CLAIMS

1. A nucleic acid construct which comprises a polynucleotide encoding at least one Chikungunya virus (CHIKV) structural protein said polynucleotide being operably linked, in particular cloned into a cDNA molecule which encodes the nucleotide sequence of the full-length, infectious antigenomic (+) RNA strand of a measles virus (MV).

2. The nucleic acid construct according to claim 1, characterized in that said nucleic acid construct complies with the rule of 6 of measles genome.

3. A nucleic acid construct according to claim 1 or 2, which comprises gene transcription units encompassing from 5' to 3':

(a) a polynucleotide encoding the N protein of a MV,

(b) a polynucleotide encoding the P protein of a MV,

(c) the polynucleotide encoding at least one CHIKV structural protein,

(d) a polynucleotide encoding the M protein of a MV,

(e) a polynucleotide encoding the F protein of a MV,

(f) a polynucleotide encoding the H protein of a MV, and

(g) a polynucleotide encoding the L protein of a MV,

said polynucleotides being operably linked in the nucleic acid construct and under the control of viral replication and transcription regulatory sequences such as MV leader and trailer sequences.

4. The nucleic acid construct according to any one of claims 1 to 3, characterized in that said Measles virus is an attenuated virus strain, said strain being in particular selected in the group of the Schwarz strain, the Zagreb strain, the AIK-C strain and the Moraten strain.

5. The nucleic acid construct according to any one of claims 1 to 4, characterized in that said polynucleotide encoding CHIKV structural protein(s) has been optimized for the Macacca codon usage or has been optimized for the human codon usage.

6. The nucleic acid construct according to any one of claims 1 to 5, characterized in that *measles editing-like sequences* have been deleted from said polynucleotide encoding CHIKV structural protein(s).

7. The nucleic acid construct according to any one of claims 1 to 6, characterized in that said polynucleotide encoding CHIKV structural protein(s) encodes one or several protein(s) selected from the group of: E1, E2, E3, C and 6K proteins.

8. The nucleic acid construct according to any one of claims 1 to 7, characterized in that said Chikungunya virus is from the strain designated 06-49 strain.

9. The nucleic acid construct according to any one of claims 1 to 8, characterized in that said nucleic acid construct encodes soluble form of envelope protein E2 as defined in SEQ ID NO: 3, 5, 7, 9.

10. The nucleic acid construct according to any one of claims 1 to 8, characterized in that in the polynucleotide encoding the ectodomain of envelope protein E2 has the sequence of SEQ ID NO: 11, 13, 15.

11. The nucleic acid construct according to any one of claims 1 to 8, characterized in that said nucleic acid construct encodes one or several CHIKV structural proteins E1, E2, E3, C and 6K as defined in SEQ ID NO: 17, 19, 21, 22, 23, 24, 25, 26 and 28.

12. The nucleic acid construct according to any one of claims 1 to 8, characterized in that said nucleic acid construct encodes soluble form of envelope protein E2 without stem region as defined in SEQ ID NO: 30.

13. The nucleic acid construct according to any one of claims 1 to 8, characterized in that said nucleic acid construct is as defined in SEQ ID NO: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 27, 29 and 31.

14. A transfer vector plasmid which comprises a nucleic acid construct of any of claims 1 to 12.

15.The vector according to claim 14, characterized in that said vector is pMV-CHIKV.

16.Cells characterized in that said cells are transformed with a nucleic acid construct or a transfer vector plasmid according to any one of claims 1 to 15, in particular eukaryotic cells, such as avian cells, in particular CEF cells, mammalian cells or yeast cells.

17.Recombinant infectious replicating MV-CHIK virus particles, characterized in that said virus particles are the product of expression of a nucleic acid construct according to any one of claims 1 to 12 or a vector according to claim 14 or 15, in a host cell producing, in particular a host cell stably producing, at least an RNA polymerase recognized by said host cell, a nucleoprotein (N) of a MV, a phosphoprotein (P) of a MV and optionally a MV RNA-polymerase large protein (L).

18.A composition or an assembly of active ingredients comprising the recombinant infectious replicating MV-CHIK virus particles according to claim 17, in association with CHIKV-Virus Like Particles expressing CHIKV structural proteins, in particular CHIKV-CE3E26KE1 VLPs and a pharmaceutically acceptable vehicle.

19.A composition or an assembly of active ingredients comprising recombinant infectious replicating MV-CHIK virus particles in association with CHIKV structural proteins especially with CHIKV-Virus Like Particles, in particular CHIKV-CE3E26KE1 VLPs, or composition according to any one of claims 1 to 18 for use as a vaccine in the elicitation of a protective immune response against CHIK virus, in particular for the elicitation of antibodies directed against said CHIKV protein(s) and/or of a cellular immune response, in a host, in particular a human host in need thereof.

20.The recombinant infectious replicating MV-CHIK virus particles in association with CHIKV structural proteins in particular CHIKV-Virus Like Particles, in particular CHIKV-CE3E26KE1 VLPs or the composition according to claim 18, for use in the treatment or the prevention of an infection by Chikungunya virus in a subject, in particular in a human.

CLAIMS

1. A nucleic acid construct which comprises a polynucleotide encoding the C-E3-E2-6K-E1 structural proteins of a Chikungunya virus (CHIKV), said polynucleotide being operably linked, in particular cloned into a cDNA molecule which encodes the nucleotide sequence of the full-length, infectious antigenomic (+) RNA strand of a measles virus (MV).

2. The nucleic acid construct according to claim 1, characterized in that said nucleic acid construct complies with the rule of 6 of measles genome.

3. The nucleic acid construct according to claim 1 or 2, which comprises gene transcription units encompassing from 5' to 3':

(a) a polynucleotide encoding the N protein of a MV,

(b) a polynucleotide encoding the P protein of a MV,

(c) the polynucleotide encoding the C-E3-E2-6K-E1 structural proteins of CHIKV,

(d) a polynucleotide encoding the M protein of a MV,

(e) a polynucleotide encoding the F protein of a MV,

(f) a polynucleotide encoding the H protein of a MV, and

(g) a polynucleotide encoding the L protein of a MV,

said polynucleotides being operably linked in the nucleic acid construct and under the control of viral replication and transcription regulatory sequences such as MV leader and trailer sequences.

4. The nucleic acid construct according to any one of claims 1 to 3, characterized in that said Measles virus is an attenuated virus strain, said strain being in particular selected in the group of the Schwarz strain, the Zagreb strain, the AIK-C strain and the Moraten strain.

5. The nucleic acid construct according to any one of claims 1 to 4, characterized in that said polynucleotide encoding the C-E3-E2-6K-E1 structural proteins of CHIKV has been optimized for the Macacca codon usage or has been optimized for the human codon usage.

6. The nucleic acid construct according to any one of claims 1 to 5, characterized in that *measles editing-like sequences* have been deleted from said polynucleotide encoding the C-E3-E2-6K-E1 structural proteins of CHIKV.

7. The nucleic acid construct according to any one of claims 1 to 6, characterized in that said Chikungunya virus is from the strain designated 06-49 strain.

8. The nucleic acid construct according to any one of claims 1 to 6, characterized in that the ectodomain of envelope protein E2 has the sequence of SEQ ID NO: 11, 13, 15.

9. The nucleic acid construct according to any one of claims 1 to 6, characterized in that said C-E3-E2-6K-E1 structural proteins are as defined in SEQ ID NO: 21, 22, 23, 24, 25, 26 and 28.

10. The nucleic acid construct according to any one of claims 1 to 6, characterized in that said nucleic acid construct is as defined in SEQ ID NO: 20, 27 and 31.

11. A transfer vector plasmid which comprises a nucleic acid construct of any one of claims 1 to 10.

12. The transfer vector plasmid according to claim 11, characterized in that said vector is pMV-CHIKV.

13. Cells characterized in that said cells are transformed with a nucleic acid construct according to any one of claims 1 to 10 or a transfer vector plasmid according to claim 11 or 12, in particular eukaryotic cells, such as avian cells, in particular CEF cells, mammalian cells or yeast cells.

14. Recombinant infectious replicating MV-CHIK virus particles, characterized in that said virus particles are the product of expression of a nucleic acid construct according to any one of claims 1 to 10 or a transfer vector plasmid according to claim 11 or 12, in a host cell producing, in particular a host cell stably producing, at least an

RNA polymerase recognized by said host cell, a nucleoprotein (N) of a MV, a phosphoprotein (P) of a MV and optionally a MV RNA-polymerase large protein (L).

15. The recombinant infectious replicating MV-CHIK virus particles according to claim 14, characterized in that said virus particles are the product of expression of a nucleic acid construct as defined in SEQ ID NO: 27 or 31.

16. A composition or an assembly of active ingredients comprising the recombinant infectious replicating MV-CHIK virus particles according to claim 14 or 15, in association with CHIKV-C-E3-E2-6K-E1 VLPs and a pharmaceutically acceptable vehicle.

17. Use of the composition or the assembly of active ingredients according to claim 16 for the manufacture of a vaccine in the elicitation of a protective immune response against CHIK virus by the elicitation of antibodies directed against said CHIKV protein(s) and/or of a cellular immune response, in a host, in particular a human host in need thereof.

18. Use of the recombinant infectious replicating MV-CHIK virus particles according to claim 14 or 15 in association with CHIKV-C-E3-E2-6K-E1 VLPs, or the composition or the assembly of active ingredients according to claim 16, for the prevention of an infection by Chikungunya virus in a subject, in particular in a human.

19. A process to rescue recombinant measles virus (MV) expressing the C-E3-E2-6K-E1 structural proteins of a Chikungunya virus (CHIKV), in particular CHIKV-C-E3-E2-6K-E1 Virus Like Particles (VLPs) comprising the steps of:
1) cotransfecting helper cells, in particular HEK293 helper cells, that stably express T7 RNA polymerase, and measles N and P proteins with (i) a transfer vector plasmid according to claim 11 or 12 and with (ii) a vector, especially a plasmid, encoding the MV L polymerase;
2) cultivating said cotransfected helper cells in conditions enabling the production of MV-CHIKV recombinant virus;
3) propagating the thus produced recombinant virus by co-cultivating said helper cells of step 2) with cells enabling said propagation such as Vero cells;

4) recovering replicating MV-CHIKV recombinant virus and the C-E3-E2-6K-E1 structural proteins of CHIKV, in particular CHIKV-C-E3-E2-6K-E1 VLPs.

20. The process according to claim 19, wherein the transfer vector plasmid comprises a nucleic acid construct as defined in SEQ ID NO: 27 or 31.