CLAIMS

1. A lipid nanoparticle (LNP) comprising:
   - an ionizable lipid;
   - a phospholipid;
   - a sterol;
   - a PEG lipid; and
   - one or more mRNA molecules;

characterized in that
   - said PEG lipid is a C14-PEG lipid;
   - said LNP comprises less than about 1 mol% of said PEG lipid;
   - the molar percentage of said ionizable lipid is about and between 50 – 70 mol%; and
   - the molar percentage of said sterol is about or above 25 mol%.

2. A lipid nanoparticle (LNP) as defined in claim 1 comprising:
   - an ionizable lipid;
   - a phospholipid;
   - a sterol;
   - a PEG lipid; and
   - one or more mRNA molecules;

characterized in that
   - said PEG lipid is a C14-PEG lipid;
   - said LNP comprises less than about 1 mol% of said PEG lipid;
   - the molar percentage of said ionizable lipid is about and between 50 – 60 mol%; and
   - the molar percentage of said sterol is about or above 30 mol%.

3. A lipid nanoparticle as defined in anyone of claims 1 or 2; wherein said LNP comprises about 0.5 mol% - about 0.9 mol% of said PEG lipid; preferably about 0.5 mol%.

4. A lipid nanoparticle as defined in anyone of claims 1 to 3; wherein the molar percentage of said phospholipid is less than about 10 mol%; preferably about 5 mol%.

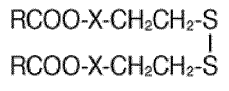
5. A lipid nanoparticle as defined in anyone of claims 1 to 4; wherein the ratio of ionizable lipid to phospholipid is above 5:1; preferably between about 6:1 and 11:1; most preferably about 11:1.

6. A lipid nanoparticle as defined in anyone of claims 1 to 5; wherein the molar percentage of said ionizable lipid is about and between 55 – 60 mol%.

7. A lipid nanoparticle as defined in anyone of claims 1 to 6; wherein said C14-PEG lipid is a C14-PEG2000 lipid, preferably selected from the list comprising DMG-PEG2000 and DMPE-PEG2000, most preferably DMG-PEG2000.

8. A lipid nanoparticle as defined in anyone of claims 1 to 7; wherein said ionizable lipid is selected from the list comprising:

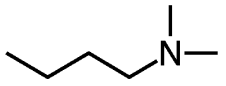
- 1,1'-((2-(4-(2-((2-(bis(2-hydroxydodecyl)amino)ethyl)(2-hydroxydodecyl)amino)ethyl) piperazin-1-yl)ethyl)azanediyl)bis(dodecan-2-ol) (C12-200);
- dilinoleylmethyl-4-dimethylaminobutyrate (DLin-MC3-DMA); or
- a compound of formula (I):



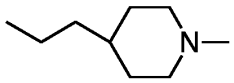
(I)

wherein:

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

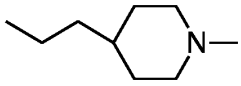


and



;

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



9. A lipid nanoparticle as defined in anyone of claims 1 to 8; wherein said phospholipid is selected from the list comprising: DOPE, DOPC, DSPC and mixtures thereof; in particular DOPE, DOPC and mixtures thereof.

10. A lipid nanoparticle as defined in anyone of claims 1 to 9; wherein said sterol is selected from the list comprising cholesterol, ergosterol, campesterol, oxysterol, antrosterol, desmosterol, nicasterol, sitosterol and stigmasterol; preferably cholesterol.

11. A lipid nanoparticle as defined in anyone of claims 1 to 10; wherein said LNP comprises:

- about 56.5 mol% of said ionizable lipid;
- about 5 mol% of DOPE;
- about 38 mol% of cholesterol; and

- about 0.5 mol% of DMG-PEG2000.

12. A lipid nanoparticle as defined in anyone of claims 1 to 10; wherein said LNP comprises:
- about 65 mol% of said ionizable lipid;
- about 9.5 mol% of DOPE;
- about 25 mol% of cholesterol; and
- about 0.5 mol% of DMG-PEG2000.

13. A lipid nanoparticle as defined in anyone of claims 1 to 12; wherein said one or more mRNA molecules are selected from the group of immunomodulatory polypeptide-encoding mRNA, such as selected from mRNA molecules encoding for CD40L, CD70 and caTLR4; and/or antigen-encoding mRNA.

14. A pharmaceutical composition or a vaccine comprising one or more lipid nanoparticles as defined in anyone of claims 1 to 13 and an acceptable pharmaceutical carrier.

15. A lipid nanoparticle as defined in anyone of claims 1 to 13 or a pharmaceutical composition or a vaccine as defined in claim 14 for use in human or veterinary medicine.

16. A lipid nanoparticle as defined in anyone of claims 1 to 13 or a pharmaceutical composition or a vaccine as defined in claim 14 for use in the treatment of cancer or infectious diseases.