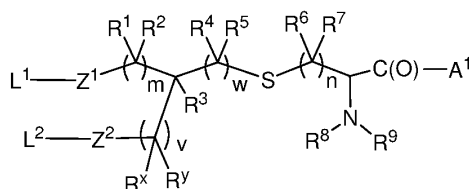


CLAIMS

1. A compound of the formula (I):



(I)

wherein

m and w are each independently an integer from 0 to 7 and v is an integer from 0 to 5,

provided that:

the sum of m, v, and w is at least 3; and

the sum of m and w is from 0 to 7;

n is 1 or 2;

Z¹ and Z² are each independently selected from the group consisting of -O-, -NR-, -S-, -S(O)-, -SO₂-, -C(O)O-, -OC(O)-, -C(O)NR-, -NRC(O)-, -C(O)S-, -SC(O)-, -OC(O)O-, -NRC(O)O-, -OC(O)NR-, and -NRC(O)NR-;

R¹, R², R^x, R^y, R⁴, R⁵, R⁶, and R⁷ at each instance of m, v, w, and n are each independently hydrogen or C1-6aliphatic;

R³, and R⁸ are each independently hydrogen or C1-6aliphatic;

R⁹ is hydrogen, C1-6aliphatic, an amino protecting group, L³-C(O)-, or

A²;

L¹ and L² are each independently selected from C5-21aliphatic or C4-20heteroaliphatic;

L³ is C1-21aliphatic or C2-20heteroaliphatic;

A¹ is an amino acid, a peptide, OH, OP¹, NH₂, or NHP², wherein P¹ is a carboxyl protecting group, and wherein P² is a carboxamide protecting group;

A² is an amino acid or a peptide;

wherein any aliphatic or heteroaliphatic present in any of R, R¹, R², R³, R⁴, R⁵, R⁶, R⁷, R⁸, R⁹, R^x, R^y, L¹, L², and L³ is optionally substituted; or a pharmaceutically acceptable salt or solvate thereof;

with the proviso that:

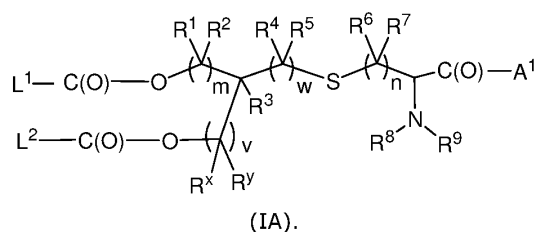
(1) at least one of R⁹ and A¹ is a peptide comprising, consisting essentially of, or consisting of an amino acid sequence selected from the group consisting of:

- (a) 8 or more contiguous amino acid residues from the sequence
 Xaa₁Xaa₂Xaa₃Xaa₄LQQLSLLMWITQXaa₂₂FLPVFLAQPPSGQRR [SEQ ID NO:1],
 wherein Xaa₁ is absent or is S, Xaa₂ is absent or is a hydrophilic amino acid, Xaa₃
 is absent or is a hydrophilic amino acid, and Xaa₄ is absent or is one or more
 5 hydrophilic amino acids,
- (b) 8 or more contiguous amino acid residues from the sequence
 Xaa₁Xaa₂Xaa₃LQQLSLLMWITQXaa₂₂FLPVFLAQPPSGQRR [SEQ ID NO:2], wherein
 Xaa₁ is absent or is S, Xaa₂ is absent or is a hydrophilic amino acid, and Xaa₃ is
 absent or is from one to ten hydrophilic amino acids,
- 10 (c) 8 or more contiguous amino acid residues from the sequence
 Xaa₁Xaa₂LQQLSLLMWITQXaa₂₂FLPVFLAQPPSGQRR [SEQ ID NO:3], wherein Xaa₁ is
 absent or is S, and Xaa₂ is absent or is from one to four hydrophilic amino acids,
- (d) 8 or more contiguous amino acid residues from the sequence
 SKKKKLQQLSLLMWITQXaa₂₂FLPVFLAQPPSGQRR [SEQ ID NO:4],
- 15 (e) the sequence of any one of SEQ ID NOs: 1 to 4,
- (f) 8 or more contiguous amino acid residues from the sequence
 LQQLSLLMWITQXaa₂₂FLPVFLAQPPSGQRR [SEQ ID NO:5],
- (g) the sequence of SEQ ID NO: 5,
- (h) 8 or more contiguous amino acid residues from the sequence
 20 SLLMWITQXaa₂₂FLPVF [SEQ ID NO:6],
- (i) the sequence of SEQ ID NO: 6,
- (j) 8 or more contiguous amino acid residues from the sequence
 SKKKKSLLMWITQXaa₂₂ [SEQ ID NO:7],
- (k) the sequence of SEQ ID NO: 7,
- 25 (l) 8 or more contiguous amino acid residues from the sequence SLLMWITQXaa₂₂
 [SEQ ID NO:8],
- (m) the sequence of SEQ ID NO: 8,
- (n) or any combination of two or more of (a) to (m) above,

wherein Xaa₂₂ in each sequence is independently any naturally occurring amino acid except C (for example, V, I, or L), and any sequence of 8 or more contiguous amino acid residues from any of the above sequences comprises Xaa₂₂; or

- 5 (2) m is an integer from 3 to 7, and at least one of R9 and A1 is an amino acid or a peptide.
2. The compound of claim 1, wherein at least one of R9 and A1 is a peptide comprising, consisting essentially of, or consisting of one or more amino acid sequences selected from the group as defined in proviso (1) of claim 1.
3. The compound of claim 2, wherein m and w are each independently from 0 to 5.
- 10 4. The compound of claim 2 or 3, wherein m and w are each independently from 1 to 4.
5. The compound of any one of claims 2 to 4, wherein the sum of m and w is from 2 to 7.
- 15 6. The compound of any one of claims 2 to 5, wherein the sum of m and w is from 2 to 5.
7. The compound of any one of claims 2 to 6, wherein the sum of m and w is 3.
8. The compound of any one of claims 2 to 7, wherein m is from 1 to 6.
9. The compound of any one of claims 2 to 8, wherein m is from 1 to 5.
10. The compound of any one of claims 2 to 9, wherein m is from 1 to 3.
- 20 11. The compound of any one of claims 2 to 10, wherein m is 2.
12. The compound of claim 1, wherein m is an integer from 3 to 7 and at least one of R9 and A1 is an amino acid or a peptide as defined in proviso (2) of claim 1.
13. The compound of claim 12, wherein at least one of R9 and A1 is a peptide.
- 25 14. The compound of claim 12 or 13, wherein the peptide comprises, consists essentially of, or consists of an amino acid sequence selected from the group consisting of 8 or more contiguous amino acids from the amino acid sequence of any one of SEQ ID NOs 8 – 129.

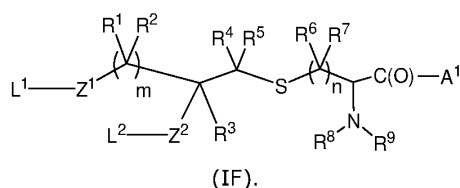
15. The compound of claims 12 or 13, wherein the peptide comprises, consists essentially of, or consists of one or more amino acid sequences selected from the group defined in proviso (1) of claim 1.
16. The compound of any one of the preceding claims, wherein Xaa₂₂ in each sequence is V.
17. The compound of any one of the preceding claims, wherein m is from 3 to 6.
18. The compound of any one of the preceding claims, wherein m is from 3 to 5.
19. The compound of any one of the preceding claims, wherein
R1, R2, Rx, Ry, R4, R5, R6, and R7 at each instance of m, v, w, and n are each independently hydrogen, C1-6alkyl, or C3-6cycloalkyl;
R, R3, and R8 are each independently hydrogen, C1-6alkyl, or C3-6cycloalkyl;
R9 is hydrogen, C1-6alkyl, C3-6cycloalkyl, an amino protecting group, L3-C(O), or A2;
L1 and L2 are each independently selected from C5-21alkyl, C5-21alkenyl, or C4-20heteroalkyl;
L3 is C1-21alkyl, C2-21alkenyl, C3-6cycloalkyl, or C2-20heteroalkyl;
A1 is an amino acid, a peptide, OH, OP1, NH₂, or NHP2, wherein P1 is a carboxyl protecting group, and wherein P2 is a carboxamide protecting group;
A2 is an amino acid or a peptide;
wherein any alkyl, alkenyl, cycloalkyl or heteroalkyl present in any of R, R1, R2, R3, R4, R5, R6, R7, R8, R9, Rx, Ry, L1, L2, and L3 is optionally substituted.
20. The compound of any one of the preceding claims, wherein Z1 and Z2 are each independently selected from the group consisting of -C(O)O-, -C(O)NR-, and -C(O)S-.
21. The compound of any one of the preceding claims, wherein the compound is a compound of the formula (IA):



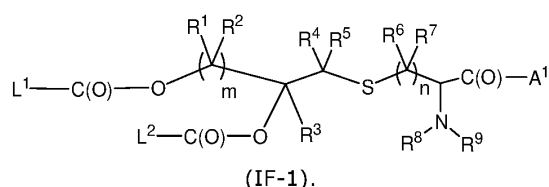
22. The compound of any one of the preceding claims, wherein v is from 0 to 3.
23. The compound of any one of the preceding claims, wherein v is 0.
24. The compound of any one of the preceding claims, wherein w is 1 or 2.
25. The compound of any one of the preceding claims, wherein w is 1.
- 5 26. The compound of any one of the preceding claims, wherein n is 1.
27. The compound of any one of the preceding claims, wherein L1 and L2 are each independently C5-21alkyl.
28. The compound of any one of the preceding claims, wherein L1 and L2 are each independently linear C15alkyl.
- 10 29. The compound of any one of the preceding claims, wherein L3 is methyl or linear C15alkyl.
30. The compound of any one of the preceding claims, wherein L3 is methyl.
31. The compound of any one of the preceding claims, wherein the amino protecting group is Boc or Fmoc.
- 15 32. The compound of any one of the preceding claims, wherein R1 and R2 at each instance of m are each independently C1-6alkyl or hydrogen, preferably hydrogen.
33. The compound of any one of the preceding claims, wherein R3 is C1-6alkyl or hydrogen, preferably hydrogen.
- 20 34. The compound of any one of the preceding claims, wherein R4 and R5 at each instance of w are each independently C1-6alkyl or hydrogen, preferably hydrogen.
35. The compound of any one of the preceding claims, wherein Rx and Ry at each instance of v are each independently C1-6alkyl or hydrogen, preferably hydrogen.
36. The compound of any one of the preceding claims, wherein R6 and R7 at each instance of n are each independently C1-6alkyl or hydrogen, preferably hydrogen.
- 25 37. The compound of any one of the preceding claims, wherein R8 is independently C1-6alkyl or hydrogen, preferably hydrogen.

38. The compound of any one of the preceding claims, wherein R₉ is C₁-6alkyl, hydrogen, an amino protecting group, L₃-C(O), or A₂, preferably hydrogen, an amino protecting group, L₃-C(O), or A₂.

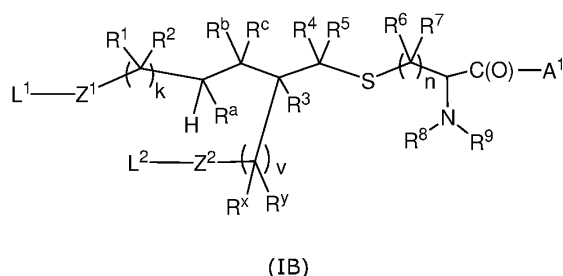
39. The compound of any one of the preceding claims, wherein the compound is a compound of the formula (IF):



40. The compound of claim 39, wherein the compound is a compound of the formula (IF-1):



41. The compound of any one of claims 1 to 38, wherein the compound is a compound of the formula (IB):



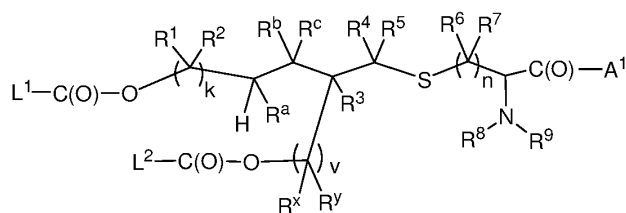
wherein

k is an integer from 0 to 4; and

R_a, R_b, and R_c are each independently hydrogen or C₁-6aliphatic.

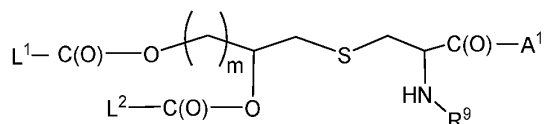
42. The compound of claim 41, wherein the compound of formula (IB) is a compound of the formula (IC):

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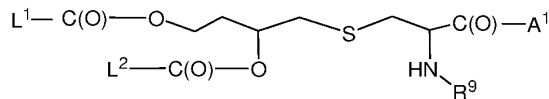
(IC).

43. The compound of claim 41 or 42, wherein k is 0 to 3.
44. The compound of any one of claims 41 to 43, wherein k is 0.
- 5 45. The compound of any one of claims 41 to 43, wherein k is 1 to 3.
46. The compound of any one of claims 41 to 45, wherein R^a , R^b , and R^c are each independently hydrogen, C1-6alkyl, or C3-6cycloalkyl, preferably hydrogen.
47. The compound of any one of claims 41 to 46, wherein R^a , R^b , and R^c are each independently selected from hydrogen or C1-6alkyl, preferably hydrogen.
- 10 48. The compound of any one of the preceding claims, wherein the compound is a compound of the formula (ID-1):



(ID-1).

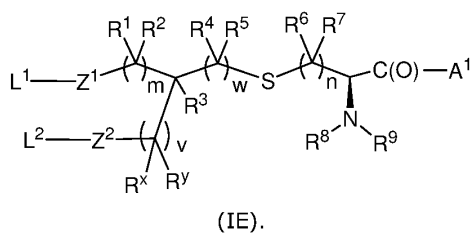
49. The compound of claim 48, wherein m is from 3 to 5.
- 15 50. The compound of claim 48, wherein the compound is a compound of the formula (ID):



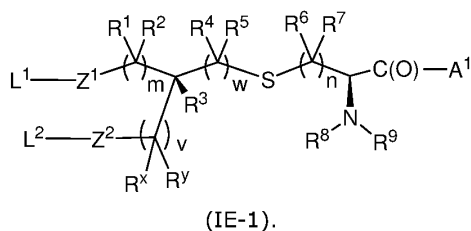
(ID).

51. The compound of any one of the preceding claims, wherein the compound of formula (I) has the formula (IE):
- 20

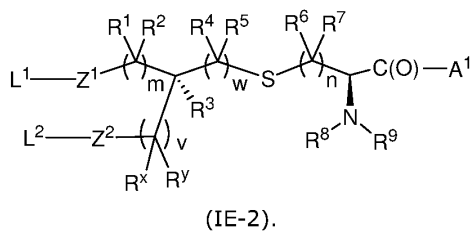
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52. The compound of any one of the preceding claims, wherein the compound has the formula (IE-1):



53. The compound of any one of the preceding claims, wherein the compound has the formula (IE-2):



54. The compound of any one of the preceding claims, wherein the peptide comprises an epitope.

55. The compound of claim 54, wherein the epitope is a peptide epitope.

56. The compound of claim 54 or 55, wherein the epitope is coupled or bound via a linker group.

57. The compound of any one of the preceding claims, wherein the amino acid of the peptide conjugate to which the lipid moieties are conjugated is an N-terminal amino acid residue.

58. The compound of any one of the preceding claims, wherein A^1 is serine or a peptide comprising serine as the first N-terminal amino acid residue.

59. The compound of any one of the preceding claims, wherein A1 and/or A2 is a peptide comprising a solubilising group.
60. The compound of claim 59, wherein the solubilising group comprises an amino acid sequence comprising two or more hydrophilic amino acid residues in the peptide chain.
61. The compound of claim 60, wherein the two or more hydrophilic amino acid residues are adjacent to the serine residue.
62. The compound of any one of the preceding claims, wherein A1 is a peptide and R9 is hydrogen or L3-C(O), for example Me-C(O).
63. The compound of any one of the preceding claims, wherein the optional substituents are selected from the group consisting of halo, CN, NO₂, OH, NH₂, NHR10, NR10R20, C1-6haloalkyl, C1-6haloalkoxy, C(O)NH₂, C(O)NHR10, C(O)NR10R20, SO₂R10, OR10, SR10, S(O)R10, C(O)R10, and C1-6aliphatic; wherein R10 and R20 are each independently C1-6aliphatic, for example C1-6alkyl.
64. A method of making a peptide conjugate of the formula (I) or a pharmaceutically acceptable salt or solvate thereof according to any one of the preceding claims, the method comprising:
- (A) reacting
- a first lipid-containing conjugation partner comprising a carbon-carbon double bond,
- a second lipid-containing conjugation partner comprising a carbon-carbon double bond, and
- an amino acid-comprising conjugation partner comprising a thiol
- under conditions effective to conjugate the first lipid-containing conjugation partner and the second lipid-containing conjugation partner to the amino acid-comprising conjugation partner and provide the peptide-conjugate of formula (I) or salt or solvate thereof,
- wherein in the amino acid- or peptide conjugate the sulfur atom from the thiol of the amino acid-comprising conjugation partner is conjugated to a carbon atom from the carbon-carbon double bond of the first lipid-containing conjugation partner, and a carbon atom from the carbon-carbon double bond of the first lipid-containing conjugation partner is conjugated to a carbon atom from the carbon-carbon double bond of the second lipid-containing conjugation partner; or

(B) reacting

a first lipid-containing conjugation partner comprising a carbon-carbon double bond,

a second lipid-containing conjugation partner comprising a carbon-carbon double bond, and

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an amino acid-comprising conjugation partner comprising a thiol under conditions effective to conjugate the first lipid-containing conjugation partner and the second lipid-containing conjugation partner to the amino acid-comprising conjugation partner and provide an amino acid- or peptide-conjugate,

10

wherein in the amino acid- or peptide conjugate the sulfur atom from the thiol of the amino acid-comprising conjugation partner is conjugated to a carbon atom from the carbon-carbon double bond of the first lipid-containing conjugation partner, and a carbon atom from the carbon-carbon double bond of the first lipid-containing conjugation partner is conjugated to a carbon atom from the carbon-carbon double bond of the second lipid-containing conjugation partner; and

15

coupling the amino acid of the amino acid conjugate or an amino acid of the peptide conjugate to an amino acid or an amino acid of a peptide to provide the peptide-conjugate of formula (I) or salt or solvate thereof.

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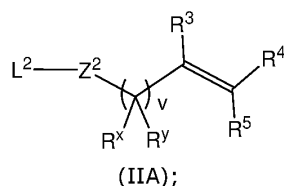
65. The method of claim 64, wherein the first and second lipid-containing conjugation partners have the same structure.

66. The method of claim 64 or 65, wherein the method comprises conjugating the sulfur atom of the thiol to a carbon atom of the carbon-carbon double bond of the first lipid containing conjugation partner and then conjugating a carbon atom from the carbon-carbon double bond to which the thiol is conjugated to a carbon atom of the carbon-carbon double bond of the second lipid-containing conjugation partner.

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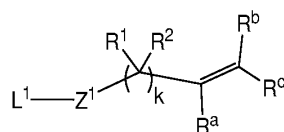
67. The method of any one of claims 64 to 66, wherein:
the first lipid-containing conjugation partner is a compound of the formula (IIA):

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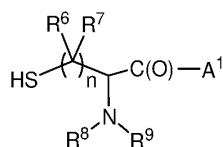
the second lipid-containing conjugation partner is a compound of the formula (IIB):

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(IIB); and

the amino acid-comprising conjugation partner comprises a structure of the formula (III):



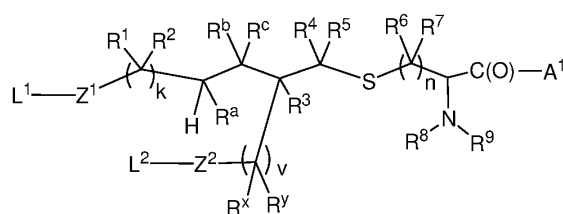
(III);

wherein:

when the method is (A), R_a , R_b , R_c , L_1 , L_2 , Z_1 , Z_2 , R_1 , R_2 , R_x , R_y , R_3 , R_4 , R_5 , R_6 , R_7 , R_8 , R_9 , A_1 , k , v , and n are as defined in the compound of formula (IB) according to any one of the preceding claims (including provisos (1) and/or (2) of claim 1); and

when the method is (B), R_a , R_b , R_c , L_1 , L_2 , Z_1 , Z_2 , R_1 , R_2 , R_x , R_y , R_3 , R_4 , R_5 , R_6 , R_7 , R_8 , R_9 , A_1 , k , v , and n are as defined in the compound of formula (IB) according to any one of the preceding claims but excluding provisos (1) and (2) of claim 1.

68. The method of any one of claims 64 to 67, wherein the amino acid- or peptide conjugate is a compound of the formula (IB):



(IB)

wherein:

when the method is (A), R_a , R_b , R_c , L_1 , L_2 , Z_1 , Z_2 , R_1 , R_2 , R_x , R_y , R_3 , R_4 , R_5 , R_6 , R_7 , R_8 , R_9 , A_1 , k , v , and n are as defined in the compound of formula (IB) according to any one of the preceding claims (including provisos (1) and (2) of claim 1); and

when the method is (B), R_a , R_b , R_c , L_1 , L_2 , Z_1 , Z_2 , R_1 , R_2 , R_x , R_y , R_3 , R_4 , R_5 , R_6 , R_7 , R_8 , R_9 , A_1 , k , v , and n are as defined in the compound of formula

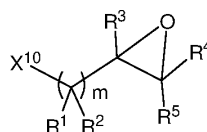
(IB) according to any one of the preceding claims but excluding provisos (1) and (2) of claim 1.

- 5 69. The method of any one of claims 64 to 68, the lipid containing conjugation partners are in stoichiometric excess to the amino acid-comprising conjugation partner.
- 10 70. The method of any one of claims 64 to 69, wherein the conditions effective to conjugate the lipid-containing conjugation partner to the amino acid-comprising conjugation partner comprises the generation of one or more free radicals initiated by the thermal degradation of a thermal initiator or the photochemical degradation of a photochemical initiator.
71. The method of claim 70, wherein the thermal initiator is AIBN or the photoinitiator is DMPA.
- 15 72. The method of claim 70 or 71, wherein photochemical degradation of the free radical initiator comprises irradiation with ultraviolet light, preferably having a frequency compatible with the side chains of naturally occurring amino acids, preferably about 365 nm.
73. The method of any one of claims 64 to 72, wherein the reaction is carried out in a liquid medium comprising a solvent, wherein the solvent comprises NMP, DMF, DMSO, or a mixture thereof.
- 20 74. The method of claim 73, wherein the solvent comprises NMP.
75. The method of any one of claims 64 to 74, wherein the reaction is carried out in the presence of one or more additives that inhibit the formation of by-products and/or that improve the yield of or conversion to the desired conjugate.
- 25 76. The method of claim 74, wherein the one or more additive is an extraneous thiol, an acid, an organosilane, or a combination of any two or more thereof.
77. The method of claim 75, wherein the extraneous thiol is a sterically hindered thiol, for example tert-butyl mercaptan.
- 30 78. The method of claim 75 or 76, wherein the acid is a strong organic acid, for example TFA.
79. The method of any one of claims 75 to 77, wherein the organosilane is a trialkylsilane, for example TIPS.

80. The method of any one of claims 75 to 78, wherein the amino acid conjugate or peptide conjugate is separated from the reaction medium after the reaction and optionally purified.

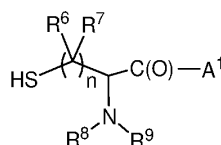
81. A method of making a peptide conjugate of the formula (IF) or a pharmaceutically acceptable salt or solvate thereof as defined in any one of the preceding claims, the method comprising:

(A) reacting
an epoxide of the formula (XVI):



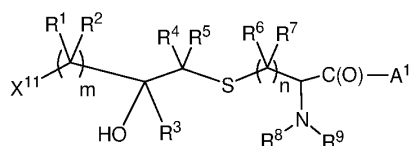
(XVI); and

an amino acid-comprising conjugation partner comprising a thiol of the formula (III):



(III),

under conditions effective to conjugate the epoxide and amino acid-comprising conjugation partner and provide a compound of formula (XV):



(XV)

wherein

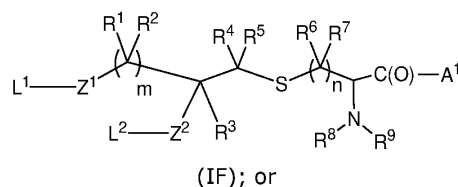
X10 is L1-Z1-, -OH, -SH, -NHR, HNRC(O)O-, P10-O-, P11-S-, P12-NR-, or P12-NRC(O)O-;

X11 is X10 or -OH, -SH, -NHR, or HNRC(O)O- when X10 is P10-O-, P11-S-, P12-NR-, or P12-NRC(O)O- and said conditions are effective to remove P10, P11, or P12;

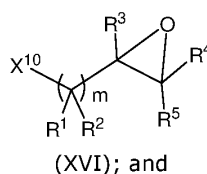
P10, P11, and P12 are each independently a protecting group;

m, n, L1, Z1, R, R1, R2, R3, R4, R5, R6, R7, R8, R9, and A1 are as defined in the compound of formula (IF) according to any one the preceding claims (including provisos (1) and/or (2) of claim 1); and

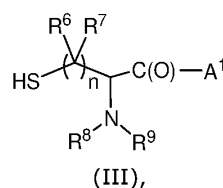
converting the compound of formula (XV) to the peptide-conjugate of the formula (IF) according to in any one of the preceding compound claims (including provisos (1) and/or (2) of claim 1) or a pharmaceutically acceptable salt or solvate thereof by one or more additional synthetic steps:



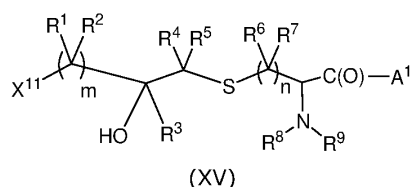
(B) reacting
an epoxide of the formula (XVI):



an amino acid-comprising conjugation partner comprising a thiol of the formula (III):



under conditions effective to conjugate the epoxide and amino acid-comprising conjugation partner and provide a compound of formula (XV):



wherein

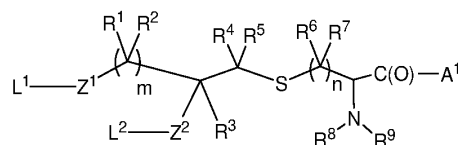
X10 is L1-Z1-, -OH, -SH, -NHR, HNRC(O)O-, P10-O-, P11-S-, P12-NR-, or P12-NRC(O)O-;

X11 is X10 or -OH, -SH, -NHR, or HNRC(O)O- when X10 is P10-O-, P11-S-, P12-NR-, or P12-NRC(O)O- and said conditions are effective to remove P10, P11, or P12;

P10, P11, and P12 are each independently a protecting group;

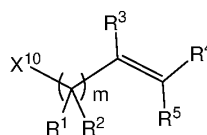
m, n, L1, Z1, R, R1, R2, R3, R4, R5, R6, R7, R8, R9, and A1 are as defined in the compound of formula (IF) according to any one the preceding claims but excluding provisos (1) and (2) of claim 1; and

- 5 converting the compound of formula (XV) to an amino acid- or peptide-conjugate of the formula (IF) according to any one of the preceding claims but excluding provisos (1) and (2) of claim 1 or a salt or solvate thereof by one or more additional synthetic steps:



(IF); and

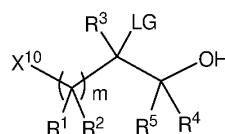
- 10 coupling the amino acid of the amino acid conjugate or an amino acid of the peptide conjugate to an amino acid or an amino acid of a peptide to provide the peptide-conjugate of formula (IF) according to any one of the preceding compound claims (including provisos (1) and/or (2) of claim 1) or pharmaceutically acceptable salt or solvate thereof.
- 15 82. The method of claim 81, wherein X10 is L1-C(O)O-, OH, or P10-O-; and X11 is L1-C(O)O-, P10-O-, or OH.
83. The method of claim 81 or 82, wherein the method comprises reacting the epoxide and amino acid-comprising conjugation partner in the presence of an acid.
- 20 84. The method of any one of claims 81 to 83, wherein the method comprises providing the epoxide by reacting an alkene of the formula (XVII):



(XVII)

and an oxidant under conditions effective to epoxidise the alkene.

- 25 85. The method of any one of claims 81 to 83, wherein the method comprises providing the epoxide by reacting an compound of the formula (XVII-A), wherein LG is a leaving group:

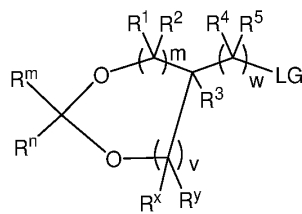


(XVII-A)

and a base under conditions effective for epoxidation.

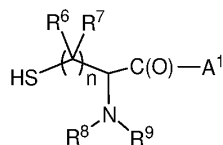
86. The method of any one of claims 81 to 85, wherein X11 is P10-O- or OH; and the one or more synthetic steps comprise acylating the compound of formula (XV) so as to replace P10 or the hydrogen atom of the hydroxyl group of X11 with L1-C(O)-; and/or acylating the compound of formula (XV) so as to replace the hydrogen atom of the hydroxyl group bound to the carbon to which R3 is attached with L2-C(O)-.
87. A method of making a peptide-conjugate of the formula (I) or a pharmaceutically acceptable salt or solvate thereof as defined in any one of the preceding claims, the method comprising:

- (A) reacting
a compound of the formula (XXI):



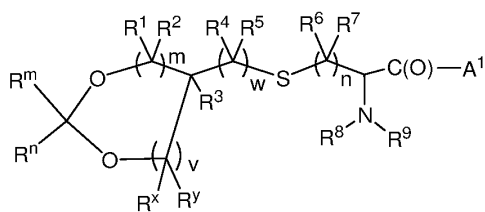
(XXI); and

an amino acid-comprising conjugation partner comprising a thiol of the formula (III):



(III),

under conditions effective to conjugate the compound of formula (XXI) and amino acid-comprising conjugation partner and provide a compound of formula (XX):



(XX)

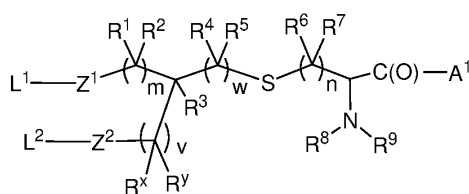
wherein

R_m and R_n are each independently hydrogen, C1-6alkyl, aryl, or heteroaryl;

LG is a leaving group; and

m, w, v, n, R_x, R_y, R₁, R₂, R₃, R₄, R₅, R₆, R₇, R₈, R₉, and A₁ are as defined in the compound of formula (I) according to any one of the preceding claims (including provisos (1) and/or (2) of claim 1); and

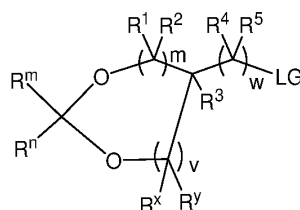
converting the compound of formula (XX) to a peptide conjugate of the formula (I) according to any one of the preceding claims (including provisos (1) and/or (2) of claim 1) or a pharmaceutically acceptable salt or solvate thereof by one or more additional synthetic steps:



(I); or

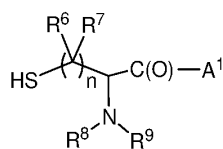
(B) reacting

a compound of the formula (XXI):



(XXI); and

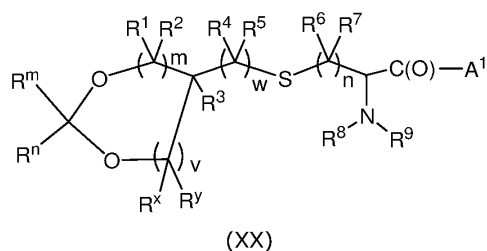
an amino acid-comprising conjugation partner comprising a thiol of the formula (III):



(III),

under conditions effective to conjugate the compound of formula (XXI) and amino acid-comprising conjugation partner and provide a compound of formula (XX):

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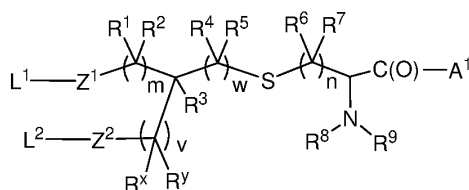
wherein

R_m and R_n are each independently hydrogen, C1-6alkyl, aryl, or heteroaryl;

LG is a leaving group; and

m, w, v, n, R_x, R_y, R₁, R₂, R₃, R₄, R₅, R₆, R₇, R₈, R₉, and A₁ are as defined in the compound of formula (I) according to any one of the preceding claims but excluding provisos (1) and (2) of claim 1; and

converting the compound of formula (XX) to an amino acid- or peptide conjugate of the formula (I) according to any one of the preceding claims but excluding provisos (1) and (2) of claim 1 or a salt or solvate thereof by one or more additional synthetic steps:



coupling the amino acid of the amino acid conjugate or an amino acid of the peptide conjugate to an amino acid or an amino acid of a peptide to provide the peptide-conjugate of formula (I) according to any one of the preceding compound claims (including provisos (1) and/or (2) of claim 1) or pharmaceutically acceptable salt or solvate thereof.

88. The method of claim 87, wherein R_m and R_n are each independently selected from hydrogen, C1-6alkyl, or aryl.

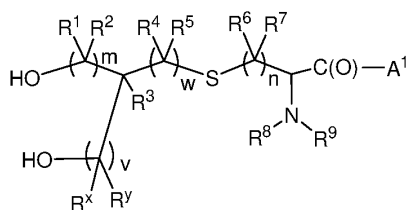
89. The method of claim 87 or 88, wherein R_m is hydrogen, C1-6alkyl, or aryl; and R_n is C1-6alkyl or aryl.

90. The method of any one of claims 87 to 89, wherein m and v are such that the compound of formula (XXI) comprises a 5-7-membered cyclic acetal.

91. The method of claim 90, wherein the cyclic acetal is a 6-membered cyclic acetal.

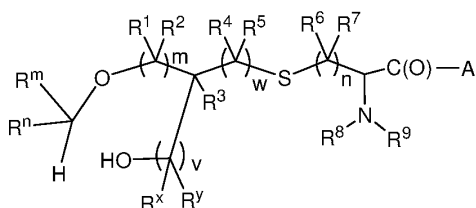
92. The method of any one of claims 87 to 91, wherein the method comprises reacting the compound of formula (XXI) and the amino acid-comprising conjugation partner of formula (III) in the presence of a base.

93. The method of any one of claims 87 to 92, wherein the one or more synthetic steps comprises removing the acetal in the compound of formula (XX) to provide a compound of the formula (XXIII-1):

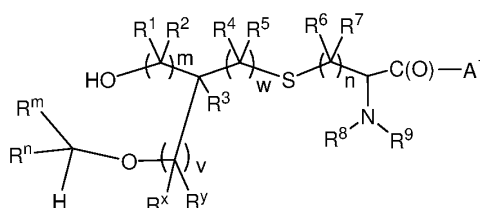


(XXIII-1).

94. The method of any one of claims 87 to 92, wherein R_m is optionally substituted aryl, for example phenyl or methoxy substituted phenyl, and the method comprises removing the acetal in the compound of formula (XX) to provide a compound of the formula (XXIII-2) or (XXIII-3):



(XXIII-2)



(XXIII-3).

95. The method of claim 93, wherein the one or more synthetic steps comprise converting the hydroxyl group bound to the carbon to which R¹ and R² are attached in the compound of formula (XXIII-1) to L1-Z1-, and/or converting the hydroxyl group bound to the carbon to which R^x and R^y are attached to L2-Z2.

96. The method of claim 94, wherein the one or more synthetic steps comprise
converting the hydroxyl group bound to the carbon atom to which Rx and
Ry are attached in the compound of formula (XXIII-2) to L2-Z2-, removing the
5 RmRnCH- group to provide a hydroxyl group, and converting the hydroxyl group
to L1-Z1; or
converting the hydroxyl group bound to the carbon to which Rx and Ry are
attached in the compound of formula (XXIII-2) to L1-Z1-, removing the RmRnCH-
group to provide a hydroxyl group, and converting the hydroxyl group to L2-Z2-.
- 10 97. The method of claim 95 or 96, wherein converting said hydroxyl group to L1-Z1-
or L2-Z2- comprises acylating so as to replace the hydrogen atom of the hydroxyl
group with L1-C(O)- or L2-C(O)-.
98. The method of any one of claims 64 to 97, wherein the amino acid-comprising
conjugation partner is a peptide-containing conjugation partner.
- 15 99. The method of claim 98, wherein the peptide-containing conjugation partner
comprises an epitope.
100. The method of any one of claims 64 to 99, wherein the amino acid-comprising
conjugation partner consists of a peptide.
- 20 101. The method of any one of claims 64 to 100, wherein the amino acid-comprising
conjugation partner is a peptide-containing conjugation partner comprising 15 or
less, 14 or less, 13 or less, 12 or less, 11 or less, 10 or less, 9 or less, 8 or less, 7
or less, 6 or less, 5 or less, 4 or less, or 3 or less amino acid residues.
102. The method of any one of claims 64 to 97, wherein the method is (B) and the
amino acid-comprising conjugation partner consists of an amino acid.
- 25 103. The method of any one of claims 64 to 102, the C-terminus of the amino acid
comprising conjugation partner is protected with a protecting group and/or the
Na-amino group of the amino acid comprising conjugation partner is protected
with a protecting group.
- 30 104. The method of any one of claims 64 to 101 and 103, wherein the amino acid
residue comprising the thiol is an N-terminal amino acid residue.
105. The method of any one of claims 64 to 104, wherein the thiol is the thiol of a
cysteine residue.

106. The method of any one of claims 64 to 105, wherein R9 in the amino acid comprising conjugation partner comprising the thiol is L3-C(O)-, for example Me-C(O)-.
107. The method of any one of claims 64 to 106, wherein the method is (B).
- 5 108. A method of making a peptide conjugate, the method comprising
providing an amino acid- or peptide conjugate of the formula (I) according
to any one of claims 1 to 63 but excluding provisos (1) and (2) of claim 1 or a salt
or solvate thereof, and
coupling the amino acid of the amino acid conjugate or an amino acid of
10 the peptide conjugate to an amino acid or an amino acid of a peptide to provide a
peptide conjugate of the formula (I) according to any one of claims 1 to 63
(including provisos (1) and/or (2) of claim 1) or a salt or solvate thereof.
109. The method of claim 107 or 108, wherein the method comprises coupling the
amino acid of the amino acid conjugate to an amino acid or an amino acid of a
15 peptide to provide the peptide conjugate.
110. The method of any one of claims 107 to 109, wherein the method comprises
coupling the amino acid of the amino acid conjugate or an amino acid of the
peptide conjugate to an amino acid or a peptide so as to provide a peptide
conjugate comprising a peptide epitope.
- 20 111. The method of any one of claims 107 to 110, wherein the method comprises
coupling an epitope to the amino acid of the amino acid conjugate or an amino
acid of the peptide conjugate.
112. The method of claim 108 or 109, wherein the peptide comprises an epitope.
113. The method of any one of claims 99, 111, and 112, wherein the epitope is a
25 peptide epitope.
114. The method of claim 113, wherein the epitope is coupled or bound via a linker
group.
115. The method of any one of claims 107 to 114, wherein the amino acid of the
peptide conjugate to which the lipid moieties are conjugated is an N-terminal
30 amino acid residue.
116. The method of any one of claims 64 to 115, wherein the method further
comprises acylating the Na-amino group of the amino acid of the amino acid

conjugate or the amino acid residue of the peptide conjugate to which the lipid moieties are conjugated.

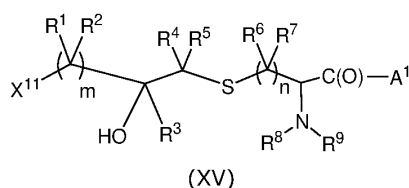
117. The method of claim 116, wherein the amino group is acylated with a C2-20 fatty acid, such as acetyl.
- 5 118. The method of any one of claims 64 to 117, wherein the peptide conjugate or amino acid-comprising conjugation partner comprises one or more solubilising groups.
119. The method of claim 118, wherein the solubilising group is an amino acid sequence comprising a sequence of two or more consecutive hydrophilic amino acid residues in the peptide chain.
- 10 120. The method of any one of claims 64 to 118, wherein the peptide conjugate or amino acid-comprising conjugation partner comprises a serine residue adjacent to the amino acid residue to which the lipid moieties are conjugated.
121. An amino acid or peptide conjugate of the formula (I) of any one of claims 1 to 63 or a salt or solvate thereof made by a method of any one of claims 64 to 120.
- 15 122. A pharmaceutical composition comprising an effective amount of a peptide conjugate compound of any one of claims 1 to 63 and 121 or a pharmaceutically acceptable salt or solvate thereof, and a pharmaceutically acceptable carrier.
123. The pharmaceutical composition of claim 122 comprising an effective amount of two or more peptide conjugate compounds of any one of claims 1 to 63 and 121.
- 20 124. A method of vaccinating or eliciting an immune response in a subject comprising administering to the subject an effective amount of one or more peptide conjugate compounds of any one of claims 1 to 63 and 121 or a pharmaceutically acceptable salt or solvate thereof, or an effective amount of a pharmaceutical composition of claim 122 or 123.
- 25 125. Use of one or more peptide conjugate compounds of any one of claims 1 to 63 and 121 or a pharmaceutically acceptable salt or solvate thereof or a pharmaceutical composition of claim 122 or 123 in the manufacture of a medicament for vaccinating or eliciting an immune response in a subject.
- 30 126. One or more peptide conjugate compounds of any one of claims 1 to 63 and 121 or a pharmaceutically acceptable salt or solvate thereof or a pharmaceutical

composition of claim 122 or 123 for vaccinating or eliciting an immune response in a subject.

127. A method of activating TLR2 in a subject, the method comprising administering to the subject an effective amount of one or more peptide conjugate of any one of claims 1 to 63 or a pharmaceutically acceptable salt or solvate thereof, or an effective amount of a pharmaceutical composition of claim 122 or 123.
128. Use of one or more peptide conjugate compounds of any one of claims 1 to 63 and 121 or a pharmaceutically acceptable salt or solvate thereof or a pharmaceutical composition of claim 122 or 123 in the manufacture of a medicament for activating TLR2 in a subject.
129. One or more peptide conjugate compounds of any one of claims 1 to 63 and 121 or a pharmaceutically acceptable salt or solvate thereof or a pharmaceutical composition of claim 122 or 123 for activating TLR2 in a subject.
130. The compound of any one of claims 1 to 63 and 121, method of any one of claims 64 to 120, pharmaceutical composition of claim 122 or 123, method of claim 124 or 127, use of claim 125 or 128, or peptide conjugate of claim 126 or 129, wherein the peptide conjugate compound of formula (I) is as defined in any one of claims 1 to 63 and 121 and has an EC₅₀ for TLR2 agonism (preferably hTLR2) of less than about 500 nM as determined using a HEK-Blue™ cell assay.
131. The compound of any one of claims 1 to 63 and 121, method of any one of claims 64 to 120, pharmaceutical composition of claim 122 or 123, method of claim 124 or 127, use of claim 125 or 128, or peptide conjugate of claim 126 or 129, wherein the peptide conjugate compound of formula (I) is as defined in any one of claims 1 to 63 and 121 and comprises a peptide comprising, consists of, or consists essentially of an amino acid sequence selected from the group consisting of:
- (a) 8 or more contiguous amino acid residues from the sequence SKKKKSLLMWITQXaa₂₂ [SEQ ID NO:7],
 - (b) the sequence of SEQ ID NO: 7,
 - (c) 8 or more contiguous amino acid residues from the sequence SLLMWITQXaa₂₂ [SEQ ID NO:8],
 - (d) the sequence of SEQ ID NO: 8,

(e) or any combination of two or more of (a) to (d) above.

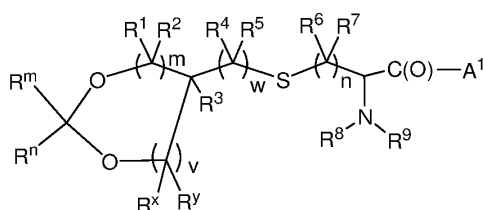
132. The compound of any one of claims 1 to 63 and 121, method of any one of claims 64 to 120, pharmaceutical composition of claim 122 or 123, method of claim 124 or 127, use of claim 125 or 128, or peptide conjugate of claim 126 or 129, wherein the peptide conjugate compound of formula (I) is as defined in any one of claims 1 to 63 and 121 and is a compound selected from the group consisting of compounds 910, 911, 912, 913, 930, 931, and 932 of the Examples herein.
133. The compound of any one of claims 1 to 63 and 121, method of any one of claims 64 to 120, pharmaceutical composition of claim 122 or 123, method of claim 124 or 127, use of claim 125 or 128, or peptide conjugate of claim 126 or 129, wherein the peptide conjugate compound of formula (I) is as defined in any one of claims 1 to 63 and 121 and comprises a peptide comprising, consisting essentially of, or consisting of an amino acid sequence selected from the group consisting of 8 or more contiguous amino acids from the amino acid sequence of any one of SEQ ID NOs 1 – 139.
134. A compound of the formula (XV):



wherein

- 20 X11 is L1-Z1-, -OH, -SH, -NHR, HNRC(O)O-, P10-O-, P11-S-, P12-NR-, or P12-NRC(O)O-;
- P10, P11, and P12 are each independently a protecting group;
- m is an integer from 2 to 6; and
- 25 n, L1, Z1, R, R1, R2, R3, R4, R5, R6, R7, R8, R9, and A1 are as defined in the compound of formula (I) as defined in any one of the preceding claims (including provisos (1) and/or (2) of claim 1); or a salt or solvate thereof.

135. A compound of the formula (XX):



(XX)

wherein:

R_m and R_n are each independently hydrogen, C₁-6alkyl, aryl, or heteroaryl;

5 m and w are each independently an integer from 0 to 7 and v is an integer from 0 to 5,

provided that:

the sum of m, v, and w is at least 3; and

the sum of m and w is from 0 to 7; and

10 n, R_x, R_y, R₁, R₂, R₃, R₄, R₅, R₆, R₇, R₈, R₉, and A₁ are as defined in the compound of formula (I) as defined in any one of the preceding claims (including provisos (1) and/or (2) of claim 1); or a salt or solvate thereof.