asn Lys Asp Ala Thr Ala Glu
1 5 10

<210> 2488
<211> 10
<212> PRT

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2491

Cys Leu Leu Leu His Tyr Ser Val Ser Lys
1 5 10

<210> 2492

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2492

Met Thr Glu Tyr Lys Leu Val Val Val
1 5

<210> 2493

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2493

Lys Lys Asn Lys Lys Asp Asp Ile Lys Asp
1 5 10

<210> 2494

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<210> 2497

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2497

Gly Lys Ser Ala Leu Thr Ile Gln Leu

1 5

<210> 2498

<211> 7

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2498

Gly Lys Ser Ala Leu Thr Ile

1 5

<210> 2499

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2499

Gln Gly Gln Asn Leu Lys Tyr Gln

1 5

<210> 2500

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2500

Ile Leu Gly Val Leu Leu Leu Ile
1 5

<210> 2501

<211> 8

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2501

Glu Lys Glu Gly Lys Ile Ser Lys
1 5

<210> 2502

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2502

Ala Ala Ser Asp Phe Ile Phe Leu Val Thr
1 5 10

<210> 2503

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2503

Lys Glu Leu Lys Gln Val Ala Ser Pro Phe
1 5 10

<210> 2504

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2504

Lys Lys Lys Leu Ile Asn Glu Lys Lys Glu
1 5 10

<210> 2505

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2505

Lys Lys Cys Asp Ile Ser Leu Gln Phe Phe
1 5 10

<210> 2506

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2506

Lys Ser Thr Ala Gly Asp Thr His Leu Gly
1 5 10

<210> 2507

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2507

Ala Thr Phe Tyr Val Ala Val Thr Val Pro
1 5 10

<210> 2508

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 2508

Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr Asp Pro
1 5 10 15

Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
20 25 30

<210> 2509

<211> 30

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
polypeptide

<400> 2509

Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr Asp Pro Thr
1 5 10 15

Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly Glu
 20 25 30

<210> 2510

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2510

Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 2511

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2511

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 2512

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic

peptide

<400> 2512

Val Val Gly Ala Val Gly Val Gly Lys

1 5

<210> 2513

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2513

Val Val Val Gly Ala Asp Gly Val Gly Lys

1 5 10

<210> 2514

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2514

Val Val Val Gly Ala Cys Gly Val Gly Lys

1 5 10

<210> 2515

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2515

Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2516

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2516

Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2517

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2517

Gly Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2518

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2518

Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2519
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2519
Gly Ala Asp Gly Val Gly Lys Ser Ala
1 5

<210> 2520
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2520
Gly Ala Cys Gly Val Gly Lys Ser Ala
1 5

<210> 2521
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2521
Gly Ala Val Gly Val Gly Lys Ser Ala
1 5

<210> 2522
<211> 10

<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2522

Lys Leu Val Val Val Gly Ala Asp Gly Val
1 5 10

<210> 2523

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2523

Lys Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2524

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2524

Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 2525

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2525

Leu Val Val Val Gly Ala Asp Gly Val
1 5

<210> 2526

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2526

Leu Val Val Val Gly Ala Cys Gly Val
1 5

<210> 2527

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2527

Leu Val Val Val Gly Ala Val Gly Val
1 5

<210> 2528

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2528

Gly Ala Asp Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2529

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2529

Gly Ala Cys Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2530

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2530

Gly Ala Val Gly Val Gly Lys Ser Ala Leu
1 5 10

<210> 2531

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2531

Gly Ala Asp Gly Val Gly Lys Ser Ala

1

5

<210> 2532

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2532

Gly Ala Cys Gly Val Gly Lys Ser Ala

1

5

<210> 2533

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2533

Gly Ala Val Gly Val Gly Lys Ser Ala

1

5

<210> 2534

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2534

Val Val Gly Ala Asp Gly Val Gly Lys

1

5

<210> 2535
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2535
Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 2536
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2536
Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2537
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2537
Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 2538
<211> 10
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2538

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 2539

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2539

Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2540

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2540

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 2541

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2541

Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2542

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2542

Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2543

<211> 188

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2543

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr
20 25 30

Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
35 40 45

Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Gln Glu Glu Tyr

50

55

60

Ser Ala Met Arg Asp Gln Tyr Met Arg Thr Gly Glu Gly Phe Leu Cys
65 70 75 80

Val Phe Ala Ile Asn Asn Thr Lys Ser Phe Glu Asp Ile His His Tyr
85 90 95

Arg Glu Gln Ile Lys Arg Val Lys Asp Ser Glu Asp Val Pro Met Val
100 105 110

Leu Val Gly Asn Lys Cys Asp Leu Pro Ser Arg Thr Val Asp Thr Lys
115 120 125

Gln Ala Gln Asp Leu Ala Arg Ser Tyr Gly Ile Pro Phe Ile Glu Thr
130 135 140

Ser Ala Lys Thr Arg Gln Gly Val Asp Asp Ala Phe Tyr Thr Leu Val
145 150 155 160

Arg Glu Ile Arg Lys His Lys Glu Lys Met Ser Lys Asp Gly Lys Lys
165 170 175

Lys Lys Lys Lys Ser Lys Thr Lys Cys Val Ile Met
180 185

<210> 2544

<211> 188

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic polypeptide

<400> 2544

Met Thr Glu Tyr Lys Leu Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10 15

Ser Ala Leu Thr Ile Gln Leu Ile Gln Asn His Phe Val Asp Glu Tyr
20 25 30

Asp Pro Thr Ile Glu Asp Ser Tyr Arg Lys Gln Val Val Ile Asp Gly
35 40 45

Glu Thr Cys Leu Leu Asp Ile Leu Asp Thr Ala Gly Gln Glu Glu Tyr
50 55 60

Ser Ala Met Arg Asp Gln Tyr Met Arg Thr Gly Glu Gly Phe Leu Cys
65 70 75 80

Val Phe Ala Ile Asn Asn Thr Lys Ser Phe Glu Asp Ile His His Tyr
85 90 95

Arg Glu Gln Ile Lys Arg Val Lys Asp Ser Glu Asp Val Pro Met Val
100 105 110

Leu Val Gly Asn Lys Cys Asp Leu Pro Ser Arg Thr Val Asp Thr Lys
115 120 125

Gln Ala Gln Asp Leu Ala Arg Ser Tyr Gly Ile Pro Phe Ile Glu Thr
130 135 140

Ser Ala Lys Thr Arg Gln Gly Val Asp Asp Ala Phe Tyr Thr Leu Val
145 150 155 160

Arg Glu Ile Arg Lys His Lys Glu Lys Met Ser Lys Asp Gly Lys Lys
165 170 175

Lys Lys Lys Lys Ser Lys Thr Lys Cys Val Ile Met

<210> 2545
<211> 9
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2545

Leu Val Val Val Gly Ala Cys Gly Val
1 5

<210> 2546
<211> 10
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2546

Lys Leu Val Val Val Gly Ala Cys Gly Val
1 5 10

<210> 2547
<211> 9
<212> PRT
<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2547

Leu Val Val Val Gly Ala Asp Gly Val
1 5

<210> 2548
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2548
Lys Leu Val Val Val Gly Ala Asp Gly Val
1 5 10

<210> 2549
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2549
Leu Val Val Val Gly Ala Val Gly Val
1 5

<210> 2550
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2550
Lys Leu Val Val Val Gly Ala Val Gly Val
1 5 10

<210> 2551
<211> 9
<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2551

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 2552

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2552

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 2553

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2553

Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 2554

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2554

Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 2555

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2555

Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2556

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2556

Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2557

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic peptide

<400> 2557

Val Val Gly Ala Cys Gly Val Gly Lys
1 5

<210> 2558

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2558

Val Val Val Gly Ala Cys Gly Val Gly Lys
1 5 10

<210> 2559

<211> 9

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2559

Val Val Gly Ala Asp Gly Val Gly Lys
1 5

<210> 2560

<211> 10

<212> PRT

<213> Artificial Sequence

<220>

<223> Description of Artificial Sequence: Synthetic
peptide

<400> 2560

Val Val Val Gly Ala Asp Gly Val Gly Lys
1 5 10

<210> 2561
<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2561
Val Val Gly Ala Val Gly Val Gly Lys
1 5

<210> 2562
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2562
Val Val Val Gly Ala Val Gly Val Gly Lys
1 5 10

<210> 2563
<211> 8
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2563
Asp Gly Val Gly Lys Ser Ala Leu
1 5

<210> 2564

<211> 9
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2564
Asp Gly Val Gly Lys Ser Ala Leu Thr
1 5

<210> 2565
<211> 10
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2565
Asp Gly Val Gly Lys Ser Ala Leu Thr Ile
1 5 10

<210> 2566
<211> 20
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: Synthetic peptide

<400> 2566
Thr Glu Tyr Lys Leu Val Val Val Gly Ala Val Gly Val Gly Lys Ser
1 5 10 15

Ala Leu Thr Ile
20

