CLAIMS

1. A ribonucleotide (RNA) sequence capable of being packaged into a DNA virus viral particle, said RNA sequence comprises:

   (1) an RNA sequence of interest (RSI), *e.g.*, a RNA coding sequence for a gene of interest (GOI), a protein (*e.g.*, a therapeutic protein, an antigen protein, or a gene-editing protein such as a CRISPR/Cas effector enzyme ("a Cas protein" for short), a ZFN protein, a TALEN protein)-encoding RNA, such as, a mRNA, or a non-coding, functional RNA (such as, a transfer RNA (tRNA), a ribosomal RNA (rRNA), a small interfering RNA (siRNA), a short hairpin RNA (shRNA), an antisense RNA, an antisense oligonucleotide, a micro RNA (miRNA), or an RNA component of a CRISPR-Cas (*e.g.*, Cas9, Cas12, Cas13) system, including a guide RNA (or a gRNA), such as, a single guide RNA (or a sgRNA, a chimeric RNA, an RNA chimera), a CRISPR RNA (crRNA), and a tracr RNA), or a precursor thereof; and,

   (2) an RNA-packaging signal (RPS) capable of interacting, *e.g.*, binding, directly or indirectly, to an RPS-interacting molecule that facilitates packaging of the RNA sequence into the DNA virus viral particle;

   optionally, a DNA sequence encoding or corresponding to said RNA sequence, or a reverse complement of said DNA sequence, has reduced, diminished, or substantially no capacity of being packaged into the DNA virus viral particle (*e.g.*, the DNA sequence or the reverse complement thereof lacks a DNA packaging signal such as a functional AAV ITR for AAV packaging).

2. The RNA sequence of claim 1, wherein the DNA virus viral particle is an AAV viral particle or an oncolytic viral particle.

3. The RNA sequence of claim 1 or 2, wherein the RPS is located at or near the 5' end of the RSI, at or near the 3' end of the RSI, or internal to the RSI (*e.g.*, inside an intron of an mRNA).

4. The RNA sequence of any one of claims 1-3, comprising more than one (*e.g.*, 1, 2, 3, or more) RPS that are identical or different.

5. The RNA sequence of claim 4, wherein two or more (*e.g.,* 3) of said more than one RPS are adjacent to each other, or are in tandem, via the same or different linkers.

6. The RNA sequence of claim 4 or 5, comprising two or more RPS that are not adjacent

to each other (*e.g.*, one each located at or near one end of the RNA sequence of interest (RSI)).

7. The RNA sequence of any one of claims 2-6, wherein the RPS comprises a transcribed modified AAV inverted terminal repeat (ITR), wherein said transcribed modified AAV ITR:

   (a) comprises a transcribed functional Rep-Binding Element (RBE), optionally further comprising a transcribed functional RBE'; and,

   (b) lacks either a transcribed terminal resolution site (TRS), or a transcribed reverse complement TRS (rcTRS), or both;

   optionally, said transcribed modified AAV ITR further comprises a transcribed D region sequence (D sequence or D' sequence); and/or

   optionally, the RPS-interacting molecule is Rep78, Rep68, Rep52, and/or Rep40.

8. The RNA sequence of claim 7, wherein the transcribed modified AAV ITR is within the 3' end 1000 nucleotides, 800 nucleotides, 500 nucleotides, 300 nucleotides, or 200 nucleotides of the RNA; optionally, the transcribed modified AAV ITR is 5' to a polyA sequence, a polyA signal sequence (*e.g.*, AAUAAA), or a sequence for RNA transcription termination (*e.g.*, a histone downstream element).

9. The RNA sequence of any one of claims 7-8, wherein the transcribed modified AAV ITR is modified based on a transcribed wild-type flip or flop ITR; optionally, said wild-type flip or flop ITR is from AAV1, AAV2, AAV3A, AAV3B, AAV4, AAV5, AAV6, AAV7, AAVrh74, AAV8, AAV9, AAV10, AAV11, AAV12, or AAV13 (optionally, said wild-type flop ITR has the nucleotide sequence of SEQ ID NO: 1).

10. The RNA sequence of any one of claims 7-9, wherein the transcribed modified AAV ITR lacks both the transcribed TRS and the transcribed rcTRS.

11. The RNA sequence of any one of claims 7-10, wherein the transcribed modified AAV ITR comprises the transcribed D region sequence (optionally, said modified AAV ITR has the nucleotide sequence of SEQ ID NO: 3).

12. The RNA sequence of any one of claims 7-10, wherein the transcribed modified AAV ITR lacks the transcribed D region sequence (optionally, said modified AAV ITR has the nucleotide sequence of SEQ ID NO: 2).

13. The RNA sequence of any one of claims 7-12, further comprising a second transcribed modified AAV ITR having a second transcribed functional RBE sequence

but lacking either a second transcribed TRS or a second transcribed rcTRS or both; optionally, said second transcribed modified AAV ITR further comprises a second transcribed D region sequence.

14. The RNA sequence of claim 13, wherein the transcribed modified AAV ITR and the second transcribed modified AAV ITR are identical (or different).

15. The RNA sequence of any one of claims 7-14, wherein the transcribed modified AAV ITR, and the second transcribed modified AAV ITR (if present), comprise a deletion from, a mutation in, or an insertion into a corresponding transcribed wild-type AAV ITR D region sequence or a corresponding transcribed wild-type TRS / rcTRS.

16. The RNA sequence of any one of claims 13-15, wherein the second transcribed modified AAV ITR is within 5' end 1000 nucleotides, 800 nucleotides, 500 nucleotides, 250 nucleotides, or 150 nucleotides of the RNA sequence.

17. The RNA sequence of any one of claims 2-6, wherein the RPS comprises an MS2 sequence, an PP7 binding site, or a com binding site, and the RPS-interacting molecule comprises an RPS-interacting protein (RPSIP) capably of interacting, *e.g.*, binding, directly or indirectly, to the RPS, such as a bacteriophage-derived MS2 coat protein (MCP) for an MS2 sequence, a PP7 bacteriophage coat protein (PCP) for an PP7 binding site, or a phage COM protein (COM) for a com binding site.

18. The RNA sequence of claim 17, wherein the RPSIP is associated directly or indirectly with (*e.g.*, fused to) a protein component of the viral packaging system for the DNA virus viral particle (such as Rep78 and/or Rep68 of adeno-associated virus 2 (AAV2), or assembly-activating protein (AAP)).

19. The RNA sequence of any one of claims 1-18, wherein the RNA sequence comprises or preferably does not comprise a transcribed DNA packaging signal, for example, a transcribed wild-type AAV ITR sequence (*e.g.*, the RNA sequence comprises a transcribed modified AAV ITR sequence having an addition, a deletion, and/or a substitution of a nucleotide of a corresponding transcribed wild-type AAV ITR sequence to reduce the DNA packaging capability of the DNA virus viral particle).

20. The RNA sequence of any one of claims 1-19, further comprising:
    (1) a transcribed transcription enhancer;
    (2) a transcribed intron sequence or exon sequence (such as one for enhancing protein expression);

(3) a 5’ UTR sequence;

(4) a 3’ UTR sequence;

(5) a polyA sequence, or a polyadenylation (polyA) signal sequence and optionally a GU-rich region downstream of the polyA signal sequence;

(6) a posttranscriptional regulatory element or sequence, such as a transcribed Woodchuck Hepatitis Virus (WHP) Posttranscriptional Regulatory Element (WPRE) sequence; and/or,

(7) a transcription termination sequence (such as a histone downstream element), optionally, the RNA sequence comprises an RPS located 3’ to the posttranscriptional regulatory element or sequence, and 5’ to the polyA sequence or the polyA signal sequence.

21. The RNA sequence of claim 20, comprising, in 5’ to 3’ orientation, the RSI, the optional transcribed WPRE sequence; the RPS (such as the transcribed modified AAV ITR, the MS2 sequence, the PP7 binding site, or the com binding site); and the polyA sequence or the polyA signal sequence.

22. The RNA sequence of any one of claims 1-21, wherein the GOI comprises a protein (*e.g.*, a fluorescent protein, a therapeutic protein, an antigen protein, or a gene-editing protein such as a Cas protein, a ZFN protein, a TALEN protein), an enzyme (such as a Cre protein, or a CRISPR/Cas effector enzyme, *e.g.*, Cas9, Cas12, Cas13, or a variant thereof), a structural protein, an mRNA, a non-coding RNA (ncRNA), an siRNA, a piRNA, a short hairpin RNA or shRNA, a microRNA (miRNA) or a precursor thereof (including pre-miRNA and pri-miRNA), a ribosomal RNA (rRNA), an antisense sequence or oligonucleotide (ASO), an RNA component of a CRISPR-Cas system, including a guide RNA (or a gRNA), such as, a single guide RNA (or a sgRNA, a chimeric RNA, an RNA chimera), a CRISPR RNA (crRNA), and a tracr RNA, a guide RNA or gRNA for a CRISPR/Cas effector enzyme, an rRNA, a tRNA, a snoRNA, a snRNA, an exRNA, a scaRNA, a lncRNA, a Xist, and a HOTAIR.

23. The RNA sequence of any one of claims 1-22, which is a single-stranded RNA less than about 8,900 nucleotides in length, less than about 8,000 nucleotides in length, less than about 7,000 nucleotides in length, less than about 6,000 nucleotides in length, less than about 5,200 nucleotides in length, less than about 4,000 nucleotides in length, less than about 3,000 nucleotides in length, less than about 2,000 nucleotides in length, about 4,700-5,200 nucleotides in length, about 4,700-5,000

nucleotide in length, about 4,700-4,800 nucleotides in length, or about 4,700 nucleotides in length.

24. A polynucleotide comprising a cassette encoding the RNA sequence of any one of claims 1-23; optionally, the polynucleotide is a DNA sequence (*e.g.*, a DNA plasmid), optionally comprising a stuffer sequence in the backbone of the DNA plasmid, and/or optionally comprising no functional DNA packaging signal such as AAV ITR.

25. The polynucleotide of claim 24, further comprising a promoter operably linked to and driving the transcription of the RNA sequence encoded by the cassette.

26. The polynucleotide of claim 25, wherein the promoter is a ubiquitous promoter.

27. The polynucleotide of claim 25, wherein the promoter is a tissue-specific promoter.

28. The polynucleotide of any one of claims 25-27, wherein the promoter is a constitutive promoter.

29. The polynucleotide of any one of claims 25-27, wherein the promoter is an inducible promoter.

30. The polynucleotide of any one of claims 25-29, further comprising an enhancer that enhances the transcription of the RNA sequence driven by the promoter.

31. A recombinant DNA virus viral particle comprising an RNA genome (such as the RNA sequence of any one of claims 1-23 or the RNA sequence transcribed from the polynucleotide of any one of claims 24-30) packaged within the protein shell (such as capsid) of a DNA virus (such as an AAV virus, or an oncolytic virus).

32. The recombinant DNA virus viral particle of claim 31, wherein the DNA virus is AAV, and the recombinant DNA virus viral particle is a recombinant RNA adeno-associated virus (rRAAV) particle, comprising:
    (1) an AAV capsid; and,
    (2) the RNA sequence of any one of claims 1-23 or the RNA sequence transcribed from the polynucleotide of any one of claims 24-30 packaged within said AAV capsid.

33. The recombinant DNA virus viral particle of claim 32, wherein the AAV capsid comprises a capsid from an AAV of the serotype AAV1, AAV2, AAV3A, AAV3B, AAV4, AAV5, AAV6, AAV7, AAV8, AAV9, AAV10, AAV11, AAV12, AAV13, AAV-DJ, AAV PHP.eB, Anc80L65, Anc80L65AAP, AAVrh74, or 7m8.

34. A population of recombinant DNA virus viral particles (*e.g.*, rRAAV particles) comprising a plurality of recombinant DNA virus viral particle (*e.g.*, rRAAV particle) of any one of claims 31-33, wherein at least about 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, 95%, 96%, 97%, 98%, 99% or more of the recombinant DNA virus viral particles (*e.g.*, rRAAV particles) within said population have the RNA sequence of any one of claims 1-23 or the RNA sequence transcribed from the polynucleotide of any one of claims 24-30 packaged therein.

35. A host cell comprising the RNA sequence of any one of claims 1-23, the polynucleotide of any one of claims 24-30, the RNA sequence transcribed from the polynucleotide of any one of claims 24-30, the recombinant DNA virus viral particle (*e.g.*, rRAAV particle) of any one of claims 31-33, and/or the population of recombinant DNA virus viral particles (*e.g.*, rRAAV particles) of claim 34.

36. The host cell of claim 35, further comprising a viral packaging system that facilitates packaging of the RNA sequence of any one of claims 1-23 or the RNA sequence transcribed from the polynucleotide of any one of claims 24-30 into the DNA virus viral particle.

37. The host cell of claim 36, wherein the viral packaging system comprises:

(1) an AAV rep gene (*e.g.*, coding sequence for Rep78, Rep68, Rep52, and/or Rep40) and an AAV cap gene (*e.g.*, coding sequence for VP1, VP2, VP3, AAP, and/or MAAP), under the transcriptional control of one or more promoters that drive the transcription of said rep gene and cap gene, or the expression products thereof;

(2) one or more coding sequences for one or more proteins required for AAV packaging, such as adenoviral E2A, E4, and VA genes, or said one or more proteins; and

(3) the RPS-interacting molecule or a coding sequence thereof;

optionally, the capacity of the viral packaging system of packaging a DNA sequence into the DNA virus viral particle is reduced, diminished, or substantially eliminated by, for example, (1) removing a part or all of the DNA packaging signals such as AAV ITR on the polynucleotide encoding the RNA sequence of any one of claims 1-23 or on the polynucleotide of any one of claims 24-30, (2) modifying, *e.g.*, mutating, said AAV rep gene, said AAV cap gene, and/or said one or more coding sequences for one or more proteins required for AAV packaging to reduce, diminish, or

substantially eliminate the capacity of the respective translated protein to facilitate the packaging of the DNA sequence into the DNA virus viral particle (*e.g.*, a Y156F mutation in the common sequence of Rep78 and Rep68 proteins, KDE-mu, or EKE-mu); and/or (3) enlarging the size of the polynucleotide encoding the RNA sequence of any one of claims 1-23 or the polynucleotide of any one of claims 24-30.

38. The host cell of any one of claims 35-37, which is a mammalian cell (such as HEK293 cells) or an insect cell (such as Sf9 or Sf21 cells).

39. A method of generating the recombinant DNA virus viral particle (*e.g.*, rRAAV particle) of any one of claims 31-33 or the population of recombinant DNA virus viral particles (*e.g.*, rRAAV particles) of claim 34, the method comprising:
    a) culturing the host cell of any one of claims 35-38 for a sufficient time, and
    b) harvesting the recombinant DNA virus viral particle or the population of recombinant DNA virus viral particles.

40. The method of claim 39, further comprising isolating or purifying said recombinant DNA virus viral particle or said population of recombinant DNA virus viral particles.

41. A method of generating a recombinant DNA virus viral particle (*e.g.*, rRAAV particle) or a population of recombinant DNA virus viral particles, the method comprising:
    a) contacting a viral packaging system (*e.g.*, a AAV packaging system) with the RNA sequence of any one of claims 1-23 or the RNA sequence transcribed from the polynucleotide of any one of claims 24-30 for a period of time sufficient to produce the recombinant DNA virus viral particle or the population of recombinant DNA virus viral particles, and
    b) harvesting the recombinant DNA virus viral particle or the population of recombinant DNA virus viral particles; and, optionally,
    c) isolating or purifying the harvested recombinant DNA virus viral particle or population of recombinant DNA virus viral particles.

42. The method of claim 41, wherein the viral packaging system (*e.g.*, a AAV packaging system) comprises:
    (1) one or more proteins for assemblying the protein shell (*e.g.*, VP1, VP2, and/or VP3 for assembling AAV capsid) of the DNA virus viral particle for packaging the RNA sequence, or one or more coding sequences thereof;

(2) one or more proteins (*e.g.*, Rep78, Rep68, Rep52, and/or Rep40 for AAV packaging) for facilitating the assemblying of the protein shell and/or the packaging of the RNA sequence into the protein shell of the DNA virus viral particle, or one or more coding sequences thereof (*e.g.*, adenoviral E2a, E4, and VA genes); and

(3) the RPS-interacting molecule or a coding sequence thereof;

optionally, the capacity of the viral packaging system of packaging a DNA sequence into the DNA virus viral particle is reduced, diminished, or substantially eliminated by, for example, (1) removing a part or all of the DNA packaging signals such as AAV ITR on the polynucleotide encoding the RNA sequence of any one of claims 1-23 or on the polynucleotide of any one of claims 24-30, (2) modifying, *e.g.*, mutating, said AAV rep gene, said AAV cap gene, and/or said one or more coding sequences for one or more proteins required for AAV packaging to reduce, diminish, or substantially eliminate the capacity of the respective translated protein to facilitate the packaging of the DNA sequence into the DNA virus viral particle (*e.g.*, a Y156F mutation in the common sequence of Rep78 and Rep68 proteins, KDE-mu, or EKE-mu); and/or (3) enlarging the size of the polynucleotide encoding the RNA sequence of any one of claims 1-23 or the polynucleotide of any one of claims 24-30.

43. A system of packaging the RNA sequence of any one of claims 1-23 or the RNA sequence transcribed from the polynucleotide of any one of claims 24-30 into a DNA virus viral particle, comprising:

(1) one or more proteins for assemblying the protein shell (*e.g.*, VP1, VP2, and/or VP3 for assembling AAV capsid) of the DNA virus viral particle for packaging the RNA sequence, or one or more coding sequences thereof;

(2) one or more proteins (*e.g.*, Rep78, Rep68, Rep52, and/or Rep40 for AAV packaging) for facilitating the assemblying of the protein shell and/or the packaging of the RNA sequence into the protein shell of the DNA virus viral particle, or one or more coding sequences thereof (*e.g.*, adenoviral E2a, E4, and VA genes); and

(3) the RPS-interacting molecule or a coding sequence thereof;

optionally, the capacity of the viral packaging system of packaging a DNA sequence into the DNA virus viral particle is reduced, diminished, or substantially eliminated by, for example, (1) removing a part or all of the DNA packaging signals such as

AAV ITR on the polynucleotide encoding the RNA sequence of any one of claims 1-23 or on the polynucleotide of any one of claims 24-30, (2) modifying, *e.g.*, mutating, said AAV rep gene, said AAV cap gene, and/or said one or more coding sequences for one or more proteins required for AAV packaging to reduce, diminish, or substantially eliminate the capacity of the respective translated protein to facilitate the packaging of the DNA sequence into the DNA virus viral particle (*e.g.*, a Y156F mutation in the common sequence of Rep78 and Rep68 proteins, KDE-mu, or EKE-mu); and/or (3) enlarging the size of the polynucleotide encoding the RNA sequence of any one of claims 1-23 or the polynucleotide of any one of claims 24-30.

44. A method of delivering a gene of interest (GOI) into a cell, a plant, or an animal, the method comprising contacting the cell, the plant, or the animal with the recombinant DNA virus viral particle (*e.g.*, rRAAV particle) of any one of claims 31-33, the population of the recombinant DNA virus viral particles (*e.g.*, rRAAV particles) of claim 34, or the recombinant DNA virus viral particle (*e.g.*, rRAAV particle) or the population of the recombinant DNA virus viral particles (*e.g.*, rRAAV particles) produced by the method of any one of claims 39-42, wherein said GOI is encoded by said RNA sequence (of any one of claims 1-23).

45. A method of delivering an RNA sequence of interest (RSI) into a cell, a plant, or an animal, the method comprising contacting the cell, the plant, or the animal with the recombinant DNA virus viral particle (*e.g.*, rRAAV particle) of any one of claims 31-33, the population of the recombinant DNA virus viral particles (*e.g.*, rRAAV particles) of claim 34, or the recombinant DNA virus viral particle (*e.g.*, rRAAV particle) or the population of the recombinant DNA virus viral particles (*e.g.*, rRAAV particles) produced by the method of any one of claims 39-42.

46. A method of diagnosing, preventing, or treating a disease or disorder in a subject in need thereof, comprising administrating to the subject a therapeutically effective amount or dose of the population of the recombinant DNA virus viral particles (*e.g.*, rRAAV particles) of claim 34 or produced by the method of any one of claims 39-42.

47. Use of the recombinant DNA virus viral particle (*e.g.*, rRAAV particle) of any one of claims 31-33, the population of the recombinant DNA virus viral particles (*e.g.*, rRAAV particles) of claim 34, or the recombinant DNA virus viral particle (*e.g.*, rRAAV particle) or the population of the recombinant DNA virus viral particles (*e.g.*,

rRAAV particles) produced by the method of any one of claims 39-42 in the manufacture of a medicament for diagnosing, preventing, or treating a disease or disorder in a subject in need thereof.

CLAIMS

1. A ribonucleotide (RNA) sequence capable of being packaged into a DNA virus viral particle, wherein said RNA sequence comprises:
   (1) an RNA sequence of interest (RSI); and,
   (2) an RNA-packaging signal (RPS) capable of binding directly or indirectly to an RPS-interacting molecule that facilitates packaging of the RNA sequence into the DNA virus viral particle.

2. The RNA sequence of claim 1, wherein the RPS is located at or near the 5' end of the RSI, at or near the 3' end of the RSI, or internal to the RSI.

3. The RNA sequence of claim 1, comprising more than one RPS that are identical or different, and wherein two or more of said more than one RPS are
   (1) adjacent to each other, or are in tandem, via the same or different linkers; or
   (2) not adjacent to each other.

4. The RNA sequence of claim 1, wherein the DNA virus viral particle is an AAV viral particle, and wherein the RPS comprises a transcribed modified AAV inverted terminal repeat (ITR), wherein said transcribed modified AAV ITR:
   (a) comprises a transcribed functional Rep-Binding Element (RBE) and,
   (b) lacks either a transcribed terminal resolution site (TRS), or a transcribed reverse complement TRS (rcTRS), or both.

5. The RNA sequence of claim 4, wherein the transcribed modified AAV ITR is modified from a transcribed wild-type flip or flop ITR.

6. The RNA sequence of claim 4, wherein the transcribed modified AAV ITR comprises the transcribed D region sequence, or wherein the transcribed modified AAV ITR lacks the transcribed D region sequence.

7. The RNA sequence of claim 4, further comprising a second transcribed modified AAV ITR having a second transcribed functional RBE sequence but lacking either a second transcribed terminal resolution site (TRS) or a second transcribed reverse complement TRS

(rcTRS) or both.

8. The RNA sequence of claim 7, wherein the second transcribed modified AAV ITR is within 5' end 1000 nucleotides, 800 nucleotides, 500 nucleotides, 250 nucleotides, or 150 nucleotides of the RNA sequence.

9. The RNA sequence of claim 1, wherein the RPS comprises an MS2 sequence, an PP7 binding site, or a com binding site, and the RPS-interacting molecule comprises an RPS-interacting protein (RPSIP) capable of binding directly or indirectly to the RPS.

10. The RNA sequence of claim 1, which is a single-stranded RNA less than about 8,900 nucleotides in length, less than about 8,000 nucleotides in length, less than about 7,000 nucleotides in length, less than about 6,000 nucleotides in length, less than about 5,200 nucleotides in length, less than about 4,000 nucleotides in length, less than about 3,000 nucleotides in length, less than about 2,000 nucleotides in length, about 4,700-5,200 nucleotides in length, about 4,700-5,000 nucleotide in length, about 4,700-4,800 nucleotides in length, or about 4,700 nucleotides in length.

11. A polynucleotide comprising a cassette encoding the RNA sequence of claim 1.

12. The polynucleotide of claim 11, further comprising a promoter operably linked to and driving the transcription of the RNA sequence encoded by the cassette.

13. An isolated host cell comprising the RNA sequence of claim 1.

14. The RNA sequence of claim 1, wherein said RNA sequence of interest is an RNA coding sequence for a gene of interest (GOI), a protein-encoding RNA, a non-coding functional RNA, or a precursor thereof.

15. The RNA sequence of claim 14, wherein the gene of interest (GOI) encodes a protein, an enzyme, a structural protein, an mRNA, a non-coding RNA (ncRNA), an siRNA, a piRNA, a short hairpin RNA or shRNA, a microRNA (miRNA) or a precursor thereof, a ribosomal RNA (rRNA), an antisense sequence or oligonucleotide (ASO), an RNA component of a CRISPR-Cas system, an rRNA, a tRNA, a snoRNA, a snRNA, an exRNA, a scaRNA, a lncRNA, an X inactive specific transcript (Xist), or a HOX transcript antisense RNA

(HOTAIR).

16. The RNA sequence of claim 14, wherein the protein-encoding RNA encodes a therapeutic protein, an antigen protein, or a gene-editing protein.

17. The RNA sequence of claim 16, wherein the gene-editing protein is a CRISPR/Cas effector enzyme, a ZFN protein, or a TALEN protein.

18. The RNA sequence of claim 14, wherein the non-coding functional RNA is a transfer RNA (tRNA), a ribosomal RNA (rRNA), a small interfering RNA (siRNA), a short hairpin RNA (shRNA), an antisense RNA, an antisense oligonucleotide, a micro RNA (miRNA), or an RNA component of a CRISPR-Cas system.

19. The RNA sequence of claim 18, wherein the CRISPR-Cas system comprises Cas9, Cas12, or Cas13.

20. The RNA sequence of claim 18, wherein the RNA component of the CRISPR-Cas system comprises a guide RNA (gRNA), a CRISPR RNA (crRNA), and/or a tracr RNA.

21. The RNA sequence of claim 5, wherein said wild-type flop ITR has the nucleotide sequence of SEQ ID NO: 1.

22. The RNA sequence of claim 6, wherein said transcribed modified AAV ITR has the nucleotide sequence of SEQ ID NO: 2.

23. The RNA sequence of claim 6, wherein said transcribed modified AAV ITR has the nucleotide sequence of SEQ ID NO: 3.

24. The RNA sequence of claim 9, wherein:
    (a) the RPS comprises the MS2 sequence, and the RPSIP comprises a bacteriophage MS2 coat protein (MCP);
    (b) the RPS comprises the PP7 binding site, and the RPSIP comprises a PP7 bacteriophage coat protein (PCP); or,
    (c) The RPS comprises the com binding site, and the RPSIP comprises a phage COM protein (COM).

25. The RNA sequence of claim 15, wherein said protein is a fluorescent protein, a therapeutic protein, an antigen protein, or a gene-editing protein.

26. The RNA sequence of claim 15, wherein said enzyme is a Cre protein, or a CRISPR/Cas effector enzyme.

27. The RNA sequence of claim 15, wherein said RNA component of the CRISPR-Cas system includes a guide RNA (gRNA), a CRISPR RNA (crRNA), and/or a tracr RNA.

28. The RNA sequence of claim 1, wherein the DNA virus viral particle is an AAV viral particle or an oncolytic viral particle.

29. The RNA sequence of claim 28, wherein the AAV viral particle comprises a capsid from an AAV of the serotype AAV1, AAV2, AAV3A, AAV3B, AAV4, AAV5, AAV6, AAV7, AAVrh74, AAV8, AAV9, AAV10, AAV11, AAV12, AAV13, AAV-DJ, AAV PHP.eB, Anc80L65, Anc80L65AAP, or 7m8.

30. The RNA sequence of claim 1, further comprising:
    (1) a transcribed transcription enhancer;
    (2) a transcribed intron sequence or exon sequence;
    (3) a 5' UTR sequence;
    (4) a 3' UTR sequence;
    (5) a polyA sequence, or a polyadenylation (polyA) signal sequence, and optionally a GU-rich region downstream of the polyA signal sequence;
    (6) a posttranscriptional regulatory element or sequence; and/or,
    (7) a transcription termination sequence.

31. The RNA sequence of claim 30, comprising, in 5' to 3' orientation, the RSI, an optional transcribed woodchuck hepatitis virus posttranscriptional regulatory element (WPRE) sequence, the RPS, and the polyA sequence or the polyA signal sequence.

32. The RNA sequence of claim 1, wherein a DNA sequence encoding said RNA sequence, or a reverse complement of said DNA sequence, has reduced, diminished, or no capacity of

being packaged into the DNA virus viral particle.

33. The RNA sequence of claim 32, wherein the DNA virus viral particle is an AAV viral particle and wherein said DNA sequence or the reverse complement thereof lacks a DNA packaging signal for AAV packaging.

34. The RNA sequence of claim 33, wherein said DNA packaging signal comprises a functional AAV ITR.

35. The RNA sequence of claim 4, wherein said transcribed modified AAV ITR further comprises a transcribed functional RBE'.

36. The RNA sequence of claim 35, wherein the protein component of the viral packaging system for the DNA virus viral particle comprises Rep78 and/or Rep68 of adeno-associated virus 2 (AAV2), or an assembly-activating protein (AAP).

37. The RNA sequence of claim 4, wherein said transcribed modified AAV ITR further comprises a transcribed D region sequence.

38. The RNA sequence of claim 4, wherein the RPS-interacting molecule is Rep78, Rep68, Rep52, and/or Rep40.

39. The RNA sequence of claim 5, wherein the wild-type flip or flop ITR is from AAV1, AAV2, AAV3A, AAV3B, AAV4, AAV5, AAV6, AAV7, AAVrh74, AAV8, AAV9, AAV10, AAV11, AAV12, or AAV13.

40. The RNA sequence of claim 7, wherein the second transcribed modified AAV ITR further comprises a second transcribed D region sequence.

41. The RNA sequence of claim 9, wherein the RPSIP is associated directly or indirectly with a protein component of the viral packaging system for the DNA virus viral particle.

42. The RNA sequence of claim 11, wherein the polynucleotide is a DNA sequence.

43. The RNA sequence of claim 11, wherein the polynucleotide is a DNA plasmid comprising a stuffer sequence in the backbone of the DNA plasmid.

44. The RNA sequence of claim 11, wherein the polynucleotide is a DNA sequence comprising

no functional DNA packaging signal.

45. The RNA sequence of claim 30, wherein the RNA sequence comprises an RPS located 3' to the posttranscriptional regulatory element or sequence, and 5' to the polyA sequence or the polyA signal sequence.