CLAIMS

1. A nucleic acid construct comprising a modified alphavirus genome or replicon RNA, wherein a substantial portion of the nucleic acid sequence encoding the viral structural proteins of the modified alphavirus genome or replicon RNA is replaced by a synthetic adaptor molecule configured for facilitating insertion of a heterologous sequence into the modified alphavirus genome or replicon RNA, and wherein the synthetic adaptor molecule having the Formula I:

[5' flanking domain]- [restriction site]$_n$ -[3' flanking domain] Formula I

wherein

a) n is an integer from 1 to 6;

b) the restriction site is cleavable by a restriction endonuclease; and

c) the 5' flanking domain and 3' flanking domain each comprise a nucleic acid sequence predicted to have minimal secondary structure as having a folding ΔG value of the minimum free energy (MFE) structure higher than a predefined threshold value of about >-9.6 kcal/mol.

2. The nucleic acid construct of claim 1,

wherein the 5' flanking domain does not comprise a sequence which encodes an RNA sequence capable of forming a stem-loop structure.

3. The nucleic acid construct of any one of claims 1 to 2, wherein the 5' flanking domain comprises a coding sequence for an autoproteolytic or self-cleaving peptide, optionally

wherein the 5' flanking domain comprises an internal ribosomal entry site (IRES).

4. The nucleic acid construct of any one of claims 1 to 3, wherein the 5' flanking domain does not comprise a translation start site in any reading frame; optionally

wherein the 5' flanking domain comprises a translation start site or a part thereof as the last nucleotides of the 5' adaptor sequence; optionally

wherein the 5' flanking domain comprises a methionine codon as the last three nucleotides of the 5' adaptor sequence.

5. The nucleic acid construct of any one of claims 1 to 4,

wherein the 3' flanking domain comprise a translation stop codon as the first three nucleotides of the 3' adaptor sequence.

6. A nucleic acid construct comprising a modified alphavirus genome or replicon RNA comprising a poly(A) tail, wherein the poly(A) tail (i) is longer than 30 residues and (ii) does not comprise a 3' non-A residue.

7. The nucleic acid construct of claim 6, further comprising an additional restriction site engineered into the sequence encoding the poly(A) tail or incorporated at the end of the sequence encoding the poly(A) tail of the alphavirus genome or replicon RNA.

8. A nucleic acid construct comprising a modified alphavirus genome or replicon RNA comprising a lengthened poly(A) tail, wherein the sequence encoding the poly(A) tail is longer than 34 residues, optionally wherein the poly(A) tail is about 60 adenylate residues or has a length ranging from about 30 to about 120 adenylate residues.

9. The nucleic acid construct of any one of claims 1 to 8, further comprising one or more expression cassettes, wherein each of the expression cassettes comprises a promoter operably linked to a heterologous nucleic acid sequence; optionally wherein at least one of the expression cassettes comprises coding sequence(s) for a gene of interest or genes of interest (GOI); optionally wherein the GOI encodes a polypeptide or polypeptides of interest.

10. A recombinant cell comprising a nucleic acid construct according to any one of claims 1 to 9.

11. A transgenic animal comprising a nucleic acid construct according to any one of claims 1 to 9, wherein the transgenic animal is a non-human animal.

12. A method for producing a recombinant RNA molecule, comprising (i) rearing a transgenic non-human animal according to claim 11, or (ii) culturing a recombinant cell according to claim 10 under conditions such that the recombinant RNA molecule is produced.

13. The method of claim 12, wherein the transgenic animal or the recombinant cell comprising a nucleic acid construct according to any one of claims 7-9, and wherein the sequence encoding

the recombinant RNA molecule is optionally digested by a restriction enzyme capable of cleaving the restriction site engineered after the end of the sequence encoding the poly(A) tail.

14. A recombinant RNA molecule produced by the method of claim 13.

15. A method for producing a polypeptide of interest, comprising (i) rearing a transgenic non-human animal comprising a nucleic acid construct according to claim 9, or (ii) culturing a recombinant cell comprising a nucleic acid construct according to claim 9 under conditions wherein the polypeptide encoded by the GOI is produced.

16. A method for producing a polypeptide of interest in a subject, comprising administering to the subject a nucleic acid construct according to claim 9.

17. A recombinant polypeptide produced by the method of claim 15 or 16.

18. A pharmaceutical composition comprising a pharmaceutically acceptable excipient and:

a) a nucleic acid construct of any one of claims 1-9;

b) a recombinant RNA molecule of claim 14;

c) a recombinant cell of claim 10; and/or

d) a recombinant polypeptide of claim 17.

19. A kit for modulating an immune response, for the prevention, and/or for the treatment of a health condition or a microbial infection, the kit comprising:

a) a nucleic acid construct of any one of claims 1-9;

b) a recombinant RNA molecule of claim 14;

c) a recombinant cell of claim 10;

d) a recombinant polypeptide of claim 17; and/or

e) a pharmaceutical composition of claim 18;

wherein the health condition may be or is selected from a proliferative disorder, inflammatory disorder, autoimmune disorder, or a microbial infection.