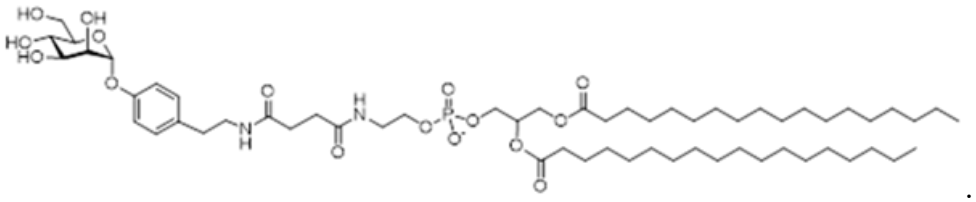
Claims

1. A compound for forming a lipid nanoparticle, wherein the compound comprises the structure of:



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2. A lipid nanoparticle, comprising a membrane defining an inner space, wherein the membrane is formed with a plurality of lipid components comprising the compound of claim 1.

3. The lipid nanoparticle of claim 2, wherein the plurality of the lipid components further comprises an ionizable lipid, a helper lipid, or a combination thereof.

4. The lipid nanoparticle of claim 3, wherein the ionizable lipid comprises heptadecan-9-yl 8-[2-hydroxyethyl-(6-oxo-6-undecoxyhexyl)amino]octanoate (SM-102^{TM}), (4-hydroxybutyl)azanediyl)bis(hexane-6,1-diyl)bis(2-hexyldecanoate) (ALC-0315^{TM}, Pfizer), or a combination thereof.

5. The lipid nanoparticle of claim 3 or claim 4, wherein the helper lipid comprises a phosphatidylcholine, a cholesterol or a derivative thereof, a polyethylene glycol-lipid (PEG-lipid), or a mixture thereof.

6. The lipid nanoparticle of claim 5, wherein the phosphatidylcholine comprises distearoylphosphatidylcholine (DSPC), dioleoylphosphatidylethanolamine (DPOE), or a mixture thereof.

7. The lipid nanoparticle of claim 5 or claim 6, wherein the cholesterol or a derivative thereof is a cholesterol, campesterol, beta-sitosterol, brassicasterol, ergosterol, dehydroergosterol, stigmasterol, fucosterol, DC-cholesterol HCl, OH-Chol, HAPC-Chol,

MHAPC-Chol, DMHAPC-Chol, DMPAC-Chol, cholesteryl chloroformate, GL67, cholesteryl myristate, cholesteryl oleate, cholesteryl nervonate, LC10, cholesteryl hemisuccinate, (3β,5β)-3-hydroxycholan-24-oic acid, alkyne cholesterol, 27-alkyne cholesterol, E-cholesterol alkyne, trifluoroacetate salt (Dios-Arg, 2H-Cho-Arg, or Cho-Arg), or a mixture thereof.

8. The lipid nanoparticle of any one of claims 5 to 7, wherein the PEG-lipid is DMG-PEG, DSG-PEG, mPEG-DPPE, DOPE-PEG, mPEG-DMPE, mPEG-DOPE, DSPE-PEG-amine, DSPE-PEG, mPEG-DSPE, PEG PE, m-PEG-Pentacosadiynoic acid, bromoacetamido-PEG, amine-PEG, azide-PEG, or a mixture thereof.

9. The lipid nanoparticle of any one of claims 2 to 8, wherein the membrane encapsulates a payload, and the payload is a nucleic acid, a compound, a polypeptide, a protein, a glycan, or a combination thereof.

10. The lipid nanoparticle of claim 9, wherein the nucleic acid is RNA or DNA, encoding a polypeptide.

11. The lipid nanoparticle of any one of claim 10, wherein the payload encodes an immunogenic polypeptide.

12. A lipid nanoparticle of any one of claims 1 to 11 for use in targeted payload delivery in a subject.

13. A lipid nanoparticle for use in boosting an adaptive immune response, wherein the lipid nanoparticle comprises a membrane defining an inner space, wherein the membrane is formed with a plurality of lipid components comprising the compound of claim 1, and the membrane encapsulates a payload, which is immunogenic or encodes an immunogenic biomolecule.