CLAIMS

1. A delivery vehicle comprising:

(a) a cargo comprising a nucleic acid; and

(b) a lipid nanoparticle (LNP) comprising:

(i) an unsaturated cationic lipid,

(ii) a saturated lipid and a cationic lipid, and

(iii) a bile salt;

wherein the saturated lipid has a phase transition temperature of at least 37 ºC.

2. The delivery vehicle of claim 1, wherein the unsaturated cationic lipid comprises an ionizable cationic lipid.

3. The delivery vehicle of claim 1 or 2, wherein the cationic lipid comprises a multivalent cationic lipid.

4. The delivery vehicle of claim 3, wherein the multivalent cationic lipid comprises N1-[2-((1S)-1-[(3-aminopropyl)amino]-4-[di(3-amino-propyl)amino]butylcarboxamido)ethyl]-3,4-di[oleyloxy]-benzamide (MVL5), TMVLBG2, TMVLG3, TMVLBG1, N4-Cholesteryl-Spermine HCl (GL67), or any combinations thereof.

5. The delivery vehicle of any one of claims 2-4, wherein the ionizable cationic lipid comprises KC2, 7-(4-(dimethylamino)butyl)-7-hydroxytridecane-1,13-diyl dioleate (CL1H6), 1,2-Dioleyloxy-3-(dimethylamino)propane (DODMA), (6Z,9Z,28Z,31Z)-heptatriaconta-6,9,28,31-tetraen-19-yl 3-(dimethylamino)propanoate (MC2), or MC3.

6. The delivery vehicle of any one of claims 1-5, wherein the saturated lipid comprises 2-distearoyl-sn-glycero-3-phosphocholine (DSPC), 1,2-Distearoyl-sn-glycero-3-phospho-L-serine (DSPS), Dipalmitoylphosphatidylcholine (DPPC), dipalmitoyl phosphatidylglycerol (DPPG), 1,2-Bis(diphenylphosphino)ethane (DPPE), or any combinations thereof.

7. The delivery vehicle of claim 6, wherein the concentration of the saturated lipid is less than 50 mole % of the total lipid concentration in the delivery vehicle.

8. The delivery vehicle of any one of claims 1-7, wherein the bile salt comprises deoxycholate, cholic acid, cholate, deoxycholic acid, taurocholic acid, taurocholate, hyodeoxycholic acid, hyodeoxycholate, glycocholic acid, glycocholate, chenodeoxycholic acid, chenodeoxycholate, lithocholic acid, lithocolate, ursodiol, isolithocholate, alloisolithocholate, dehydrolithochlate, 5-beta-cholanic acid, and any combination thereof.

9. The delivery vehicle of claim 8, wherein the concentration of the bile salt is between about 80 mole % to about 10 mole %.

10. The delivery vehicle of any one of claims 1-9, wherein the multivalent cationic lipid comprises MVL5 and the bile salt comprises deoxycholate.

11. The delivery vehicle of any one of claims 1-10, wherein the delivery vehicle comprises a conjugated lipid comprising a lipid conjugated to a stabilizing component.

12. The delivery vehicle of claim 11, wherein the stabilizing component comprises a hydrophilic polymer comprising a polyethylene glycol (PEG), a poly(2-alkyl-2-oxazoline), a polyvinyl alcohol, or any combinations thereof.

13. The delivery vehicle of claim 12, wherein the conjugated lipid comprises a PEGylated lipid.

14. The delivery vehicle of any one of claims 1-13, wherein the nucleic acid comprises DNA, modified DNA, RNA, modified RNA, miRNA, siRNA, antisense RNA, or any combinations thereof.

15. The delivery vehicle of any one of claims 1-14, wherein the delivery vehicle is stable in a solution containing at least about 5 g/L of bile salt, compared to an otherwise identical delivery vehicle that does not comprise the bile salt.

16. A pharmaceutical composition comprising the delivery vehicle according to any one of claims 1-15.