

by β -amyloid deposition in some neurodegenerative diseases, including Alzheimer's disease and Parkinson's disease.

[0005] Accordingly, there exists the need for new therapies and reagents for the prevention or treatment of alpha-synucleinopathies, in particular, therapies and reagents capable of causing an immune response to Alpha-synuclein present in patients.

SUMMARY

[0005a] In one aspect, provided herein is a peptide comprising 3-10 amino acids from residues 81-140 of SEQ ID NO:01 and optionally a C-terminal cysteine.

[0005b] In one aspect, provided herein is a peptide comprising an amino acid sequence of DPDNEAYRRPDNEAYEGGC (SEQ ID NO:79).

[0005c] In one aspect, provided herein is a peptide comprising an amino acid sequence of PDNEAYEGGC (SEQ ID NO:76), DPDNEAYEGGC (SEQ ID NO:77), PDNEAYERRDPDNEAYGGC (SEQ ID NO:78), PDNEAYERRTGTFVKKDGGC (SEQ ID NO:80), or TGFVKKDRRDPDNEAYEGGC (SEQ ID NO:81).

[0005d] In one aspect, provided herein is an immunotherapy composition, comprising one or more of the peptides as described herein.

[0005e] In one aspect, provided herein is a pharmaceutical composition comprising (a) one or more of the polypeptide as described herein or (b) the immunotherapy composition as described herein and at least one adjuvant.

[0005f] In one aspect, provided herein is a nucleic acid comprising a nucleic acid sequence encoding a polypeptide as described herein or the immunotherapy composition as described herein.

[0005g] In one aspect, provided herein is a nucleic acid immunotherapy composition comprising the nucleic acid as described herein and at least one adjuvant.

[0005h] In one aspect, provided herein is a use of the immunotherapy composition as described herein or the pharmaceutical composition as described herein in the manufacture of a medicament for treating or effecting prophylaxis of an alpha-synucleinopathy in a subject.

[0005i] In one aspect, provided herein is a use of the immunotherapy composition as described herein or the pharmaceutical composition as described herein 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.

[0005j] In one aspect, provided herein is a use of the nucleic acid immunotherapy composition as described herein in the manufacture of a medicament for treating or effecting prophylaxis of an alpha-synucleinopathy in a subject.

[0005k] In one aspect, provided herein is a use of the nucleic acid immunotherapy composition as described herein 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.

[0005l] In one aspect, provided herein is a use of the polypeptide as described herein, the immunotherapy composition as described herein, the pharmaceutical compositions as described herein or the nucleic acid immunotherapy composition as described herein 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.

[0005m] In one aspect, provided herein is an immunization kit comprising the immunotherapy composition as described herein.

[0005n] In one aspect, provided herein is a kit comprising the nucleic acid immunotherapy composition as described herein.

[0005o] In one aspect, provided herein is a polypeptide as described herein, an immunotherapy composition as described herein, a pharmaceutical composition as described herein or the nucleic acid immunotherapy composition as described herein for use in therapy.

[0006] In some embodiments, the disclosure is directed to a peptide or polypeptide including a first peptide comprising 3-10, and in some embodiments 5-10, amino acids from residues 81-140 of SEQ ID NO:01. For example, the peptide may include an amino acid sequence of one of SEQ ID NO:02 to SEQ ID NO:72. In

some embodiments, the peptide is from the C-terminal end of alpha-synuclein (residues 111-131 of SEQ ID NO:01) and, as an example, can include any one of SEQ ID NO:02 to SEQ ID NO:37. In some embodiments, the peptide is from the NAC region of alpha-synuclein (residues 83-106 of SEQ ID NO:01) and, as an example, can include any one of SEQ ID NO:38 to SEQ ID NO:72. In some embodiments, the disclosure is directed to a peptide comprising an amino acid sequence selected from the group consisting of any one of SEQ ID NO:73 to SEQ ID NO:81. In some embodiments, the peptide further includes one or more of an N-terminal cysteine and a C-terminal cysteine.

[0007] In some embodiments, the peptide may include a linker (for example, to a carrier) at a C-terminal portion of the peptide, or at a N-terminal portion of the peptide, which linker may be an amino acid sequence. A linker, if present, can be 1-10 amino acids in length. In some embodiments, the linker comprises between about 1-10 amino acids, about 1-9 amino acids, about 1-8 amino acids, about 1-7 amino acids, about 1-6 amino acids, about 1-5 amino acids, about 1-4 amino acids, about 1-3 amino acids, about 2 amino acids, or one (1) amino acid. In some embodiments, the linker is 1 amino acid, 2 amino acids, 3 amino acids, 4 amino acids, 5 amino acids, 6 amino acids, 7 amino acids, 8 amino acids, 9 amino acids, or 10 amino acids. For example, the linker may include an amino acid sequence 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). In addition, the linker to the carrier, if present at the C-