WHAT IS CLAIMED IS:

1. An engineered protein comprising a metapneumovirus (MPV) F protein ectodomain having at least 90% identity to amino acids 19-489 of any one of SEQ ID NOs: 4-7, said engineered protein comprising at least one mutation relative to the sequence of any one of SEQ ID NOs: 4-7, said at least one mutation comprising a substitution at a position corresponding to: V262, H435, N46, L158, L50, N457, N322, S291, S444, S355, S22, G53, E305, L302, V47, T127, G121, I128, A190, L165, S149, V/I122, S192, T317, L134, S347, I268, S265, F48, V231, I217, S194, L219, V148, L73, Q195, and/or E453.

2. The engineered protein of claim 1, further comprising a proline substitution corresponding to A/D185P.

3. The engineered protein of claim 1, further comprising a substitution of residues corresponding to positions 87-104 of any one of SEQ ID NOs: 4-7 to GGGGSGGGGSR (SEQ ID NO: 8).

4. The engineered protein of claim 1, further comprising an engineered disulfide bond comprising paired cysteine substitutions corresponding to A140C and A147C.

5. The engineered protein of claim 1, comprising an engineered disulfide bond comprising paired cysteine substitutions corresponding to L110C and N322C.

6. The engineered protein of claim 1, comprising an engineered disulfide bond comprising paired cysteine substitutions corresponding to T127C and N153C.

7. The engineered protein of claim 6, further comprising substitutions at positions corresponding to L219 and V231.

8. The engineered protein of claim 6, further comprising substitutions corresponding to L219K and V231I.

9. The engineered protein of claim 6, further comprising paired cysteine substitutions corresponding to T365C and V463C.

10. The engineered protein of claim 6, further comprising paired cysteine substitutions corresponding to L110C and N322C.

11. The engineered protein of claim 6, further comprising paired cysteine substitutions corresponding to A140C and A147C.

12. The engineered protein of claim 6, further comprising a substitution corresponding to G366S.

13. The engineered protein of claim 1, comprising an electrostatic interaction substitution at a position corresponding to L66, L73, N145, Q195, E453, K188, H368, D461, T49 and/or V262.

14. The engineered protein of claim 13, comprising a substitution corresponding to L66N, L73E, N145E, Q195K, E453Q, L66D, K188R, H368R, D461E, T49E, and/or V262D.

15. The engineered protein of claim 1, comprising substitutions corresponding to L110C, T127C, A140C, A147C, N153C, L219K, V231I, N322C, T365C, E453Q, and/or V463C.

16. The engineered protein of claim 1, comprising substitutions corresponding to T127C, N153C, A185P, T365C, V463C, L219K, and V231I.

17. The engineered protein of claim 1, comprising substitutions corresponding to T127C, N153C, A185P, T365C, V463C, L219K, V231I, and RQSR (residues corresponding to positions 99-102 of any one of SEQ ID NOs: 4-7) to RRRR (SEQ ID NO: 10).

18. The engineered protein of claim 1, comprising substitutions corresponding to T127C, N153C, T365C, V463C, L219K, and V231I.

19. The engineered protein of claim 1, comprising substitutions corresponding to L110C, T127C, A140C, A147C, N153C, A185P, L219K, V231I, N322C, T365C, E453Q, and V463C.

20. The engineered protein of claim 1, comprising substitutions corresponding to L110C, T127C, A140C, A147C, N153C, A185P, L219K, V231I, N322C, T365C, E453Q, V463C, and RQSR (residues corresponding to positions 99-102 of any one of SEQ ID NOs: 4-7) to RRRR (SEQ ID NO: 10).

21. The engineered protein of claim 1, comprising substitutions corresponding to L110C, T127C, A140C, A147C, N153C, L219K, V231I, N322C, T365C, E453Q, and V463C.

22. The engineered protein of claim 1, wherein the engineered protein comprises a polypeptide sequence at least 95% identical to SEQ ID NO: 14.

23. The engineered protein of claim 1, wherein the engineered protein comprises a polypeptide sequence at least 95% identical to SEQ ID NO: 15.

24. The engineered protein of claim 1, having at least 95% identity to the amino acid sequence of SEQ ID NO: 2.

25. The engineered protein of claim 1, comprising an engineered hMPV F protein ectodomain having 95% identity to amino acids 19-489 of SEQ ID NO: 4.

26. The engineered protein of claim 1, wherein the protein is fused to a trimerization domain.

27. The engineered protein of claim 26, wherein the trimerization domain comprises a T4 fibritin trimerization domain.

28. A nucleic acid molecule comprising a nucleotide sequence that encodes an amino acid sequence of the engineered protein of any one of claims 1-27.

29. Use of the nucleic acid molecule of claim 28 in the manufacture of a medicament for preventing metapneumovirus (MPV) infection or a disease associated with metapneumovirus infection.

30. Use of the engineered protein of claim 1 in the manufacture of a medicament for preventing metapneumovirus (MPV) infection or a disease associated with metapneumovirus infection.