CLAIMS

1. An mRNA vaccine comprising one or more lipid nanoparticles comprising:

- 50 – 65 mol% of an ionizable lipid;
- 6 – 15 mol% of a phospholipid;
- a sterol;
- a PEG lipid; and
- one or more mRNA molecules;

characterized in that said PEG lipid is a C18-PEG2000 lipid, and in that said LNP comprises less than 1 mol% of said PEG lipid; preferably between 0.5 – 0.9 mol% of said PEG lipid.

2. A lipid nanoparticle (LNP) for use in mRNA vaccination, said LNP comprising:

- 50 – 65 mol% of an ionizable lipid;
- 6 – 15 mol% of a phospholipid;
- a sterol;
- a PEG lipid; and
- one or more mRNA molecules;

characterized in that said PEG lipid is a C18-PEG2000 lipid, and in that said LNP comprises less than 1 mol% of said PEG lipid; preferably between 0.5 – 0.9 mol% of said PEG lipid.

3. A lipid nanoparticle (LNP) comprising:

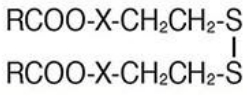
- 50 - 65 mol% of an ionizable lipid;
- 6 – 15 mol% of a phospholipid;
- a sterol;
- a PEG lipid; and
- one or more nucleic acid molecules;

characterized in that said PEG lipid is a C18-PEG2000 lipid; and in that said LNP comprises less than 1 mol% of said PEG lipid; preferably between 0.5 – 0.9 mol% of said PEG lipid.

4. A lipid nanoparticle as defined in claim 3; wherein said C18-PEG2000 lipid is selected from the list comprising: a (distearoyl-based)-PEG2000 lipid such as DSG-PEG2000 lipid or DSPE-PEG2000 lipid; or a (dioleolyl-based)-PEG2000 lipid such as DOG-PEG2000 lipid or DOPE-PEG2000 lipid.

5. A lipid nanoparticle as defined in any one of claims 3 to 4; wherein said ionizable lipid is selected from the list comprising:

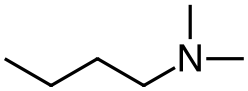
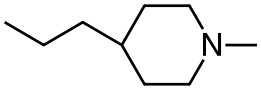
- 1,1‘-((2-(4-(2-((2-(bis(2-hydroxydodecyl)amino)ethyl)(2-hydroxydodecyl)amino)ethyl) piperazin-1yl)ethyl)azanediyl)bis(dodecan-2 ol) (C12-200);
- dilinoleylmethyl-4-dimethylaminobutyrate (DLin-MC3-DMA); or
- a compound of formula (I):

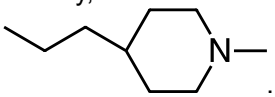


(I)

wherein:

RCOO is selected from the list comprising: myristoyl, α-D-Tocopherolsuccinoyl, linoleoyl and oleoyl; and X is selected from the list comprising:


and

;

preferably, said ionizable lipid is a lipid of formula (I) wherein RCOO is α-D-Tocopherolsuccinoyl and X is

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6. A lipid nanoparticle as defined in any one of claims 3 to 5; wherein said phospholipid is selected from the list comprising: DOPE, DOPC and mixtures thereof.

7. A lipid nanoparticle as defined in any one of claims 3 to 6; wherein said sterol is selected from the list comprising cholesterol, ergosterol, campesterol, oxysterol, antrosterol, desmosterol, nicasterol, sitosterol and stigmasterol; preferably cholesterol.

8. A lipid nanoparticle comprising:
- 60-65 mol% of said ionizable lipid;
- 8 mol% of said phospholipid;
- 0.5 – 0.9 mol% of said PEG lipid; and

balanced by the amount of said sterol.

9. A lipid nanoparticle comprising:
- 64 mol% of said ionizable lipid;
- 8 mol% of said phospholipid;
- 0.5 – 0.9 mol% of said PEG lipid; and

balanced by the amount of said sterol.

10. A lipid nanoparticle comprising: (LNP36)
- 64 mol% of said ionizable lipid;
- 8 mol% of said phospholipid;
- 0.5 mol% of said PEG lipid; and

balanced by the amount of said sterol.

11. A lipid nanoparticle comprising: (LNP15)
- 59.5 mol% of said ionizable lipid;
- 12.24 mol% of said phospholipid;
- 0.78 mol% of said PEG lipid; and

balanced by the amount of said sterol.

12. A lipid nanoparticle comprising: (LNP20)

- 50 mol% of said ionizable lipid;
- 7.76 mol% of said phospholipid;
- 0.58 mol% of said PEG lipid; and

balanced by the amount of said sterol.

13. A lipid nanoparticle as defined in any one of claims 3 to 12; wherein said one or more nucleic acid molecules are selected from the list comprising mRNA and DNA, preferably mRNA.

14. A lipid nanoparticle as defined in any one of claims 3 to 13; wherein said one or more mRNA molecules are selected from the group of immunomodulatory polypeptide-encoding mRNA and/or antigen-encoding mRNA.

15. A lipid nanoparticle as defined in claim 14; wherein said immunomodulatory-encoding mRNA is selected from a list comprising mRNA molecules encoding for CD40L, CD70 and caTLR4.

16. A pharmaceutical composition or a vaccine comprising one or more lipid nanoparticles as defined in any one of claims 3 to 15 and an acceptable pharmaceutical carrier.

17. A lipid nanoparticle as defined in any one of claims 3 to 15 or a pharmaceutical composition or a vaccine as defined in claim 16 for use in human or veterinary medicine; such as for example for use in the treatment of cancer or infectious diseases.