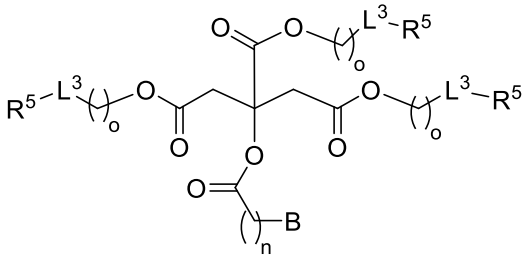
CLAIMS

WHAT IS CLAIMED IS:

1. A compound having a structure according to Formula (V1):



(V1),

or a pharmaceutically acceptable salt thereof, wherein:

B is an ionizable nitrogen-containing group;

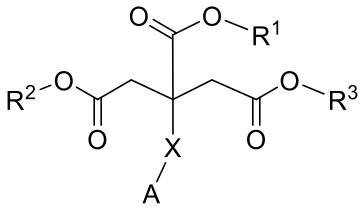
n is an integer of 4, 5, 6, or 7, and

L^3 is OC(O) or (O)CO, optionally OC(O); o is an integer of 2-5; and R^5 is C_4-C_{24} alkyl; or

L^3 is OC(O) or (O)CO, optionally OC(O); o is an integer of 6-12; and R^5 is C_1-C_6 alkyl.

2. The compound or pharmaceutically acceptable salt of claim 1, wherein n is 5.

3. A compound having a structure according to Formula (A2):

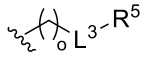


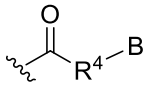
(A2),

or a pharmaceutically acceptable salt thereof, wherein:

X is O,

R^1, **R^2**, and **R^3** are each independently C_{14}-C_{30} heteroalkyl, optionally C_{15} heteroalkyl,

having a structure that is ,

A is  (a4),

B is an ionizable nitrogen-containing group,

R^4 is C_1-C_{10} alkylene, optionally C_2 alkylene, and

L^3 is OC(O), or (O)CO, optionally OC(O); **o** is an integer of 2-5; and **R^5** is C_4-C_{24} alkyl; or

L^3 is OC(O), or (O)CO, optionally OC(O); **o** is an integer of 6-12; and **R^5** is C_1-C_6 alkyl.

4. The compound or pharmaceutically acceptable salt of any one of claims 1-3, wherein:

o is an integer of 2-5, optionally 5, and R^5 is C_4-C_{24} alkyl, optionally C_7 alkyl;

o is an integer of 6-12 and R^5 is C_1-C_6 alkyl;

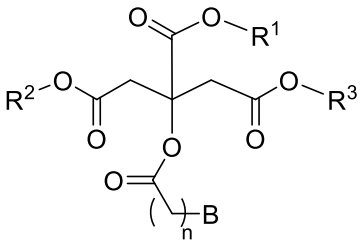
o is 5 and R^5 is C_9 alkyl;

o is 4 and R^5 is C_{10} alkyl; or

o is 8 and R^5 is C_6 alkyl.

5. A compound having

(i) a structure according to Formula (VI):



(VI),

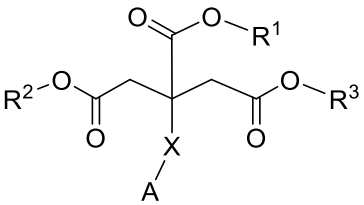
or a pharmaceutically acceptable salt thereof, wherein:

R^1, **R^2**, and **R^3** are each independently C_6-C_{30} heteroalkyl comprising a disulfide group;

n is an integer of 2, 3, or 4; and

B is independently an ionizable nitrogen-containing group; or

(ii) a structure according to Formula (A2):

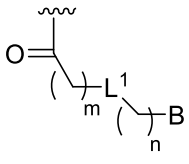
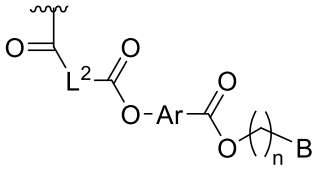
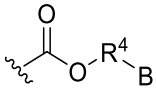


(A2),

or a pharmaceutically acceptable salt thereof, wherein

X is O or NH;

R^1, R^2, and R^3 are each independently C_4-C_{30} alkyl, C_4-C_{30} alkenyl, C_4-C_{30} alkynyl, or C_4-C_{30} heteroalkyl;

A is a substructure selected from:  (a1),  (a2), or  (a3);

B is an ionizable nitrogen-containing group or a permanently charged nitrogen group;

m is an integer of 2-10;

n is an integer of 2-10;

L^1 is carbonyl, ester, or amide;

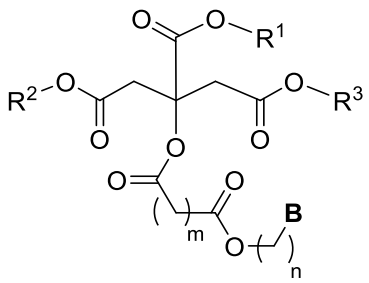
L^2 is C_2-C_{10} alkylene or C_2-C_{10} alkenylene;

Ar is phenylene optionally comprising 1-4 substituents independently selected from halogen, OCH_3, and CH_3; and

R^4 is C_1-C_{10} alkylene, optionally C_2-C_{10} alkylene.

6. The compound or pharmaceutically acceptable salt of claim 5, wherein:

(i) the compound has a structure according to Formula (I):



(I)

wherein:

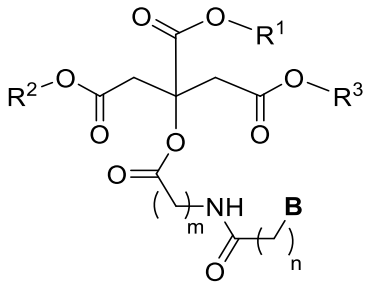
R^1, R^2, and R^3 are each independently C_6-C_{30} alkyl, C_6-C_{30} alkenyl, C_6-C_{30} alkynyl, or C_4-C_{30} heteroalkyl;

m is an integer of 2-10;

n is an integer of 2-10; and

B is an ionizable nitrogen-containing group or a permanently charged nitrogen group,

(ii) the compound has a structure according to Formula (IV):



(IV),

wherein:

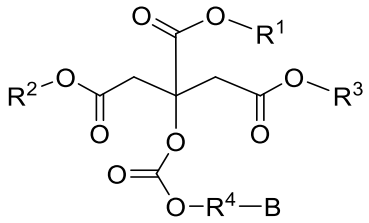
R^1, R^2, and R^3 are each independently C_6-C_{30} alkyl, C_6-C_{30} alkenyl, C_6-C_{30} alkynyl, or C_4-C_{30} heteroalkyl;

m is an integer of 2-10;

n is an integer of 2-10; and

B is an ionizable nitrogen-containing group; or

(iii) the compound has a structure according to Formula (III):



(III)

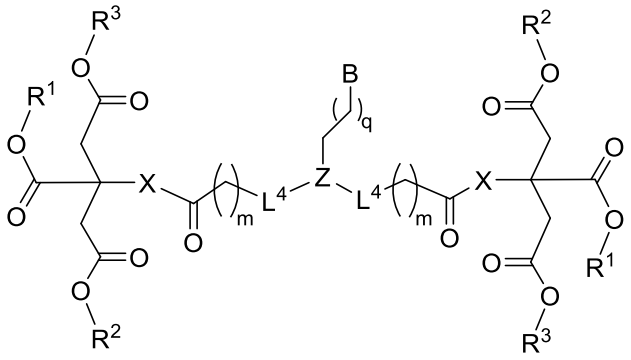
wherein

R^1, R^2, and R^3 are each independently C_6-C_{30} alkyl, C_6-C_{30} alkenyl, C_6-C_{30} alkynyl, or C_4-C_{30} heteroalkyl;

R^4 is C_2-C_{10} alkylene; and

B is an ionizable nitrogen-containing group.

7. A compound having a formula according to Formula (VII),



(VII),

or a pharmaceutically acceptable salt thereof, wherein

X is O or NH;

R^1, **R^2**, and **R^3** are each independently C_4-C_{30} alkyl, C_4-C_{30} alkenyl, C_4-C_{30} alkynyl, or C_4-C_{30} heteroalkyl;

each **m** is an integer of 2-10;

each **L^4** is a carbonyl, ester, or amide;

Z is

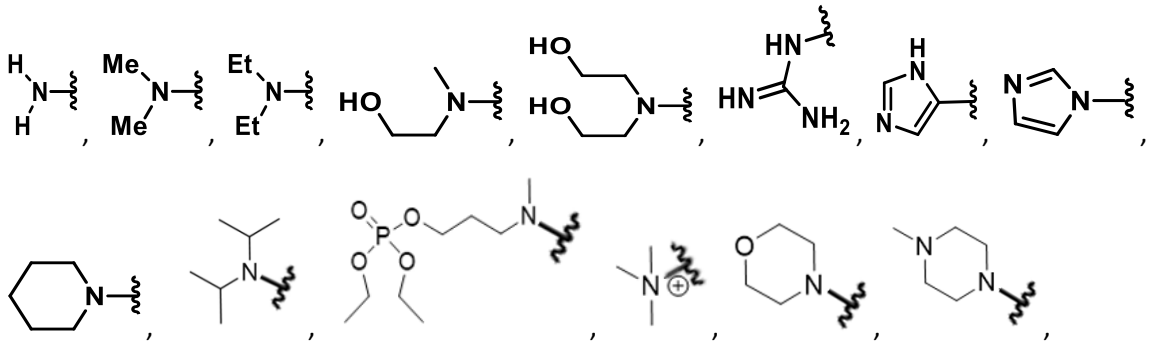
$–(CH_2)_{q1}–N–(CH_2)_{q2}–$, wherein **q1** and **q2** are each independently an integer of 2-10; or

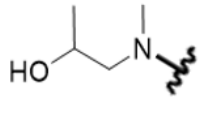
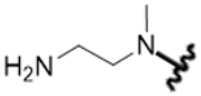
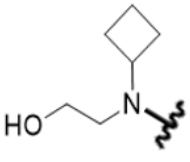
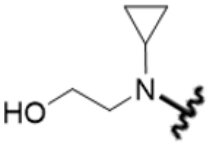
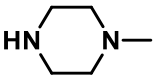
C_6H_3-Z^1, wherein **Z^1** is carbonyl, ester, or amide that is covalently attached to the $–CH_2(CH_2)_qB$ moiety;

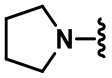
q is an integer of 1-9; and

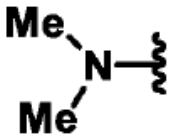
B is an ionizable nitrogen-containing group.

8. The compound or pharmaceutically acceptable salt of any one of claims 1-7, wherein B is:

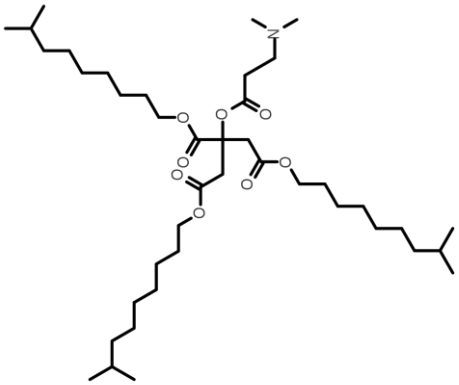
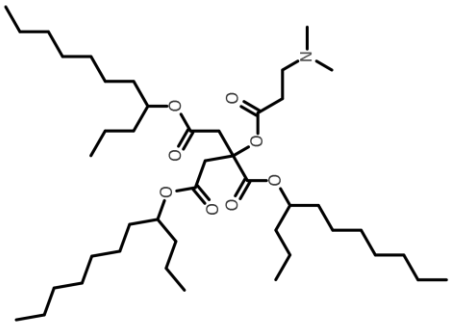


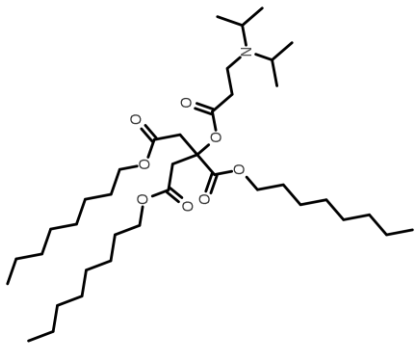
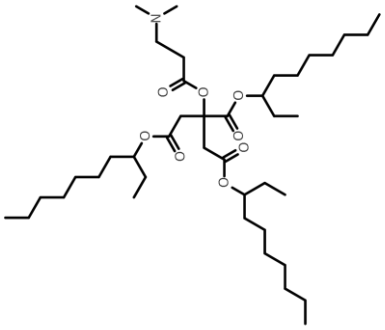
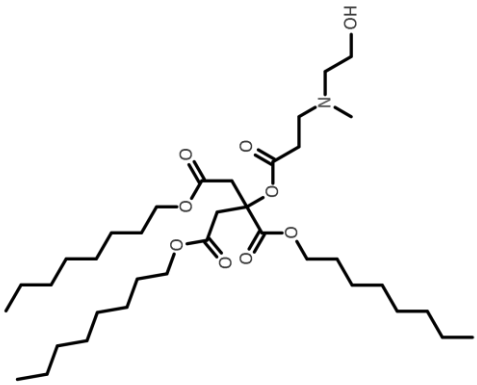
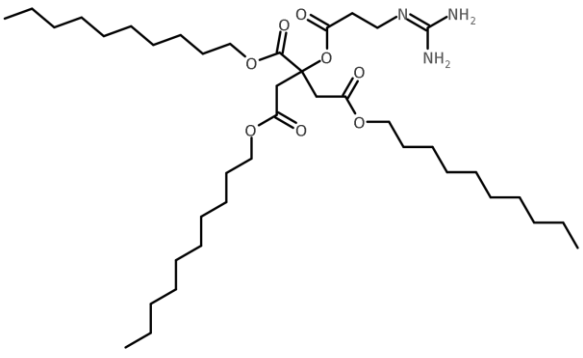

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or

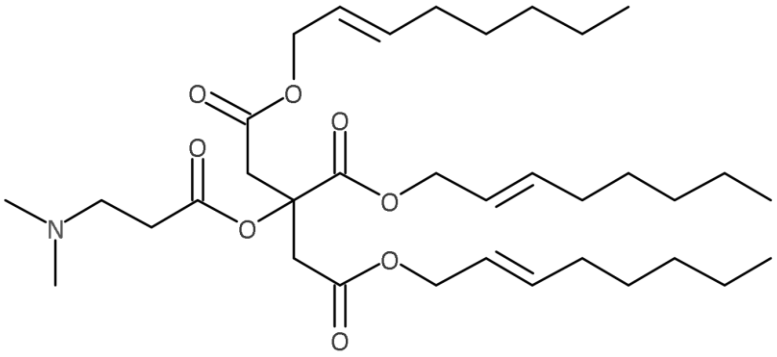
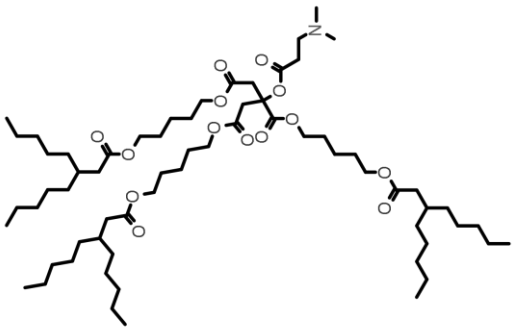
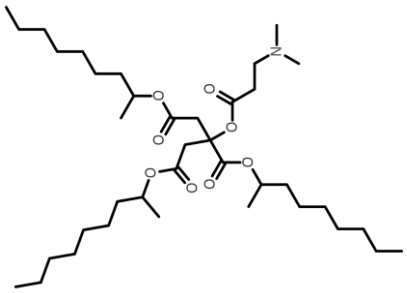
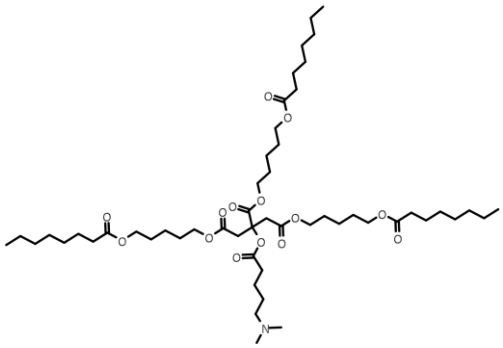

, optionally wherein B is:

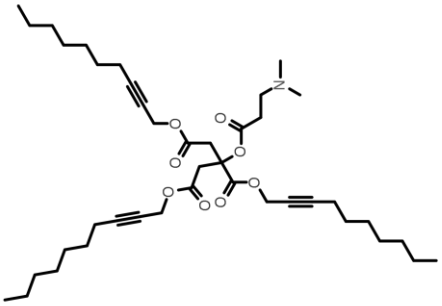
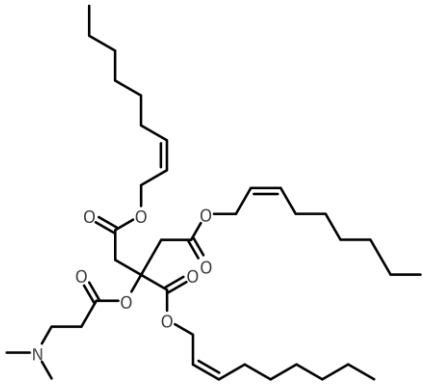
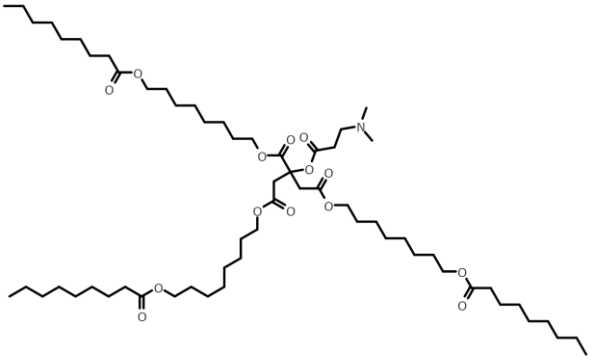
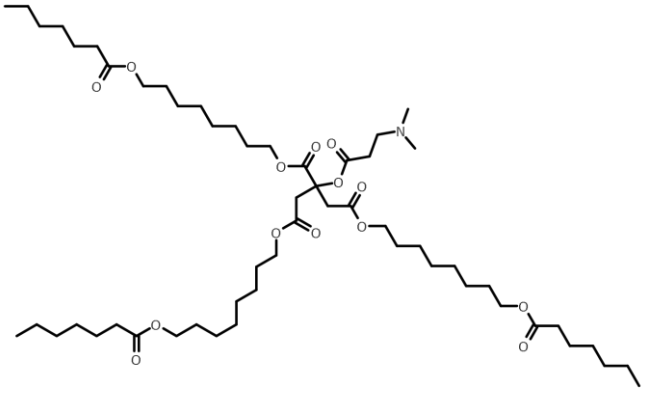

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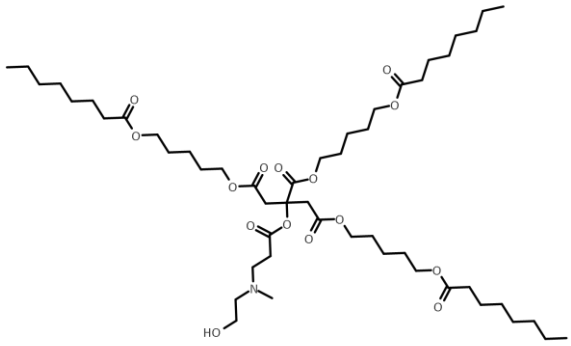
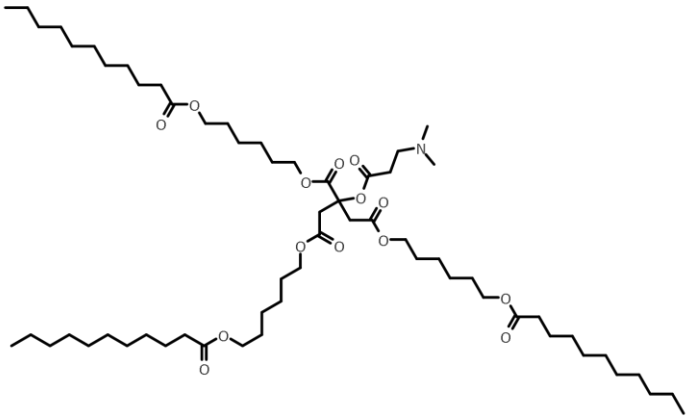
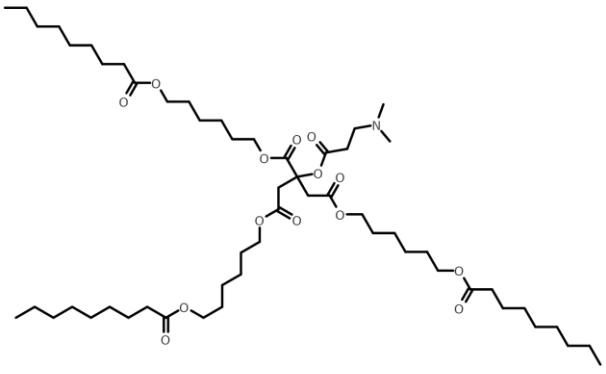
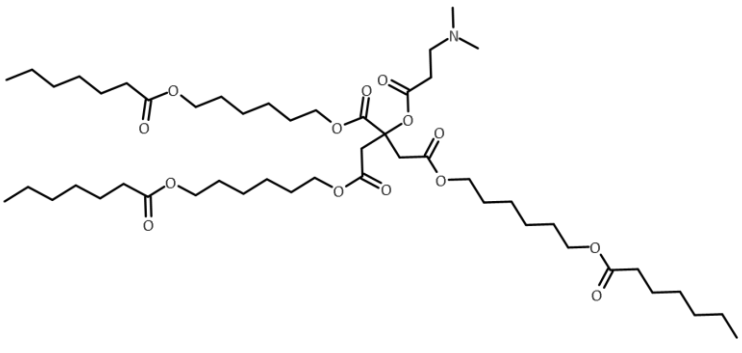
9. A compound selected from the group of (a) Compounds 41-64 and 90, or a pharmaceutically acceptable salt thereof:

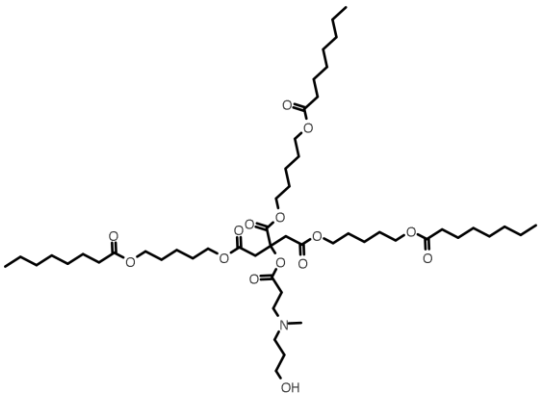
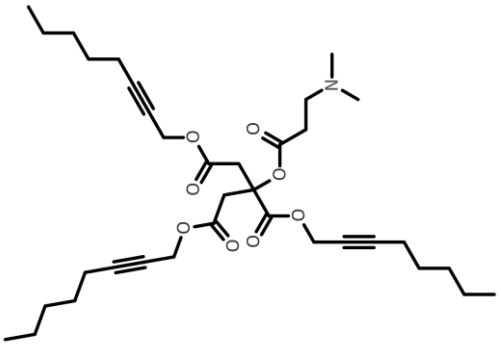
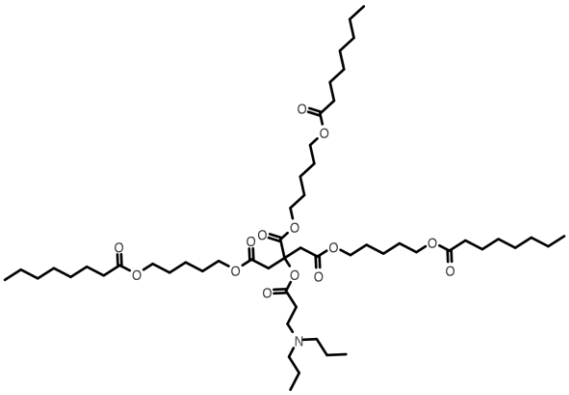
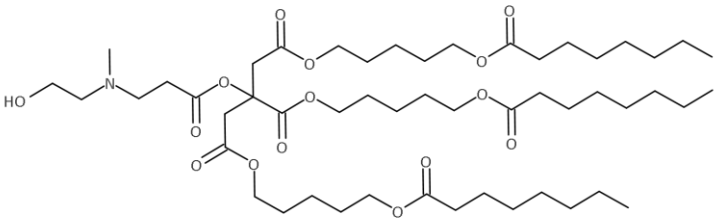
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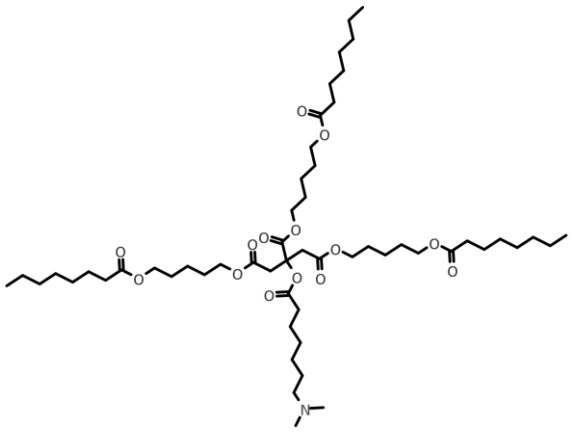
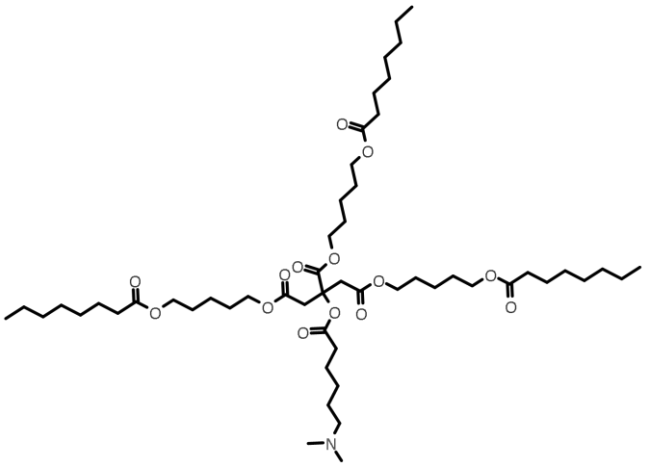
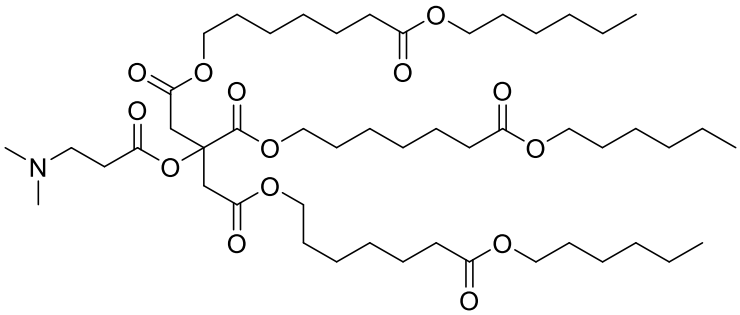
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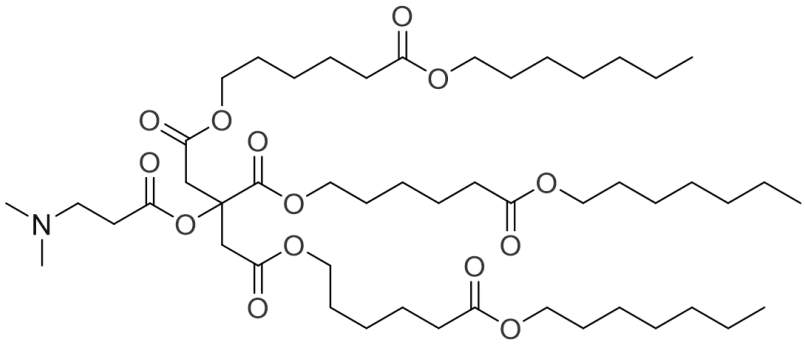
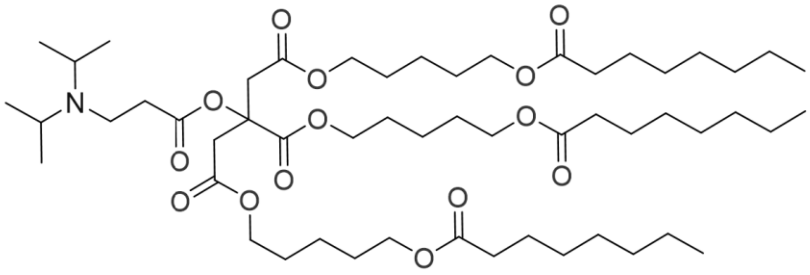
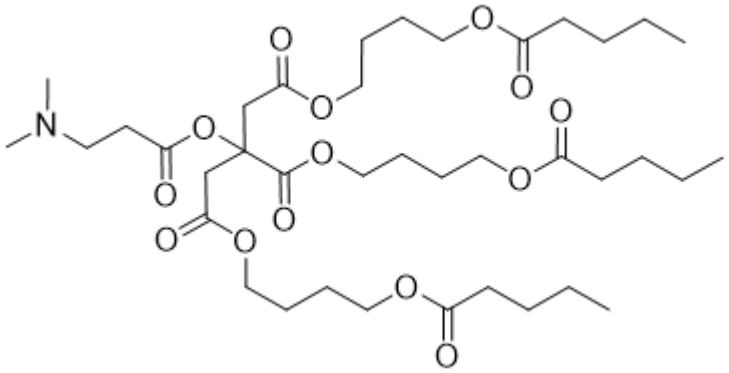
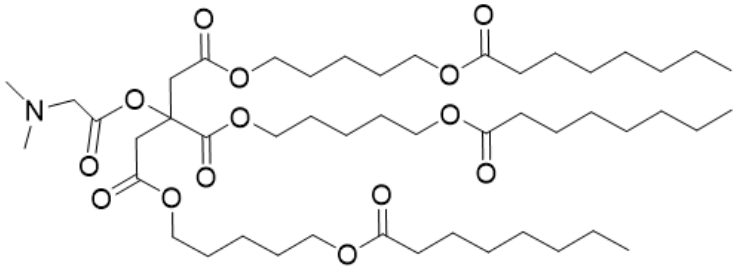
No.	Structure
55	
56	
57	
58	

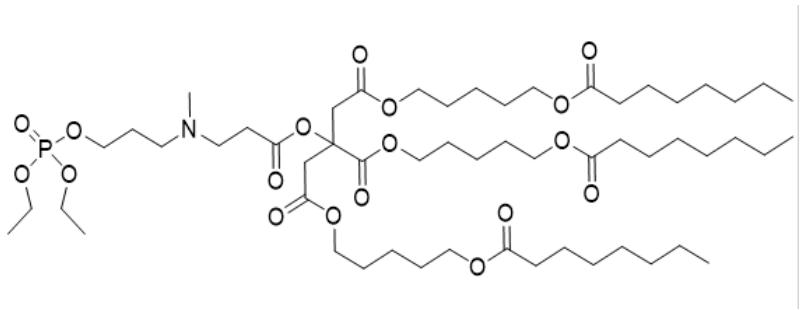
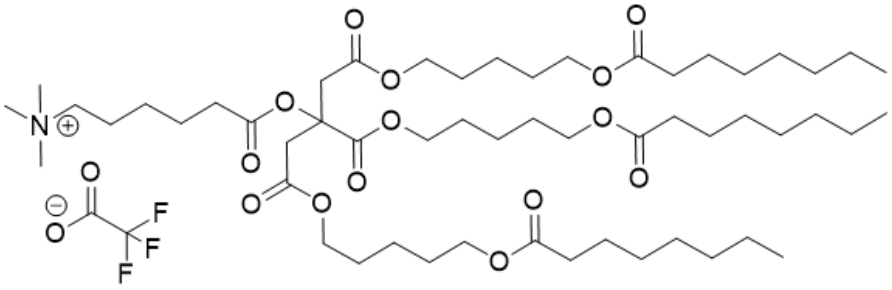
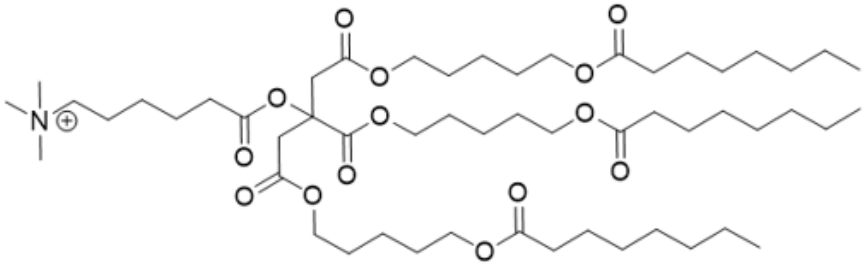
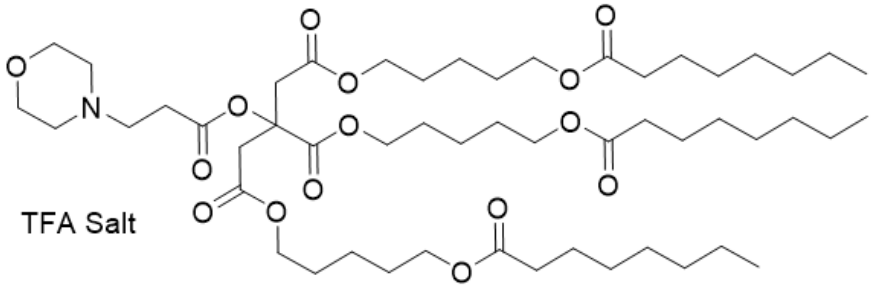
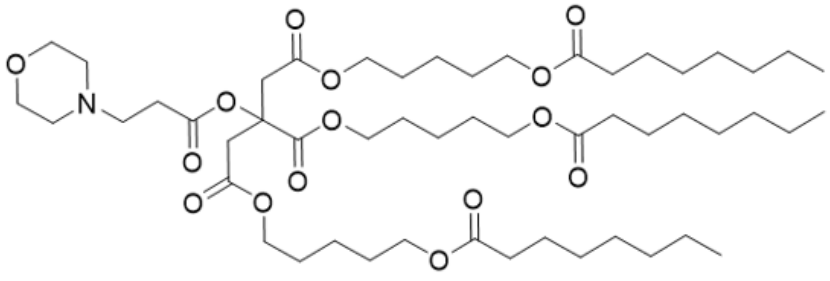
No.	Structure
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60	
61	
62	

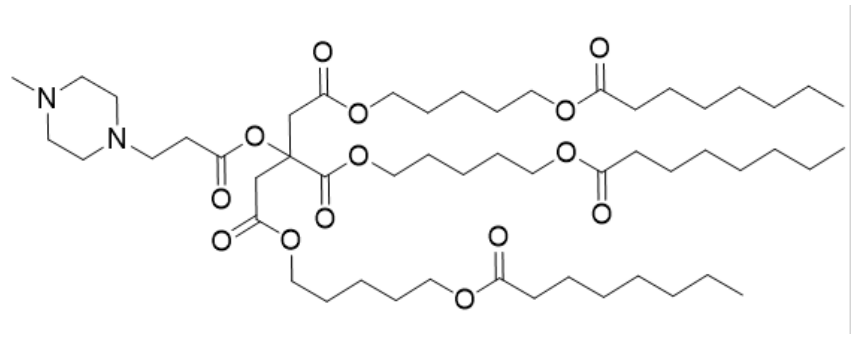
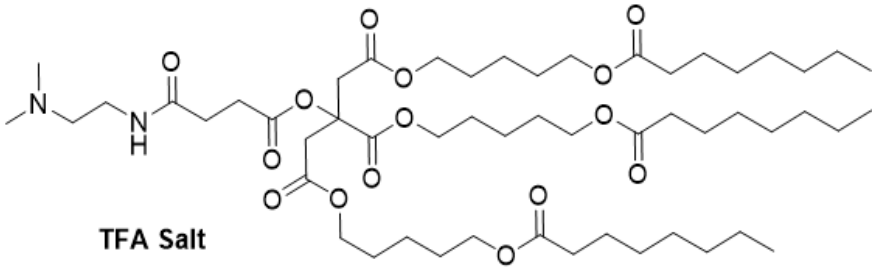
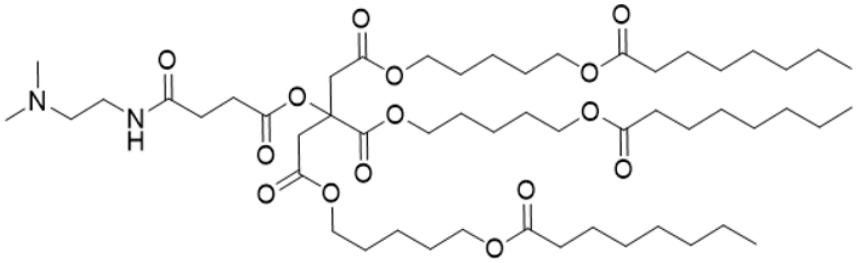
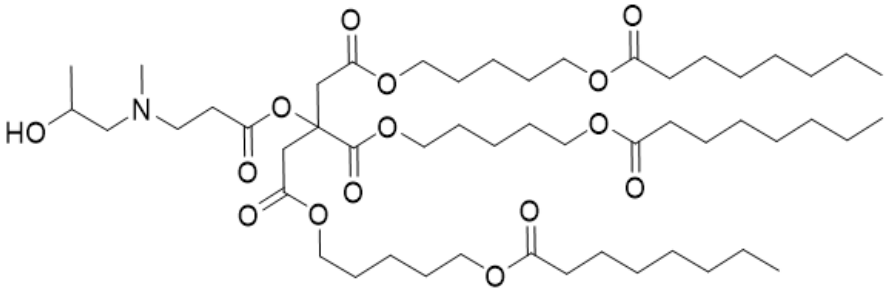
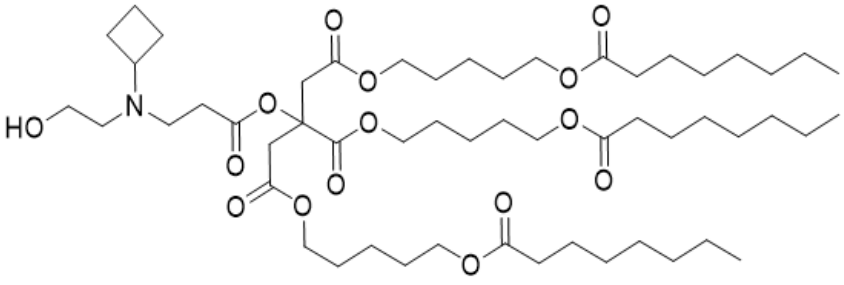
No.	Structure
63	
64	
90	

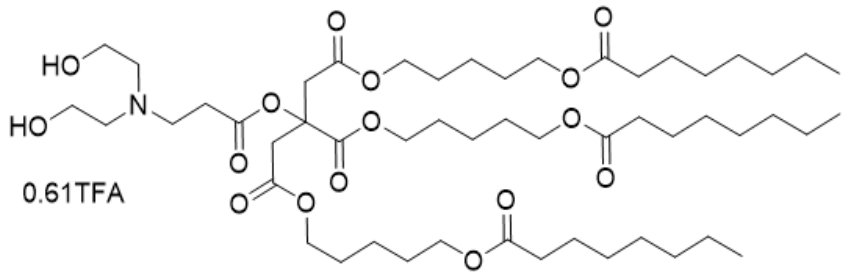
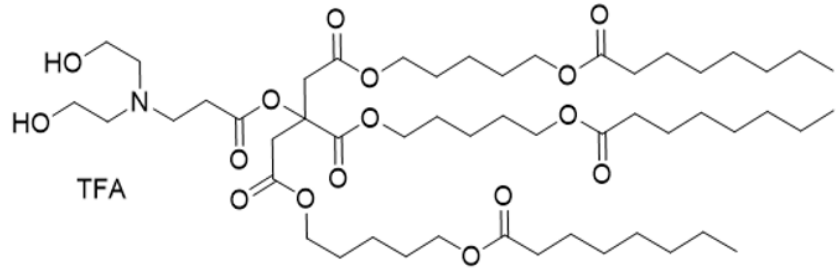
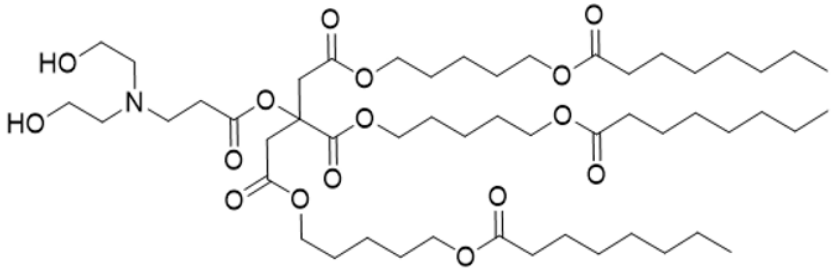
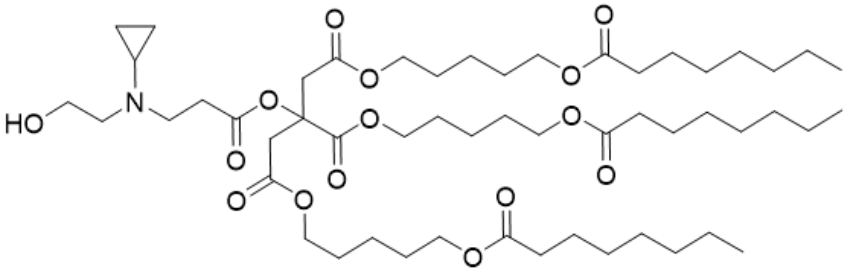
; or

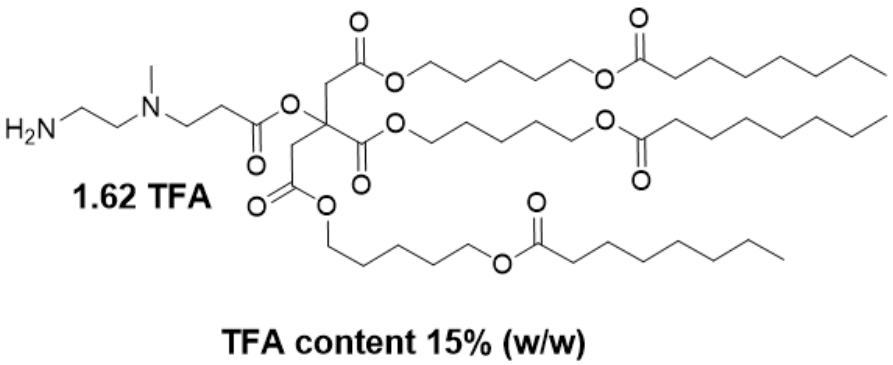
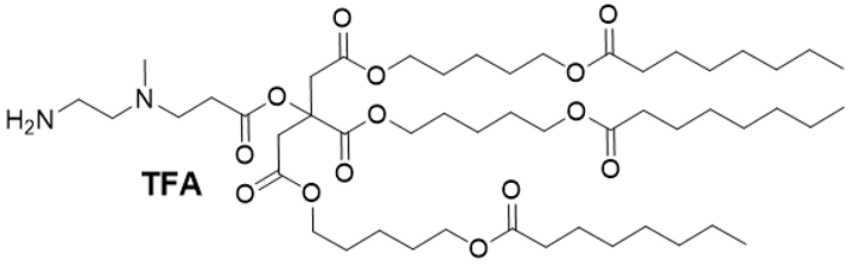
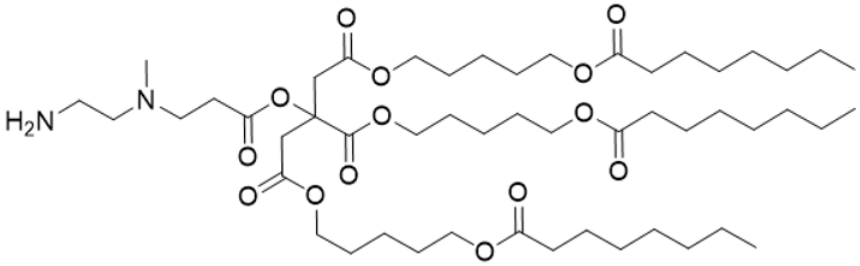
(b) Compounds 91-111, or a pharmaceutically acceptable salt of Compound 91-95, 97, 99, 100, 102-104, 107, 108, or 111:

No.	Structure
91	
92	
93	
94	

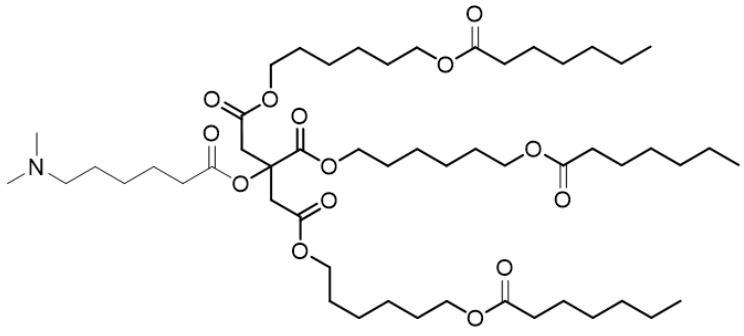
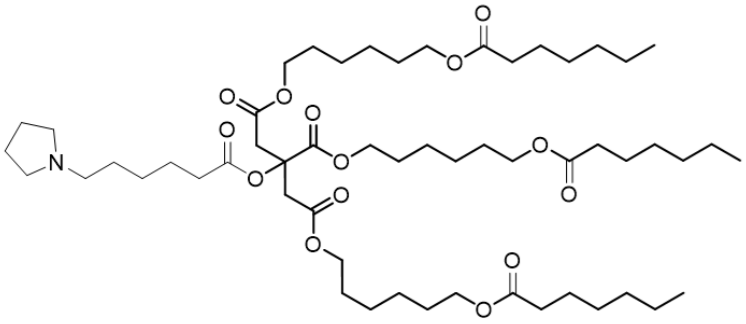
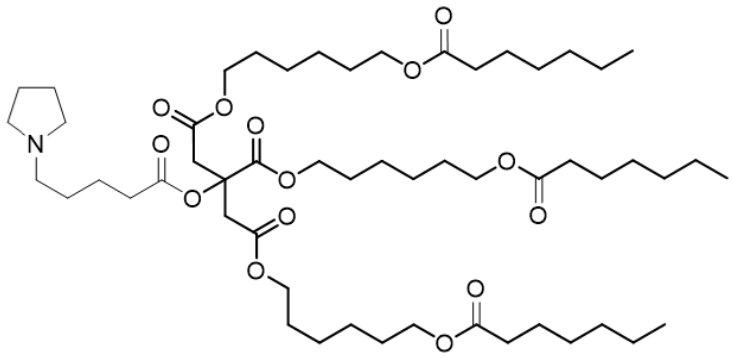
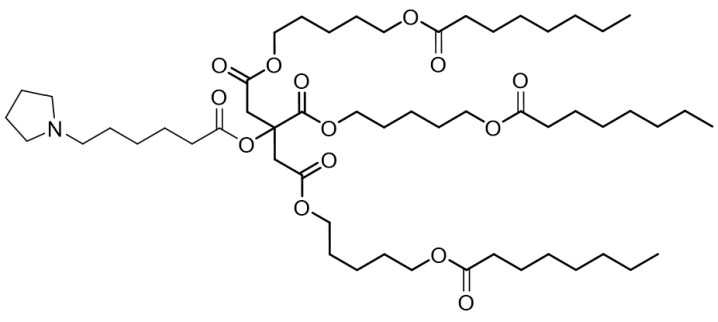
No.	Structure
95	
96	
97	
98	
99	

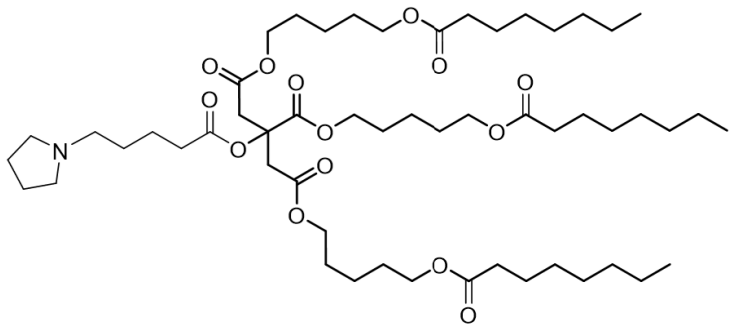
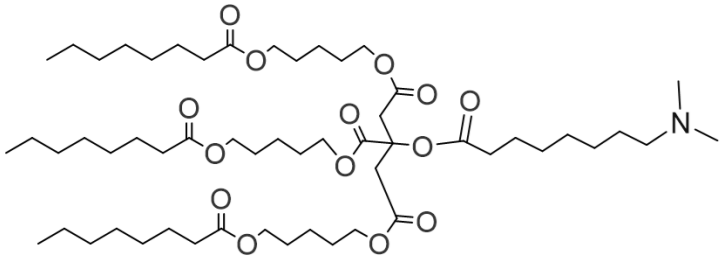
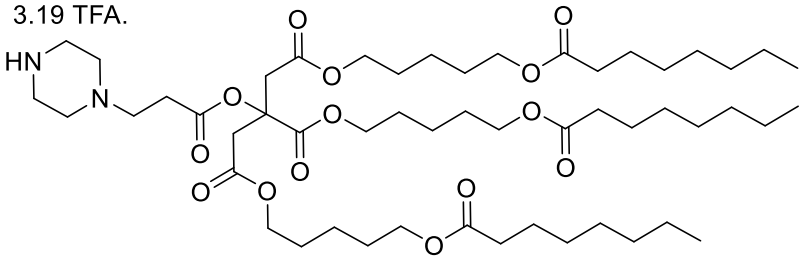
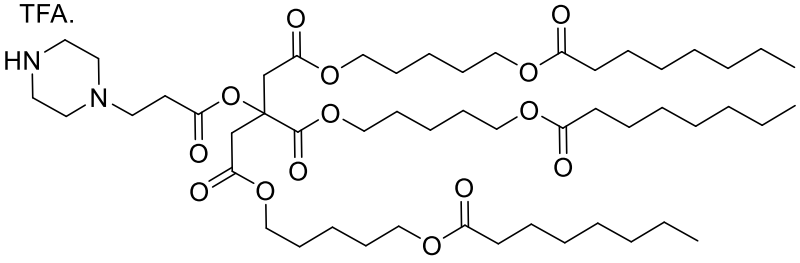
No.	Structure
100	
101	 TFA Salt
102	
103	
104	

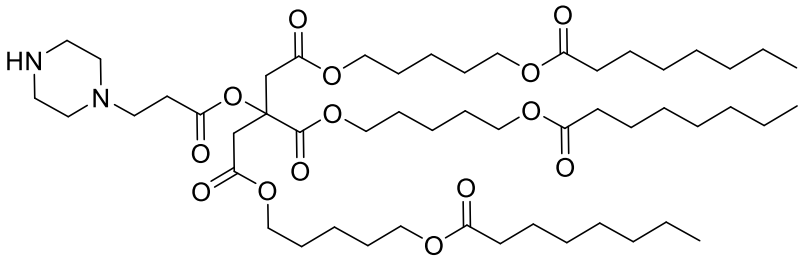
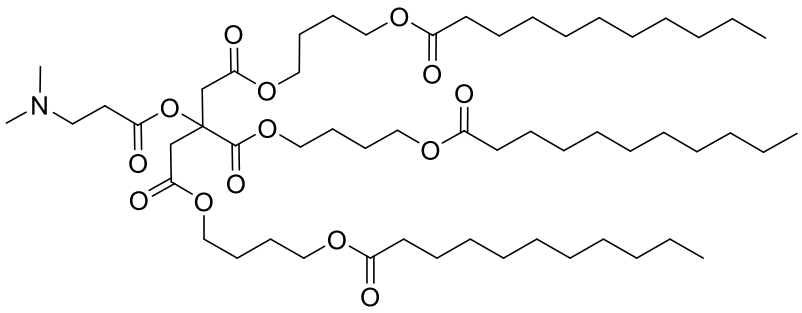
No.	Structure
105	
106	
107	
108	

No.	Structure
109	 TFA content 15% (w/w)
110	
111	

(c) Compounds 112-117 or 126-129, or a pharmaceutically acceptable salt of Compound 112-117, 128, or 129:

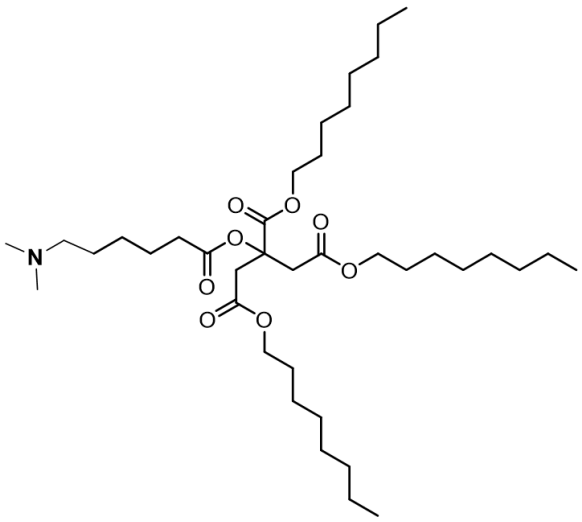
No.	Structure
112	
113	
114	
115	

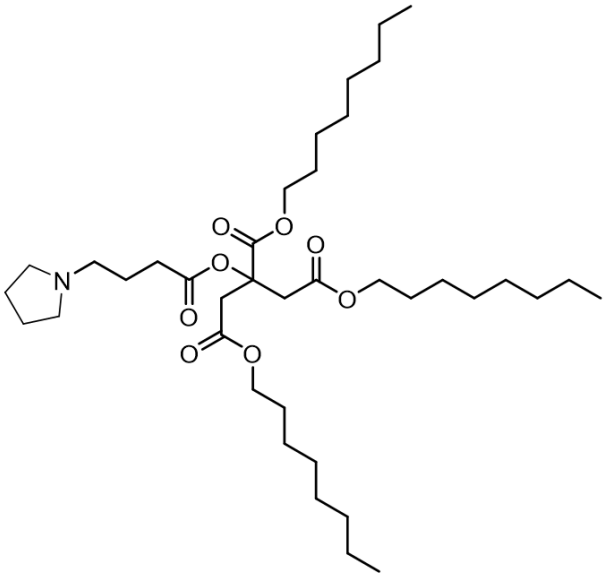
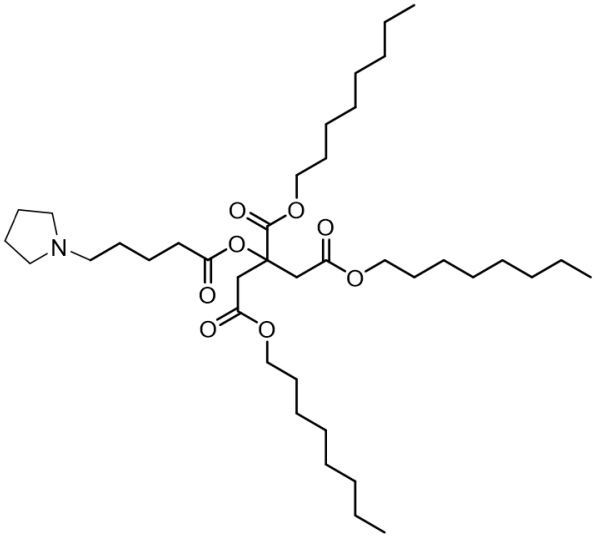
No.	Structure
116	
117	
126	
127	

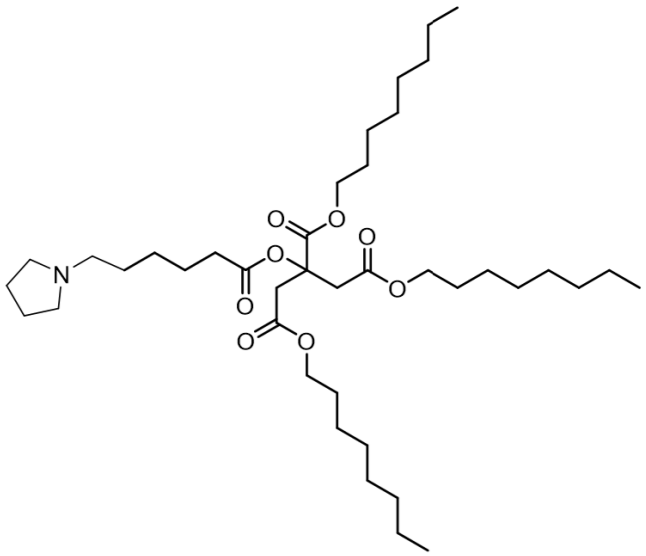
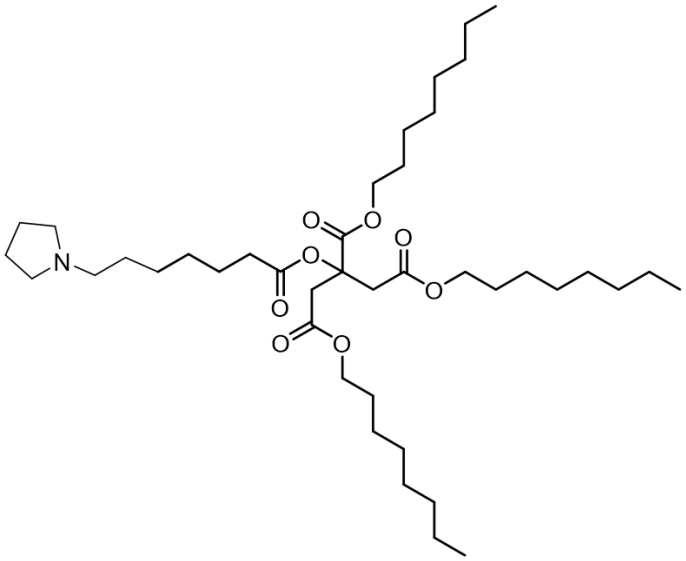
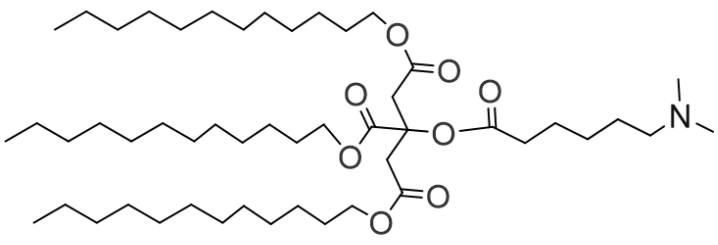
No.	Structure
128	
129	

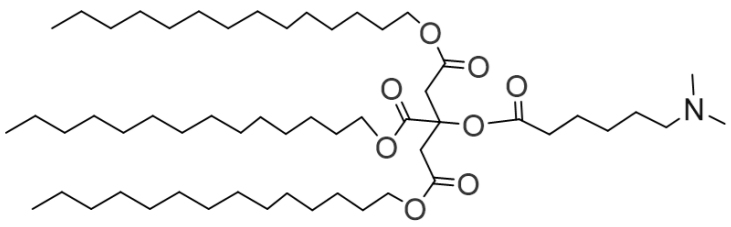
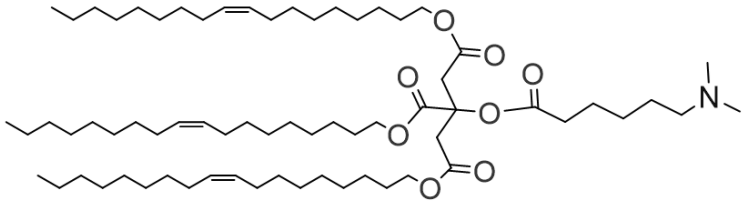
and

(d) Compounds 118-125, or a pharmaceutically acceptable salt thereof:

118	

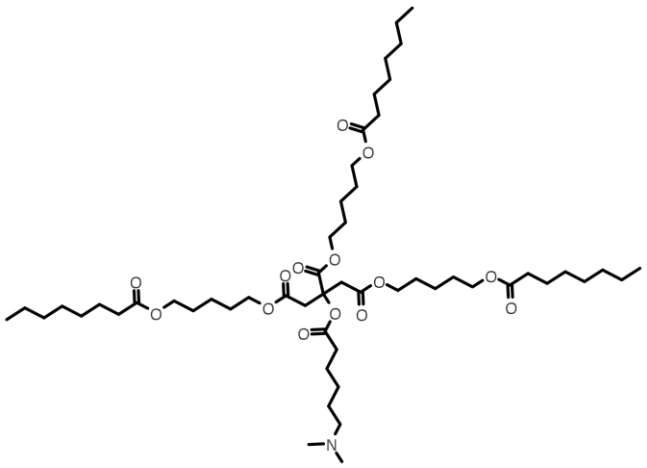
119	
120	

121	
122	
123	

124	
125	

.

10. The compound or pharmaceutically acceptable salt of claim 9, wherein the compound is:



.

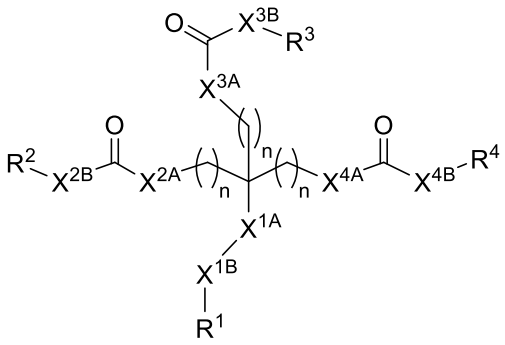
11. The compound of any one of claims 1-10.

12. The pharmaceutically acceptable salt of any one of claims 1-10.

13. A composition comprising a nucleic acid encapsulated within a liposome, wherein the liposome comprises the compound or pharmaceutically acceptable salt of any one of claims 1–12.

14. Use of a composition comprising an mRNA encoding a protein or polypeptide, encapsulated within a liposome, for the manufacture of a medicament for treating a disease in a subject in need thereof, wherein the medicament is to be pulmonarily, intranasally, or intramuscularly administered to the subject in need thereof,

wherein the liposome comprises one or more cationic lipids, wherein the one or more one cationic lipids are or comprise a compound, or a pharmaceutically acceptable salt thereof, wherein the compound has a structure according to Formula (B):



(B)

wherein:

each n is independently 0 or 1;

X^{1A} is O or NR^{1A};

R^{1A} is H or C_1-C_6 alkyl;

X^{1B} is a covalent bond, C(O), CH_2CO_2, or $CH_2C(O)$;

one of X^{2A} and X^{2B} is O and the other is a covalent bond;

one of X^{3A} and X^{3B} is O and the other is a covalent bond;

one of X^{4A} and X^{4B} is O and the other is a covalent bond;

R^1 is L^1-B^1, C_6-C_{30} alkyl, C_6-C_{30} alkenyl, or C_6-C_{30} alkynyl;

R^2 is L^2-B^2, C_6-C_{30} alkyl, C_6-C_{30} alkenyl, or C_6-C_{30} alkynyl;

R^3 is L^3-B^3, C_6-C_{30} alkyl, C_6-C_{30} alkenyl, or C_6-C_{30} alkynyl;

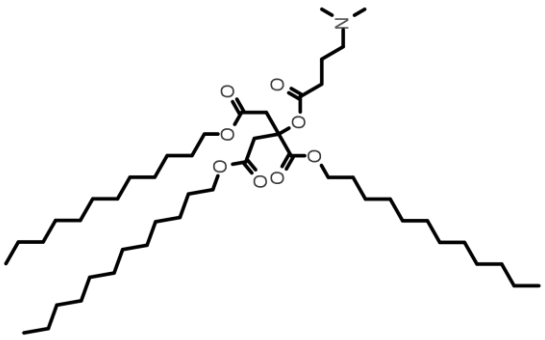
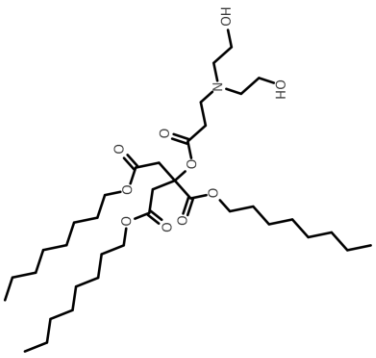
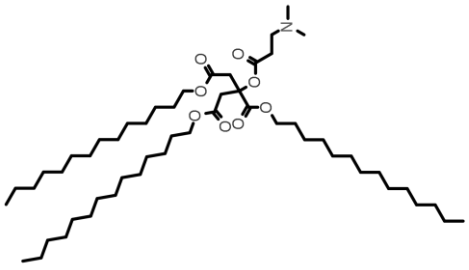
R^4 is L^4-B^4, C_6-C_{30} alkyl, C_6-C_{30} alkenyl, or C_6-C_{30} alkynyl;

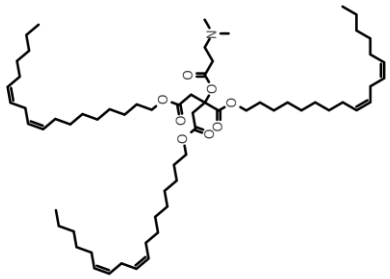
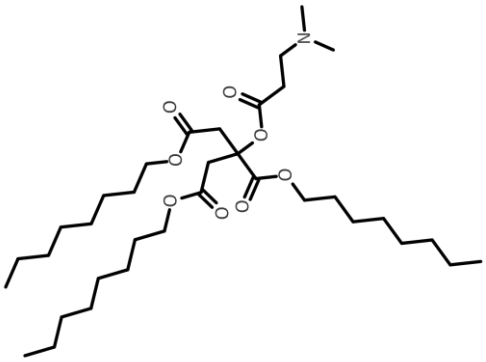
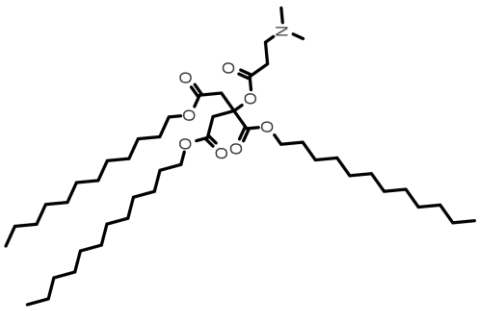
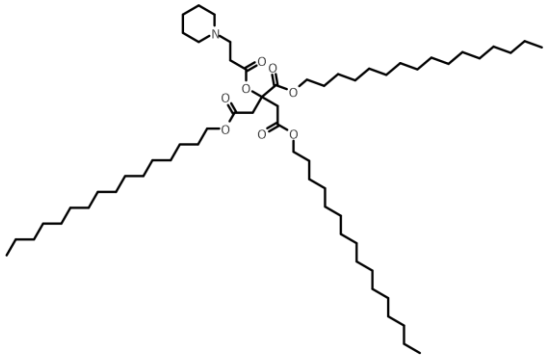
L^1, L^2, L^3, and L^4 are each independently C_1–C_{30} alkylene; C_2–C_{30} alkenylene; or C_2–C_{30} alkynylene;

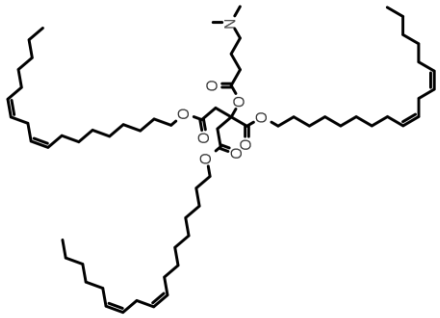
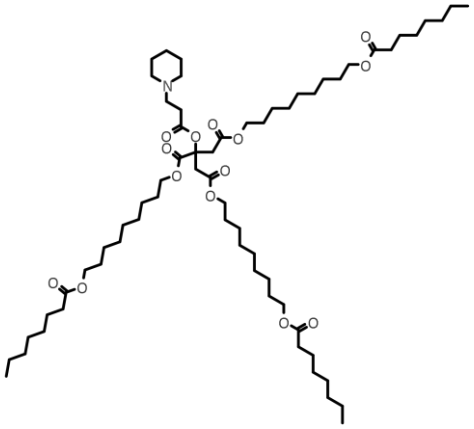
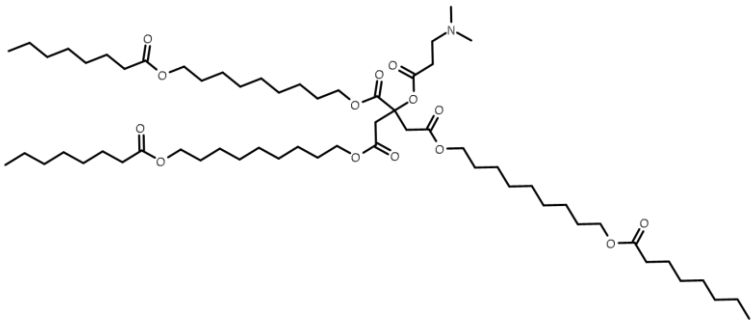
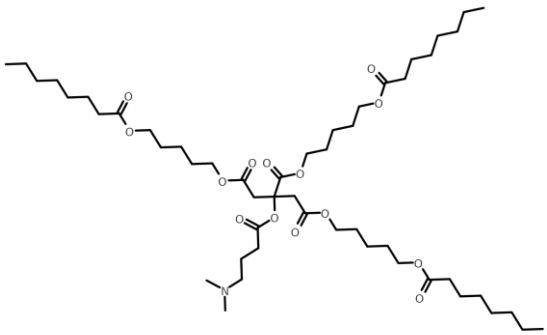
B^1, B^2, B^3, and B^4 are each independently an ionizable nitrogen-containing group, and wherein the cationic lipid comprises at least one ionizable nitrogen-containing group.

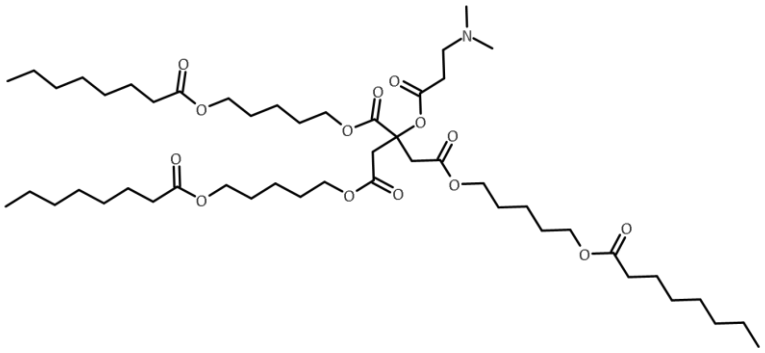
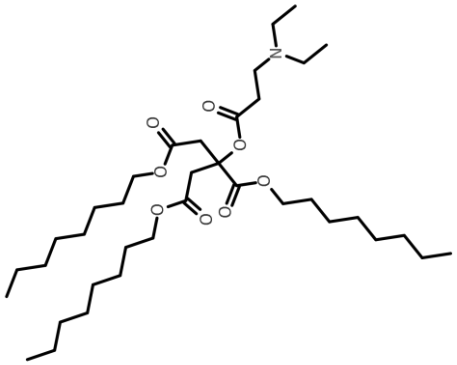
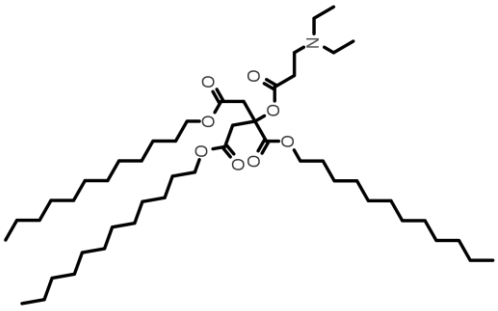
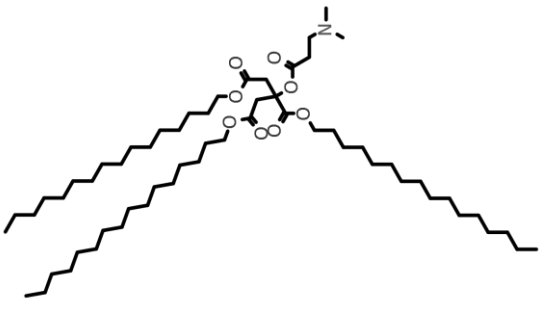
15. The use of claim 14, wherein the the liposome further comprises one or more non-cationic lipids, one or more cholesterol-based lipids, one or more PEG-modified lipids, or a combination thereof.

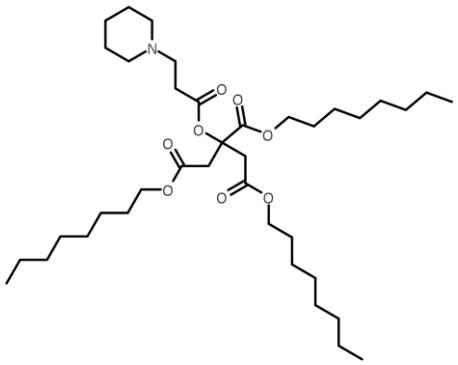
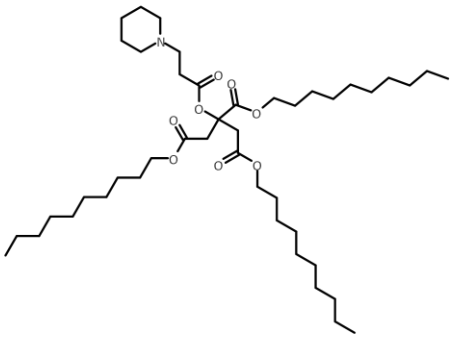
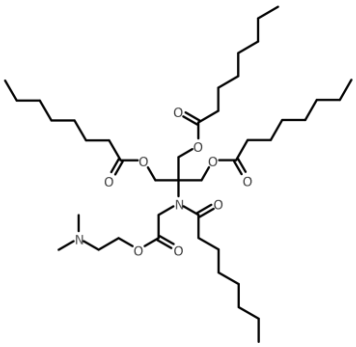
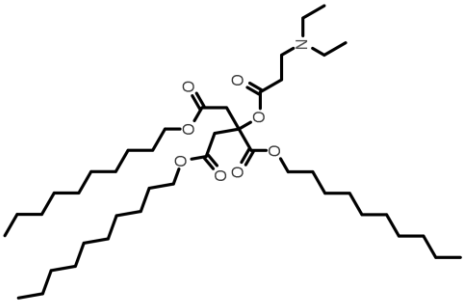
16. The use of claim 14 or 15, wherein the compound is selected from the group consisting of: (a) Compounds (65)-(89), or a pharmaceutically acceptable salt thereof:

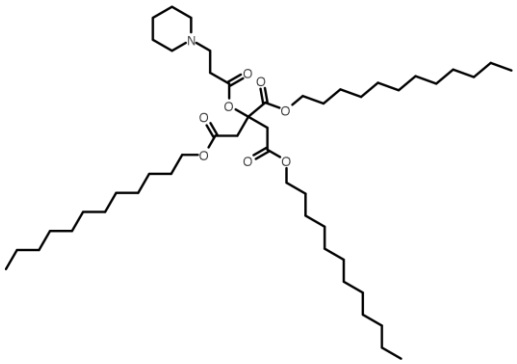
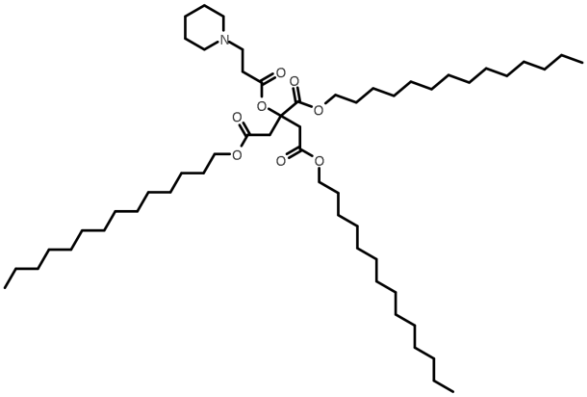
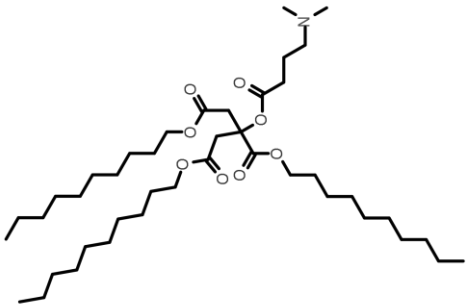
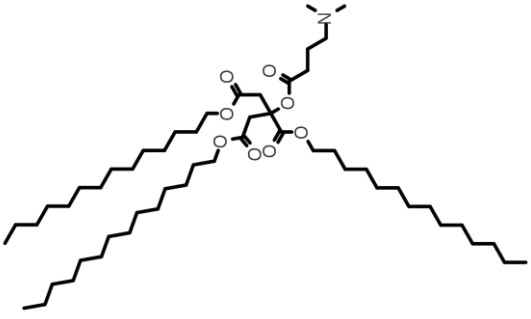
No.	Structure
65	
66	
67	

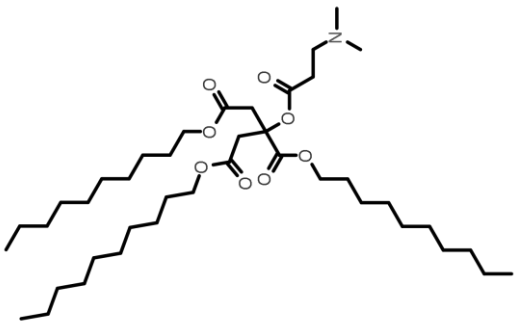
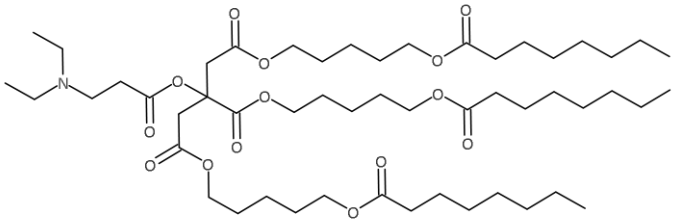
No.	Structure
68	
69	
70	
71	

No.	Structure
72	
73	
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75	

No.	Structure
76	
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78	
79	

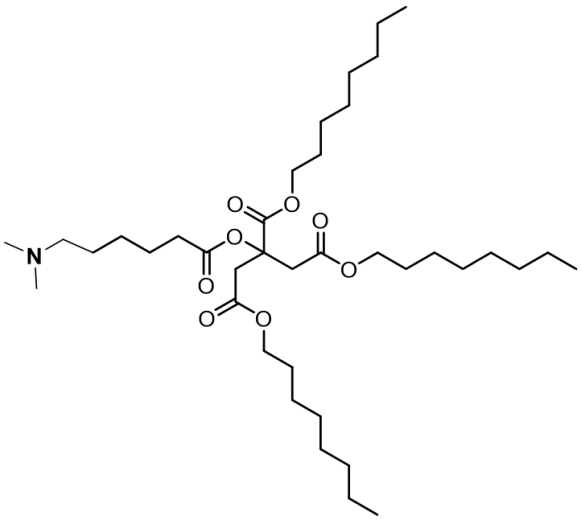
No.	Structure
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81	
82	
83	

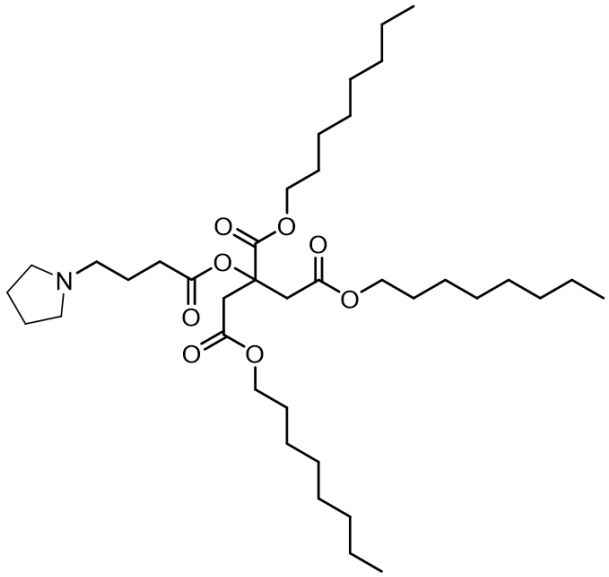
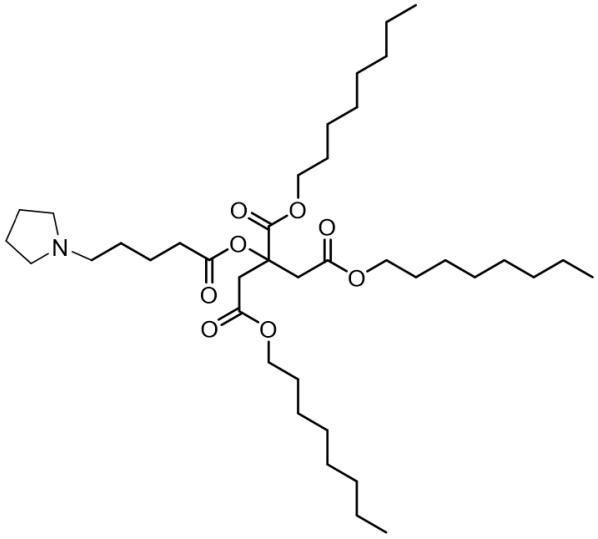
No.	Structure
84	
85	
86	
87	

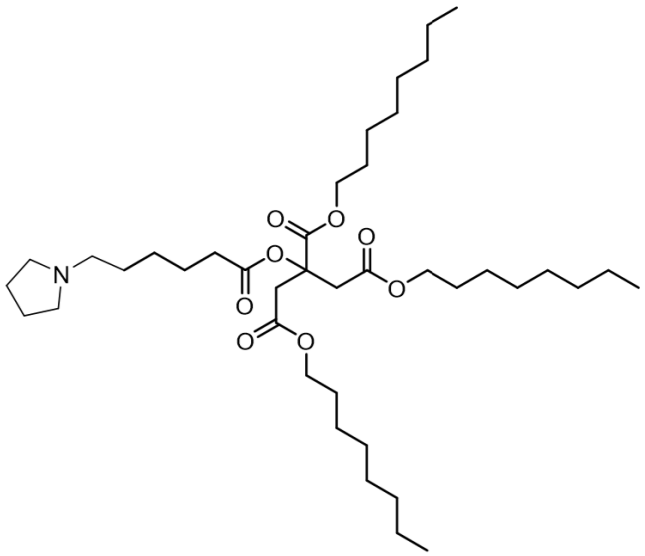
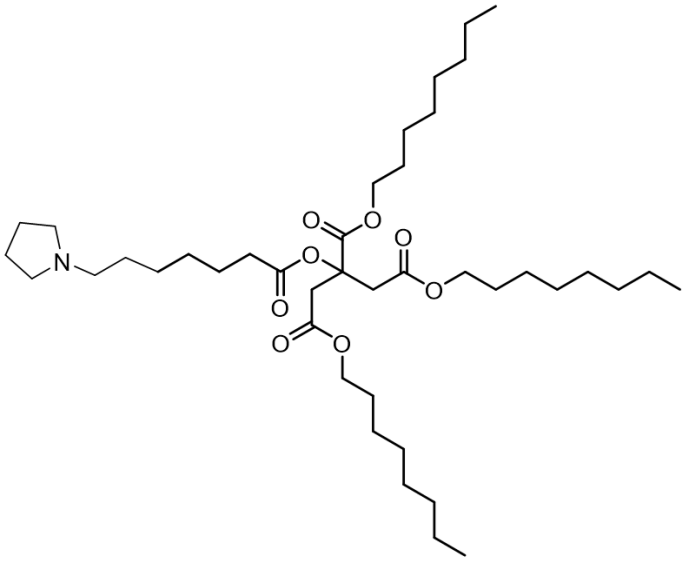
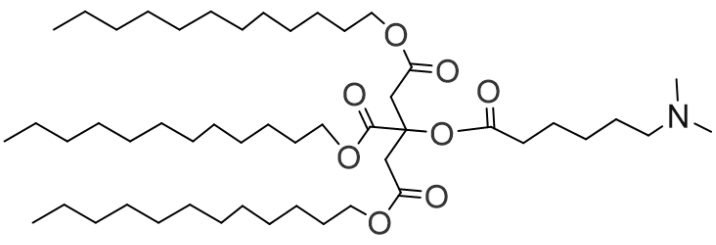
No.	Structure
88	
89	

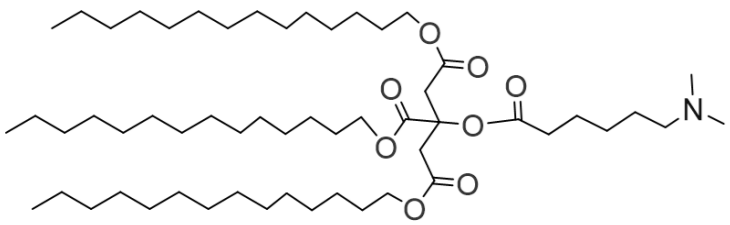
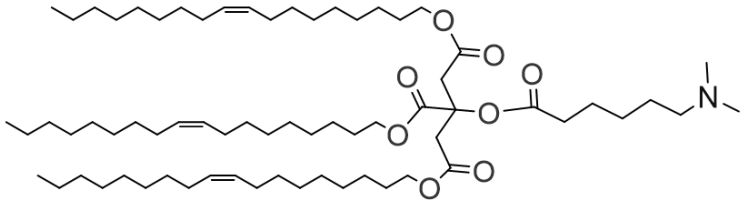
and

(b) Compounds 118-125, or a pharmaceutically acceptable salt thereof:

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125	

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17. The use of any one of claims 14-16, wherein the liposome comprises the compound.

18. The use of any one of claims 14-16, wherein the liposome comprises the pharmaceutically acceptable salt.

19. The use of any one of claims 14-18, wherein the medicament is to be administered intranasally.

20. The use of any one of claims 14-18, wherein the medicament is to be administered intramuscularly or pulmonarily.

21. The use of any one of claims 14-20, wherein the nucleic acid is an mRNA that encodes for an antigen from an infectious agent, optionally a virus, further optionally an influenza virus.