

Claims

1. Recombinant pre-fusion SARS CoV-2 S protein, or a fragment thereof, comprising an
5 S1 and an S2 domain, and comprising at least one mutation selected from the group
consisting of a mutation of at least one amino acid in the loop region corresponding to
amino acid residues 941 – 945 into G and a disulfide bridge between residues 970 and
999, wherein the numbering of the amino acid positions is according to the numbering
of the amino acid positions in SEQ ID NO: 1.
- 10 2. The protein according to claim 1, wherein the at least one mutation in the loop region
corresponding to amino acid residues 941 – 945 is a mutation of the amino acid at
position 941 into G.
3. The protein according to claim 1 or 2, wherein the at least one mutation in the loop
region corresponding to amino acid residues 941 – 945 is a mutation of the amino acid
15 at position 943 into G.
4. The protein according to claim 1, 2 or 3, wherein the at least one mutation in the loop
region corresponding to amino acid residues 941 – 945 is a mutation of the amino acid
at position 944 into G.
5. The protein according to any one of the preceding claims, further comprising a
20 deletion of the furin cleavage site.
6. The protein according to claim 5, wherein the deletion of the furin cleavage site
comprises a mutation of the amino acid at position 682 into S and/or a mutation of the
amino acid at position 685 into G.
7. The protein according to any one of the preceding claims, further comprising a
25 mutation of the amino acids at position 986 and/or 987 into P.

8. The protein according to any of the preceding claims, comprising an amino acid sequence selected from the group consisting of SEQ ID NO: 8-119, or a fragment thereof.
9. The protein according to anyone of the preceding claims, wherein the proteins do not
5 comprise a signal peptide or a tag sequence.
10. The protein according to any one of the preceding claims, comprising a truncated S2 domain.
11. The protein according to claim 10, wherein the transmembrane and cytoplasmic domain have been removed.
- 10 12. The protein according to claim 10 or 11, wherein a heterologous trimerization domain has been linked to the truncated S2 domain.
13. The protein according to claim 12, wherein the heterologous trimerization domain is a foldon domain comprising the amino acid sequence of SEQ ID NO:4.
14. Nucleic acid molecule encoding a protein according to any one of the preceding claims
15 1-13.
15. Nucleic acid according to claim 14, wherein the nucleic acid molecule is DNA or RNA.
16. Vector comprising a nucleic acid according to claim 14 or 15.
17. Vector according to claim 16, wherein the vector is a human recombinant adenoviral
20 vector.
18. A composition comprising a protein according to any one of the claims 1-13, a nucleic acid according to claim 14 and/or vector according to claim 16 or 17.
19. A vaccine against COVID-19 comprising a protein according to any one of the claims
25 1-13, a nucleic acid according to claim 14 or 15 and/or vector according to claim 16 or 17.

20. A method for preventing COVID-19, the method comprising administering to the subject a vaccine according to claim 19.
21. A method for reducing infection and/or replication of SARS-CoV-2 in a subject, comprising administering to the subject a composition according to claim 18 or a vaccine according to claim 19.
22. An isolated host cell comprising a nucleic acid according to claim 14.
23. An isolated host cell comprising a recombinant human adenovirus of serotype 26 comprising a nucleic acid according to claim 14