CLAIMS

WHAT IS CLAIMED IS:

1. A polypeptide comprising a first peptide comprising 3-10 amino acids from residues 1-10 or 12-25 of SEQ ID NO:01 linked to a second peptide comprising 3-10 amino acids from residues 81-140 of SEQ ID NO:02.

2. The polypeptide of claim 1, wherein the second peptide is from the C-terminal region of alpha-synuclein (residues 111-131 of SEQ ID NO:02).

3. The polypeptide of claim 1, wherein the first peptide is N-terminal to the second peptide.

4. The polypeptide of claim 1, wherein the first peptide is C-terminal to the second peptide.

5. The polypeptide of any of claims 1 to 4, wherein:

(a) the first peptide comprises an amino acid sequence selected from the group consisting of

DAEFRHDSGY (SEQ ID NO:03),
DAEFRHDSG (SEQ ID NO:04),
DAEFRHDS (SEQ ID NO:05),
DAEFRHD (SEQ ID NO:06),
DAEFRH (SEQ ID NO:07),
DAEFR (SEQ ID NO:08),
DAEF (SEQ ID NO:09),
DAE (SEQ ID NO:10),
AEFRHDSGY (SEQ ID NO:11),
AEFRHDSG (SEQ ID NO:12),
AEFRHDS (SEQ ID NO:13),
AEFRHD (SEQ ID NO:14),
AEFRH (SEQ ID NO:15),
AEFR (SEQ ID NO:16),
AEF (SEQ ID NO:17),

EFRHDSGY (SEQ ID NO:18),
EFRHDSG (SEQ ID NO:19),
EFRHDS (SEQ ID NO:20),
EFRHD (SEQ ID NO:21),
EFRH (SEQ ID NO:22),
EFR (SEQ ID NO:23),
FRHDSGY (SEQ ID NO:24),
FRHDSG (SEQ ID NO:25),
FRHDS (SEQ ID NO:26),
FRHD (SEQ ID NO:27),
FRH (SEQ ID NO:28),
RHDSGY (SEQ ID NO:29),
RHDSG (SEQ ID NO:30),
RHDS (SEQ ID NO:31),
RHD (SEQ ID NO:32),
HDSGY (SEQ ID NO:33),
HDSG (SEQ ID NO:34),
HDS (SEQ ID NO:35),
DSGY (SEQ ID NO:36),
DSG (SEQ ID NO:37),
SGY (SEQ ID NO:38),
VHHQKLVFFA (SEQ ID NO:121),
VHHQKLVFF (SEQ ID NO:122),
VHHQKLVF (SEQ ID NO:123),
VHHQKLV (SEQ ID NO:124),
VHHQKL (SEQ ID NO:125),
HHQKLVFFAE (SEQ ID NO:126),
HHQKLVFFA (SEQ ID NO:127),
HHQKLVFF (SEQ ID NO:128),
HHQKLVF (SEQ ID NO:129),
HHQKLV (SEQ ID NO:130),
HHQKL (SEQ ID NO:131),
HQKLVFFAED (SEQ ID NO:132),
HQKLVFFAE (SEQ ID NO:133),

HQKLVFFA (SEQ ID NO:134),
HQKLVFF (SEQ ID NO:135),
HQKLVF (SEQ ID NO:136),
HQKLV (SEQ ID NO:137),
HQKL (SEQ ID NO:138),
QKLVFFAEDV (SEQ ID NO:139),
QKLVFFAED (SEQ ID NO:140),
QKLVFFAE (SEQ ID NO:141),
QKLVFFA (SEQ ID NO:142),
QKLVFF (SEQ ID NO:143),
QKLVF (SEQ ID NO:144),
QKLV (SEQ ID NO:145),
QKL (SEQ ID NO:146),
KLVFFAEDVG (SEQ ID NO:147),
KLVFFAEDV (SEQ ID NO:148),
KLVFFAED (SEQ ID NO:149),
KLVFFAE (SEQ ID NO:150),
KLVFFA (SEQ ID NO:151),
KLVFF (SEQ ID NO:152),
KLVF (SEQ ID NO:153),
KLV (SEQ ID NO:154),
LVFFAEDVG (SEQ ID NO:155),
LVFFAEDV (SEQ ID NO:156),
LVFFAED (SEQ ID NO:157),
LVFFAE (SEQ ID NO:158),
LVFFA (SEQ ID NO:159),
LVFF (SEQ ID NO:160),
LVF (SEQ ID NO:161),
VFFAEDVG (SEQ ID NO:162),
VFFAEDV (SEQ ID NO:163),
VFFAED (SEQ ID NO:164),
VFFAE (SEQ ID NO:165),
VFFA (SEQ ID NO:166),
VFF (SEQ ID NO:167),

FFAEDVG (SEQ ID NO:168),

FFAEDV (SEQ ID NO:169),

FFAED (SEQ ID NO:170),

FFAE (SEQ ID NO:171),

FFA (SEQ ID NO:172),

FAEDVG (SEQ ID NO:173),

FAEDV (SEQ ID NO:174),

FAED (SEQ ID NO:175),

FAE (SEQ ID NO:176); and

(b) the second peptide comprises an amino acid sequence selected from the group consisting of

VDPDNEAYEM (SEQ ID NO:39),

VDPDNEAYE (SEQ ID NO:40),

VDPDNEAY (SEQ ID NO:41),

VDPDNEA (SEQ ID NO:42),

VDPDNE (SEQ ID NO:43),

VDPDN (SEQ ID NO:44),

VDPD (SEQ ID NO:45),

VDP (SEQ ID NO:46),

DPDNEAYEM (SEQ ID NO:47),

DPDNEAYE (SEQ ID NO:48),

DPDNEAY (SEQ ID NO:49),

DPDNEA (SEQ ID NO:50),

DPDNE (SEQ ID NO:51),

DPDN (SEQ ID NO:52),

DPD (SEQ ID NO:53),

PDNEAYEM (SEQ ID NO:54),

PDNEAYE (SEQ ID NO:55),

PDNEAY (SEQ ID NO:56),

PDNEA (SEQ ID NO:57),

PDNE (SEQ ID NO:58),

PDN (SEQ ID NO:59),

DNEAYEM (SEQ ID NO:60),

DNEAYE (SEQ ID NO:61),

DNEAY (SEQ ID NO:62),
DNEA (SEQ ID NO:63),
DNE (SEQ ID NO:64),
NEAYEM (SEQ ID NO:65),
NEAYE (SEQ ID NO:66),
NEAY (SEQ ID NO:67),
NEA (SEQ ID NO:68),
EAYEM (SEQ ID NO:69),
EAYE (SEQ ID NO:70),
EAY (SEQ ID NO:71),
AYEM (SEQ ID NO:72),
AYE(SEQ ID NO:73),
YEM (SEQ ID NO:74),
ATGFVKKDQL (SEQ ID NO:75),
ATGFVKKDQ (SEQ ID NO:76),
ATGFVKKD (SEQ ID NO:77),
ATGFVKK (SEQ ID NO:78),
ATGFVK (SEQ ID NO:79),
ATGFV(SEQ ID NO:80),
ATGF (SEQ ID NO:81),
ATG (SEQ ID NO:82),
TGFVKKDQL (SEQ ID NO:83),
TGFVKKDQ (SEQ ID NO:84),
TGFVKKD (SEQ ID NO:85),
TGFVKK (SEQ ID NO:86),
TGFVK (SEQ ID NO:87),
TGFV (SEQ ID NO:88),
TGF (SEQ ID NO:89),
GFVKKDQL (SEQ ID NO:90),
GFVKKDQ (SEQ ID NO:91),
GFVKKD (SEQ ID NO:92),
GFVKK (SEQ ID NO:93),
GFVK (SEQ ID NO:94),
GFV(SEQ ID NO:95),

FVKKDQL (SEQ ID NO:96),
FVKKDQ(SEQ ID NO:97),
FVKKD (SEQ ID NO:98)
FVKK (SEQ ID NO:99),
FVK (SEQ ID NO:100),
VKKDQL (SEQ ID NO:101),
VKKDQ (SEQ ID NO:102),
VKKD (SEQ ID NO:103),
VKK (SEQ ID NO:104),
KKDQL (SEQ ID NO:105),
KKDQ (SEQ ID NO:106),
KKD (SEQ ID NO:107),
KDQL (SEQ ID NO:108), and
KDQ (SEQ ID NO:109).

6. The polypeptide of any of claims 1 to 5, wherein the first peptide and second peptide are linked by a cleavable linker.

7. The polypeptide of claim 6, wherein the cleavable linker comprises an amino acid sequence.

8. The polypeptide of claim 7, wherein the amino acid sequence comprises arginine-arginine (Arg-Arg), arginine-valine-arginine-arginine (Arg-Val-Arg-Arg (SEQ ID NO:113)), valine-citrulline (Val-Cit), valine-arginine (Val-Arg), valine-lysine (Val-Lys), valine-alanine (Val-Ala), phenylalanine-lysine (Phe-Lys), glycine-alanine-glycine-alanine (Gly-Ala-Gly-Ala; SEQ ID NO:114), alanine-glycine-alanine-glycine (Ala-Gly-Ala-Gly; SEQ ID NO:115), or lysine-glycine-lysine-glycine (Lys-Gly-Lys-Gly; SEQ ID NO:116).

9. The polypeptide of any of claims 1 to 8, further comprising a linker to a carrier at either a C-terminal portion of the polypeptide, or a N-terminal portion of the polypeptide.

10. The polypeptide of claim 9, wherein the linker comprises an amino acid sequence selected from the group consisting of GG, GGG, AA, AAA, KK, KKK, SS, SSS, GAGA (SEQ ID NO:114), AGAG (SEQ ID NO:115), and KGKG (SEQ ID NO:116).

11. The polypeptide of any of claims 1 to 10, wherein the polypeptide or linker to the carrier, if present, further comprises a C-terminal cysteine (C).

12. The polypeptide of any of claims 1 to 11, wherein the first peptide is DAEFRHD (SEQ ID NO:06).

13. The polypeptide of any of claims 1 to 11, wherein the first peptide is DAEFR (SEQ ID NO:08).

14. The polypeptide of any of claims 1 to 11, wherein the first peptide is EFRHD (SEQ ID NO:21).

15. The polypeptide of any of claims 1 to 11, wherein the second peptide comprises 5-10 amino acids.

16. The polypeptide of any of claims 1 to 11, wherein the second peptide comprises the amino acid sequence PDNEAYE (SEQ ID NO:55).

17. The polypeptide of any of claims 1 to 11, wherein the second peptide comprises the amino acid sequence DPDNEAYE (SEQ ID NO:48).

18. The polypeptide of any of claims 1 to 11, wherein the second peptide comprises the amino acid sequence ATGFVKK (SEQ ID NO:78), TGFVKKD (SEQ ID NO:85), or GFVKKDQ (SEQ ID NO:91).

19. The polypeptide of claim 1, comprising an amino acid sequence of DAEFRHDRRPDNEAYEGGC (SEQ ID NO:110).

20. The polypeptide of claim 1, comprising an amino acid sequence of DAEFRHDRRDPDNEAYEGGC (SEQ ID NO:111).

21. The polypeptide of claim 1, comprising the amino acid sequence of DAEFRHDRRX$_1$PDNEAYEXXC (SEQ ID NO:112), wherein X_1 is optional, and if present is D, and wherein XX and C are independently optional and, if present, XX can be GG, AA, KK, SS, GAGA (SEQ ID NO:114), AGAG (SEQ ID NO:115), or KGKG (SEQ ID NO:116).

22. An immunotherapy composition, comprising the polypeptide of any of claims 1 to 21, wherein the polypeptide is linked to a carrier.

23. The immunotherapy composition of claim 22, wherein the carrier comprises serum albumins, immunoglobulin molecules, thyroglobulin, ovalbumin, tetanus toxoid (TT), diphtheria toxoid (DT), a genetically modified cross-reacting material (CRM) of diphtheria toxin, CRM197, meningococcal outer membrane protein complex (OMPC) and *H. influenzae* protein D (HiD), rEPA (*Pseudomonas aeruginosa* exotoxin A), KLH (keyhole limpet hemocyanin), and flagellin.

24. The immunotherapy composition of claim 23, wherein the carrier is CRM197.

25. The immunotherapy composition of claim 23, wherein the carrier is diphtheria toxoid.

26. A pharmaceutical formulation comprising (a) the polypeptide of any one of claims 1 to 21 or the immunotherapy composition of any of claims 22 to 25 and (b) at least one adjuvant.

27. The pharmaceutical formulation of claim 26, wherein the adjuvant is selected from the group consisting of aluminum hydroxide, aluminum phosphate, aluminum sulfate, 3 De-O-acylated monophosphoryl lipid A (MPL), QS-21, TQL1055, QS-18, QS-17, QS-7, Complete Freund's Adjuvant (CFA), Incomplete Freund's Adjuvant (IFA), oil in water emulsions (such as squalene or peanut oil), CpG, polyglutamic acid, polylysine, AddaVax™, MF59®, and combinations thereof.

28. The pharmaceutical formulation of claim 27, wherein the adjuvant is QS-21 or TQL1055.

29. The pharmaceutical formulation of claim 27, wherein the adjuvant is MPL.

30. The pharmaceutical formulation of claim 27, wherein the adjuvant is a combination of MPL and QS-21 or a combination of MPL and TQL1055.

31. The pharmaceutical formulation of any of claims 26 to 30, wherein the adjuvant comprises a liposomal formulation.

32. The pharmaceutical formulation of any of claims 26 to 31, wherein the composition comprises at least one pharmaceutically acceptable diluent.

33. The pharmaceutical formulation of any of claims 26 to 32, comprising a multiple antigen presenting system (MAP).

34. The pharmaceutical formulation of claim 33, wherein the MAP comprises one or more of a Lys-based dendritic scaffold, helper T-cell epitopes, immune stimulating lipophilic moieties, cell penetrating peptides, radical induced polymerization, self-assembling nanoparticles as antigen-presenting platforms and gold nanoparticles.

35. An immunotherapy composition, comprising a first peptide sequence comprising 3-10 amino acid residues from the first ten N-terminal residues or residues 12 to 25 of SEQ ID NO:01 and a second peptide sequence comprising 3-8 amino acids from residues 81-140 of SEQ ID NO:02.

36. The immunotherapy composition of claim 35, wherein:

(a) the first peptide sequence comprises an amino acid sequence selected from the group consisting of

DAEFRHDSGY (SEQ ID NO:03),

DAEFRHDSG (SEQ ID NO:04),

DAEFRHDS (SEQ ID NO:05),

DAEFRHD (SEQ ID NO:06),

DAEFRH (SEQ ID NO:07),
DAEFR (SEQ ID NO:08),
DAEF (SEQ ID NO:09),
DAE (SEQ ID NO:10),
AEFRHDSGY (SEQ ID NO:11),
AEFRHDSG (SEQ ID NO:12),
AEFRHDS (SEQ ID NO:13),
AEFRHD (SEQ ID NO:14),
AEFRH (SEQ ID NO:15),
AEFR (SEQ ID NO:16),
AEF (SEQ ID NO:17),
EFRHDSGY (SEQ ID NO:18),
EFRHDSG (SEQ ID NO:19),
EFRHDS (SEQ ID NO:20),
EFRHD (SEQ ID NO:21),
EFRH (SEQ ID NO:22),
EFR (SEQ ID NO:23),
FRHDSGY (SEQ ID NO:24),
FRHDSG (SEQ ID NO:25),
FRHDS (SEQ ID NO:26),
FRHD (SEQ ID NO:27),
FRH (SEQ ID NO:28),
RHDSGY (SEQ ID NO:29),
RHDSG (SEQ ID NO:30),
RHDS (SEQ ID NO:31),
RHD (SEQ ID NO:32),
HDSGY (SEQ ID NO:33),
HDSG (SEQ ID NO:34),
HDS (SEQ ID NO:35),
DSGY (SEQ ID NO:36),
DSG (SEQ ID NO:37),
SGY (SEQ ID NO:38),
VHHQKLVFFA (SEQ ID NO:121),
VHHQKLVFF (SEQ ID NO:122),

VHHQKLVF (SEQ ID NO:123),
VHHQKLV (SEQ ID NO:124),
VHHQKL (SEQ ID NO:125),
HHQKLVFFAE (SEQ ID NO:126),
HHQKLVFFA (SEQ ID NO:127),
HHQKLVFF (SEQ ID NO:128),
HHQKLVF (SEQ ID NO:129),
HHQKLV (SEQ ID NO:130),
HHQKL (SEQ ID NO:131),
HQKLVFFAED (SEQ ID NO:132),
HQKLVFFAE (SEQ ID NO:133),
HQKLVFFA (SEQ ID NO:134),
HQKLVFF (SEQ ID NO:135),
HQKLVF (SEQ ID NO:136),
HQKLV (SEQ ID NO:137),
HQKL (SEQ ID NO:138),
QKLVFFAEDV (SEQ ID NO:139),
QKLVFFAED (SEQ ID NO:140),
QKLVFFAE (SEQ ID NO:141),
QKLVFFA (SEQ ID NO:142),
QKLVFF (SEQ ID NO:143),
QKLVF (SEQ ID NO:144),
QKLV (SEQ ID NO:145),
QKL (SEQ ID NO:146),
KLVFFAEDVG (SEQ ID NO:147),
KLVFFAEDV (SEQ ID NO:148),
KLVFFAED (SEQ ID NO:149),
KLVFFAE (SEQ ID NO:150),
KLVFFA (SEQ ID NO:151),
KLVFF (SEQ ID NO:152),
KLVF (SEQ ID NO:153),
KLV (SEQ ID NO:154),
LVFFAEDVG (SEQ ID NO:155),
LVFFAEDV (SEQ ID NO:156),

LVFFAED (SEQ ID NO:157),

LVFFAE (SEQ ID NO:158),

LVFFA (SEQ ID NO:159),

LVFF (SEQ ID NO:160),

LVF (SEQ ID NO:161),

VFFAEDVG (SEQ ID NO:162),

VFFAEDV (SEQ ID NO:163),

VFFAED (SEQ ID NO:164),

VFFAE (SEQ ID NO:165),

VFFA (SEQ ID NO:166),

VFF (SEQ ID NO:167),

FFAEDVG (SEQ ID NO:168),

FFAEDV (SEQ ID NO:169),

FFAED (SEQ ID NO:170),

FFAE (SEQ ID NO:171),

FFA (SEQ ID NO:172),

FAEDVG (SEQ ID NO:173),

FAEDV (SEQ ID NO:174),

FAED (SEQ ID NO:175),

FAE (SEQ ID NO:176); and

(b) the second peptide sequence comprises an amino acid sequence selected from the group consisting of

VDPDNEAYEM (SEQ ID NO:39),

VDPDNEAYE (SEQ ID NO:40),

VDPDNEAY (SEQ ID NO:41),

VDPDNEA (SEQ ID NO:42),

VDPDNE (SEQ ID NO:43),

VDPDN (SEQ ID NO:44),

VDPD (SEQ ID NO:45),

VDP (SEQ ID NO:46),

DPDNEAYEM (SEQ ID NO:47),

DPDNEAYE (SEQ ID NO:48),

DPDNEAY (SEQ ID NO:49),

DPDNEA (SEQ ID NO:50),

DPDNE (SEQ ID NO:51),
DPDN (SEQ ID NO:52),
DPD (SEQ ID NO:53),
PDNEAYEM (SEQ ID NO:54),
PDNEAYE (SEQ ID NO:55),
PDNEAY (SEQ ID NO:56),
PDNEA (SEQ ID NO:57),
PDNE (SEQ ID NO:58),
PDN (SEQ ID NO:59),
DNEAYEM (SEQ ID NO:60),
DNEAYE (SEQ ID NO:61),
DNEAY (SEQ ID NO:62),
DNEA (SEQ ID NO:63),
DNE (SEQ ID NO:64),
NEAYEM (SEQ ID NO:65),
NEAYE (SEQ ID NO:66),
NEAY (SEQ ID NO:67),
NEA (SEQ ID NO:68),
EAYEM (SEQ ID NO:69),
EAYE (SEQ ID NO:70),
EAY (SEQ ID NO:71),
AYEM (SEQ ID NO:72),
AYE(SEQ ID NO:73),
YEM (SEQ ID NO:74),
ATGFVKKDQL (SEQ ID NO:75),
ATGFVKKDQ (SEQ ID NO:76),
ATGFVKKD (SEQ ID NO:77),
ATGFVKK (SEQ ID NO:78),
ATGFVK (SEQ ID NO:79),
ATGFV(SEQ ID NO:80),
ATGF (SEQ ID NO:81),
ATG (SEQ ID NO:82),
TGFVKKDQL (SEQ ID NO:83),
TGFVKKDQ (SEQ ID NO:84),

TGFVKKD (SEQ ID NO:85),
TGFVKK (SEQ ID NO:86),
TGFVK (SEQ ID NO:87),
TGFV (SEQ ID NO:88),
TGF (SEQ ID NO:89),
GFVKKDQL (SEQ ID NO:90),
GFVKKDQ (SEQ ID NO:91),
GFVKKD (SEQ ID NO:92),
GFVKK (SEQ ID NO:93),
GFVK (SEQ ID NO:94),
GFV(SEQ ID NO:95),
FVKKDQL (SEQ ID NO:96),
FVKKDQ(SEQ ID NO:97),
FVKKD (SEQ ID NO:98)
FVKK (SEQ ID NO:99),
FVK (SEQ ID NO:100),
VKKDQL (SEQ ID NO:101),
VKKDQ (SEQ ID NO:102),
VKKD (SEQ ID NO:103),
VKK (SEQ ID NO:104),
KKDQL (SEQ ID NO:105),
KKDQ (SEQ ID NO:106),
KKD (SEQ ID NO:107),
KDQL (SEQ ID NO:108), and
KDQ (SEQ ID NO:109);

wherein each of the first peptide sequence and the second peptide sequence may optionally comprise a C-terminal cysteine.

37. The immunotherapy composition of any one of claims 35 to 36, wherein the at least one of the first peptide and the second peptide further comprise a linker to a carrier at either a C-terminal portion of the polypeptide, or a N-terminal portion of the polypeptide.

38. The immunotherapy composition of claim 37, wherein the linker comprises an amino acid sequence selected from the group consisting of GG, GGG, AA, AAA, KK, KKK, SS, SSS, GAGA (SEQ ID NO:114), AGAG (SEQ ID NO:115), and KGKG (SEQ ID NO:116).

39. The immunotherapy composition of claim 38, wherein the linker to the carrier may optionally comprise a C-terminal cysteine (C).

40. The immunotherapy composition of any one of claims 38 to 39, wherein the carrier comprises serum albumins, immunoglobulin molecules, thyroglobulin, ovalbumin, tetanus toxoid (TT), diphtheria toxoid (DT), a genetically modified cross-reacting material (CRM) of diphtheria toxin, CRM197, meningococcal outer membrane protein complex (OMPC) and *H. influenzae* protein D (HiD), rEPA (*Pseudomonas aeruginosa* exotoxin A), KLH (keyhole limpet hemocyanin), and flagellin.

41. The immunotherapy composition of claim 40, wherein the carrier is CRM197.

42. The immunotherapy composition of claim 40, wherein the carrier is diphtheria toxoid.

43. The immunotherapy composition of any one of claims 35 to 42, further comprising at least one pharmaceutically acceptable diluent.

44. The immunotherapy composition of any one of claims 35 to 43, further comprising a multiple antigen presenting system (MAP).

45. The immunotherapy composition of claim 44, wherein the MAP comprises one or more of a Lys-based dendritic scaffold, helper T-cell epitopes, immune stimulating lipophilic moieties, cell penetrating peptides, radical induced polymerization, self-assembling nanoparticles as antigen-presenting platforms and gold nanoparticles.

46. A pharmaceutical composition comprising the immunotherapy composition of any of claims 35 to 45 and at least one adjuvant.

47. The pharmaceutical composition of claim 46, wherein the adjuvant is selected from the group consisting of aluminum hydroxide, aluminum phosphate, aluminum sulfate, 3 De-O-acylated monophosphoryl lipid A (MPL), QS-21, TQL1055, QS-18, QS-17, QS-7, Complete Freund's Adjuvant (CFA), Incomplete Freund's Adjuvant (IFA), oil in water emulsions (such as squalene or peanut oil), CpG, polyglutamic acid, polylysine, AddaVax™, MF59®, and combinations thereof.

48. The pharmaceutical composition of claim 47, wherein the adjuvant is QS-21 or TQL1055.

49. The pharmaceutical composition of claim 47, wherein the adjuvant is MPL.

50. The pharmaceutical composition of claim 47, wherein the adjuvant is a combination of MPL and QS-21 or a combination of MPL and TQL1055.

51. A nucleic acid comprising a nucleic acid sequence encoding a polypeptide of any one of claims 1 to 21 of the immunotherapy composition of claims 35 to 39.

52. A nucleic acid immunotherapy composition comprising the nucleic acid of claim 51 and at least one adjuvant.

53. Use of an immunotherapy composition of any of claims 22 to 25 and 35 to 45 or the pharmaceutical formulations of any of claims 26 to 34 and 46 to 50 in the manufacture of a medicament for treating or effecting prophylaxis of Alzheimer’s disease in a subject, wherein the immunotherapy composition is to be administered to the subject.

54. Use of an immunotherapy composition of any of claims 22 to 25 and 35 to 45 or the pharmaceutical formulations of any of claims 26 to 34 and 46 to 50 in the manufacture of a medicament for inhibiting or reducing aggregation of at least one of Aβ and alpha-synuclein in a subject having, or at risk of developing Alzheimer’s disease, wherein the immunotherapy composition or pharmaceutical formulation is to be administered to the subject.

55. Use of the nucleic acid immunotherapy composition of claim 52 in the manufacture of a medicament for treating or effecting prophylaxis of Alzheimer's disease in a subject, wherein the nucleic acid immunotherapy composition is to be administered to the subject.

56. Use of the nucleic acid immunotherapy composition of claim 52 in the manufacture of a medicament for inhibiting or reducing aggregation of at least one of Aβ and alpha-synuclein in a subject having, or at risk of developing Alzheimer's disease, wherein the nucleic acid immunotherapy composition is to be administered to the subject.

57. The use of any of claims 53 to 56, wherein the administration is to be repeated at least a second time, at least a third time, at least a fourth time, at least a fifth time, or at least a sixth time.

58. The use of claim 57, wherein the administration is to be repeated at an interval of about 21 to about 28 days.

59. Use of the polypeptide of claims 1 to 21, the immunotherapy composition of claims 22 to 25 and 35 to 45, the pharmaceutical formulations of claims 26 to 34 and 46 to 50 or the nucleic acid immunotherapy composition of claim 52 in the manufacture of a medicament for inducing an immune response in an animal, wherein the polypeptide, immunotherapy composition, pharmaceutical composition or nucleic acid immunotherapy composition is to be administered to the animal in a regimen effective to generate an immune response comprising antibodies that specifically bind to Aβ, alpha-synuclein, or both Aβ and alpha-synuclein.

60. The use of claim 59, wherein the immune response comprises antibodies that specifically bind to Aβ and antibodies that specifically bind to alpha-synuclein.

61. The use of any of claims 59 to 60, wherein the immune response comprises antibodies that specifically bind to the N-terminal region of Aβ and/or the C-terminal region of alpha-synuclein.

62. An immunization kit comprising the immunotherapy composition of any of claims 22 to 25 and 35 to 45.

63. The kit of claim 62, further comprising an adjuvant.

64. The kit of claim 63, wherein the immunotherapy composition is in a first container and the adjuvant is in a second container.

65. A kit comprising the nucleic acid immunotherapy composition of claim 52.

66. The kit of claim 65, further comprising an adjuvant.

67. The kit of claim 66, wherein the nucleic acid is in a first container and the adjuvant is in a second container.