CLAIMS

1. A modified adeno-associated virus (AAV) capsid protein comprising an ocular cell targeting peptide, wherein the targeting peptide comprises a sequence from 7 to 10 amino acids in length that comprises GSTPPPM (SEQ ID NO: 1), in an amino to carboxy orientation or in a carboxy to amino orientation, and wherein the targeting peptide targets an AAV to an ocular cell.

2. The capsid protein of claim 1, wherein the targeting peptide is 7 amino acids in length.

3. The capsid protein of claim 1, wherein the targeting peptide comprises a sequence up to 10 amino acids in length having therein amino acid sequence GSTPPPM (SEQ ID NO: 1) in an amino to carboxy orientation or in a carboxy to amino orientation.

4. The capsid protein of claim 1, wherein the targeting peptide consists of amino acid sequence GSTPPPM (SEQ ID NO: 1) in an amino to carboxy orientation or in a carboxy to amino orientation.

5. The capsid protein of claim 1, wherein the targeting peptide is inserted between the AAV2 capsid residues at positions P34-A35, T138-A139, A139-P140, G453-T454, N587-R588, and/or R588-Q589 of SEQ ID NO:8.

6. The capsid protein of claim 1, wherein the targeting peptide is inserted after the AAV9 capsid residues at positions D384, G385, I560, T561, N562, E563, E564, E565, N704, and/or Y705 of SEQ ID NO:11.

7. The capsid protein of claim 1, wherein the capsid protein comprises or consists of SEQ ID NO:9.

8. The capsid protein of claim 1 or 2, wherein the targeting peptide targets a diseased ocular cell.

9. The capsid protein of claim 8, wherein the target peptide targets an ocular cell in a subject that has retinitis pigmentosa, maculopathies, Leber’s congenital amaurosis, early onset severe retinal dystrophy, achromatopsia, retinoschisis, ocular albinism, oculocutaneous albinism, glaucoma, Stargardt disease, choroideremia, age-related

macular degeneration, Spinocerebellar Ataxia type 7 (SCAT), color blindness, and lysosomal storage diseases that affect the cornea, such as Mucopolysaccharidosis (MPS) IV and MPS VII.

10. The capsid protein of any one of claims 1-4 or 7-9, wherein the AAV capsid is AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV9, AAV10, AAV-Rh74 (Rhesus macaque-derived AAV), or AAVRh10, or modified capsids of serotypes AAV1, AAV2, AAV3, AAV4, AAV5, AAV6, AAV7, AAV8, AAV9, AAV10, AAV-Rh74 (Rhesus macaque-derived AAV), or AAVRh10.

11. The capsid protein of claim 10, wherein the AAV capsid is AAV2 capsid.

12. A nucleic acid sequence encoding the modified capsid as described in any one of claims 1-11.

13. The nucleic acid sequence of claim 12, comprising the nucleic acid sequence GGGTCGACGCCGCCTCCTATG (SEQ ID NO:2).

14. An AAV virus containing the capsid protein of any one of claims 1-11.

15. A viral vector comprising the capsid protein of any one of claims 1-11.

16. The viral vector of claim 15, wherein the viral vector further comprises a nucleic acid sequence encoding a nucleic acid or protein of interest.

17. The viral vector of claim 16, wherein the nucleic acid or protein of interest is a therapeutic agent.

18. The viral vector of claim 17, wherein the therapeutic agent is an enzyme or an RNAi molecule.

19. The viral vector of claim 17, wherein the therapeutic agent is Ataxin 7 miRNA, Retinal pigment epithelium-specific 65 kDa protein (RPE 65), vascular endothelial growth factor (VEGF) inhibitor or soluble VEGF receptor 1 (sFifl), (Rab escort protein-1) REP1, L-opsin, rhodopsin (Rho), phosphodiesterase 6(3 (PDE6I3), ATP-binding cassette, sub-family A, member 4 (ABCA4), lecithin retinol acyltransferase (LRAT), Retinal degeneration, slow/Peripherin (RDS/Peripherin), Tyrosine-protein kinase Mer (MERTK), Inosine-5 prime-monophosphate dehydrogenase, type I

(IMPDHI), guanylate cyclase 2D (GUCY2D), aryl-hydrocarbon interacting protein-like 1 (AIPL 1), retinitis pigmentosa GTPase regulator interacting protein 1 (RPGRIPI), Inosine-5-prime-monophosphate dehydrogenase, type I (IMPDH1 guanine nucleotide binding protein, alpha transducing activity polypeptide 2 (GNAT2), cyclic nucleotide gated channel beta 3 (CNGB3), retinoschisin 1 (Rsl), ocular albinism type 1 (OA1), oculocutaneous albinism type 1 (OCA1) tyrosinase, P21 WAF-1/Cipl, platelet-derived growth factor (PDGF), Endostatin Angiostatin, arylsulfatase B, or 13 -glucuronidase.

20. A composition comprising the AAV virus of claim 14 or viral vector of any of claims 15-19 and a carrier.

21. A pharmaceutical composition comprising the AAV virus of claim 14 or viral vector of any of claims 15-19 and a pharmaceutically acceptable carrier.

22. An *in vitro* cell comprising the viral vector of any one of claims 15-19.

23. The cell of claim 22, wherein the cell is a mammalian cell.

24. The cell of claim 23, wherein the cell is a human cell.

25. The cell of claim 23, wherein the cell is a non-human cell.

26. The cell of any one of claims 22-25, wherein the cell is an ocular cell.

27. A viral vector as described by any one of claims 15-19 for use as a medicament or in diagnosis, wherein the viral vector is an AAV vector.

28. Use of the viral vector of any one of claims 15-19 in the manufacture of a medicament for the prophylactic or therapeutic treatment of an ocular disease in a mammal wherein the disease is retinitis pigmentosa, maculopathies, Leber's congenital amaurosis, early onset severe retinal dystrophy, achromatopsia, retinoschisis, ocular albinism, oculocutaneous albinism, glaucoma, Stargardt disease, choroideremia, age-related macular degeneration, SCAT, color blindness, or lysosomal storage diseases that affect the cornea, such as MPS IV and MPS VII, wherein the viral vector is an AAV vector.

29. A cell as described by any one of claims 22-25 for use as a medicament or in diagnosis, wherein the cell is an ocular cell.

30. Use of the cell of any one of claims 22-25 in the manufacture of a medicament for the treatment of an ocular disease in a mammal wherein the disease is retinitis pigmentosa, maculopathies, Leber's congenital amaurosis, early onset severe retinal dystrophy, achromatopsia, retinoschisis, ocular albinism, oculocutaneous albinism, glaucoma, Stargardt disease, choroideremia, age-related macular degeneration, SCAT, color blindness, or lysosomal storage diseases that affect the cornea, such as MPS IV and MPS VII, wherein the cell is an ocular cell.

31. The use of claim 30, wherein the cells used in the manufacture of the medicament comprise retina outer plexiform layer (OPL) cells.