WHAT IS CLAIMED IS:

1. A modified adeno-associated virus (AAV) capsid protein comprising a targeting peptide that targets a viral vector comprising the modified AAV capsid protein to a distinct brain structure, wherein the targeting peptide is three to ten amino acids in length, wherein the target peptide comprises a sequence up to ten amino acids in length having therein an amino acid sequence selected from the group consisting of SEQ ID NOs: 110, 1-109, 111-137, and 144.

2. The modified AAV capsid protein of claim 1, wherein the modified AAV1 capsid protein has a sequence at least 95% identical to SEQ ID NO: 141.

3. The modified AAV capsid protein of claim 2, wherein the targeting peptide is SEQ ID NO: 2, wherein the distinct brain structure is the brainstem, ependyma, hippocampus, optic nerve, spinal cord, substantia nigra, subthalamic nuclei, or thalamus.

4. The modified AAV capsid protein of claim 2, wherein the targeting peptide is SEQ ID NO: 12, wherein the distinct brain structure is the caudate, cerebral cortex, globus pallidus, meninges, putamen, subthalamic nuclei, or thalamus.

5. The modified AAV capsid protein of claim 2, wherein the targeting peptide is SEQ ID NO: 21, wherein the distinct brain structure is the cerebellar cortex, cerebral cortex, ependyma, globus pallidus, meninges, optic nerve, putamen, spinal cord, or thalamus.

6. The modified AAV capsid protein of claim 2, wherein the targeting peptide is any one of SEQ ID NOs: 23-26, wherein the distinct brain structure is the cerebral cortex.

7. The modified AAV capsid protein of claim 2, wherein the targeting peptide is SEQ ID NO: 144, wherein the distinct brain structure is the caudate.

8. The modified AAV capsid protein of claim 1, wherein the modified AAV2 capsid protein has a sequence at least 95% identical to SEQ ID NO: 142.

9. The modified AAV capsid protein of claim 8, wherein the targeting peptide is SEQ ID NO: 73, wherein the distinct brain structure is the cerebellar cortex or meninges.

10. The modified AAV capsid protein of claim 8, wherein the targeting peptide is SEQ ID NO: 103, wherein the distinct brain structure is the substantia nigra.

11. The modified AAV capsid protein of claim 8, wherein the targeting peptide is SEQ ID NO: 104 or 105, wherein the distinct brain structure is the subthalamic nuclei.

12. The modified AAV capsid protein of any claim 1, wherein the modified AAV9 capsid protein has a sequence at least 95% identical to SEQ ID NO: 143.

13. The modified AAV capsid protein of claim 12, wherein the targeting peptide is SEQ ID NO: 110, wherein the distinct brain structure is the brainstem, caudate, cerebellar, cochlea (ear), cortex, cerebral cortex, deep cerebellar nuclei, ependyma, globus pallidus, hippocampus, meninges, motor cortex, optic nerve, prefrontal cortex, putamen, spinal cord, substantia nigra, subthalamic nuclei, temporal cortex, thalamus, or visual cortex.

14. The modified AAV capsid protein of claim 12, wherein the targeting peptide is SEQ ID NO: 113, wherein the distinct brain structure is the brainstem, caudate, cerebellar cortex, cerebral cortex, ependyma, hippocampus, meninges, putamen, spinal cord, substantia nigra, subthalamic nuclei, or thalamus.

15. The modified AAV capsid protein of claim 12, wherein the targeting peptide is SEQ ID NO: 136 or 137, wherein the distinct brain structure is the thalamus.

16. The modified AAV capsid protein of claim 1, wherein the distinct brain structure is the brainstem, caudate, cerebellar cortex, cerebral cortex, ependyma, globus pallidus, hippocampus, meninges, optic nerve, putamen, spinal cord, substantia nigra, subthalamic nuclei, or thalamus.

17. A recombinant adeno-associated virus (rAAV) virus comprising the modified capsid protein of any one of claims 1-16.

18. A viral vector comprising a nucleic acid encoding the modified capsid protein of any one of claims 1-16.

19. The viral vector of claim 18, further comprising a nucleic acid sequence encoding a nucleic acid of interest, wherein the nucleic acid of interest is a therapeutic agent.

20. An in vitro cell comprising the viral vector of any one of claims 18-19.

21. A pharmaceutical composition comprising the viral vector of claim 18 or 19 and a pharmaceutically acceptable carrier.

22. Use of the virus of claim 17 in the manufacture of a medicament for treating a disease in a mammal.

23. The use of claim 22, wherein the disease is a neurodegenerative disease.

24. The use of claim 23, wherein the neurodegenerative disease is Huntington's disease, ALS, hereditary spastic hemiplegia, primary lateral sclerosis, spinal muscular atrophy, Kennedy's disease, Alzheimer's disease, a polyglutamine repeat disease, or Parkinson's disease.