

Claims

1. A liposome, comprising:

- a. tau peptide having an amino acid sequence selected from the group consisting of SEQ ID NOs: 2, 5, 9, and 12;
 - b. helper T cell epitope comprising at least one amino acid sequence selected from the group consisting of: SEQ ID NOs:23, 24, 25, and 26;
 - c. lipidated CpG oligonucleotide having the nucleotide sequence of SEQ ID NO:18, wherein the CpG oligonucleotide comprises one or more phosphorothioate internucleotide linkages, and wherein the CpG oligonucleotide is covalently linked to at least one cholesterol via a linker; and
 - d. monophosphoryl lipid A (MPLA),
- wherein the tau peptide is presented on the surface of the liposome.

2. The liposome of claim 1, wherein:

- a. the tau peptide has an amino acid sequence selected from the group consisting of SEQ ID NO: 28, 31, 35, and 38;
- b. the lipidated CpG oligonucleotide has the nucleotide sequence of SEQ ID NO:18; and
- c. the helper T cell epitope comprises the amino acid sequences of SEQ ID NO: 23, SEQ ID NO:24 and SEQ ID NO:25, wherein the amino acid sequences are covalently linked together, optionally via one or more linkers.

3. The liposome of claim 2, wherein the helper T cell epitope comprises an amino acid sequence selected from the group consisting of SEQ ID NOs:39, 40, 41, 42, and 43.

4. The liposome of claim 2, wherein the helper T cell epitope comprises an amino acid sequence selected from the group consisting of SEQ ID NOs:13, 14, 15, 16, 17, and 44.

5. The liposome of claim 1, further comprising one or more lipids selected from the group consisting of 1,2-dimyristoyl-sn-glycero-3-phosphocholine (DMPC), 1,2-dimyristoyl-sn-glycero-3-phosphoryl-3'-rac-glycerol (DMPG), and cholesterol.

6. A liposome, comprising:

- a. a tau peptide comprising the amino acid sequence of SEQ ID NO:2;
- b. a helper T cell epitope having an amino acid sequence selected from the group consisting of SEQ ID NOs:39, 40, 41, 42, and 43;
- c. a lipidated CpG oligonucleotide having the nucleotide sequence of SEQ ID NO:18, wherein the CpG oligonucleotide is covalently linked to at least one cholesterol via a linker; and
- d. monophosphoryl lipid A (MPLA);

wherein the tau peptide is presented on the surface of the liposome.

7. The liposome of claim 6, further comprising one or more lipids selected from the group consisting of 1,2-dimyristoyl-sn-glycero-3-phosphocholine (DMPC), 1,2-dimyristoyl-sn-glycero-3-phosphoryl-3'-rac-glycerol (DMPG), and cholesterol, wherein:

- a. the tau peptide has the amino acid sequence of SEQ ID NO:28;
- b. the helper T cell epitope has the amino acid sequence of SEQ ID NO:39; and
- c. the lipidated CpG oligonucleotide has the nucleotide sequence of SEQ ID NO:18.

8. The liposome of claim 7, wherein the helper T cell epitope has the amino acid sequence of SEQ ID NO:13.

9. The liposome of claim 6, further comprising one or more lipids selected from the group consisting of 1,2-dimyristoyl-sn-glycero-3-phosphocholine (DMPC), 1,2-dimyristoyl-sn-glycero-3-phosphoryl-3'-rac-glycerol (DMPG), and cholesterol, wherein:

- a. the tau peptide has the amino acid sequence of SEQ ID NO:28;
- b. the helper T cell epitope has the amino acid sequence of SEQ ID NO:40; and
- c. the lipidated CpG oligonucleotide has the nucleotide sequence of SEQ ID NO:18.

10. The liposome of claim 9, wherein the helper T cell epitope has the amino acid sequence of SEQ ID NO:14.

11. The liposome of claim 6, further comprising one or more lipids selected from the group consisting of 1,2-dimyristoyl-sn-glycero-3-phosphocholine (DMPC), 1,2-dimyristoyl-sn-glycero-3-phosphoryl-3'-rac-glycerol (DMPG), and cholesterol, wherein:

- a. the tau peptide has the amino acid sequence of SEQ ID NO:28;
- b. the helper T cell epitope has the amino acid sequence of SEQ ID NO:41; and
- c. the lipidated CpG oligonucleotide has the nucleotide sequence of SEQ ID

NO:18.

12. The liposome of claim 11, wherein the helper T cell epitope has the amino acid sequence of SEQ ID NO:15.

13. A pharmaceutical composition comprising the liposome of claim 6 and a pharmaceutically acceptable carrier.

14. A pharmaceutical composition comprising the liposome of claim 1 and a pharmaceutically acceptable carrier.