CLAIMS

1. A pharmaceutical composition, comprising a protein complex comprising a first component comprising a receptor-binding domain of a coronavirus S protein attached to a first multimerization domain, and optionally a second component comprising a second multimerization domain; and one or more pharmaceutically acceptable diluents or excipients.

2. The pharmaceutical composition of claim 1, wherein the pharmaceutical composition comprises an adjuvant.

3. The pharmaceutical composition of claim 2, wherein:

(i) the adjuvant is a squalene-in-water emulsion, optionally wherein the adjuvant is MF59®;

(ii) the adjuvant is an aluminum salt;

(iii) the adjuvant is CPG-1018; or

(iv) the pharmaceutical composition comprises both an aluminum salt and CPG-1018.

4. The pharmaceutical composition of claim 1, wherein the pharmaceutical composition is free of or substantially free of any adjuvant.

5. The pharmaceutical composition of any one of claims 1 to 4, wherein:

(i) the first multimerization domain is a trimerization domain and the second multimerization domain is a pentamerization domain; and/or

(ii) the protein complex is an icosahedral protein complex; and/or

(iii) the first multimerization domain comprises an amino acid sequence which is at least 75%, 80%, 85%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or 100% identical to an amino acid sequence selected from the group consisting of SEQ ID NOS: 9-13 or 18; and/or

(iv) the second multimerization domain comprises an amino acid sequence which is at least 95%, at least 96%, at least 97%, at least 98%, at least 99%, or at least 100% identical to an amino acid sequence selected from the group consisting of SEQ ID NOS: 14-17, 20 or 27; and/or

(v) the first component comprises an amino acid sequence which is at least 75%, 80%, 85%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or 100% identical to any one of SEQ ID NOs: 1-6; and

wherein the second component comprises an amino acid sequence which is at least 75%, 80%, 85%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, 99%, or 100% identical to SEQ ID NO: 14.

6. The pharmaceutical composition of any one of claims 1 to 5 for use in a method of vaccinating a subject at risk of infection with SARS-CoV-2, wherein the method comprises administering to the subject the pharmaceutical composition comprising an effective amount of a protein complex comprising a first component comprising a receptor-binding domain of a coronavirus S protein attached to a first multimerization domain, and optionally a second component comprising a second multimerization domain; and one or more pharmaceutically acceptable diluents or excipients.

7. The pharmaceutical composition of any one of claims 1 to 5 for use in a method of boosting an immune response to a prior vaccination for SARS-CoV-2, wherein the method comprises administering to a subject previously vaccinated for SARS-CoV-2 the pharmaceutical composition comprising an effective amount of a protein complex comprising a first component comprising a receptor-binding domain of a coronavirus S protein attached to a first multimerization domain, and optionally a second component comprising a second multimerization domain, optionally wherein the subject has been previously vaccinated with a full vaccination course of a primary vaccine.

8. The pharmaceutical composition of any one of claims 1 to 5 for use in a method of safely and effectively immunizing a subject for SARS-CoV-2, wherein the method comprises administering to the subject previously vaccinated for SARS-CoV-2 the pharmaceutical composition comprising an effective amount of a protein complex comprising a first component comprising a receptor-binding domain of a coronavirus S protein attached to a first multimerization domain, and optionally a second component comprising a second multimerization domain.

9. The pharmaceutical composition of any one of claims 1 to 5 for use in a method according to any one of claims 6 to 8, wherein the effective amount is 2 µg, 5 µg, 10 µg, 15 µg, 25 µg, 50 µg, 100 µg, or 125 µg of the protein complex.

10. The pharmaceutical composition of any one of claims 1 to 5 for use in a method according to any one of claims 6 to 8, wherein the method comprises repeating the administering step; and/or

wherein the method comprises administering a booster vaccine; and/or

wherein the method comprises administering a prime vaccine, optionally wherein the prime vaccine is an mRNA-based vaccine, an adenoviral vector-based vaccine, a protein--based vaccine, or an inactivated virus vaccine; or optionally wherein the prime vaccine is the protein complex.

11. The pharmaceutical composition of any one of claims 1 to 5 for use in a method according to any one of claims 6 to 8, wherein the subject is a previously vaccinated subject.

12. The pharmaceutical composition of any one of claims 1 to 5 for use in a method according to any one of claims 6 to 8, wherein:

a) (i) the subject is a vaccination naïve subject; and/or

b) (i) the subject has previously been infected with SARS-CoV-2; or

(ii) the subject has not previously been infected with SARS-CoV-2; and/or.

c) (i) the subject does not have antibodies against SARS-CoV-2 prior to the administering step; or

(ii) the subject has antibodies against SARS-CoV-2 prior to the administering step.

13. The pharmaceutical composition of any one of claims 1 to 5 for use in a method according to any one of claims 6 to 8, wherein:

(i) the method induces neutralizing antibody titers in the subject; and/or

(ii) the method induces S protein-specific and IgG antibody titers in the subject; and/or

(iii) the method prevents infection with SARS-CoV-2, optionally wherein the method prevents infection with an original strain of SARS-CoV-2; or optionally wherein the method prevents infection with a variant strain of SARS-CoV-2; and/or

(iv) the method reduces the severity of infection with coronavirus, optionally wherein the method reduces the severity of infection with an original strain of SARS-CoV-2; or optionally wherein the method reduces the severity of infection with a variant strain of SARS-CoV-2.