

WHAT IS CLAIMED IS:

1. A recombinant nucleic acid comprising a mitochondrial protein coding sequence, wherein said mitochondrial protein coding sequence comprises a sequence that is at least 90%, at least 95%, at least 97%, at least 99%, or 100% identical to SEQ ID NO: 11 or 12.
2. The recombinant nucleic acid of claim 1, further comprising a mitochondrial targeting sequence.
3. The recombinant nucleic acid of claim 2, wherein said mitochondrial targeting sequence encodes a polypeptide comprising a peptide sequence that is at least 90%, at least 95%, at least 97%, at least 99%, or 100% identical to a sequence selected from the group consisting of SEQ ID NO: 129-159.
4. The recombinant nucleic acid of claim 2, wherein said mitochondrial targeting sequence comprises a sequence that is at least 90%, at least 95%, at least 97%, at least 99%, or 100% identical to a sequence as set forth in any one of SEQ ID NO: 1-5.
5. The recombinant nucleic acid of any one of claims 1-4, wherein said mitochondrial protein coding sequence comprises a sequence that is at least 99% or 100% identical to a sequence as set forth in SEQ ID NO: 11.
6. The recombinant nucleic acid of any one of claims 1-4, wherein said mitochondrial protein coding sequence comprises a sequence that is at least 99% or 100% identical to a sequence as set forth in SEQ ID NO: 12.
7. The recombinant nucleic acid of any one of claims 1-6, further comprising a 3'UTR nucleic acid sequence.
8. The recombinant nucleic acid of claim 7, wherein said 3'UTR nucleic acid sequence comprises a sequence that is at least 90%, at least 95%, at least 97%, at least 99%, or 100% identical to a sequence selected from the group consisting of SEQ ID NO: 13-14 and 111-125.
9. The recombinant nucleic acid of any one of claims 1-8, wherein said recombinant nucleic acid comprises a sequence that is at least 90%, at least 95%, at least 97%, at least 99%, or 100%

identical to a sequence selected from the group consisting of SEQ ID NO: 25-28, 39-42, 53-56, 67-70, and 81-84.

10. The recombinant nucleic acid of any one of claims 1-9, wherein said mitochondrial protein coding sequence encodes a mitochondrial protein comprising or consisting of a sequence that is at least 90%, at least 95%, at least 97%, at least 99%, or 100% identical to a sequence as set forth in SEQ ID NO: 162.

11. A viral vector comprising said recombinant nucleic acid of any one of claims 1-10.

12. The viral vector of claim 11, wherein said viral vector is an adeno-associated virus (AAV) vector.

13. The viral vector of claim 12, wherein said AAV vector is selected from the group consisting of AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV9, AAV10, AAV11, AAV12, AAV13, AAV14, AAV15, and AAV16 vectors.

14. The viral vector of claim 12 or 13, wherein said AAV vector is a recombinant AAV (rAAV) vector, and wherein said rAAV vector is rAAV2 vector.

15. A pharmaceutical composition, comprising the viral vector of any one of claims 11-14, and a pharmaceutically acceptable excipient.

16. The pharmaceutical composition of claim 15, wherein said pharmaceutically acceptable excipient comprises phosphate-buffered saline (PBS), α,α -trehalose dehydrate, L-histidine monohydrochloride monohydrate, polysorbate 20, NaCl, NaH_2PO_4 , Na_2HPO_4 , KH_2PO_4 , K_2HPO_4 , poloxamer 188, or any combination thereof.

17. The pharmaceutical composition of claim 16, wherein said pharmaceutically acceptable excipient comprises poloxamer 188.

18. The pharmaceutical composition of claim 17, wherein said pharmaceutically acceptable excipient comprises 0.0001%-0.01%, or 0.001% poloxamer 188.

19. The pharmaceutical composition of any one of claims 15-18, wherein said pharmaceutically acceptable excipient further comprises NaCl, NaH₂PO₄, Na₂HPO₄, and KH₂PO₄.

20. The pharmaceutical composition of any one of claims 15-19, wherein said pharmaceutical composition has a pH of 7.2-7.4.

21. The pharmaceutical composition of any one of claims 15-20, wherein said pharmaceutical composition has a viral titer of at least 5.0×10^{10} vg/mL.

22. The pharmaceutical composition of any one of claims 15-21, when said pharmaceutical composition is subject to five freeze/thaw cycles, said pharmaceutical composition retains at least 60%, 70%, 80%, or 90% of a viral titer as compared to the viral titer prior to the five freeze/thaw cycles.

23. The pharmaceutical composition of any one of claims 15-22, wherein said pharmaceutical composition, when administered to a patient with Leber's hereditary optic neuropathy, generates a higher average recovery of vision than a comparable pharmaceutical composition comprising a recombinant nucleic acid as set forth in SEQ ID NO: 15.

24. Use of the pharmaceutical composition of any one of claims 15-23 in the manufacture of a medicament for treating an eye disorder in a patient in need thereof, wherein said pharmaceutical composition is to be administered to the patient.

25. The use of claim 24, wherein said eye disorder is Leber's hereditary optic neuropathy (LHON).

26. The use of any one of claims 24-25, wherein said pharmaceutical composition is to be administered via intraocular or intravitreal injection.

27. The use of claim 26, wherein said pharmaceutical composition is to be administered via intravitreal injection.

28. The use of claim 27, wherein about 0.05 mL of said pharmaceutical composition is to be administered to the eye of the patient via intravitreal injection.

29. The use of any one of claims 24-28, wherein methylprednisolone is to be further administered.

30. The use of claim 29, wherein said methylprednisolone is to be administered prior to said intravitreal injection of said pharmaceutical composition.

31. The use of claim 29 or 30, wherein said methylprednisolone is to be administered orally.

32. The use of any one of claims 29-31, wherein said methylprednisolone is to be administered daily for at least 1, 2, 3, 4, 5, 6, or 7 days prior to said intravitreal injection of said pharmaceutical composition.

33. The use of any one of claims 24-32, wherein creatine phosphate sodium is to be further administered.

34. The use of claim 33, wherein said creatine phosphate sodium is to be administered intravenously.

35. The pharmaceutical composition of any one of claims 15-23 for use as a medicament.