Claims

1. A recombinant pre-fusion respiratory syncitial virus (RSV) Fusion (F) protein comprising a mutation of the amino acid S on position 215 into P (S215P), a mutation of the amino acid T on position 357 into K (T357K) and a mutation of the amino acid N on position 371 into Y (N371Y) wherein the amino acid positions are given in reference to SEQ ID NO: 13.

2. Pre-fusion RSV F protein according to claim 1, comprising at least one further mutation selected from the group consisting of:

(a) a mutation of the amino acid residue N/T on position 67 into I; and

(b) a mutation of the amino acid residue D on position 486 into N.

3. Pre-fusion RSV F protein according to any one of the preceding claims, wherein the protein comprises at least one epitope that is specific to the pre-fusion conformation F protein, wherein the at least one epitope is recognized by a pre-fusion specific monoclonal antibody, comprising a heavy chain CDR1 region of SEQ ID NO: 1, a heavy chain CDR2 region of SEQ ID NO: 2, a heavy chain CDR3 region of SEQ ID NO: 3 and a light chain CDR1 region of SEQ ID NO: 4, a light chain CDR2 region of SEQ ID NO: 5, and a light chain CDR3 region of SEQ ID NO: 6 and/or a pre-fusion specific monoclonal antibody, comprising a heavy chain CDR1 region of SEQ ID NO: 7, a heavy chain CDR2 region of SEQ ID NO: 8, a heavy chain CDR3 region of SEQ ID NO: 9 and

a light chain CDR1 region of SEQ ID NO: 10, a light chain CDR2 region of SEQ ID NO: 67, and a light chain CDR3 region of SEQ ID NO: 11.

4. Pre-fusion RSV F protein according to any one of the preceding claims, wherein the protein is trimeric.

5. Pre-fusion RSV F protein according to any one of the preceding claims, comprising a truncated F1 domain and a heterologous trimerization domain linked to said truncated F1 domain.

6. Pre-fusion RSV F protein according to claim 5, wherein the heterologous trimerization domain comprises the amino acid sequence GYIPEAPRDGQAYVRKDGEWVLLSTFL (SEQ ID NO: 14).

7. Pre-fusion RSV F protein according to claim 5 or 6, wherein the trimerization domain is linked to amino acid residue 513 of the RSV F protein.

8. Pre-fusion RSV F protein according to any one of the preceding claims, wherein the RSV F protein comprises the amino acid sequence of SEQ ID NO: 21.
9. Nucleic acid molecule encoding a pre-fusion RSV F protein according to any one of the preceding claims 1-8.

10. Nucleic acid molecule according to claim 9, wherein the nucleic acid molecule has been codon-optimized for expression in mammalian cells.

11. Vector comprising a nucleic acid molecule according to claim 9 or claim 10.
12. Composition comprising a pre-fusion RSV F protein according to any of the claims 1-8, a nucleic acid molecule according to claim 9 or claim 10 and/or a vector according to claim 11.
13. Pre-fusion RSV F protein according to any of the claims 1-8, a nucleic acid molecule according to claim 9 or claim 10, and/or a vector according to claim 11 for use in inducing an immune response against RSV F protein.
14. Pre-fusion RSV F protein according to any of the claims 1-8, a nucleic acid molecule according to claim 9 or claim 10, and/or a vector according to claim 11 for use as a vaccine.
15. Pre-fusion RSV F protein according to any of the claims 1-8, a nucleic acid molecule according to claim 9 or claim 10, and/or a vector according to claim 11 for use in the prophylaxis and/or treatment of RSV infection.