CLAIMS

What is claimed:

1. A composition suitable for stimulating an immune response against two or more viruses in a mammalian subject, comprising an excipient, and a messenger RNA (mRNA) comprising an open reading frame (ORF) encoding a fusion protein, wherein the ORF comprises from 5’ to 3’:
(i) a nucleotide sequence encoding a mammalian signal peptide; and
(ii) a nucleotide sequence encoding a first nucleocapsid protein of a first virus and a second nucleocapsid protein of a second virus.

2. The composition of claim 1, wherein the first and second viruses are capable of causing disease upon infection of a human subject.

3. The composition of claim 1, wherein the first and second viruses are different variants, subtypes or lineages of the same species.

4. The composition of claim 1, wherein the first and second viruses are different species of the same genus.

5. The composition of claim 1, wherein the first and second viruses are members of different families, orders, classes, or phyla of the same kingdom.

6. The composition of claim 1, wherein the first and second viruses are both members of the orthomyxoviridae family.

7. The composition of claim 6, wherein the first and second viruses comprise an influenza A virus and an influenza B virus.

8. The composition of claim 7, wherein the amino acid sequence of the fusion protein comprises SEQ ID NO:16, or the amino acid sequence at least 75%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to SEQ ID NO:16.

9. The composition of claim 1, wherein the first and second viruses are both members of the orthornavirae kingdom, and comprise an influenza A virus or an influenza B virus.

10. The composition of claim 1, wherein the nucleotide sequence (ii) encodes a shared portion of the first nucleocapsid protein of the first virus for stimulating an immune response against both the first and second viruses.

11. The composition of claim 10, wherein the nucleotide sequence (ii) encodes an individual portion of each of the first and second nucleocapsid proteins for stimulating an immune response against both the first and second viruses.

12. The composition of any one of claims 1-11, wherein the nucleotide sequence of (ii) further encodes at least one further nucleocapsid protein of at least one further virus, and wherein the at least one further virus is different from the first and second viruses.

13. The composition of any one of claims 1-12, wherein the first and second, or the first, second, and further nucleocapsid proteins are separated by a linker of from one to ten residues in length.

14. The composition of any one of claims 1-13, wherein the mammalian signal peptide is a signal peptide of a surface protein expressed in mammalian antigen presenting cells.

15. The composition of any one of claims 1-14, wherein the mRNA is a self-replicating mRNA.

16. A composition suitable for stimulating an immune response against a virus in a mammalian subject, comprising an excipient, and a messenger RNA (mRNA) comprising an open reading frame (ORF) encoding a fusion protein, wherein the ORF comprises from 5’ to 3’:

(i) a nucleotide sequence encoding a mammalian signal peptide;

(ii) a nucleotide sequence encoding a first viral antigen or fragment thereof of a first virus; and

(iii) a nucleotide sequence encoding a second viral antigen or fragment thereof of the first virus or a second virus,

wherein the first viral antigen is a nucleocapsid protein and the second viral antigen is a surface protein, or the first viral antigen is a surface protein and the second viral antigen is a nucleocapsid protein.

17. A composition suitable for stimulating an immune response against two or more viruses in a mammalian subject, comprising an excipient, and a messenger RNA (mRNA) comprising an

open reading frame (ORF) encoding a fusion protein, wherein the ORF comprises from 5' to 3':

(i) a nucleotide sequence encoding a mammalian signal peptide;

(ii) a nucleotide sequence encoding a first viral antigen or fragment thereof of a first virus;

(iii) a nucleotide sequence encoding a second viral antigen or fragment thereof of the first virus;

(iv) a nucleotide sequence encoding a third viral antigen or fragment thereof of a second virus;

(iii) a nucleotide sequence encoding a fourth viral antigen or fragment thereof of the second virus,

wherein the first viral antigen is a first nucleocapsid protein and the second viral antigen is a first surface protein, or the first viral antigen is a first surface protein and the second viral antigen is a first nucleocapsid protein, and

wherein the third viral antigen is a second nucleocapsid protein and the fourth viral antigen is a second surface protein, or the third viral antigen is a second surface protein and the fourth viral antigen is a second nucleocapsid protein.

18. The composition of claim 16 or claim 17, wherein the first virus and/or the second virus is a member of the orthomyxoviridae family.

19. The composition of claim 18, wherein the first and/or the second virus is independently selected from the group consisting of an influenza A virus (IAV) and an influenza B virus (IBV).

20. The composition of claim 19, wherein the first virus is IAV and the second virus is IBV.

21. The composition of any one of claims 18-20, wherein the surface protein, the first surface protein and/or the second surface protein each comprise a portion of an influenza hemagglutinin.

22. The composition of claim 21, wherein the amino acid sequence of the fusion protein comprises SEQ ID NO:29, or the amino acid sequence at least 75%, 85%, 90%, 95%, 96%, 97%, 98% or 99% identical to SEQ ID NO:29.

23. The composition of any one of claims 1-22, wherein the composition further comprises chitosan.

24. The composition of any one of claims 1-23 for use as a medicament.

25. Use of the composition of any one of claims 1-23 in the manufacture of a medicament for prevention of disease caused by the virus.

26. The use of claim 25, wherein the disease is influenza.