

CLAIMS:

1. A chimeric protein comprising an ectodomain of a SARS-CoV-2 spike protein and a cytoplasmic tail portion of an RSV fusion (F) protein.
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2. The chimeric protein of Claim 1, wherein the chimeric protein comprises, in an N- to C-terminal direction, the ectodomain of the SARS-CoV-2 spike protein and the cytoplasmic tail portion of the RSV fusion (F) protein.
- 10 3. The chimeric protein of Claim 1, wherein the chimeric protein further comprises a transmembrane portion of the SARS-CoV-2 spike protein.
4. The chimeric protein of Claim 1, wherein the chimeric protein comprises a sequence selected from the group consisting of SEQ ID NOs: 1-6, 62, 68, 74, 80, 86, 92, 98, and 110 or a variant thereof
15 having at least about 85% (*e.g.*, at least about 90%, at least about 95%, at least about 96%, at least about 97%, at least about 98%, or at least about 99%) sequence identity to a sequence selected from the group consisting of SEQ ID NOs: 1-6, 62, 68, 74, 80, 86, 92, 98, and 110.
5. An immunogenic composition comprising live chimeric virus comprising a nucleic acid
20 encoding the chimeric protein of any one of Claims 1-4.
6. The immunogenic composition of Claim 5, wherein the nucleic acid comprises a sequence selected from the group consisting of SEQ ID NOs: 7-12, 63, 69, 75, 81, 87, 93, 99, and 111 or a variant thereof having at least about 85% (*e.g.*, at least about 90%, at least about 90%, at least about
25 95%, at least about 96%, at least about 97%, at least about 98%, or at least about 99%) sequence identity to a sequence selected from the group consisting of SEQ ID NOs: 7-12, 63, 69, 75, 81, 87, 93, 99, and 111, or an RNA counterpart of any of the foregoing, or a complementary sequence of any of the foregoing.
- 30 7. The immunogenic composition of Claim 5 or Claim 6, further comprising an NS1 and/or an NS2 protein of RSV.

8. The immunogenic composition of any one of claims 5-7, wherein the live chimeric virus does not comprise a gene that encodes RSV G protein.
9. The immunogenic composition of any one of claims 5-8, further comprising an adjuvant
5 and/or other pharmaceutically acceptable carrier.
10. The immunogenic composition of Claim 9, wherein the adjuvant is an aluminum gel, aluminum salt, or monophosphoryl lipid A.
- 10 11. The immunogenic composition of Claim 9, wherein the adjuvant is an oil-in-water emulsion optionally comprising α -tocopherol, squalene, and/or a surfactant.
12. A method for immunizing a subject against a SARS-CoV-2 virus, the method comprising administering to the subject an effective amount of an immunogenic composition of any one of Claims
15 4-11.
13. The method of claim 12, wherein the administration is intranasal administration.
14. The method of claim 12 or 13, wherein the immunogenic composition is administered a dose of
20 between about 10^3 and about 10^6 .
15. The method of any one of claims 12-14, wherein administration of the immunogenic composition induces a SARS-CoV-2 spike-specific mucosal IgA response or generates serum neutralizing antibodies.
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16. A nucleic acid encoding the chimeric protein of Claim 1 or Claim 2.
17. The nucleic acid of Claim 16 comprising a sequence selected from the group consisting of SEQ ID NOs: 7-12, 63, 69, 75, 81, 87, 93, 99, and 111 or a variant thereof having at least about 85% (*e.g.*,
30 at least about 90%, at least about 95%, at least about 96%, at least about 97%, at least about 98%, or at least about 99%) sequence identity to a sequence selected from the group consisting of SEQ ID

NOs: 7-12, 63, 69, 75, 81, 87, 93, 99, and 111, or an RNA counterpart of any of the foregoing, or a complementary sequence of any of the foregoing.

18. A vector comprising a nucleic acid of Claim 16 or Claim 17.

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19. The vector of Claim 18 selected from a plasmid or a bacterial artificial chromosome.

20. The vector of Claim 19, wherein the vector is a bacterial artificial chromosome comprising a sequence selected from the group consisting of SEQ ID NOs: 54-59, 66, 67, 72, 73, 78, 79, 84, 85, 100, 91, 96, 97, 102, 103, 114, 115, and 131-136 or a variant thereof having at least about 85% (*e.g.*, at least about 90%, at least about 95%, at least about 96%, at least about 97%, at least about 98%, or at least about 99%) sequence identity to a sequence selected from the group consisting of SEQ ID NOs: 54-59, 66, 67, 72, 73, 78, 79, 84, 85, 90, 91, 96, 97, 102, 103, 114, 115, and 131-136.

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15 21. An isolated recombinant particle comprising an NS1 and/or an NS2 protein of RSV and the chimeric F protein of Claim 1 or Claim 2.

22. The isolated recombinant particle of Claim 21, comprising a live attenuated chimeric RSV- SARS-CoV-2 genome or antigenome.

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23. A live attenuated chimeric RSV-SARS-CoV-2 antigenome comprising a sequence selected from the group consisting of SEQ ID NOs: 13-18, 65, 71, 77, 83, 89, 95, 101, 104-109, and 113 or a variant thereof having at least about 85% (*e.g.*, at least about 90%, at least about 95%, at least about 96%, at least about 97%, at least about 98%, or at least about 99%) sequence identity to a sequence selected from the group consisting of SEQ ID NOs: 13-18, 65, 71, 77, 83, 89, 95, 101, 104-109, and 113, or an RNA counterpart of any of the foregoing, or a complementary sequence of any of the foregoing.

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