

CLAIMS

1. A recombinant modified vaccinia virus Ankara (MVA) comprising a nucleotide sequence encoding an antigenic determinant of at least one respiratory syncytial virus (RSV) membrane glycoprotein for treating or preventing an RSV infection by intranasal administration, wherein an intramuscular administration is excluded.
2. The recombinant MVA of claim 1 comprising solely intranasal administration.
3. The recombinant MVA of claim 1 or 2, wherein the recombinant MVA further comprises a nucleotide sequence encoding an antigenic determinant of an RSV nucleocapsid protein.
4. A recombinant modified vaccinia virus Ankara (MVA) comprising at least one nucleotide sequence encoding an antigenic determinant of a respiratory syncytial virus (RSV) membrane glycoprotein and at least one nucleotide sequence encoding an RSV nucleocapsid antigenic determinant.
5. The recombinant MVA of any one of claims 1 to 4, wherein the nucleotide sequence encoding an antigenic determinant of the RSV membrane glycoprotein encodes an RSV F and/or an RSV G antigenic determinant.
6. The recombinant MVA of any one of claims 3 to 5, wherein the nucleotide sequence encoding an antigenic determinant of an RSV nucleocapsid protein encodes an antigenic determinant of the RSV N nucleocapsid and/or of the RSV M2 matrix protein.
7. The recombinant MVA of any of the preceding claims comprising one nucleotide sequence encoding an antigenic determinant of an RSV membrane glycoprotein, preferably of the RSV F or of the RSV G membrane glycoprotein, and one nucleotide sequence encoding an antigenic determinant of an RSV nucleocapsid protein, preferably of the RSV N or of the RSV M2 protein.
8. The recombinant MVA of any one of claims 1 to 6 comprising two nucleotide sequences encoding an antigenic determinant of an RSV membrane glycoprotein, preferably of the RSV F and/or of the RSV G membrane glycoproteins, and one nucleotide sequence encoding an antigenic determinant of an RSV nucleocapsid protein, preferably of the RSV N nucleocapsid or of the RSV M2 matrix protein.

9. The recombinant MVA of any one of claims 1 to 6 comprising two nucleotide sequences encoding antigenic determinants of an RSV membrane glycoprotein, preferably of an RSV F and/or of an RSV G membrane glycoprotein and two nucleotide sequences encoding antigenic determinants of an RSV nucleocapsid protein, preferably of an RSV N and/or of the RSV M2 protein.
10. The recombinant MVA of any one of claims 1 to 6 comprising three nucleotide sequences encoding an antigenic determinant of an RSV membrane glycoprotein, preferably of two RSV F membrane glycoproteins and/or of one RSV G membrane glycoprotein or of two RSV G membrane glycoproteins and/or of one RSV F membrane glycoprotein, and two nucleotide sequences encoding antigenic determinants of an RSV nucleocapsid protein, preferably of the RSV N nucleocapsid and/or of the RSV M2 matrix proteins.
11. The recombinant MVA of any one of claims 1 to 6 comprising four nucleotide sequences encoding antigenic determinants of RSV membrane glycoproteins, preferably of two RSV F membrane glycoproteins and/or of two RSV G membrane glycoproteins, and one nucleotide sequence encoding an antigenic determinant of an RSV nucleocapsid protein, preferably of the RSV N nucleocapsid or of the RSV M2 matrix protein.
12. The recombinant MVA of any one of claims 1 to 6 comprising four nucleotide sequences encoding antigenic determinants of RSV membrane glycoproteins, preferably of two RSV F membrane glycoproteins and/or of two RSV G membrane glycoproteins, and two nucleotide sequences encoding antigenic determinants of RSV nucleocapsid proteins, preferably of the RSV N and/or of the RSV M2 proteins.
13. A method for determining whether a subject is at risk of recurrent RSV infection, comprising determining by means of RT-qPCR whether in a sample obtained from the subject RSV is present, whereby the presence of RSV indicates the presence of a recurrent RSV infection.
14. A method for determining whether a subject has acquired sterile immunity against RSV, comprising determining by means of RT-qPCR whether in a sample obtained from the subject RSV is present, whereby the presence of RSV indicates that the subject has not acquired sterile immunity against RSV.

15. The recombinant MVA of any one of claims 1 to 12 for use in a method of immunizing and/or of inducing sterile immunity in a subject diagnosed by the method of claim 14 to not have acquired sterile immunity against RSV, said method comprising intranasal administration of said recombinant MVA to the subject.

CLAIMS

1. A recombinant modified vaccinia virus Ankara (MVA) comprising at least one nucleotide sequence encoding an antigenic determinant of a respiratory syncytial virus (RSV) membrane glycoprotein F comprising the nucleotide sequence of SEQ ID NO:5 or a variant thereof with at least about 75% identity with the nucleotide sequence of SEQ ID NO:5 and at least one nucleotide sequence encoding an RSV nucleocapsid antigenic determinant of an RSV M2 matrix protein.
2. A recombinant modified vaccinia virus Ankara (MVA) of claim 1, wherein the variant has at least about 85% identity with the nucleotide sequence of SEQ ID NO:5.
3. A recombinant modified vaccinia virus Ankara (MVA) of claim 1, wherein the variant has at least about 95% identity with the nucleotide sequence of SEQ ID NO:5.
4. A recombinant modified vaccinia virus Ankara (MVA) of claim 1, wherein the at least one nucleotide sequence encoding an antigenic determinant of the respiratory syncytial virus (RSV) membrane glycoprotein F comprises the nucleotide sequence of SEQ ID NO:5.
5. A recombinant modified vaccinia virus Ankara (MVA) of claims 1 to 4, wherein the nucleotide sequence encoding the antigenic determinant of the RSV F membrane glycoprotein comprises the nucleotide sequence encoding the amino acid sequence of SEQ ID NO:6.
6. The recombinant MVA of any one of claims 1 to 5, wherein the nucleotide sequence encoding an antigenic determinant of an RSV nucleocapsid protein encodes an antigenic determinant of the RSV N nucleocapsid and of the RSV M2 matrix protein.
7. The recombinant MVA of claim 6, wherein both the antigenic determinant of the RSV N nucleocapsid and of the RSV M2 matrix protein are encoded by a single open reading frame separated by a self-cleavage protease domain.
8. The recombinant MVA of claim 7, wherein the self-cleaving protease domain is the protease 2A fragment sequence derived from Foot and Mouth Disease Virus.
9. The recombinant MVA of claim 7 or 8, wherein the single open reading frame comprises a nucleotide sequence encoding the amino acid sequence of SEQ ID NO:18.

10. The recombinant MVA of claims 7 to 9, wherein the single open reading frame comprises the nucleotide sequence of SEQ ID NO:17.
11. The recombinant MVA of claims 1 to 10 further comprising at least one nucleotide sequence encoding an antigenic determinant of an RSV G membrane glycoprotein.
12. The recombinant MVA of claim 11, wherein the nucleotide sequence encoding an antigenic determinant of the RSV G membrane glycoprotein is derived from RSV strain A, preferably from strain A2, and/or B.
13. The recombinant MVA of claim 11 or 12, wherein the nucleotide sequence encoding an antigenic determinant of the RSV G membrane glycoprotein comprises a nucleotide sequence encoding the amino acid sequence selected from SEQ ID NO:2 or 8.
14. The recombinant MVA of claims 11 or 12, wherein the nucleotide sequence encoding an antigenic determinant of the RSV G membrane glycoprotein comprises the nucleotide sequence selected from SEQ ID NO:1 or 7.
15. The recombinant MVA of claims 11 to 14, further comprising an antigenic determinant of a second RSV G membrane glycoprotein.
16. A pharmaceutical composition and/or vaccine comprising the recombinant MVA of claims 1 to 15 and, optionally, a pharmaceutically acceptable carrier and/or diluent.
17. The use of a recombinant MVA of claim 1 to 15 for the manufacture of a medicament for treating or preventing RSV infection.
18. The use of a recombinant modified vaccinia virus Ankara (MVA) comprising a nucleotide sequence encoding an antigenic determinant of at least one respiratory syncytial virus (RSV) membrane glycoprotein, a nucleotide sequence encoding an antigenic determinant of the RSV nucleocapsid protein N and a nucleotide sequence encoding an antigenic determinant of the RSV M2 matrix protein for the manufacture of a medicament for treating or preventing an RSV infection by intranasal administration, wherein an intramuscular administration is excluded.
19. The use of the recombinant MVA of claim 17 or 18 or the use of the pharmaceutical composition and/or vaccine of claims 16, wherein the recombinant MVA or the pharmaceutical composition and/or vaccine is or is to be administered in a single or in

multiple doses to an immunologically naïve or an immunologically experienced human subject.

20. The use of the recombinant MVA of claim 18 comprising solely intranasal administration.
21. The use of the recombinant MVA of claim 18, wherein the nucleotide sequence encoding the antigenic determinant of the RSV F membrane glycoprotein comprises a nucleotide sequence of SEQ ID NO:5 or a variant thereof with at least about 75% identity with the nucleotide sequence of SEQ ID NO:5.
22. The use of the recombinant MVA of any one of claim 18 or claim 21, wherein the nucleotide sequence encoding the antigenic determinant of the RSV F membrane glycoprotein comprises a nucleotide sequence encoding the amino acid of SEQ ID NO:6.
23. The use of the recombinant MVA of any one of claims 17 to 22 or the use of the pharmaceutical composition and/or vaccine of claim 16, wherein the recombinant MVA or the pharmaceutical composition and/or vaccine is administered to a human subject with more than 2 years of age.
24. The use of the recombinant MVA of any one of claims 17 to 22 or the use of the pharmaceutical composition and/or vaccine of claim 16, wherein the recombinant MVA or the pharmaceutical composition and/or vaccine is administered to a human subject with less than 2 years of age.