

Claims

1. ~~— An artificial RNA comprising~~
 - a) ~~— at least one heterologous 5' untranslated region (5' UTR) and/or at least one heterologous 3' untranslated region (3' UTR); and~~
 - b) ~~— at least one coding sequence operably linked to said 3' UTR and/or 5' UTR encoding at least one antigenic peptide or protein derived from a RSV fusion (F) protein or a fragment or variant thereof.~~
2. ~~— Artificial RNA according to claim 1, wherein the at least one heterologous 3' UTR comprises a nucleic acid sequence derived from a 3' UTR of a gene selected from PSMB3, ALB7, alpha-globin, CASP1, COX6B1, GNAS, NDUFA1 and RPS9, or from a homolog, a fragment or a variant of any one of these genes.~~
3. ~~— Artificial RNA according to claim 1 or 2, wherein the at least one heterologous 5' UTR comprises a nucleic acid sequence derived from a 5' UTR of a gene selected from HSD17B4, RPL32, ASAH1, ATP5A1, MP68, NDUFA4, NOSIP, RPL31, SLC7A3, TUBB4B and UBQLN2, or from a homolog, a fragment or variant of any one of these genes.~~
4. ~~— Artificial RNA according to any one of the preceding claims, comprising~~
 - ~~— a 1. — at least one 5' UTR derived from a 5' UTR of a HSD17B4 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a PSMB3 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or~~
 - ~~— a 2. — at least one 5' UTR derived from a 5' UTR of a NDUFA4 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a PSMB3 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or~~
 - ~~— a 3. — at least one 5' UTR derived from a 5' UTR of a SLC7A3 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a PSMB3 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or~~
 - ~~— a 4. — at least one 5' UTR from a 5' UTR of a NOSIP gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a PSMB3 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or~~
 - ~~— a 5. — at least one 5' UTR derived from a 5' UTR of a MP68 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a PSMB3 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or~~
 - ~~— b 1. — at least one 5' UTR derived from a 5' UTR of a UBQLN2 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a RPS9 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or~~
 - ~~— b 2. — at least one 5' UTR derived from a 5' UTR of a ASAH1 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a RPS9 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or~~
 - ~~— b 3. — at least one 5' UTR derived from a 5' UTR of a HSD17B4 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a RPS9 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or~~
 - ~~— b 4. — at least one 5' UTR derived from a 5' UTR of a HSD17B4 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a CASP1 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or~~

- [illegible]

- h-2. — at least one 5' UTR derived from a 5' UTR of a RPL31 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a GNAS gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or
 - h-3. — at least one 5' UTR derived from a 5' UTR of a RPL31 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a NDUFA1 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or
 - h-4. — at least one 5' UTR derived from a 5' UTR of a SLC7A3 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a CASP1 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or
 - h-5. — at least one 5' UTR derived from a 5' UTR of a SLC7A3 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a COX6B1 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof; or
 - i-1. — at least one 5' UTR derived from a 5' UTR of a SLC7A3 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a RPS9 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof.
 - i-2. — at least one 5' UTR derived from a 5' UTR of a RPL32 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof and at least one 3' UTR derived from a 3' UTR of a ALB7 gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof.
 - i-3. — at least one 3' UTR derived from a 3' UTR of a alpha globin gene, or from a corresponding RNA sequence, homolog, fragment or variant thereof. —
5. — Artificial RNA according to claim 4 comprising UTR elements according to a 1 (HSD17B4/PSMB3), a 4 (NDUFA4/PSMB3), c-1 (NDUFA4/RPS9), e-4 (NOSIP/RPS9), g-2 (NDUFA4/CASP1), i-2 (RPL32/ALB7), or i-3 (alpha globin), preferably a 1 (HSD17B4/PSMB3)
6. — Artificial RNA according to any one of the preceding claims, wherein
- said 5' UTR derived from a HSD17B4 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 1 or 2 or a fragment or a variant thereof;
 - said 5' UTR derived from a ASAH1 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 3 or 4 or a fragment or a variant thereof;
 - said 5' UTR derived from a ATP5A1 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 5 or 6 or a fragment or a variant thereof;
 - said 5' UTR derived from a MP68 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 7 or 8 or a fragment or a variant thereof;
 - said 5' UTR derived from a NDUFA4 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 9 or 10 or a fragment or a variant thereof;
 - said 5' UTR derived from a NOSIP gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 11 or 12 or a fragment or a variant thereof;

- ~~— said 5' UTR derived from a RPL31 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 13 or 14 or a fragment or a variant thereof;~~
 - ~~— said 5' UTR derived from a RPL32 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 21 or 22 or a fragment or a variant thereof;~~
 - ~~— said 5' UTR derived from a SLC7A3 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 15 or 16 or a fragment or a variant thereof;~~
 - ~~— said 5' UTR derived from a TUBB4B gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 17 or 18 or a fragment or a variant thereof;~~
 - ~~— said 5' UTR derived from a UBQLN2 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 19 or 20 or a fragment or a variant thereof;~~
 - ~~— said 3' UTR derived from a PSMB3 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 23 or 24 or a fragment or a variant thereof;~~
 - ~~— said 3' UTR derived from a CASP1 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 25 or 26 or a fragment or a variant thereof;~~
 - ~~— said 3' UTR derived from a COX6B1 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 27 or 28 or a fragment or a variant thereof;~~
 - ~~— said 3' UTR derived from a GNAS gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 29 or 30 or a fragment or a variant thereof;~~
 - ~~— said 3' UTR derived from a NDUFA1 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 31 or 32 or a fragment or a variant thereof;~~
 - ~~— said 3' UTR derived from a RPS9 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 33 or 34 or a fragment or a variant thereof; 1~~
 - ~~— said 3' UTR derived from a ALB7 gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 35 or 36 or a fragment or a variant thereof;~~
 - ~~— said 3' UTR derived from a alpha-globin gene comprises or consists of a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NO: 37 or 38 or a fragment or a variant thereof.~~
7. Artificial RNA according to any one of the preceding claims, wherein the at least one antigenic peptide or protein derived from RSV F protein is a full-length F protein (F0) or an F protein with deleted C terminus (F-del), or a fragment or a variant thereof.

8. ~~Artificial RNA according to any one of the preceding claims, wherein the RSV F protein is designed to stabilize the antigen in pre-fusion conformation.~~
9. ~~Artificial RNA according to any one of the preceding claims, wherein the RSV F protein comprises a DSCav1 mutation (S155C, S290C, S190F, and V207L), or a fragment or a variant thereof.~~
10. ~~Artificial RNA according to any one of the preceding claims, wherein the RSV F protein comprises the two subunits F2 and F1 in a single polypeptide chain, wherein F2 and F1 are connected via a linker element, preferably a GS linker, to generate a stable F2-linker-F1 protein, wherein said F2-linker-F1 protein preferably lacks aa104-aa144.~~
11. ~~Artificial RNA according to any one of the preceding claims, wherein the RSV F protein comprises at least one further mutation selected from (S46G, A149C, S215P, Y458C, K465Q), (S46G, E92D, A149C, S215P, Y458C, K465Q), (S46G, N67I, E92D, A149C, S215P, Y458C, K465Q), (A149C, Y458C), (N183GC, N428C), (Q98C, Q361C, S46G, E92D, L95M, S215P, I217P, I221M, R429K, K465Q), (Q98C, Q361C, L95M, I221M, R429K), or (N183GC, N428C, S46G, N67I, E92D, S215P, K465Q) or a fragment or a variant thereof.~~
12. ~~Artificial RNA according to any one of the preceding claims, wherein the RSV F protein is selected from F0, F-del, F0_DSCav1, F_DSCav1_mut0, F_DSCav1_mut1, F_DSCav1_mut2, F_DSCav1_mut3, F_DSCav1_mut4, F_DSCav1_mut5, F_DSCav1_mut6, F_DSCav1_mut7, F_DSCav1_mut8, F-del_DSCav1, F-del_DSCav1_mut0, F-del_DSCav1_mut1, F-del_DSCav1_mut2, F-del_DSCav1_mut3, F-del_DSCav1_mut4, F-del_DSCav1_mut5, F-del_DSCav1_mut6, F-del_DSCav1_mut7, F-del_DSCav1_mut8 or a fragment or a variant thereof.~~
13. ~~Artificial RNA according to any one of the preceding claims, wherein the at least one coding sequence encodes at least one of the amino acid sequences being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to any one of SEQ ID NO: 68, 483, 898, 1267, 1636, 2005, 2374, 2743, 3112, 3481, 3850, 4219, 4588, 4957, 5326, 5695, 6064, 6433, 6802, 7171, 7540, 7909, 8279, 9683, 11726, 12095, 12464, 12833, 13940, 14309, 14678, 15047, 15416, 15785, 13202, 13571, 16154, 16523, 16892, 17261, 17630, 17999, 18368, 18737, 19106, 19475 or a fragment or variant of any of these sequences.~~
14. ~~Artificial RNA according to any one of the preceding claims, wherein the at least one coding sequence comprises at least one of the nucleic acid sequences being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NOs: 69-77, 484-492, 899-906, 1268-1275, 1637-1644, 2006-2013, 2375-2382, 2744-2751, 3113-3120, 3482-3489, 3851-3858, 4220-4227, 4589-4596, 4958-4965, 5327-5334, 5696-5703, 6065-6072, 6434-6441, 6803-6810, 7172-7179, 7541-7548, 7910-7917, 11727-11734, 12096-12103, 12465-12472, 12834-12841, 13941-13948, 14310-14317, 14679-14686, 15048-15055, 15417-15424, 15786-15793, 13203-13210, 13572-13579, 16155-16162, 16524-16531, 16893-16900, 17262-17269, 17631-17638, 18000-18007, 18369-18376, 18738-18745, 19107-19114, 19476-19483, 21363-21384, 21389-21410 or a fragment or a fragment or variant of any of these sequences.~~
15. ~~Artificial RNA according to any one of the preceding claims, wherein the at least one coding sequence is a codon modified coding sequence, wherein the amino acid sequence encoded by the at least one codon~~

~~modified coding sequence is preferably not being modified compared to the amino acid sequence encoded by the corresponding wild type coding sequence.~~

16. ~~Artificial RNA according to claim 15, wherein the at least one codon modified coding sequence is selected from C maximized coding sequence, CAI maximized coding sequence, human codon usage adapted coding sequence, G/C content modified coding sequence, and G/C optimized coding sequence, or any combination thereof.~~
17. ~~Artificial RNA according to claim 15 or 16, wherein the at least one coding sequence comprises a codon modified coding sequence comprising a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to any one SEQ ID NOs: 70-77, 485-492, 899-906, 1268-1275, 1637-1644, 2006-2013, 2375-2382, 2744-2751, 3113-3120, 3482-3489, 3851-3858, 4220-4227, 4589-4596, 4958-4965, 5327-5334, 5696-5703, 6065-6072, 6434-6441, 6803-6810, 7172-7179, 7541-7548, 7910-7917, 11728-11734, 12097-12103, 12465-12472, 12834-12841, 13941-13948, 14310-14317, 14679-14686, 15048-15055, 15417-15424, 15786-15793, 13203-13210, 13572-13579, 16155-16162, 16524-16531, 16893-16900, 17262-17269, 17631-17638, 18000-18007, 18369-18376, 18738-18745, 19107-19114, 19476-19483, 21363-21384, 21389-21410 or a fragment or variant of any of these sequences.~~
18. ~~Artificial RNA according to claim 15 to 17, wherein the at least one coding sequence comprises a codon modified coding sequence comprising a nucleic acid sequence being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to any one of SEQ ID NOs: 70-71, 75-77, 485-486, 490-492, 899-900, 904-906, 1268-1269, 1273-1275, 1637-1638, 1642-1644, 2006-2007, 2011-2013, 2375-2376, 2380-2382, 2744-2745, 2749-2751, 3113-3114, 3118-3120, 3482-3483, 3487-3489, 3852, 4221, 4590, 4959, 5328, 5697, 6066, 6435, 6804, 7173, 7542, 7911, 3856-3858, 4225-4227, 4594-4596, 4963-4965, 5332-5334, 5701-5703, 6070-6072, 6439-6441, 6808-6810, 7177-7179, 7546-7548, 7915-7917, 11728, 11732-11734, 12097, 12101-12103, 12465, 12466, 12470-12472, 12834, 12835, 12839-12841, 13941, 13942, 13946-13948, 14310, 14311, 14315-14317, 14679, 14680, 14684-14686, 15048, 15049, 15053-15055, 15417, 15418, 15422-15424, 15786, 15787, 15791-15793, 13203, 13204, 13208-13210, 13572, 13573, 13577-13579, 16155, 16156, 16160-16162, 16524, 16525, 16529-16531, 16893, 16894, 16898-16900, 17262, 17263, 17267-17269, 17631, 17632, 17636-17638, 18000, 18001, 18005-18007, 18369, 18370, 18374-18376, 18738, 18739, 18743-18745, 19107, 19108, 19112-19114, 19476, 19477, 19481-19483, 21363-21384, 21389-21410 or a fragment or variant of any of these sequences.~~
19. ~~Artificial RNA according to any one of the preceding claims, wherein the RNA is an mRNA, a self-replicating RNA, a circular RNA, or a replicon RNA.~~
20. ~~Artificial RNA according to claim 19, wherein the RNA is an mRNA.~~
21. ~~Artificial RNA according to any one of the preceding claims, wherein the RNA comprises a 5' cap structure, preferably m7G, cap0, cap1, cap2, a modified cap0 or a modified cap1 structure.~~
22. ~~Artificial RNA according to any one of the preceding claims, wherein the RNA comprises at least one poly(A) sequence, preferably comprising 30 to 150 adenosine nucleotides, more preferably comprising 100 adenosine nucleotides and/or at least one poly(C) sequence, preferably comprising 10 to 40 cytosine nucleotides.~~
23. ~~Artificial RNA according to any one of the preceding claims, wherein the RNA comprises at least one histone stem-loop, wherein the histone stem-loop preferably comprises a nucleic acid sequence according to SEQ ID NO: 39 or 40 or a fragment or variant thereof.~~

24. Artificial RNA according to any one of the preceding claims comprising the following elements, preferably in 5' to 3' direction:

- a) 5'-cap structure, preferably as specified herein;
- b) optionally, 5'-UTR as specified herein, preferably at least one selected from SEQ ID NOs: 1-22;
- c) a ribosome binding site, preferably as specified herein
- d) at least one coding sequence as specified herein, preferably as specified in Table 3 and Table 4;
- e) 3'-UTR as specified herein, preferably at least one selected from SEQ ID NOs: 23-38;
- f) optionally, a poly(A) sequence, preferably as specified herein;
- g) optionally, a poly(C) sequence, preferably as specified herein;
- h) optionally, a histone stem-loop, preferably as specified herein;
- i) optionally, a 3'-terminal sequence element as specified herein, preferably according to according to SEQ ID NOs: 44-63, or 21322-21328; and

wherein optionally at least one or more than one, preferably wherein all uracil nucleotides are replaced by pseudouridine (ψ) nucleotides or N1-methylpseudouridine (m1 ψ) nucleotides.

25. Artificial RNA according claims 1 to 24 comprising the following elements, preferably in 5' to 3' direction:

- a) 5'-cap structure, preferably as defined in claim 21; most preferably a Cap1 structure;
- b) 5'-UTR and/or 3'-UTR according to a-1, a-4, c-1, e-4, g-2, i-2, or i-3;
- c) at least one coding sequence as defined by any one of claims 13 to 18 or encoding a protein as defined by any one of claims 7 to 12 or;
- d) optionally, a poly(A) sequence, preferably as defined by claim 22;
- e) optionally, poly(C) sequence, preferably as defined by claim 22;
- f) optionally, histone stem-loop, preferably as defined by any one of claim 23;
- g) optionally, a 3'-terminal sequence according to SEQ ID NOs: 44-63, 21322-21328 and

wherein optionally at least one or more than one, preferably wherein all uracil nucleotides are replaced by pseudouridine (ψ) nucleotides or N1-methylpseudouridine (m1 ψ) nucleotides.

26. Artificial RNA according claims 1 to 25 comprising the following elements in 5' to 3' direction:

- a) 5'-cap structure, preferably as defined in claim 21, most preferably a Cap1 structure;
- b) 5'-UTR and/or 3'-UTR according to a-1, a-4, c-1, e-4, g-2, i-2, or i-3, preferably a-1;
- c) at least one coding sequence as defined by any one of claims 13 to 18 or encoding a protein as defined by any one of claims 7 to 12, wherein said coding sequence is located between said 5'-UTR and said 3'-UTR, preferably downstream of said 5'-UTR and upstream of said 3'-UTR;
- d) a histone stem-loop, preferably as defined by any one of claim 23
- e) a poly(A) sequence, preferably as defined by claim 22
- f) a 3'-terminal sequence according to SEQ ID NOs: 21322-21328.

wherein optionally at least one or more than one, preferably wherein all uracil nucleotides are replaced by pseudouridine (ψ) nucleotides or N1-methylpseudouridine (m1 ψ) nucleotides.

27. Artificial RNA any one of the preceding claims, wherein the artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 78-482, 493-897, 907-1266, 1276-1635, 1645-2004, 2014-2373, 2383-2742, 2752-3111, 3121-3480, 3490-3849, 3859-4218, 4228-4587, 4597-4956, 4966-5325, 5335-5694, 5704-6063, 6073-6432, 6442-6801, 6811-7170, 7180-7539, 7549-7908, 7918-8277, 8278, 11735-12094, 12104-12463, 12473-12832, 12842-13201, 13949-14308, 14318-14677, 14687-15046, 15056-15415,

~~15425-15784, 15794-16153, 13211-13570, 13580-13939, 16163-16522, 16532-16891, 16901-17260, 17270-17629, 17639-17998, 18008-18367, 18377-18736, 18746-19105, 19115-19474, 19484-19843, 21415-21480, 21561-21626, 21489-21552, 21635-21698 or a fragment or variant of any of these sequences.~~

28. Artificial RNA according to claim 27, wherein

~~said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 78-482, 11735-12094, 21415-21417, 21561-21563, 21489, 21490, 21635, 21636 or a fragment or variant of any of these sequences;~~

~~said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 493-897, 12104-12463, 21418-21420, 21564-21566, 21491, 21492, 21637, 21638 or a fragment or variant of any of these sequences;~~

~~said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 907-1266, 12473-12832, 21421-21423, 21567-21569, 21493-21495, 21639-21641 or a fragment or variant of any of these sequences;~~

~~said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 1276-1635, 8278, 12842-13201, 21424-21426, 21570-21572, 21496-21498, 21642-21644 or a fragment or variant of any of these sequences;~~

~~said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 1645-2004, 13949-14308, 21433-21435, 21579-21581, 21505-21507, 21651-21653 or a fragment or variant of any of these sequences;~~

~~said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 2014-2373, 14318-14677, 21436-21438, 21582-21584, 21508-21510, 21654-21656 or a fragment or variant of any of these sequences;~~

~~said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 2383-2742, 14687-15046, 21439-21441, 21585-21587, 21511-21513, 21657-21659 or a fragment or variant of any of these sequences;~~

~~said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 2752-3111, 15056-15415, 21442-21444, 21588-21590, 21514-21516, 21660-21662 or a fragment or variant of any of these sequences;~~

~~_____ said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 3121-3480, 15425-15784, 21445-21447, 21591-21593, 21517-21519, 21663-21665 or a fragment or variant of any of these sequences;~~

~~_____ said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 3490-3849, 15794-16153, 21448-21450, 21594-21596, 21520-21522, 21666-21668 or a fragment or variant of any of these sequences;~~

~~_____ said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 3859-4218, 13211-13570, 21427-21429, 21573-21575, 21499-21501, 21645-21647 or a fragment or variant of any of these sequences;~~

~~_____ said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 4228-4587, 13580-13939, 21430-21432, 21576-21578, 21502-21504, 21648-21650 or a fragment or variant of any of these sequences;~~

~~_____ said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 4597-4956, 16163-16522, 21451-21453, 21597-21599, 21523-21525, 21669-21671 or a fragment or variant of any of these sequences;~~

~~_____ said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 4966-5325, 16532-16891, 21454-21456, 21600-21602, 21526-21528, 21672-21674 or a fragment or variant of any of these sequences;~~

~~_____ said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 5335-5694, 16901-17260, 21457-21459, 21603-21605, 21529-21531, 21675-21677 or a fragment or variant of any of these sequences;~~

~~_____ said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 5704-6063, 17270-17629, 21460-21462, 21606-21608, 21532-21534, 21678-21680 or a fragment or variant of any of these sequences;~~

~~_____ said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 6073-6432,~~

~~17639-17998, 21463-21465, 21609-21611, 21535-21537, 21681-21683 or a fragment or variant of any of these sequences;~~

~~— said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 6442-6801, 18008-18367, 21466-21468, 21612-21614, 21538-21540, 21684-21686 or a fragment or variant of any of these sequences;~~

~~— said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 6811-7170, 18377-18736, 21469-21471, 21615-21617, 21541-21543, 21687-21689 or a fragment or variant of any of these sequences;~~

~~— said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 7180-7539, 18746-19105, 21472-21474, 21618-21620, 21544-21546, 21690-21692 or a fragment or variant of any of these sequences;~~

~~— said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 7549-7908, 19115-19474, 21475-21477, 21621-21623, 21547-21549, 21693-21695 or a fragment or variant of any of these sequences;~~

~~— said artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 7918-8277, 19484-19843, 21478-21480, 21624-21626, 21550-21552, 21696-21698 or a fragment or variant of any of these sequences.~~

29. ~~A composition comprising at least one artificial RNA as defined in any one of claims 1 to 28, wherein the composition optionally comprises at least one pharmaceutically acceptable carrier.~~
30. ~~A composition according to claim 29 comprising at least one further artificial RNA comprising at least one coding sequence encoding at least one antigenic peptide or protein derived from RSV selected from matrix protein M, nucleoprotein N, M2-1 protein, and/or phosphoprotein P or combinations thereof, preferably selected from M2-1.~~
31. ~~A composition according to claim 29 or 30, comprising two further artificial RNA species each comprising at least one coding sequence encoding at least one antigenic peptide or protein derived from RSV selected from matrix protein M, nucleoprotein N, M2-1, and phosphoprotein P.~~
32. ~~A composition according to claim 29 or 30, comprising three further artificial RNA species each comprising at least one coding sequence encoding at least one antigenic peptide or protein derived from RSV selected from matrix protein M, nucleoprotein N, M2-1, and phosphoprotein P.~~
33. ~~A composition according to claims 30 to 32, wherein the coding sequence of the further artificial RNA encodes at least one of the amino acid sequences being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to any one of SEQ ID NOs: 9684, 10053-10133, 10134, 10503-10636, 10637, 11006-11182, 11183, 11552-11725, 19844, 20213, 20582, 20951 or a fragment or variant of any of these sequences.~~

34. ~~A composition according to claim 30 to 33, wherein the coding sequence is operably linked to a 3' UTR and a 5' UTR selected from a-1, a-2, a-3, a-4, a-5, b-1, b-2, b-3, b-4, b-5, c-1, c-2, c-3, c-4, c-5, d-1, d-2, d-3, d-4, d-5, e-1, e-2, e-3, e-4, e-5, e-6, f-1, f-2, f-3, f-4, f-5, g-1, g-2, g-3, g-4, g-5, h-1, h-2, h-3, h-4, h-5, i-1, i-2, or i-3.~~
35. ~~A composition according to claim 30 to 34, wherein the coding sequence comprises at least one of the nucleic acid sequences being identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NOs: 9685-9692, 10135-10142, 10638-10645, 11184-11191, 19845-19852, 20214-20221, 20583-20590, 20952-20959, 21385-21388, 21411-21414 or a fragment or a fragment or variant of any of these sequences.~~
36. ~~A composition according to claim 30 to 35, wherein the further artificial RNA comprises or consists of an RNA sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 9693-10052, 10143-10502, 10646-11005, 11192-11551, 19853-20212, 20222-20581, 20591-20950, 20960-21319, 21481-21634, 21553-21706 or a fragment or variant of any of these sequences.~~
37. ~~A composition according to claim 29 to 36 comprising~~
- ~~— an artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 78-482, 493-897, 907-1266, 1276-1635, 1645-2004, 2014-2373, 2383-2742, 2752-3111, 3121-3480, 3490-3849, 3859-4218, 4228-4587, 4597-4956, 4966-5325, 5335-5694, 5704-6063, 6073-6432, 6442-6801, 6811-7170, 7180-7539, 7549-7908, 7918-8277, 8278, 11735-12094, 12104-12463, 12473-12832, 12842-13201, 13949-14308, 14318-14677, 14687-15046, 15056-15415, 15425-15784, 15794-16153, 13211-13570, 13580-13939, 16163-16522, 16532-16891, 16901-17260, 17270-17629, 17639-17998, 18008-18367, 18377-18736, 18746-19105, 19115-19474, 19484-19843, 21415-21480, 21561-21626, 21489-21552, 21635-21698 and a further artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 9693-10052, 19853-20212, 21481, 21482, 21627, 21628, 21553, 21554, 21699, 21700; or~~
 - ~~— an artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 78-482, 493-897, 907-1266, 1276-1635, 1645-2004, 2014-2373, 2383-2742, 2752-3111, 3121-3480, 3490-3849, 3859-4218, 4228-4587, 4597-4956, 4966-5325, 5335-5694, 5704-6063, 6073-6432, 6442-6801, 6811-7170, 7180-7539, 7549-7908, 7918-8277, 8278, 11735-12094, 12104-12463, 12473-12832, 12842-13201, 13949-14308, 14318-14677, 14687-15046, 15056-15415, 15425-15784, 15794-16153, 13211-13570, 13580-13939, 16163-16522, 16532-16891, 16901-17260, 17270-17629, 17639-17998, 18008-18367, 18377-18736, 18746-19105, 19115-19474, 19484-19843, 21415-21480, 21561-21626, 21489-21552, 21635-21698 and a further artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 10143-10502, 20222-20581, 21483, 21484, 21629, 21630, 21555, 21556, 21701, 21702; or~~
 - ~~— an artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 78-482, 493-897, 907-1266, 1276-1635, 1645-2004, 2014-2373, 2383-2742, 2752-3111, 3121-3480, 3490-3849, 3859-4218, 4228-4587, 4597-4956, 4966-5325, 5335-5694, 5704-6063, 6073-6432,~~

6442-6801, 6811-7170, 7180-7539, 7549-7908, 7918-8277, 8278, 11735-12094, 12104-12463, 12473-12832, 12842-13201, 13949-14308, 14318-14677, 14687-15046, 15056-15415, 15425-15784, 15794-16153, 13211-13570, 13580-13939, 16163-16522, 16532-16891, 16901-17260, 17270-17629, 17639-17998, 18008-18367, 18377-18736, 18746-19105, 19115-19474, 19484-19843, 21415-21480, 21561-21626, 21489-21552, 21635-21698 and a further artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 10646-11005, 20591-20950, 21485, 21486, 21631, 21632, 21557, 21558, 21703, 21704; or

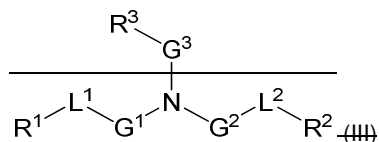
— an artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 78-482, 493-897, 907-1266, 1276-1635, 1645-2004, 2014-2373, 2383-2742, 2752-3111, 3121-3480, 3490-3849, 3859-4218, 4228-4587, 4597-4956, 4966-5325, 5335-5694, 5704-6063, 6073-6432, 6442-6801, 6811-7170, 7180-7539, 7549-7908, 7918-8277, 8278, 11735-12094, 12104-12463, 12473-12832, 12842-13201, 13949-14308, 14318-14677, 14687-15046, 15056-15415, 15425-15784, 15794-16153, 13211-13570, 13580-13939, 16163-16522, 16532-16891, 16901-17260, 17270-17629, 17639-17998, 18008-18367, 18377-18736, 18746-19105, 19115-19474, 19484-19843, 21415-21480, 21561-21626, 21489-21552, 21635-21698 and a further artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from the group consisting of SEQ ID NOs: 11192-11551, 20960-21319, 21487, 21488, 21633, 21634, 21559, 21560, 21705, 21706 or

— an artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 78-482, 493-897, 907-1266, 1276-1635, 1645-2004, 2014-2373, 2383-2742, 2752-3111, 3121-3480, 3490-3849, 3859-4218, 4228-4587, 4597-4956, 4966-5325, 5335-5694, 5704-6063, 6073-6432, 6442-6801, 6811-7170, 7180-7539, 7549-7908, 7918-8277, 8278, 11735-12094, 12104-12463, 12473-12832, 12842-13201, 13949-14308, 14318-14677, 14687-15046, 15056-15415, 15425-15784, 15794-16153, 13211-13570, 13580-13939, 16163-16522, 16532-16891, 16901-17260, 17270-17629, 17639-17998, 18008-18367, 18377-18736, 18746-19105, 19115-19474, 19484-19843, 21415-21480, 21561-21626, 21489-21552, 21635-21698 and a further artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 9693-10052, 19853-20212, 21481, 21482, 21627, 21628, 21553, 21554, 21699, 21700 and a further artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 10646-11005, 20591-20950, 21485, 21486, 21631, 21632, 21557, 21558, 21703, 21704; or

— an artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 78-482, 493-897, 907-1266, 1276-1635, 1645-2004, 2014-2373, 2383-2742, 2752-3111, 3121-3480, 3490-3849, 3859-4218, 4228-4587, 4597-4956, 4966-5325, 5335-5694, 5704-6063, 6073-6432, 6442-6801, 6811-7170, 7180-7539, 7549-7908, 7918-8277, 8278, 11735-12094, 12104-12463, 12473-12832, 12842-13201, 13949-14308, 14318-14677, 14687-15046, 15056-15415, 15425-15784, 15794-16153, 13211-13570, 13580-13939, 16163-16522, 16532-16891, 16901-17260, 17270-17629, 17639-17998, 18008-18367, 18377-18736, 18746-19105, 19115-19474, 19484-19843, 21415-21480, 21561-21626, 21489-21552, 21635-21698 and a further artificial RNA which is identical or at least 70%, 80%,

~~85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 9693-10052, 19853-20212, 21481, 21482, 21627, 21628, 21553, 21554, 21699, 21700 and a further artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 10646-11005, 20591-20950, 21485, 21486, 21631, 21632, 21557, 21558, 21703, 21704 and a further artificial RNA which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to a nucleic acid sequence selected from SEQ ID NOs: 10143-10502, 20222-20581, 21483, 21484, 21629, 21630, 21555, 21556, 21701, 21702.~~

- ~~38. Composition according to claim 29 to 37, wherein the at least one artificial RNA and, optionally, the further artificial RNA is complexed or associated with or at least partially complexed or partially associated with one or more cationic or polycationic compound, preferably cationic or polycationic polymer, cationic or polycationic polysaccharide, cationic or polycationic lipid, cationic or polycationic protein, cationic or polycationic peptide, or any combinations thereof.~~
- ~~39. Composition according to claim 38, wherein the artificial RNA and, optionally, the further artificial RNA is complexed or associated with one or more lipids, thereby forming liposomes, lipid nanoparticles, lipoplexes, and/or nanoliposomes.~~
- ~~40. Composition according to claim 39, wherein the artificial RNA and, optionally, the further artificial RNA is complexed with one or more lipids thereby forming lipid nanoparticles (LNP).~~
- ~~41. Composition according to claim 40, wherein the LNP comprises a cationic lipid with the formula III:~~



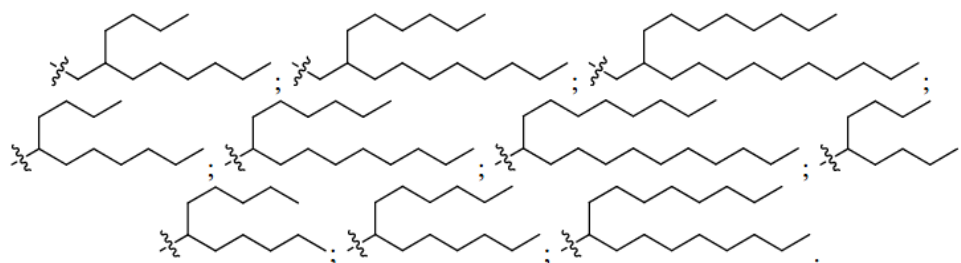
- ~~or a pharmaceutically acceptable salt, tautomer, prodrug or stereoisomer thereof, wherein:~~
- ~~L¹ or L² is each independently -O(C=O)-, -(C=O)O-, -C(=O)-, -O-, -S(O)_x-, -S-S-, -C(=O)S-, -SC(=O)-, -NR^aC(=O)-, -C(=O)NR^a-, -NR^aC(=O)NR^a-, -OC(=O)NR^a- or -NR^aC(=O)O-, preferably L¹ or L² is -O(C=O)- or~~
- ~~-(C=O)O-;~~
- ~~G¹ and G² are each independently unsubstituted C₁-C₁₂-alkylene or C₁-C₁₂-alkenylene;~~
- ~~G³ is C₁-C₂₄-alkylene, C₁-C₂₄-alkenylene, C₃-C₈-cycloalkylene, or C₃-C₈-cycloalkenylene;~~
- ~~R^a is H or C₁-C₁₂-alkyl;~~
- ~~R¹ and R² are each independently C₆-C₂₄-alkyl or C₆-C₂₄-alkenyl;~~
- ~~R³ is H, OR⁵, CN-, C(=O)OR⁴-, OC(=O)R⁴- or -NR⁵C(=O)R⁴;~~
- ~~R⁴ is C₁-C₁₂-alkyl;~~
- ~~R⁵ is H or C₁-C₆-alkyl; and~~
- ~~x is 0, 1 or 2;~~

- ~~42. Composition according to claim 41, wherein the cationic lipid is a compound of formula III, and wherein:~~
- ~~L¹ and L² are each independently -O(C=O)- or (C=O)-O-;~~
- ~~G³ is C₁-C₂₄-alkylene or C₁-C₂₄-alkenylene; and~~
- ~~R³ is H or OR⁵.~~

43. Composition according to any one of claims 41 to 42, wherein the cationic lipid is a compound of formula III, and wherein:

— L^1 and L^2 are each independently $-O(C=O)-$ or $(C=O)-O-$; and

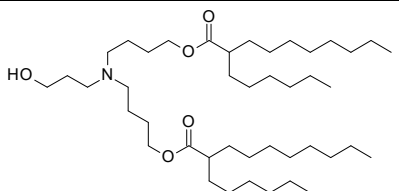
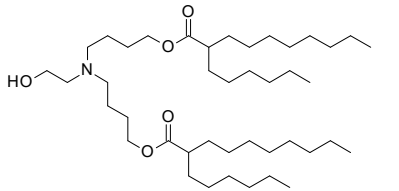
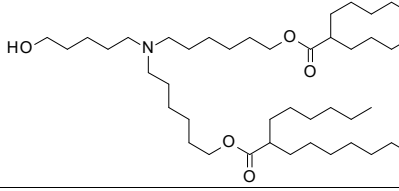
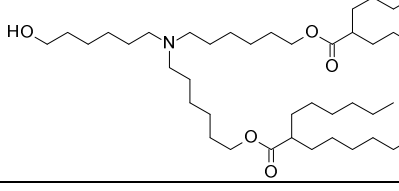
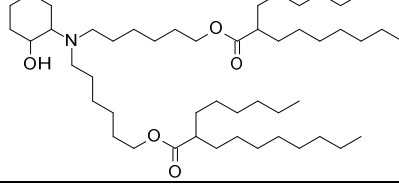
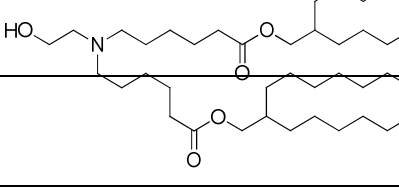
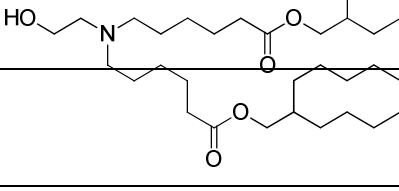
— R^1 and R^2 each independently have one of the following structures:

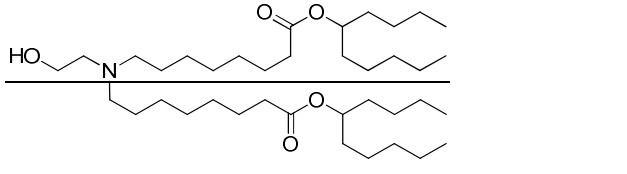
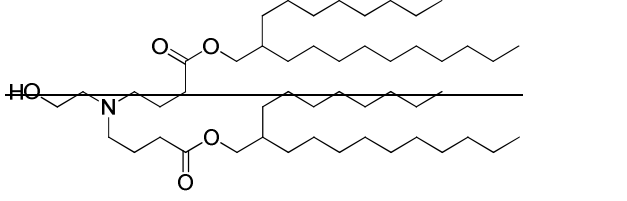
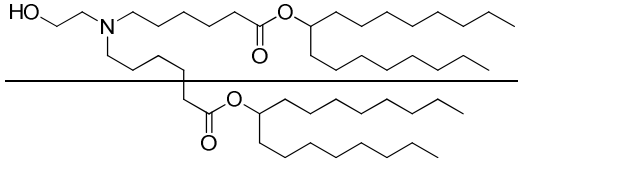
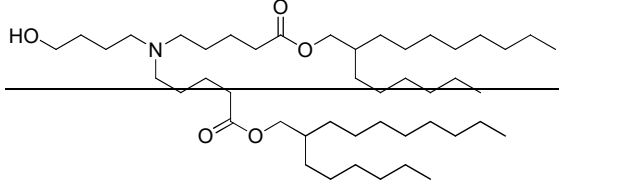
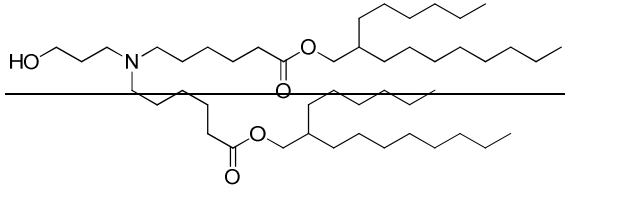
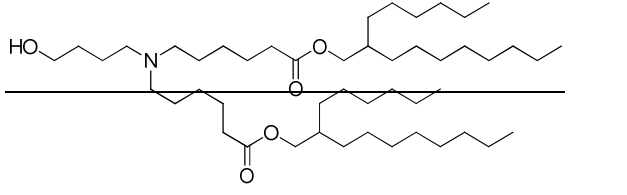
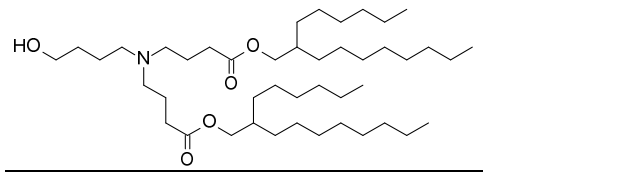
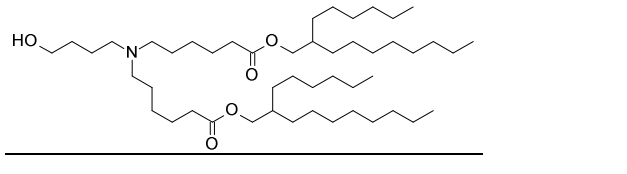


44. Composition according to any one of claims 41 to 43, wherein the cationic lipid is a compound of formula III, and wherein R^3 is OH.

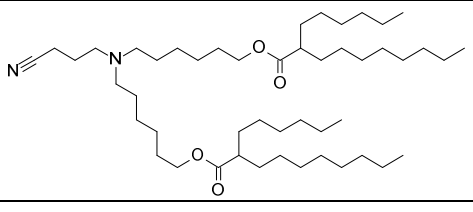
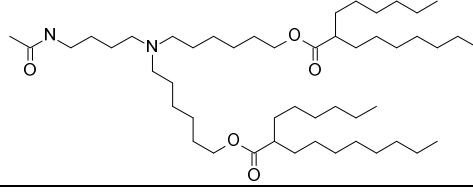
45. Composition according to any one of claims 41 to 44, wherein the cationic lipid is selected from structures III-1 to III-36:

No.	Structure
III-1	
III-2	
III-3	
III-4	

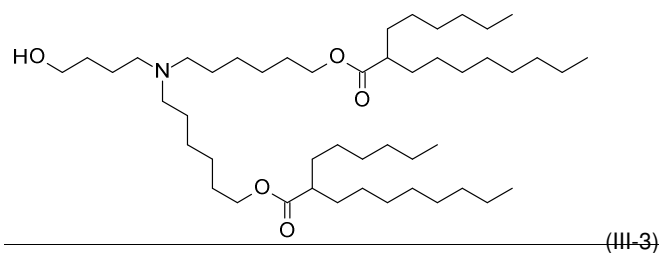
No.	Structure
III-5	
III-6	
III-7	
III-8	
III-9	
III-10	
III-11	

№.	Structure
III-12	
III-13	
III-14	
III-15	
III-16	
III-17	
III-18	
III-19	

No.	Structure
III-28	 <chem>CCCCCCCCC(=O)OCCN(CCCOC(=O)CCCCCCCC)CCOC(=O)CCCCCCCC</chem>
III-29	 <chem>CCCCCCCCC(=O)OCCN(CCCOC(=O)CCCCCCCC)CCOC(=O)CCCCCCCC</chem>
III-30	 <chem>CCCCCCCCC(=O)OCCN(CCCOC(=O)CCCCCCCC)CCOC(=O)CCCCCCCC</chem>
III-31	 <chem>CCCCCCCCC(=O)OCCN(CCCOC(=O)CCCCCCCC)CCOC(=O)CCCCCCCC</chem>
III-32	 <chem>CCCCCCCCC(=O)OCCN(CCCOC(=O)CCCCCCCC)CCOC(=O)CCCCCCCC</chem>
III-33	 <chem>CCCCCCCCC(=O)OCCN(CCCOC(=O)CCCCCCCC)CCOC(=O)CCCCCCCC</chem>
III-34	 <chem>CCCCCCCCC(=O)OCCN(CCCOC(=O)CCCCCCCC)CCOC(=O)CCCCCCCC</chem>

No.	Structure
III-35	
III-36	

46. Composition according to any one of claims 41 to 45, wherein the cationic lipid is



47. Composition according to any one of claims 40 to 46, wherein the LNP comprises a PEG lipid with the formula (IV):

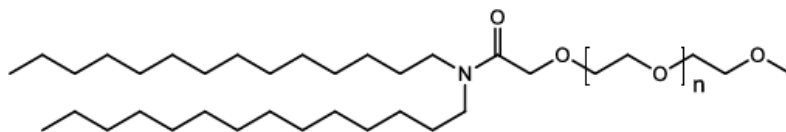


wherein R^8 and R^9 are each independently a straight or branched, saturated or unsaturated alkyl chain containing from 10 to 30 carbon atoms, wherein the alkyl chain is optionally interrupted by one or more ester bonds;

and w has a mean value ranging from 30 to 60.

48. Composition according to claim 47, wherein in the PEG lipid R^8 and R^9 are saturated alkyl chains.

49. Composition according to claim 47 or 48, wherein the PEG lipid is



wherein n has a mean value ranging from 30 to 60, preferably wherein n has a mean value of about 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, most preferably wherein n has a mean value of 49.

50. Composition according to any one of claims 40 to 49, wherein the LNP comprises one or more neutral lipids and/or a steroid or steroid analogues.

51. ~~Composition according to claim 50, wherein the neutral lipid is selected from the group comprising distearoylphosphatidylcholine (DSPC), dioleoylphosphatidylcholine (DOPC), dipalmitoylphosphatidylcholine (DPPC), dioleoylphosphatidylglycerol (DOPG), dipalmitoylphosphatidylglycerol (DPPG), dioleoyl-phosphatidylethanolamine (DOPE), palmitoyl-oleoylphosphatidylcholine (POPC), palmitoyl-oleoyl-phosphatidylethanolamine (POPE) and dioleoyl-phosphatidylethanolamine 4-(N-maleimidomethyl)-cyclohexane-1-carboxylate (DOPE-mal), dipalmitoyl-phosphatidyl-ethanolamine (DPPE), dimyristoylphosphoethanolamine (DMPE), distearoyl-phosphatidylethanolamine (DSPE), 16-O-monomethyl PE, 16-O-dimethyl PE, 18-1-trans PE, 1-stearoyl-2-oleoylphosphatidylethanol-amine (SOPE), and 1,2-dilauroyl-sn-glycero-3-phosphoethanolamine (transDOPE).~~
52. ~~Composition according to claim 50 or 51, wherein the neutral lipid is 1,2-distearoyl-sn-glycero-3-phosphocholine (DSPC), and wherein the molar ratio of the cationic lipid to DSPC is optionally in the range from about 2:1 to 8:1.~~
53. ~~Composition according to claim 50, wherein the steroid is cholesterol, and wherein the molar ratio of the cationic lipid to cholesterol is optionally in the range from about 2:1 to 1:1.~~
54. ~~Composition according to any one of claims 40 to 53, wherein the LNP essentially consists of~~
 - ~~(i) at least one cationic lipid, preferably as defined in any one of claims 41 to 46;~~
 - ~~(ii) a neutral lipid, preferably as defined in any one of claims 50 to 52;~~
 - ~~(iii) a steroid or steroid analogue, preferably as defined in claim 53; and~~
 - ~~(iv) a PEG-lipid, e.g. PEG-DMG or PEG-cDMA, preferably as defined in any one of claims 47 to 49,~~~~wherein (i) to (iv) are in a molar ratio of about 20-60% cationic lipid, 5-25% neutral lipid, 25-55% sterol, and 0.5-15% PEG-lipid.~~
55. ~~Polypeptide encoded by the artificial RNA according to any one of claims 1 to 28, preferably having an amino acid sequence which is identical or at least 70%, 80%, 85%, 86%, 87%, 88%, 89%, 90%, 91%, 92%, 93%, 94%, 95%, 96%, 97%, 98%, or 99% identical to SEQ ID NOs: 1267, 2005, 2743, 3481, 4219, 4957, 5695, 6433, 7171, 7909, 12833, 14309, 15047, 15785, 13571, 16523, 17261, 17999, 18737, 19475 or a variant of any of these polypeptides.~~
56. ~~A composition comprising the polypeptide as defined in claim 55, wherein the composition optionally comprises at least one pharmaceutically acceptable carrier or at least one artificial RNA as defined in any one of claims 1 to 28, or a composition as defined in any one of claims 29 to 54.~~
57. ~~A vaccine comprising the artificial RNA as defined in any one of claims 1 to 28, the composition as defined in any one of claims 29 to 54, the polypeptide as defined in claim 55, or the composition as defined in claim 56.~~
58. ~~Vaccine according to claim 49, wherein the artificial RNA as defined in any one of claims 1 to 28, the composition as defined in any one of claims 29 to 54, the polypeptide as defined in claim 55, or the composition as defined in claim 56 elicits an adaptive immune response.~~
59. ~~Vaccine according to claim 57 or 58, wherein the vaccine further comprises a pharmaceutically acceptable carrier and optionally at least one adjuvant.~~
60. ~~A kit or kit of parts comprising the artificial RNA as defined in any one of claims 1 to 28, the composition as defined in any one of claims 29 to 54, the polypeptide as defined in claim 55, the composition as defined in claim 56, and/or the vaccine as defined in any one of claims 57 to 59, optionally comprising a liquid vehicle for solubilising, and optionally technical instructions providing information on administration and dosage of the components.~~
61. ~~Kit or kit of parts according to claim 60 comprising at least the following components~~

- a) ~~at least one artificial RNA as defined in any one of claims 1 to 28 encoding at least one antigenic peptide or protein derived from a RSV fusion (F) protein, wherein said artificial RNA is preferably complexed with one or more lipids thereby forming lipid nanoparticles (LNP); and~~
- b) ~~at least one, two or three further artificial RNA species each encoding an antigenic peptide or protein derived from RSV selected from M, N, M2-1, or P, wherein each of said further artificial RNA species are preferably complexed with one or more lipids thereby forming lipid nanoparticles (LNP),~~
- ~~wherein components a) and b) are provided as separate entities or as a single entity.~~

~~62. Kit or kit of parts according to claim 60 or 61 further comprising Ringer lactate solution.~~

~~63. Artificial RNA as defined in any one of claims 1 to 28, the composition as defined in any one of claims 29 to 54, the polypeptide as defined in claim 55, the composition as defined in claim 56, the vaccine as defined in any one of claims 57 to 59, or the kit or kit of parts as defined in claim 60 to 62 for use as a medicament.~~

~~64. Artificial RNA as defined in any one of claims 1 to 28, the composition as defined in any one of claims 29 to 54, the polypeptide as defined in claim 55, the composition as defined in claim 56, the vaccine as defined in any one of claims 57 to 59, or the kit or kit of parts as defined in claim 60 to 62 for use in the treatment or prophylaxis of an infection with a virus, preferably with RSV, or a disorder related to such an infection.~~

~~65. A method of treating or preventing a disorder, wherein the method comprises applying or administering to a subject in need thereof the artificial RNA, comprising~~

~~a) at least one heterologous 5' untranslated region (5'-UTR) and/or at least one heterologous 3' untranslated region (3'-UTR); and~~

~~b) at least one coding sequence operably linked to said 3'-UTR and/or 5'-UTR encoding at least one antigenic peptide or protein derived from a RSV fusion (F) protein or a fragment or variant thereof;~~

~~as defined in any one of claims 1 to 28, the composition as defined in any one of claims 29 to 54, the polypeptide as defined in claim 55, the composition as defined in claim 56, the vaccine as defined in any one of claims 57 to 59, or the kit or kit of parts as defined in claim 60 to 62~~

~~66. Method according to claim 65, wherein the disorder is an infection with a RSV, or a disorder related to such an infection;~~

~~67. Method according to claims 65 or 66, wherein the subject in need is a mammalian subject;~~

~~68. Method according to claim 67, and wherein the mammalian subject is a human subject, preferably a newborn, a pregnant woman, a breast-feeding woman, an elderly, and/or an immunocompromised human subject.~~