What is claimed is:

1. An adeno-associated virus (AAV) capsid protein comprising at least an AAV VP3 amino acid sequence of an avian AAV (AAAV) capsid protein, a sea lion AAV capsid protein, or a squamate AAV capsid protein,

wherein the AAV capsid protein is modified to comprise a first member of a protein:protein binding pair ("first member"),

wherein the first member is selected from the group consisting of SpyTag, KTag, SnoopTag, isopeptag, SpyTag002, or a biologically active portion thereof.

2. The AAV capsid protein of claim 1, wherein the AAV capsid protein comprises a non-chimeric AAV amino acid sequence.

3. The AAV capsid protein of claim 1, wherein the AAV capsid protein comprises a VP1-unique region of a primate AAV capsid protein.

4. The AAV capsid protein of any one of claims 1-3, wherein an AAV particle comprising the AAV capsid protein is capable of infecting a mammalian host.

5. The AAV capsid protein of any one of claims 1-4, wherein the AAV capsid protein comprises a VP1/VP2 common region amino acid sequence of the AAAV capsid protein, the sea lion AAV capsid protein, or the squamate AAV capsid protein.

6. The AAV capsid protein of any one of claims 1-5, wherein the squamate AAV capsid protein is a bearded dragon AAV capsid protein.

7. The AAV capsid protein of any one of claims 1-6, further comprising:

(a) a detectable label, and/or

(b) a point mutation, wherein the point mutation reduces the natural tropism of the AAV capsid protein and/or creates a detectable label.

8. The AAV capsid protein of of any one of claims 1-7, wherein the first member is flanked by a first linker and/or a second linker that link(s) the first member to the AAV capsid protein, and wherein the first linker and/or the second linker is each independently at least one amino acid in length.

9. The AAV capsid protein of any one of claims 1-8, wherein the AAV capsid protein further comprises a second cognate member of the protein:protein binding pair ("second cognate member"), wherein the first member and the second cognate member are bound by a covalent isopeptide bond.

10. The AAV capsid protein of any one of claims 1-9, wherein:
(i) the first member comprises SpyTag and the second cognate member comprises SpyCatcher;
(ii) the first member comprises SpyTag and the second cognate member comprises KTag;
(iii) the first member is KTag and the second cognate member comprises SpyTag;
(iv) the first member is SnoopTag and the second cognate member comprises SnoopCatcher;
(v) the first member is isopeptag and the second cognate member comprises Pilin-C; or
(vi) the first member is SpyTag002 and the second cognate member comprises SpyCatcher002.

11. The AAV capsid protein of claim 10, wherein the second cognate member is operably linked to a targeting ligand.

12. The AAV capsid protein of claim 11, wherein the targeting ligand is an antibody, or a portion thereof.

13. The AAV capsid protein of claim 7, wherein the detectable label comprises a B1 epitope comprising an amino acid sequence set forth as SEQ ID NO:45.

14. The AAV capsid protein of any one of claims 1-13, wherein the first member is:

(i) at position I-444 or I-580 of a VP1 capsid protein of AAAV;

(ii) at position I-573 or I-436 of a VP1 capsid protein of a bearded dragon AAV; or

(iii) is at a position selected from the group consisting of I-429, I-430, I-431, I-432, I-433, I-436, and I-437 of a VP1 capsid protein of a sea lion AAV.

15. The AAV capsid protein of claim 14, wherein:

(a) the AAV capsid protein comprises an amino acid sequence selected from the group consisting of:

(i) an amino acid sequence set forth as SEQ ID NO:2,

(ii) an amino acid sequence set forth as SEQ ID NO:4,

(iii) an amino acid sequence set forth as SEQ ID NO:6,

(iv) an amino acid sequence set forth as SEQ ID NO:8,

(v) an amino acid sequence set forth as SEQ ID NO:10,

(vi) an amino acid sequence set forth as SEQ ID NO:12,

(vii) an amino acid sequence set forth as SEQ ID NO:14,

(viii) an amino acid sequence set forth as SEQ ID NO:16,

(ix) an amino acid sequence set forth as SEQ ID NO:18,

(x) an amino acid sequence set forth as SEQ ID NO:20,

(xi) an amino acid sequence set forth as SEQ ID NO:22,

(xii) an amino acid sequence set forth as SEQ ID NO:24,

(xiii) an amino acid sequence set forth as SEQ ID NO:26,

(xiv) an amino acid sequence set forth as SEQ ID NO:28,

(xv) an amino acid sequence set forth as SEQ ID NO:30,

(xvi) an amino acid sequence set forth as SEQ ID NO:32,

(xvii) an amino acid sequence set forth as SEQ ID NO:34,

(xviii) an amino acid sequence set forth as SEQ ID NO:36,

(xix) an amino acid sequence set forth as SEQ ID NO:53,

(xx) an amino acid sequence set forth as SEQ ID NO:55,

(xxi) an amino acid sequence set forth as SEQ ID NO:57,

(xxii) an amino acid sequence set forth as SEQ ID NO:59,

(xxiii) an amino acid sequence set forth as SEQ ID NO:61,

(xxiv) an amino acid sequence set forth as SEQ ID NO:63,

(xxv) an amino acid sequence set forth as SEQ ID NO:65,

(xxvi) an amino acid sequence set forth as SEQ ID NO:67,

(xxvii) an amino acid sequence set forth as SEQ ID NO:69,

(xxviii) an amino acid sequence set forth as SEQ ID NO:71,

(xxix) an amino acid sequence having at least 95% identity, to SEQ ID NO:2, SEQ ID NO:4, SEQ ID NO:6, SEQ ID NO:8, SEQ ID NO:10, SEQ ID NO:12, SEQ ID NO:14, SEQ ID NO:16, SEQ ID NO:18, SEQ ID NO:20, SEQ ID NO:22, SEQ ID NO:24, SEQ ID NO:26, SEQ ID NO:28, SEQ ID NO:30, SEQ ID NO:32, SEQ ID NO:34, SEQ ID NO:36, SEQ ID NO:53, SEQ ID NO:55, SEQ ID NO:57, SEQ ID NO:59, SEQ ID NO:61, SEQ ID NO:63, SEQ ID NO:65, SEQ ID NO:67, SEQ ID NO:69, or SEQ ID NO:71, and

(xxx) an amino acid sequence of any VP2 and/or VP3 portions of the amino acid sequences set forth in any of (i)-(xxix); and/or

(b) the first member comprises a detectable label; and/or

(c) the first member comprises c-myc (SEQ ID NO:44).

16. An AAV capsid comprising the AAV capsid protein of claim 1.

17. The AAV capsid of claim 16, wherein the AAV capsid comprises:

(a) a chimeric AAV VP1 capsid protein comprising:

(i) a primate AAV VP1-unique amino acid sequence,

(ii) a VP1/VP2 common region amino acid sequence of the AAAV capsid protein, the sea lion AAV capsid protein, or the squamate AAV capsid protein; and

(iii) a VP3 amino acid sequence of the AAAV capsid protein, the sea lion AAV capsid protein, or the squamate AAV capsid protein;

(b) a non-chimeric AAV VP2 capsid protein comprising a VP2 amino acid sequence of the AAAV capsid protein, the sea lion AAV capsid protein, or the squamate AAV capsid protein; and

(c) a non-chimeric AAV VP3 capsid protein comprising a VP3 amino acid sequence of the AAAV capsid protein, the sea lion AAV capsid protein, or the squamate AAV capsid protein.

18. The AAV capsid of claim 16 or claim 17, wherein the AAV capsid is a mosaic AAV capsid further comprising a reference AAV capsid protein lacking the first member of the protein:protein binding pair.

19. An AAV particle comprising the AAV capsid protein of any one of claims 1-15 or the AAV capsid of any one of claims 16-18.

20. The AAV particle of claim 19, further comprising a viral genome.

21. The AAV particle of claim 20, wherein the viral genome comprises an AAV Inverted Terminal Repeat (ITR) sequence.

22. The AAV particle of claim 21, wherein the AAV ITR sequence is a primate animal AAV ITR sequence.

23. A nucleic acid molecule comprising an AAV *cap* gene encoding the AAV capsid protein of any one of claims 1-15.

24. A packaging cell for producing AAV particles comprising the nucleic acid molecule of claim 23.

25. A method of producing an AAV particle comprising culturing the packaging cell of claim 24 in conditions sufficient for the production of AAV particles.

26. A pharmaceutical composition comprising (a) (i) an AAV particle comprising the AAV capsid protein according to any one of claims 1-15, (ii) an AAV particle comprising the AAV capsid according to any one of claims 16-18, or (iii) the AAV particle according to any one of claims 19-22 or made according to the method of claim 25, and (b) a pharmaceutically acceptable carrier or excipient.

27. The pharmaceutical composition of claim 26 for use in a method of delivering a viral genome to a target cell comprising contacting the target cell with the AAV particle, wherein the capsid of the AAV particle comprises a targeting ligand that specifically binds a protein expressed on the surface of the target cell.

28. The pharmaceutical composition of claim 27, wherein:

(a) the target cell is in a subject;

(b) the target cell is in a primate animal subject;

(c) the target cell is in a human subject;

(d) the target cell is a human cell; and/or

(e) the viral genome encodes a therapeutic protein, a suicide gene, an antibody or a fragment thereof, a CRISPR/Cas system or a portion(s) thereof, an antisense oligonucleotide, a ribozyme, an RNAi molecule, or an shRNA molecule.

29. The pharmaceutical composition of claim 27, wherein the contacting is performed *ex vivo*.