

WHAT IS CLAIMED IS:

1. A peptide comprising 3-10 amino acids from residues 81-140 of SEQ ID NO:01 and optionally a C-terminal cysteine.
2. The peptide of claim 1, wherein the peptide is from residues 111-131 of SEQ ID NO:01 and optionally a C-terminal cysteine.
3. The peptide of claim 2, wherein the peptide comprises an amino acid sequence selected from the group consisting any one of SEQ ID NO:02 through SEQ ID NO:37.
4. The peptide of claim 1, wherein the peptide is from residues 83-106 of SEQ ID NO:01 and optionally a C-terminal cysteine.
5. The peptide of claim 4, wherein the peptide comprises an amino acid sequence selected from the group consisting of any one of SEQ ID NO:38 through SEQ ID NO:72.
6. The peptide of claim 1, wherein the peptide comprises an amino acid sequence selected from the group consisting of any one of SEQ ID NO:02 through SEQ ID NO:72.
7. The peptide of claim 1, comprising an amino acid sequence of any one of DPDNEAYE (SEQ ID NO:48), DPDNEAY (SEQ ID NO:49), PDNEAYE (SEQ ID NO:55), ATGFVKK (SEQ ID NO:41), TGFVKKD (SEQ ID NO:48), GFVKKDQ (SEQ ID NO:54) or DPDNEAYC (SEQ ID NO:74).
8. The peptide of any one of claims 1 to 7, optionally comprising an N-terminal cysteine.
9. The peptide of claim 8, comprising an amino acid sequence of CPDNEAYE (SEQ ID NO:73) or CGFVKKDQ (SEQ ID NO:75).

10. A peptide comprising an amino acid sequence of ~~PDNEAYEGGC (SEQ ID NO:76), DPDNEAYEGGC (SEQ ID NO:77), PDNEAYERRDPDNEAYGGC (SEQ ID NO:78), DPDNEAYRRPDNEAYEGGC (SEQ ID NO:79), PDNEAYERRTGFVKKDGGC (SEQ ID NO:80), or TGFVKKDRRDPDNEAYEGGC (SEQ ID NO:81).~~

11. A peptide comprising an amino acid sequence of PDNEAYEGGC (SEQ ID NO:76), DPDNEAYEGGC (SEQ ID NO:77), PDNEAYERRDPDNEAYGGC (SEQ ID NO:78), PDNEAYERRTGFVKKDGGC (SEQ ID NO:80), or TGFVKKDRRDPDNEAYEGGC (SEQ ID NO:81).

~~11~~12. The peptide of any one of claims 1 to 10, further comprising a linker at a C-terminal portion of the peptide, optionally wherein the linker comprises an amino acid sequence.

~~12. The polypeptide of claim 11, wherein the linker comprises an amino acid sequence.~~

13. The peptide of claim 12, wherein the linker comprises an amino acid sequence selected from the group consisting of GG, GGG, AA, AAA, KK, KKK, SS, SSS, AGAG (SEQ ID NO:84), GG, GAGA (SEQ ID NO:83) and KGKG (SEQ ID NO:85).

14. The peptide of any one of claims 1 to 13, wherein the polypeptide or linker to the carrier, if present, further comprises a C-terminal cysteine (C).

15. The peptide of any one of claims 1 to 14, wherein the peptide further comprises a blocked amine at the N-terminus.

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

17. An immunotherapy composition, comprising one or more of the peptides of any one of claims 1 to 16.

18. The immunotherapy composition of claim 17, wherein the one or more peptides further comprises a linker to a carrier at a C-terminal portion of the peptide.
19. The immunotherapy composition of claim 18, wherein the linker comprises an amino acid sequence selected from the group consisting of GG, GGG, AA, AAA, KK, KKK, SS, SSS, AGAG (SEQ ID NO:84), GG, GAGA (SEQ ID NO:83) and KGKG (SEQ ID NO:85).
20. The immunotherapy composition of either of claim 18 or 19, 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.
21. The immunotherapy composition of claim 20, wherein the carrier is CRM197.
22. The immunotherapy composition of claim 20, wherein the carrier is diphtheria toxoid.
23. The immunotherapy composition of any one of claims 17 to 22, further comprising at least one pharmaceutically acceptable diluent.
24. The immunotherapy composition of any one of claims 17 to 23, further comprising a multiple antigen presenting system (MAP).
25. The immunotherapy composition of claim 24, 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.

26. A pharmaceutical composition comprising (a) one or more of the polypeptide of any one of claims 1 to 16 or (b) the immunotherapy composition of any of claims 17 to 25 and at least one adjuvant.

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

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

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

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

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

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

34. The pharmaceutical composition 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. A nucleic acid comprising a nucleic acid sequence encoding a polypeptide of any one of claims 1 to 16 or the immunotherapy composition of any one of claims 17 to 25.

36. A nucleic acid immunotherapy composition comprising the nucleic acid of claim 35 and at least one adjuvant.

37. Use of ~~A method of treating or effecting prophylaxis of an alpha-synucleinopathy in a subject, comprising administering to the subject~~ the immunotherapy composition of any one of claims 17 to 25 or the pharmaceutical compositions of any one of claims 26 to 34 in the manufacture of a medicament for treating or effecting prophylaxis of an alpha-synucleinopathy in a subject.

38. Use of ~~A method of blocking the uptake of alpha-synuclein by neurons, inhibiting cell-to-cell transmission of alpha-synuclein seeds or inhibiting or reducing aggregation of alpha-synuclein in a subject having or at risk of developing an alpha-synucleinopathy, comprising administering to the subject~~ the immunotherapy composition of any one of claims 17 to 25 or the pharmaceutical composition of any one of claims 26 to 34 in the manufacture of a medicament for blocking the uptake of alpha-synuclein by neurons, inhibiting cell-to-cell transmission of alpha-synuclein seeds or inhibiting or reducing aggregation of alpha-synuclein in a subject having or at risk of developing an alpha-synucleinopathy.

39. Use of ~~A method of treating or effecting prophylaxis of an alpha-synucleinopathy in a subject, comprising administering to the subject~~ the nucleic acid immunotherapy composition of claim 36 in the manufacture of a medicament for treating or effecting prophylaxis of an alpha-synucleinopathy in a subject.

40. Use of ~~A method of blocking the uptake of alpha-synuclein by neurons, inhibiting cell-to-cell transmission of alpha-synuclein seeds or inhibiting or reducing aggregation of alpha-synuclein in a subject having or at risk of developing an alpha-synucleinopathy, comprising administering to the subject~~ the nucleic acid immunotherapy composition of claim 36 in the manufacture of a medicament for blocking the uptake of alpha-synuclein by neurons, inhibiting cell-to-cell transmission

of alpha-synuclein seeds or inhibiting or reducing aggregation of alpha-synuclein in a subject having or at risk of developing an alpha-synucleinopathy.

41. ~~The use~~ ~~The method~~ of any one of claims 37 to 40, wherein the alpha-synucleinopathy is selected from the group consisting of Parkinson's disease, dementia with Lewy bodies (DLB), multiple system atrophy (MSA), Alzheimer's disease, and neurodegeneration with brain iron accumulation (NBIA).

42. The ~~method~~ use of claim 41, wherein the multiple system atrophy (MSA) is selected from the group consisting of the MSA-parkinsonian (MSA-P) variant and the MSA-cerebellar (MSA-C) variant.

43. The ~~method~~ use of claim 41, wherein the Parkinson's disease is Parkinson's disease with dementia (PDD).

44. The ~~method~~ use of claim 41, wherein the Alzheimer's disease is the Lewy body variant of Alzheimer's disease.

45. The ~~method~~ use of any of claims 37 to 44, ~~further comprising repeating the administering~~ wherein the medicament is to be administered to the subject 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.

46. The ~~method~~ use of claim 45, ~~further comprising repeating the administering~~ wherein the medicament is to be administered to the subject at an interval of about 14 days, or about 21 to about 28 days, or about quarterly, or about biannually, or about annually.

47. ~~A method~~ Use ~~of inducing an immune response in an animal, comprising administering to the animal any one of~~ the polypeptide of any one of claims 1 to 16, the immunotherapy composition of any one of claims 17 to 25, the pharmaceutical compositions of any one of claims 26 to 34 or the nucleic acid immunotherapy composition of claim 36 in the manufacture of a medicament for inducing an immune response in an animal, wherein the medicament is to be administered in a regimen

effective to generate an immune response comprising antibodies that specifically bind to alpha-synuclein.

48. The ~~method~~-use of claim 47, wherein the immune response comprises antibodies that specifically bind to alpha-synuclein.

49. The ~~method~~-use of any of claims 47 to 48, wherein the inducing the immune response comprises antibodies that specifically bind to the C-terminal region of alpha-synuclein.

50. The ~~method~~-use of any of claims 47 to 48, wherein the inducing the immune response comprises antibodies that specifically bind to the NAC region of alpha-synuclein.

51. An immunization kit comprising the immunotherapy composition of any of claims 17 to 25.

52. The kit of claim 51, further comprising an adjuvant.

53. The kit of claim 52, wherein the immunotherapy composition is in a first container and the adjuvant is in a second container.

54. A kit comprising the nucleic acid immunotherapy composition of claim 36.

55. The kit of claim 54, further comprising an adjuvant.

56. The kit of claim 55, wherein the nucleic acid is in a first container and the adjuvant is in a second container.

57. The polypeptide of any one of claims 1 to 16, the immunotherapy composition of any one of claims 17 to 25, the pharmaceutical compositions of any one of claims 26 to 34 or the nucleic acid immunotherapy composition of claim 36 for use in therapy.