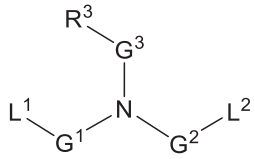
WHAT IS CLAIMED IS:

1. A compound of Formula (I):



(I),

or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof, wherein:

G^1 and G^2 are each independently a bond, C_2-C_{12} alkylene, or C_2-C_{12} alkenylene, wherein one or more -CH_2- in the alkylene or alkenylene is optionally replaced by -O-;

L^1 is –OC(=O)R^1, -C(=O)OR^1, -OC(=O)OR^1, -C(=O)R^1, -OR^1, -S(O)$_x$$R^1$, -S-S$R^1$, -C(=O)S$R^1$, -SC(=O)$R^1$, -N$R^a$C(=O)$R^1$, -C(=O)N$R^b$$R^c$, -N$R^a$C(=O)N$R^b$$R^c$, -OC(=O)N$R^b$$R^c$, -N$R^a$C(=O)O$R^1$, -SC(=S)$R^1$, -C(=S)S$R^1$, -C(=S)$R^1$, -CH(OH)$R^1$, -P(=O)(O$R^b$)(O$R^c$), -($C_6$-$C_{10}$ arylene)-R^1, -(6- to 10-membered heteroarylene)-R^1, or R^1;

L^2 is –OC(=O)R^2, -C(=O)OR^2, -OC(=O)OR^2, -C(=O)R^2, -OR^2, -S(O)$_x$$R^2$, -S-S$R^2$, -C(=O)S$R^2$, -SC(=O)$R^2$, -N$R^d$C(=O)$R^2$, -C(=O)N$R^e$$R^f$, -N$R^d$C(=O)N$R^e$$R^f$, -OC(=O)N$R^e$$R^f$, -N$R^d$C(=O)O$R^2$, -SC(=S)$R^2$, -C(=S)S$R^2$, -C(=S)$R^2$, -CH(OH)$R^2$, -P(=O)(O$R^e$)(O$R^f$), -($C_6$-$C_{10}$ arylene)-R^2, -(6- to 10-membered heteroarylene)-R^2, or R^2;

R^1 and R^2 are each independently C_6-C_{32} alkyl or C_6-C_{32} alkenyl;

R^a, R^b, R^d, and R^e are each independently H, C_1-C_{24} alkyl, or C_2-C_{24} alkenyl;

R^c and R^f are each independently C_1-C_{32} alkyl or C_2-C_{32} alkenyl;

G^3 is C_2-C_{24} alkylene, C_2-C_{24} alkenylene, C_3-C_8 cycloalkylene, or C_3-C_8 cycloalkenylene;

R^3 is -N(R^4)R^5;

R^4 is C_3-C_8 cycloalkyl, C_3-C_8 cycloalkenyl, 4- to 8-membered heterocyclyl, or C_6-C_{10} aryl; and R^4 is unsubstituted or substituted with one or more hydroxyl, halogen, C_1-C_6 alkyl, or oxo;

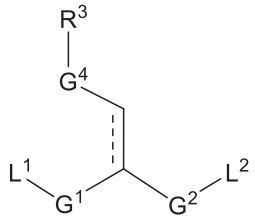
R^5 is C_1-C_{12} alkyl or C_3-C_8 cycloalkyl; and R^5 is unsubstituted, substituted with one or more hydroxyl, or substituted with one or more hydroxyl and one or more oxo;

x is 0, 1 or 2; and

wherein each alkyl, alkenyl, cycloalkyl, cycloalkenyl, heterocyclyl, aryl, alkylene, alkenylene, cycloalkylene, cycloalkenylene, arylene, and heteroarylene is independently optionally substituted,

wherein prodrug is acetate, formate and benzoate derivatives of alcohol or amide derivatives of amine functional groups of said compound of Formula (I).

2. A compound of Formula (II):



(II),

or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof, wherein:

$\overline{\text{------}}$ is a single bond or a double bond;

G^1 and G^2 are each independently a bond, C_2-C_{12} alkylene, or C_2-C_{12} alkenylene, wherein one or more -CH_2- in the alkylene or alkenylene is optionally replaced by -O-;

L^1 is –OC(=O)R^1, -C(=O)OR^1, -OC(=O)OR^1, -C(=O)R^1, -OR^1, -S(O)$_x$$R^1$, -S-S$R^1$, -C(=O)S$R^1$, -SC(=O)$R^1$, -N$R^a$C(=O)$R^1$, -C(=O)N$R^b$$R^c$, -N$R^a$C(=O)N$R^b$$R^c$, -OC(=O)N$R^b$$R^c$, -N$R^a$C(=O)O$R^1$, -SC(=S)$R^1$, -C(=S)S$R^1$, -C(=S)$R^1$, -CH(OH)$R^1$, -P(=O)(O$R^b$)(O$R^c$), -($C_6$-$C_{10}$ arylene)-R^1, -(6- to 10-membered heteroarylene)-R^1, or R^1;

L^2 is –OC(=O)R^2, -C(=O)OR^2, -OC(=O)OR^2, -C(=O)R^2, -OR^2, -S(O)$_x$$R^2$, -S-S$R^2$, -C(=O)S$R^2$, -SC(=O)$R^2$, -N$R^d$C(=O)$R^2$, -C(=O)N$R^e$$R^f$, -N$R^d$C(=O)N$R^e$$R^f$, -OC(=O)N$R^e$$R^f$, -N$R^d$C(=O)O$R^2$, -SC(=S)$R^2$, -C(=S)S$R^2$, -C(=S)$R^2$, -CH(OH)$R^2$, -P(=O)(O$R^e$)(O$R^f$), -($C_6$-$C_{10}$ arylene)-R^2, -(6- to 10-membered heteroarylene)-R^2, or R^2;

R^1 and R^2 are each independently C_6-C_{32} alkyl or C_6-C_{32} alkenyl;

R^a, R^b, R^d, and R^e are each independently H, C_1-C_{24} alkyl, or C_2-C_{24} alkenyl;

R^c and R^f are each independently C_1-C_{32} alkyl or C_2-C_{32} alkenyl;

G^4 is a bond, C_1-C_{23} alkylene, C_2-C_{23} alkenylene, C_3-C_8 cycloalkylene, or C_3-C_8 cycloalkenylene;

R^3 is -N(R^4)R^5;

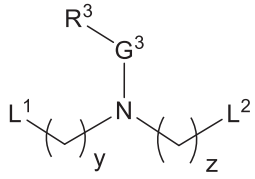
R^4 is C_1-C_{12} alkyl, C_3-C_8 cycloalkyl, C_3-C_8 cycloalkenyl, 4- to 8-membered heterocyclyl, or C_6-C_{10} aryl;

R^5 is C_1-C_{12} alkyl or C_3-C_8 cycloalkyl; or R^4, R^5, together with the nitrogen to which they are attached form a cyclic moiety;

x is 0, 1 or 2; and

wherein each alkyl, alkenyl, cycloalkyl, cycloalkenyl, heterocyclyl, aryl, alkylene, alkenylene, cycloalkylene, cycloalkenylene, arylene, heteroarylene, and cyclic moiety is independently optionally substituted.

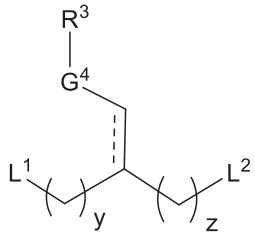
3. The compound of claim 1, wherein G^1 and G^2 are each independently C_2-C_{12} alkylene, preferably is a compound of Formula (I-A):



(I-A),

wherein y and z are each independently an integer from 2 to 12, or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof, more preferably G^1 and G^2 are each independently C_5 alkylene.

4. The compound of claim 2, which is a compound of Formula (II-A):



(II-A),

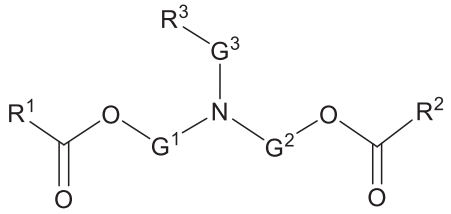
wherein y and z are each independently an integer from 2 to 12,

or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof.

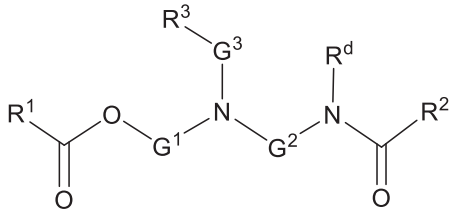
5. The compound of any one of claims 1 to 4, wherein L^1 is $–OC(=O)R^1$, $-C(=O)OR^1$, or -

C(=O)NR^{b}R^c; and L^2 is –OC(=O)R^2, -C(=O)OR^2, or -C(=O)NR^{e}R^f.

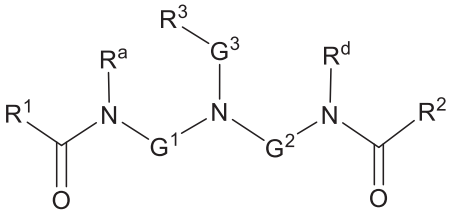
6. The compound of claim 1, which is a compound of Formula (I-B), (I-B'), (I-B"), (I-C), (I-D), or (I-E):



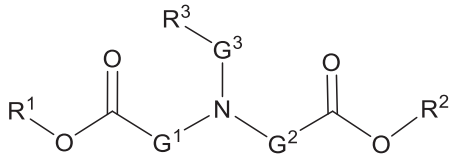
(I-B),



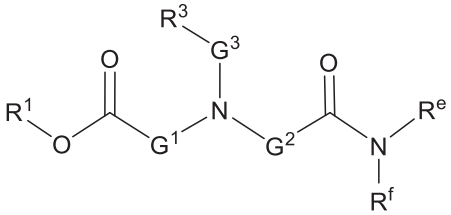
(I-B'),



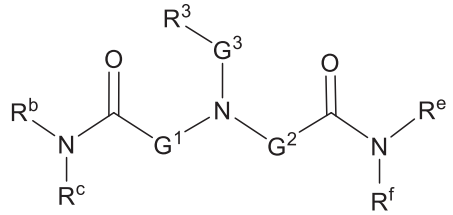
(I-B"),



(I-C),

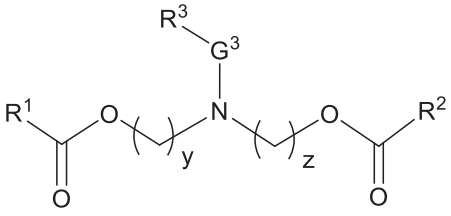


(I-D), or

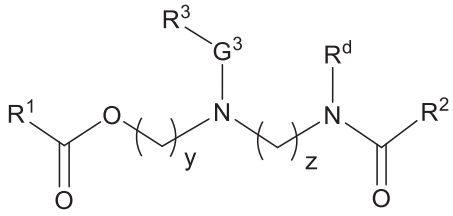


(I-E),

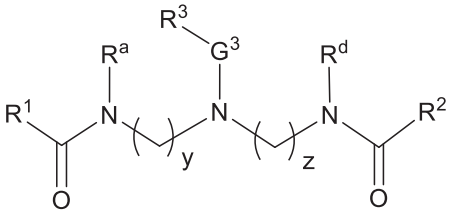
preferably is a compound of Formula (I-F), (I-F'), (I-F"), (I-G), (I-H), or (I-I):



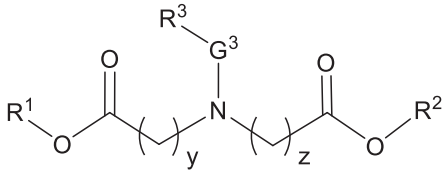
(I-F),



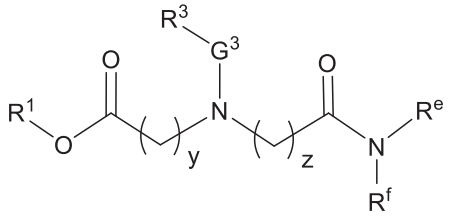
(I-F'),



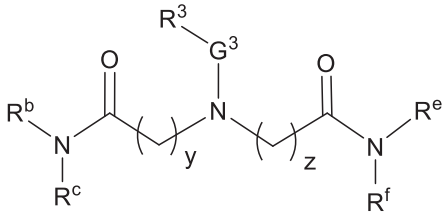
(I-F"),



(I-G),



(I-H), or

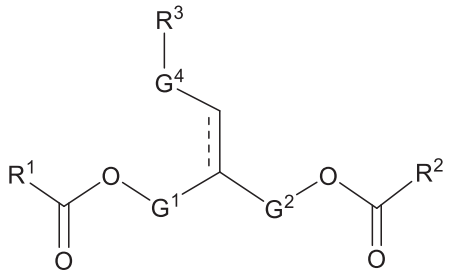


(I-I),

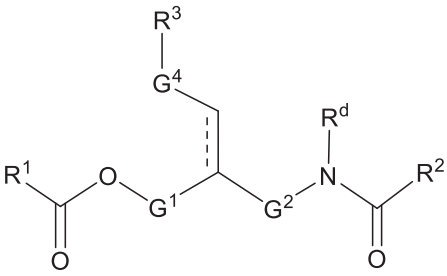
wherein y and z are each independently an integer from 2 to 12, more preferably wherein y is 5 and z is 5,

or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof.

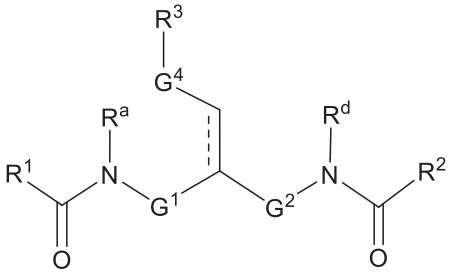
7. The compound of claim 2, which is a compound of Formula (II-B), (II-B'), (II-B"), (II-C), (II-D), or (II-E):



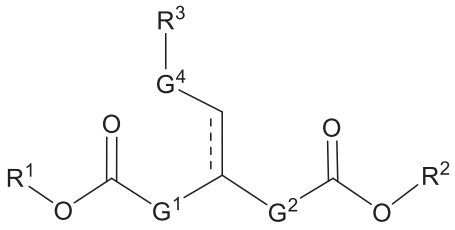
(II-B),



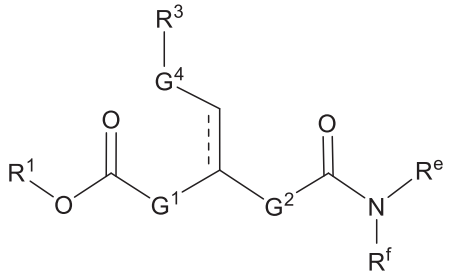
(II-B'),



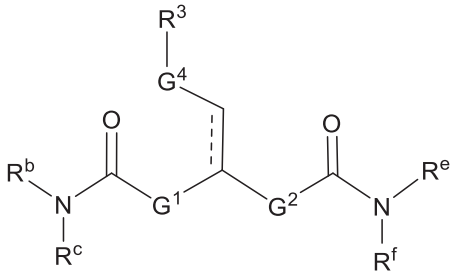
(II-B"),



(II-C),



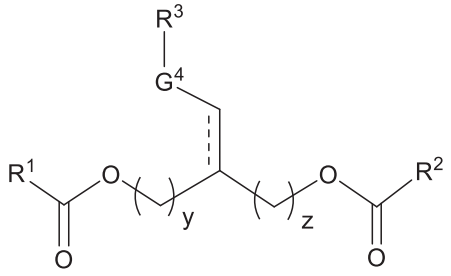
(II-D), or



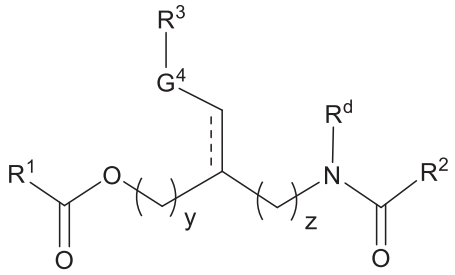
(II-E),

or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof,

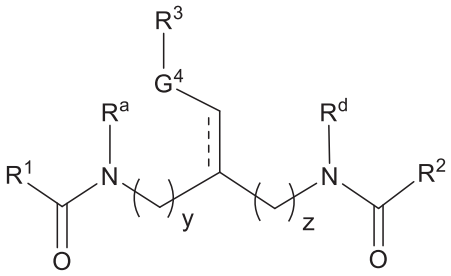
preferably is a compound of Formula (II-F), (II-F'), (II-F"), (II-G), (II-H), or (II-I):



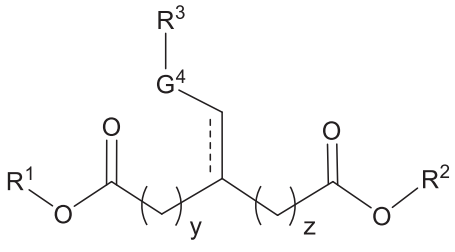
(II -F),



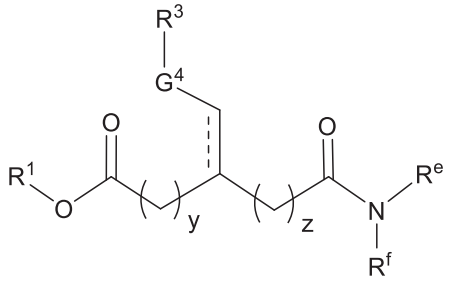
(II -F'),



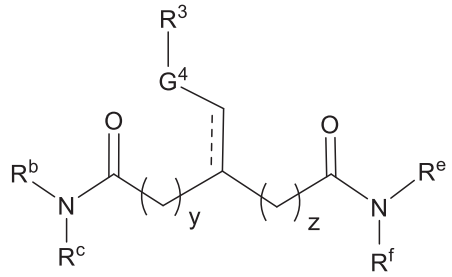
(II -F"),



(II -G),



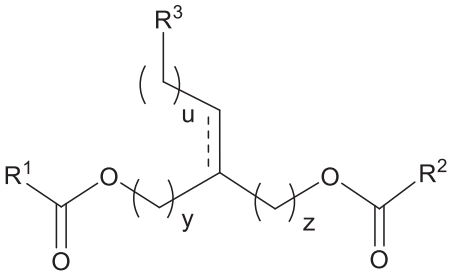
(II -H), or



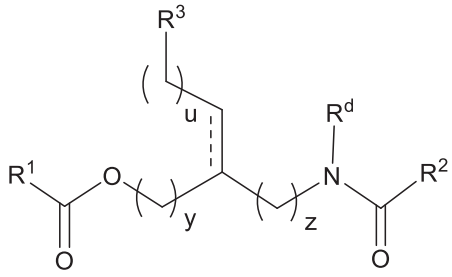
(II -I),

wherein y and z are each independently an integer from 2 to 12, or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof,

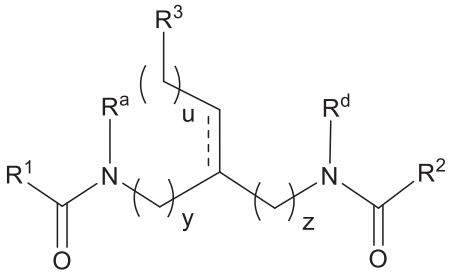
more preferably is a compound of Formula (II-J), (II-J'), (II-J"), (II-K), (II-L), or (II-M):



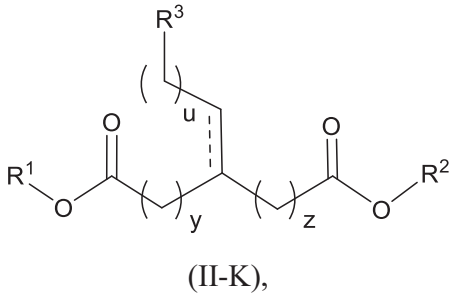
(II-J),



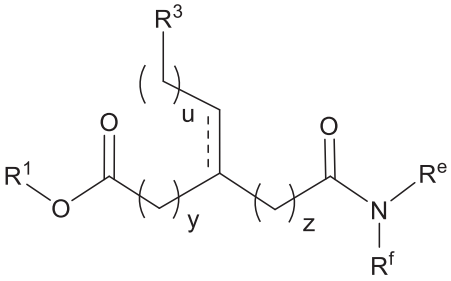
(II-J'),



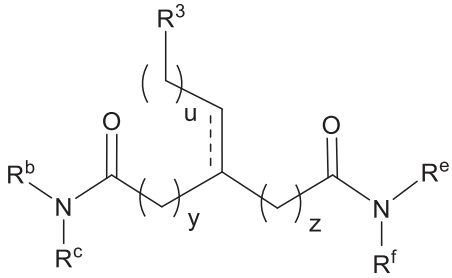
(II-J"),



(II-K),



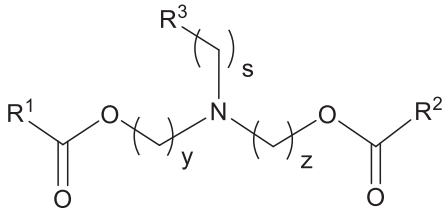
(II-L), or



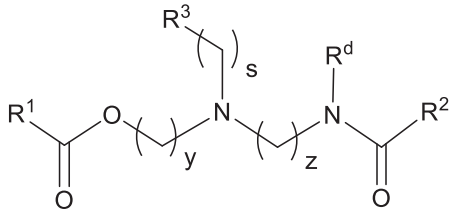
(II-M).

8. The compound of any one of claims 1 to 7, wherein G^3 is C_2-C_4 alkylene, wherein optionally G^3 is substituted with one or more oxo.

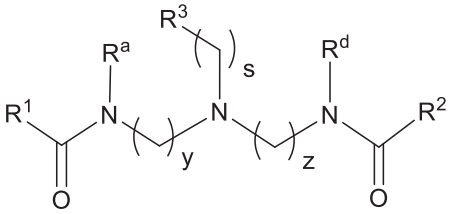
9. The compound of claim 1, which is a compound of Formula (I-J), (I-J'), (I-J"), (I-K), (I-L), or (I-M):



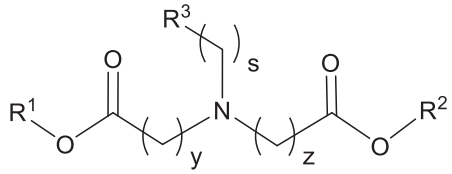
(I-J),



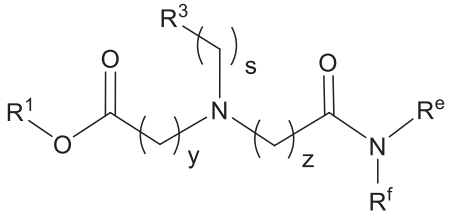
(I-J'),



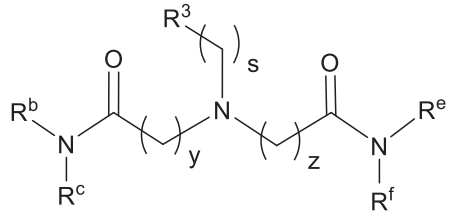
(I-J"),



(I-K),



(I-L), or



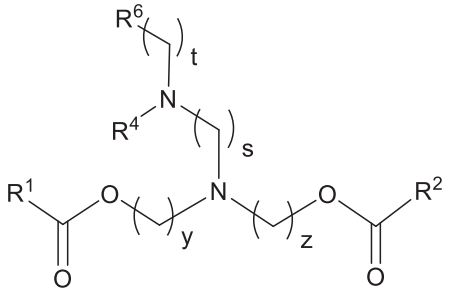
(I-M),

wherein y and z are each independently an integer from 2 to 12, and

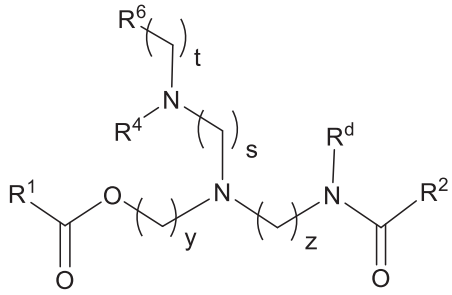
s is an integer from 2 to 24, preferably wherein y is 5, z is 5, and s is 2 or 4,

or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof.

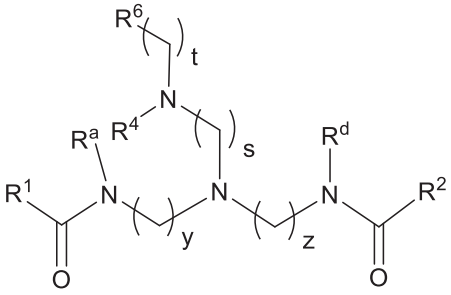
10. The compound of claim 1, which is a compound of Formula (I-N), (I-N'), (I-N"), (I-O), (I-P), or (I-Q):



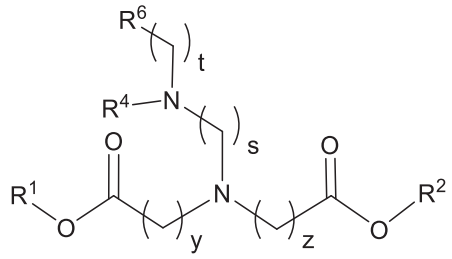
(I-N),



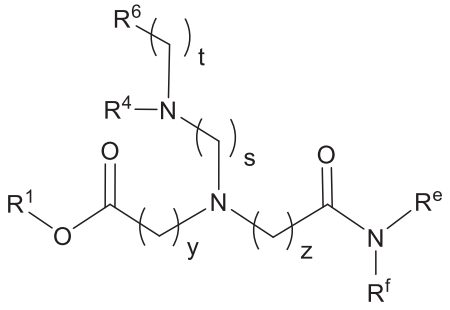
(I-N'),



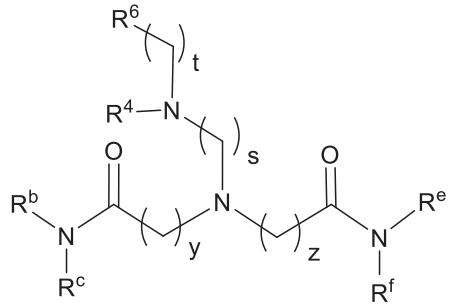
(I-N"),



(I-O),



(I-P), or



(I-Q),

wherein y and z are each independently an integer from 2 to 12,

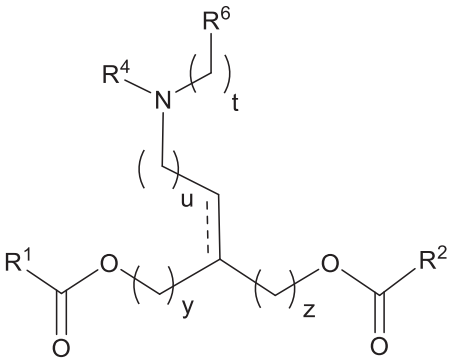
s is an integer from 2 to 24,

t is an integer from 1 to 12, and

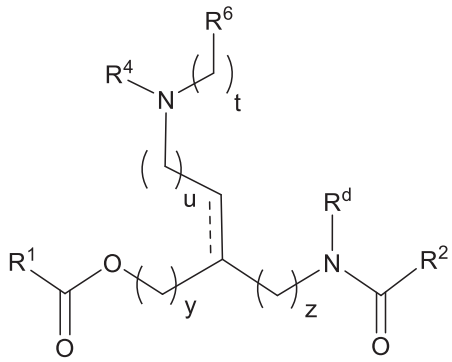
R^6 is hydrogen or hydroxyl,

or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof.

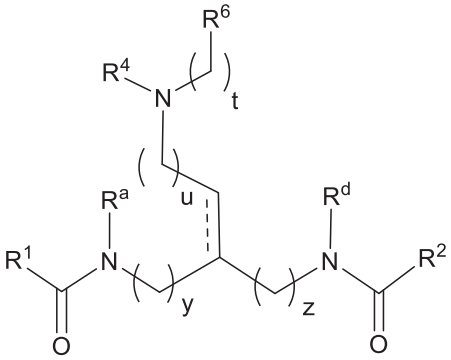
11. The compound of claim 2, which is a compound of Formula (II-N), (II-N'), (II-N"), (II-O), (II-P), or (II-Q):



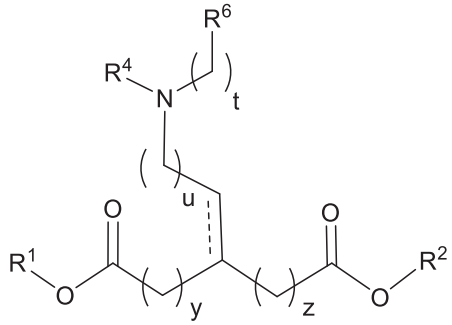
(II-N),



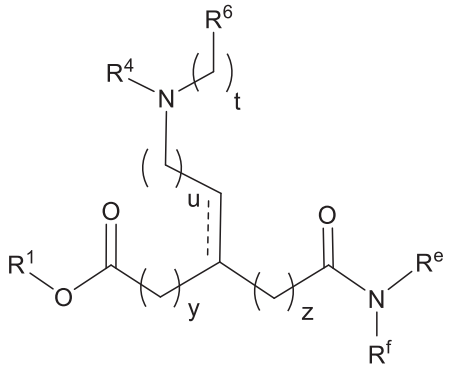
(II-N'),



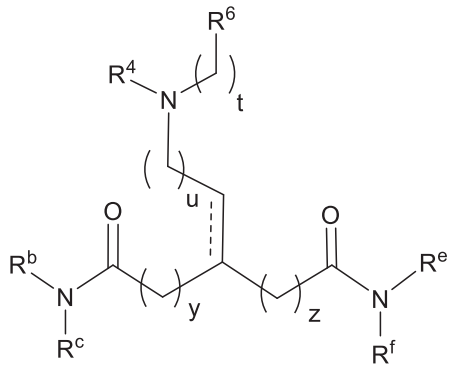
(II-N"),



(II-O),



(II-P), or



(II-Q),

wherein y and z are each independently an integer from 2 to 12,

u is an integer from 0 to 23,

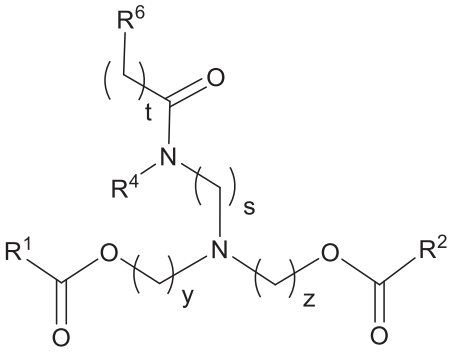
t is an integer from 1 to 12, and

R^6 is hydrogen or hydroxyl,

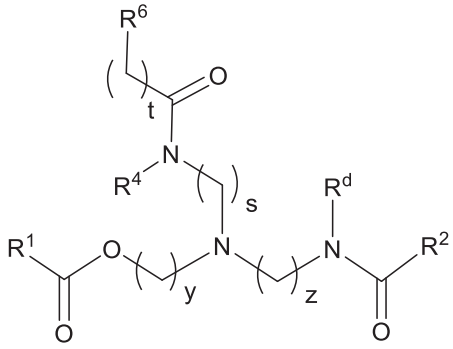
or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof.

12. The compound of any one of claims 1 to 11, wherein R^5 is $–CH_2CH_2OH$.

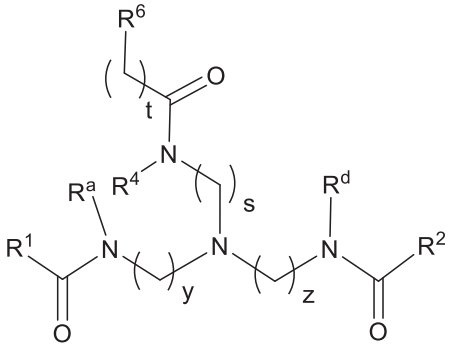
13. The compound of claim 1, which is a compound of Formula (I-R), (I-R'), (I-R"), (I-S), (I-T), or (I-U):



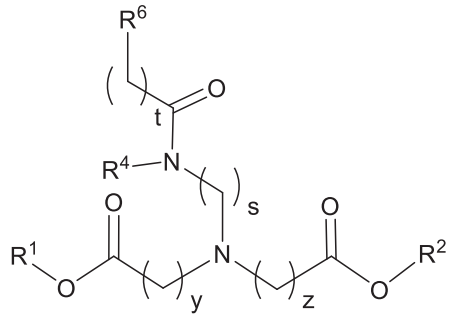
(I-R),



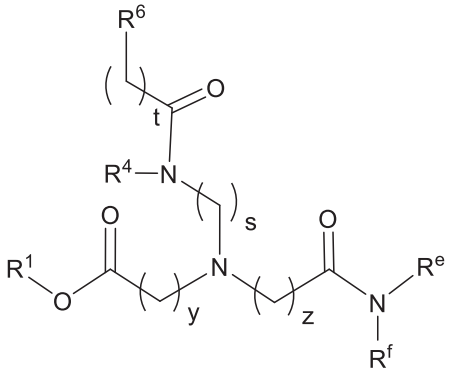
(I-R'),



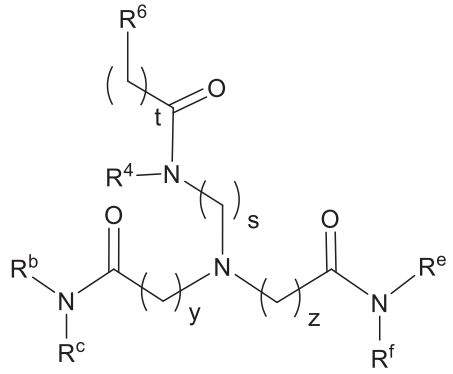
(I-R"),



(I-S),



(I-T), or



(I-U),

wherein y and z are each independently an integer from 2 to 12,

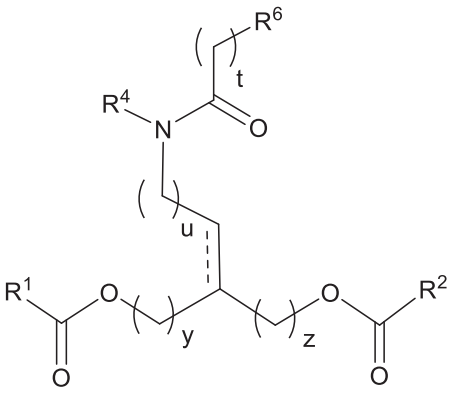
s is an integer from 2 to 24,

t is an integer from 1 to 12, and

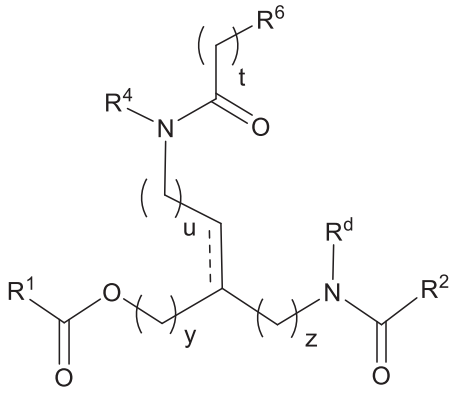
R^6 is hydrogen or hydroxyl,

or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof.

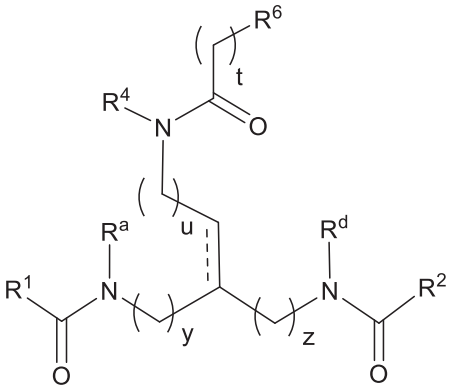
14. The compound of claim 2, which is a compound of Formula (II-R), (II-R'), (II-R"), (II-S), (II-T), or (II-U):



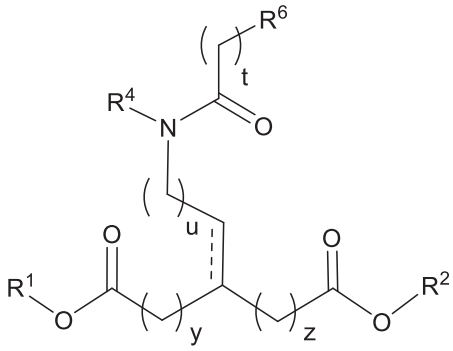
(II-R),



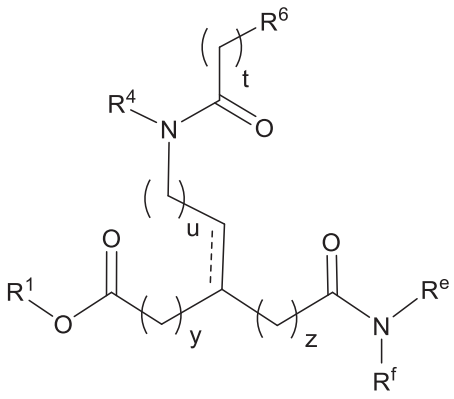
(II-R'),



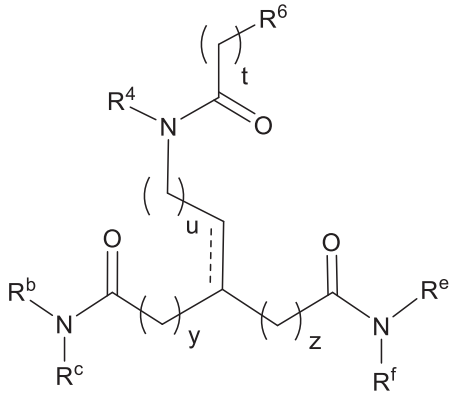
(II-R"),



(II-S),



(II-T), or



(II-U),

wherein y and z are each independently an integer from 2 to 12,

u is an integer from 0 to 23,

t is an integer from 1 to 12, and

R^6 is hydrogen or hydroxyl,

or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof.

15. The compound of any one of claims 2 to 14, wherein R^4 is C_1-C_{12} alkyl.

16. The compound of any one of claims 1 to 14, wherein R^4 is C_3-C_8 cycloalkyl.

17. The compound of any one of claims 1 to 16, wherein R^4 is unsubstituted.

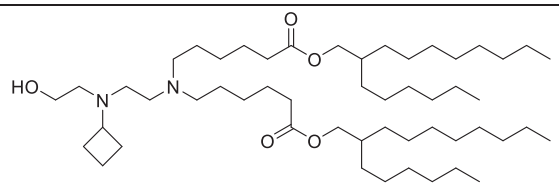
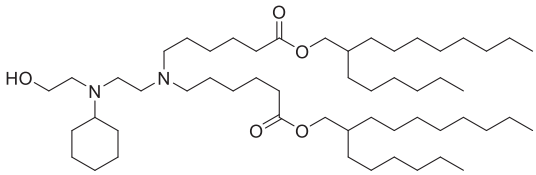
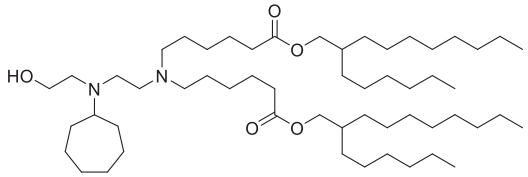
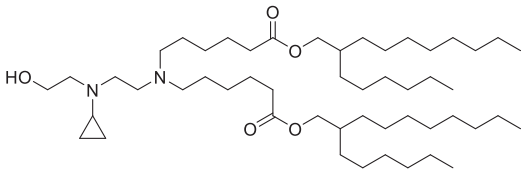
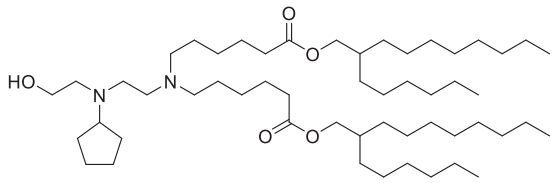
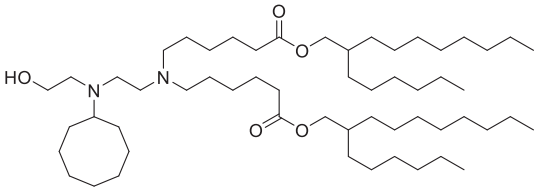
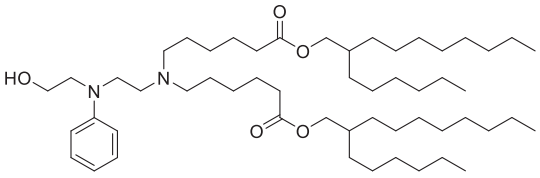
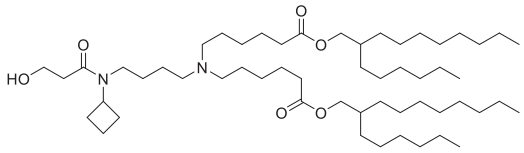
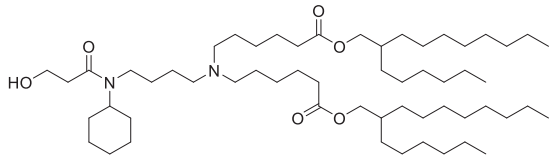
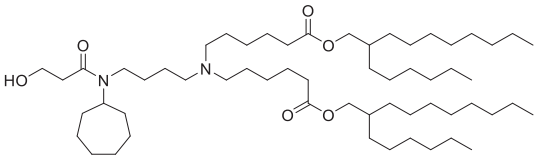
18. The compound of any one of claims 1 to 16, wherein R^4 is substituted with one hydroxyl.

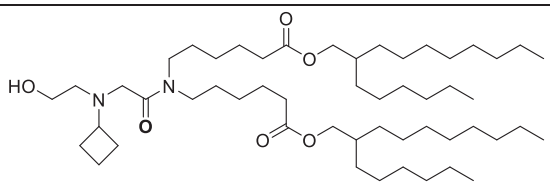
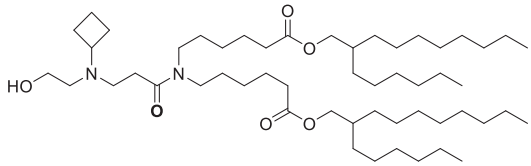
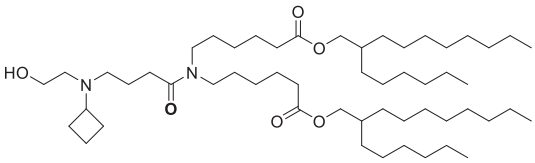
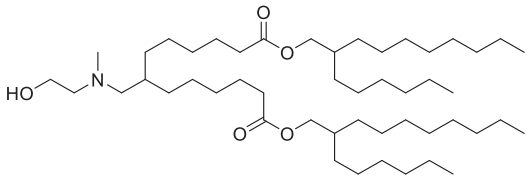
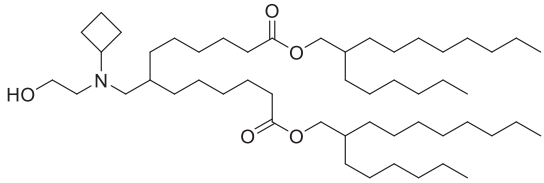
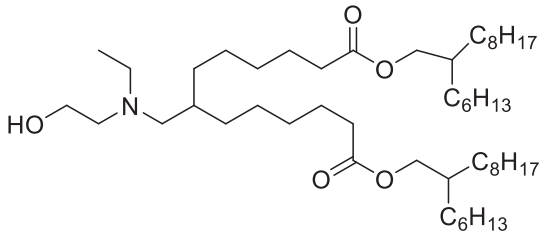
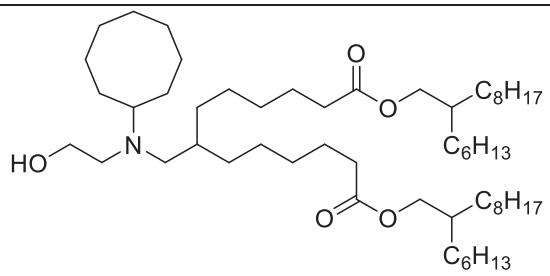
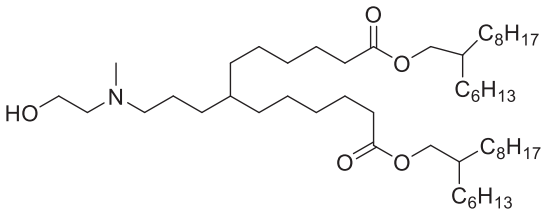
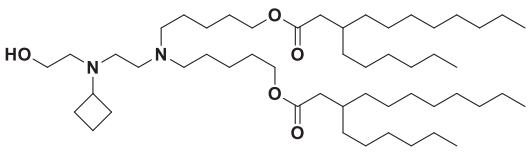
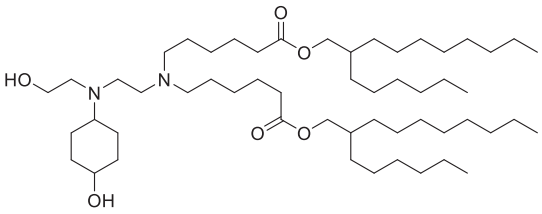
19. The compound of any one of claims 1 to 18, wherein R^1 and R^2 are each independently branched C_6-C_{24} alkyl or branched C_6-C_{24} alkenyl, preferably R^1 and R^2 are each independently -R^7-CH(R^8)(R^9), wherein R^7 is C_1-C_5 alkylene, and R^8 and R^9 are independently C_2-C_{10} alkyl or C_2-C_{10} alkenyl.

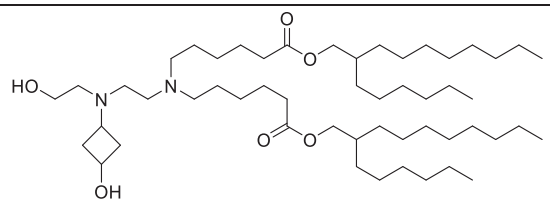
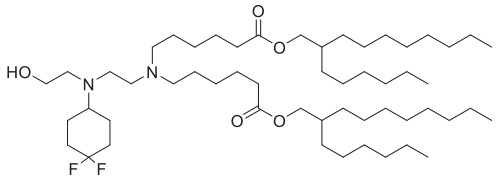
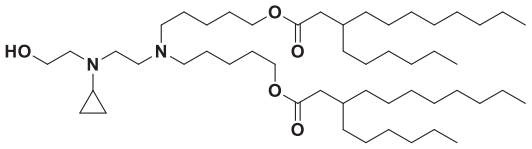
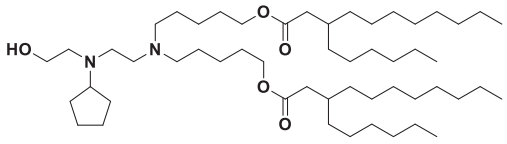
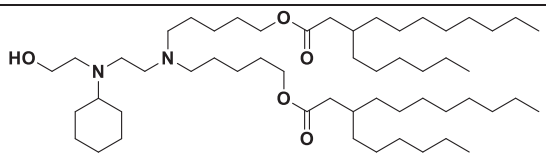
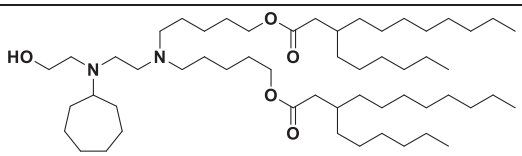
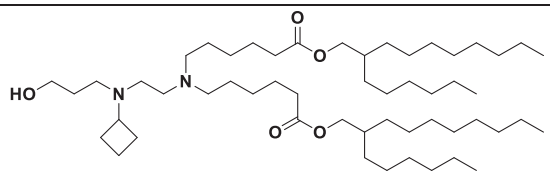
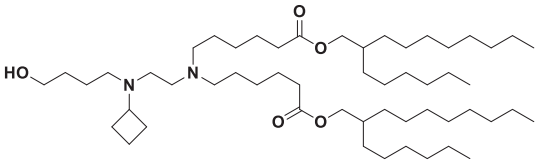
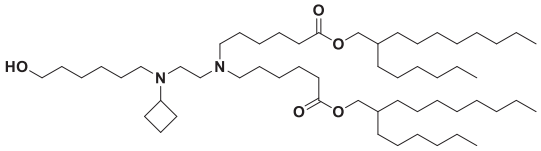
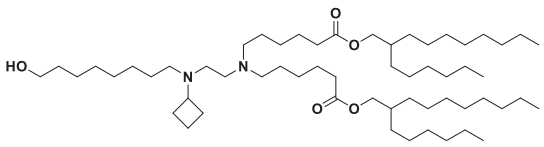
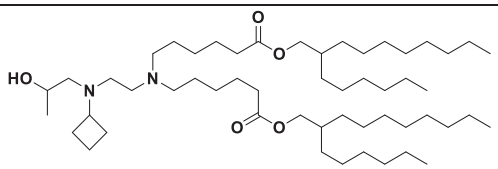
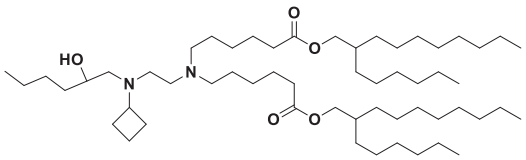
20. The compound of any one of claims 1 to **Error! Reference source not found.**, wherein R^a, R^b, R^d, and R^e are each independently H, and/or, wherein Rc and Rf are each independently branched C6-C24 alkyl or branched C_6-C_{24} alkenyl, preferably R^c and R^f are each independently -R^7-CH(R^8)(R^9), wherein R^7 is C_1-C_5 alkylene, and R^8 and R^9 are independently

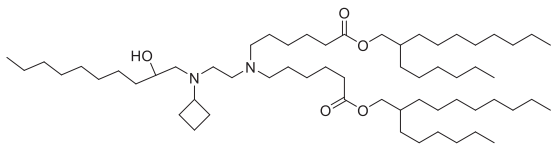
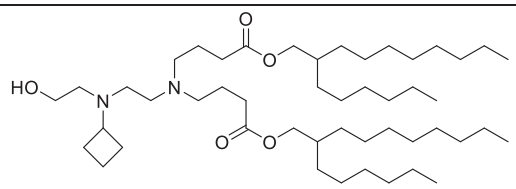
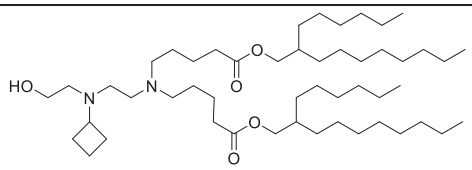
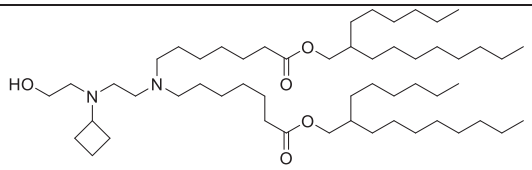
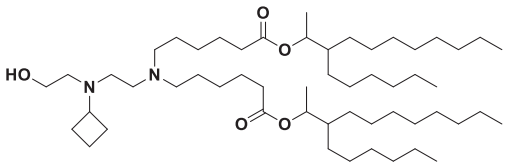
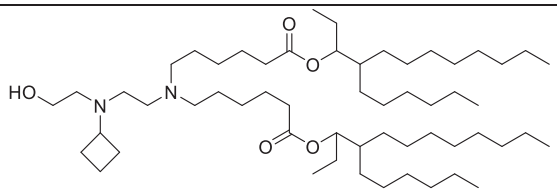
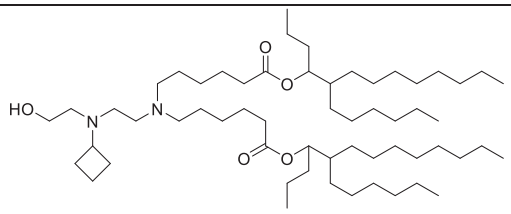
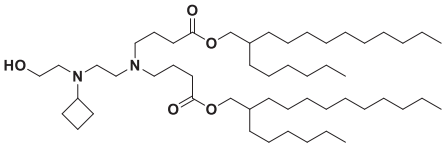
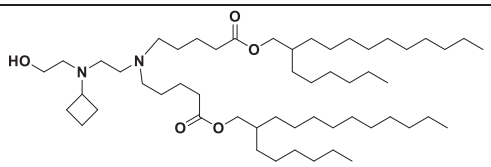
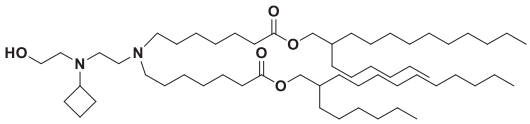
C_2-C_{10} alkyl or C_2-C_{10} alkenyl.

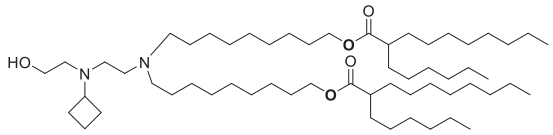
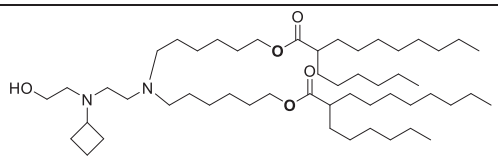
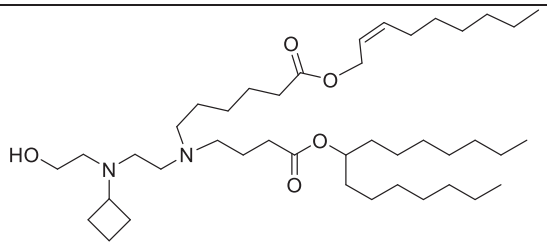
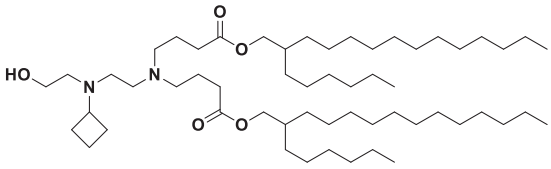
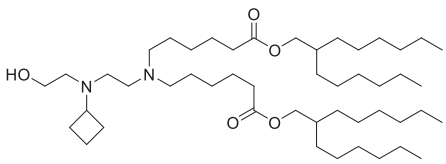
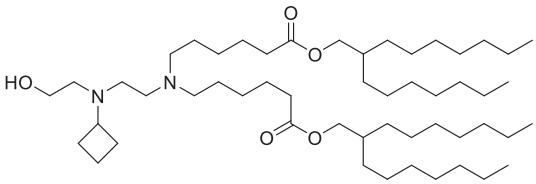
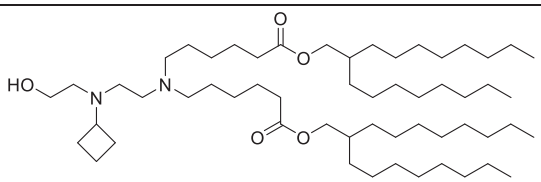
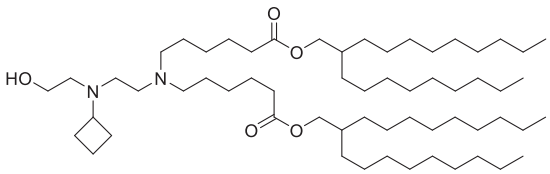
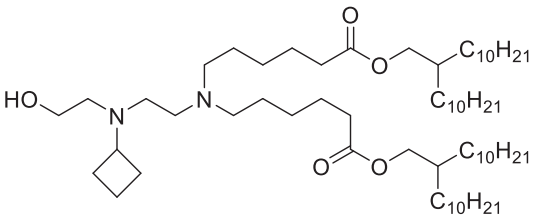
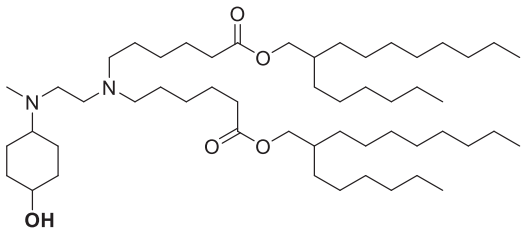
21. A compound which is

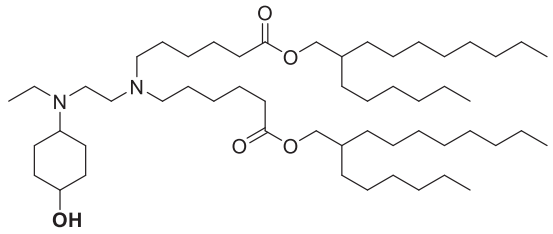
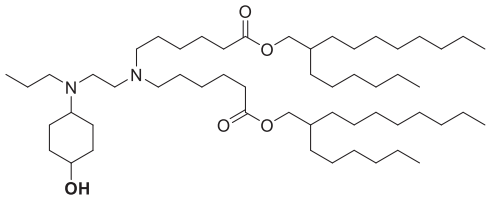
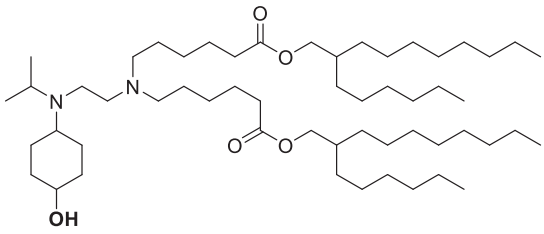
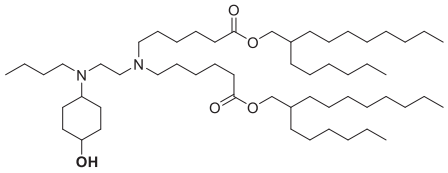
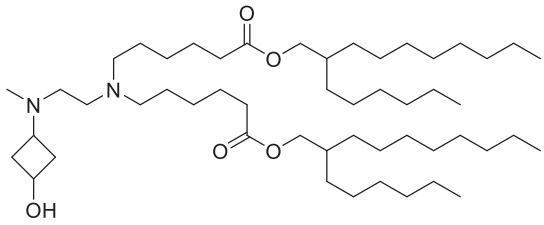
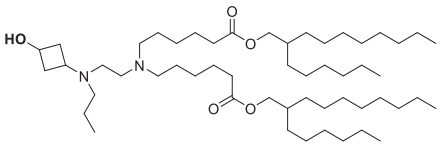
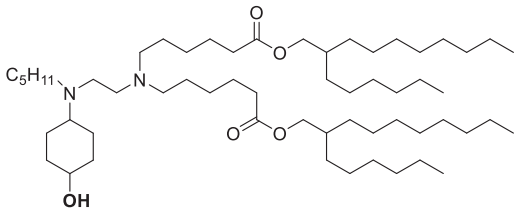
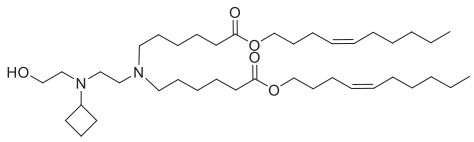
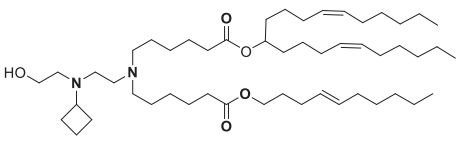
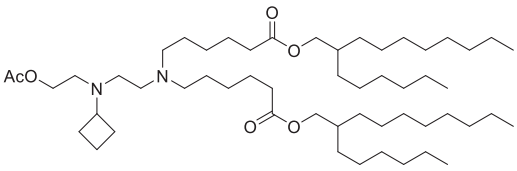
 Compound 1	 Compound 2
 Compound 3	 Compound 4
 Compound 5	 Compound 6
 Compound 7	 Compound 8
 Compound 9	 Compound 10

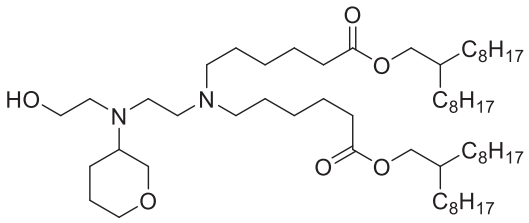
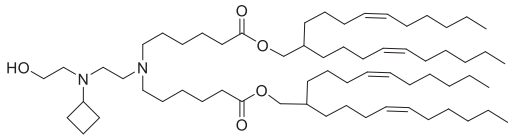
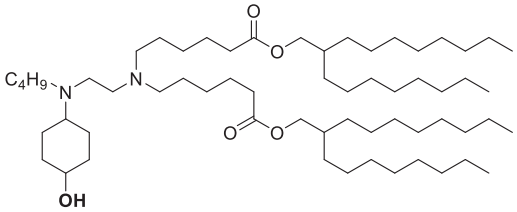
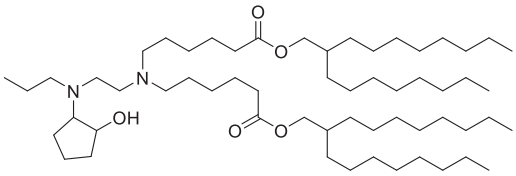
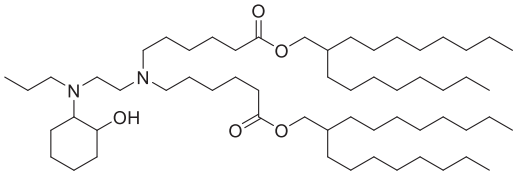
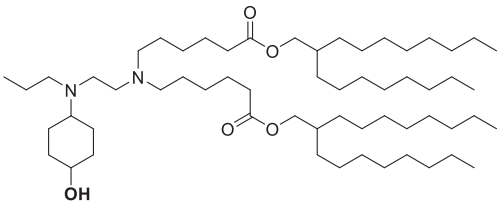
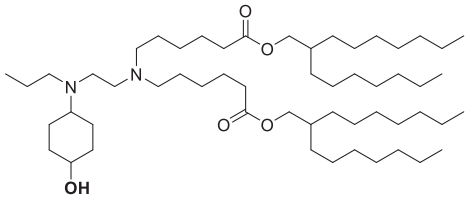
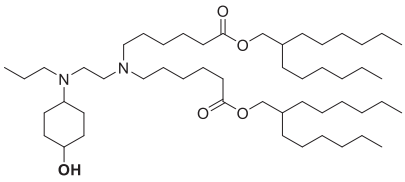
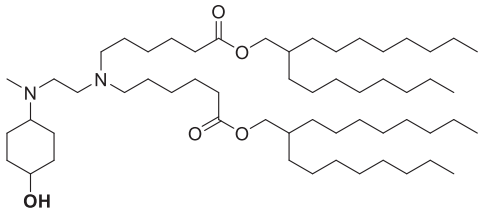
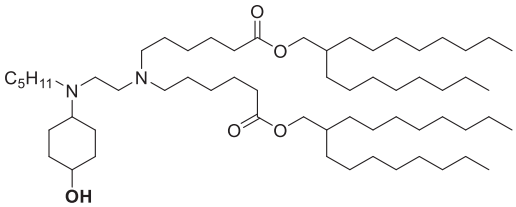
 Compound 11	 Compound 12
 Compound 13	 Compound 14
 Compound 15	 Compound 16
 Compound 17	 Compound 18
 Compound 20	 Compound 21

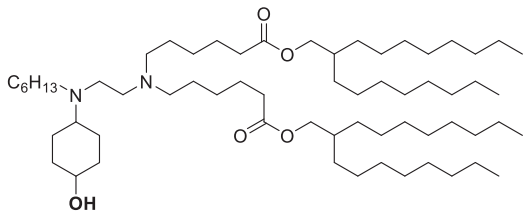
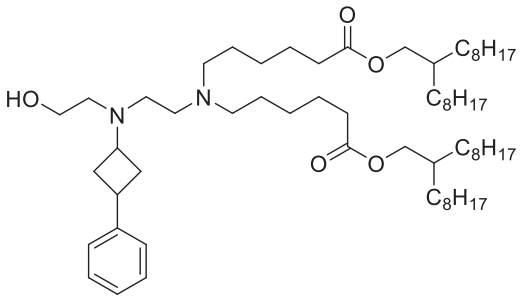
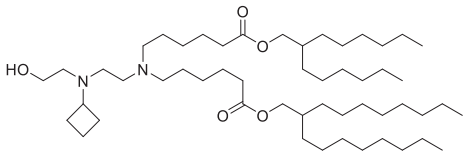
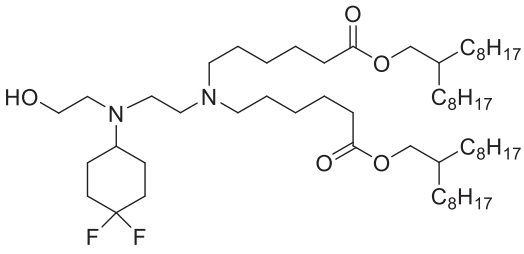
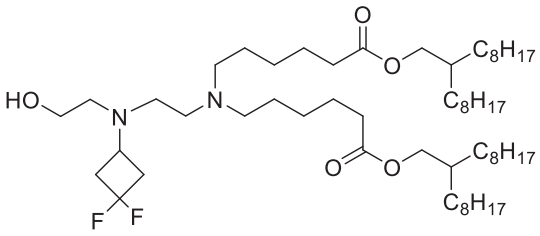
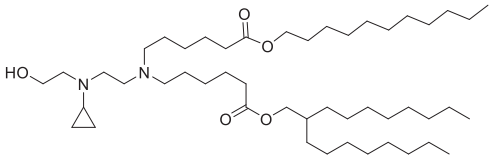
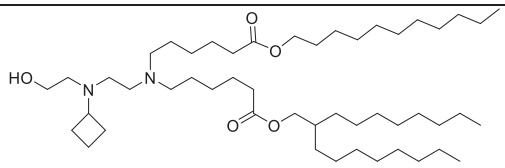
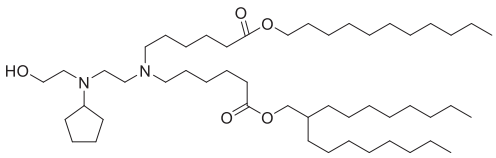
 Compound 22	 Compound 23
 Compound 24	 Compound 25
 Compound 26	 Compound 27
 Compound 28	 Compound 29
 Compound 30	 Compound 31
 Compound 32	 Compound 33

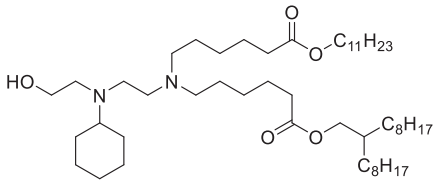
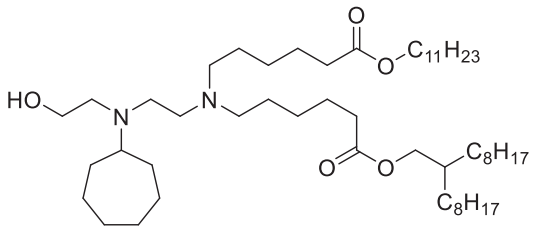
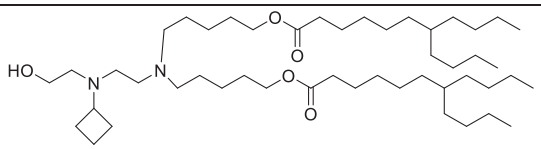
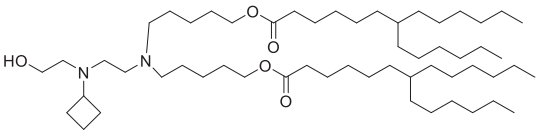
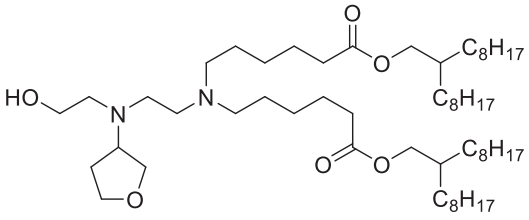
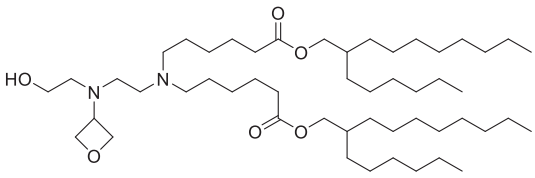
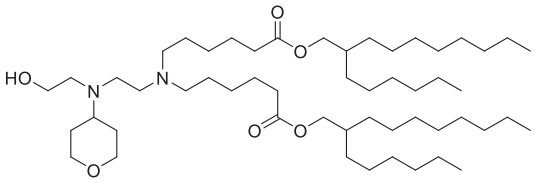
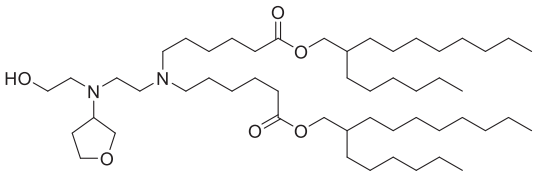
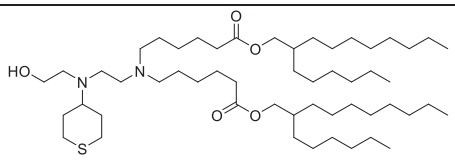
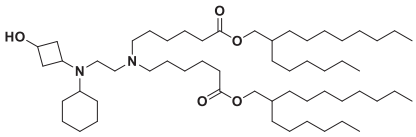
 Compound 34	 Compound 35
 Compound 36	 Compound 37
 Compound 38	 Compound 39
 Compound 40	 Compound 41
 Compound 42	 Compound 43

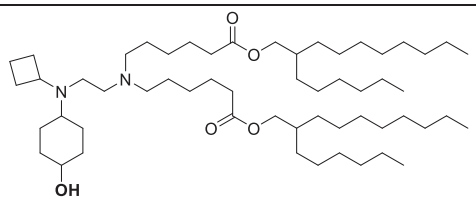
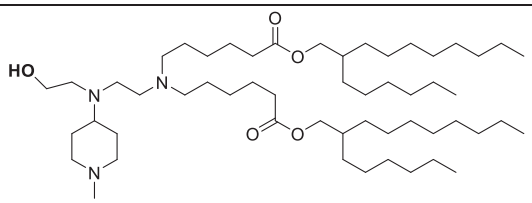
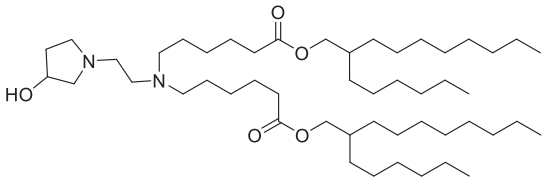
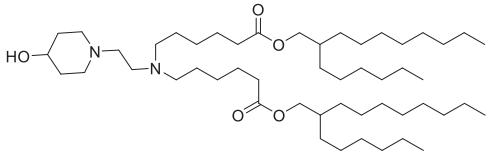
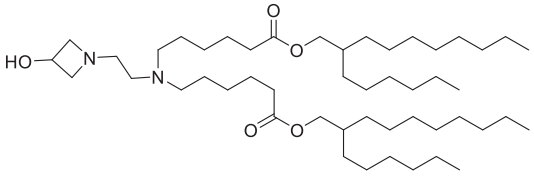
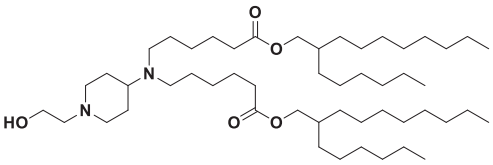
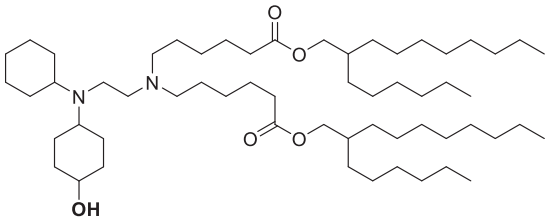
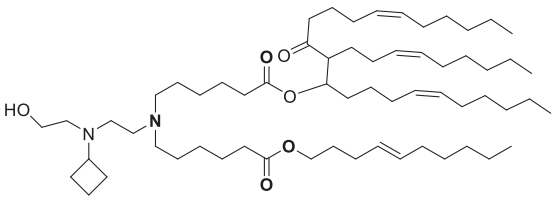
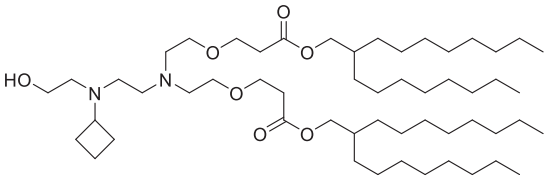
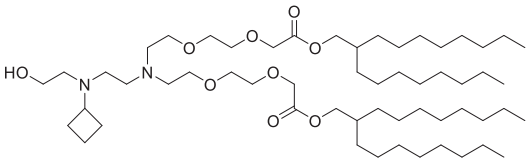
 Compound 44	 Compound 45
 Compound 46	 Compound 47
 Compound 48	 Compound 49
 Compound 50	 Compound 51
 Compound 52	 Compound 54

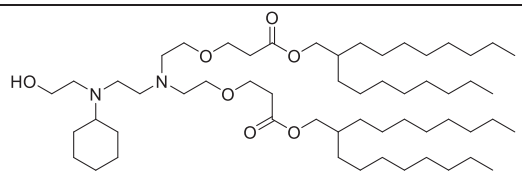
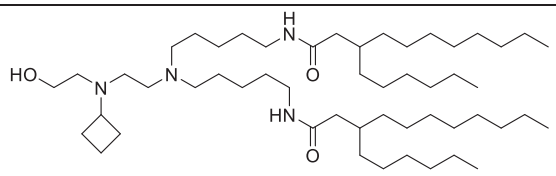
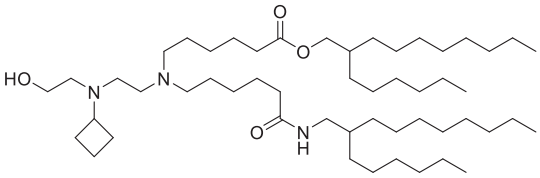
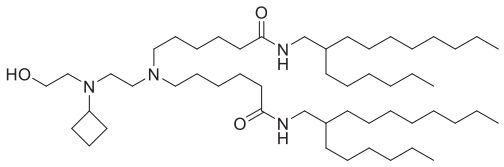
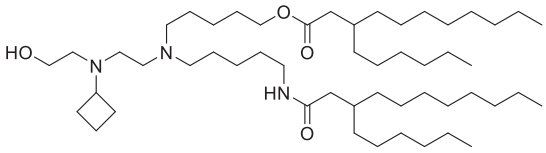
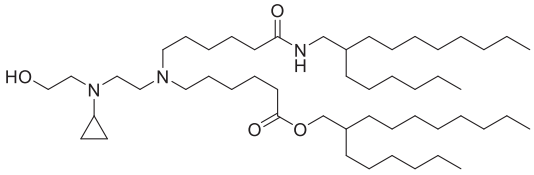
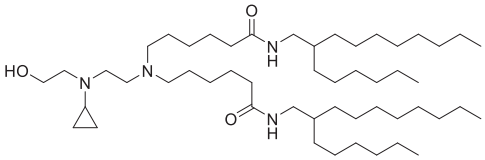
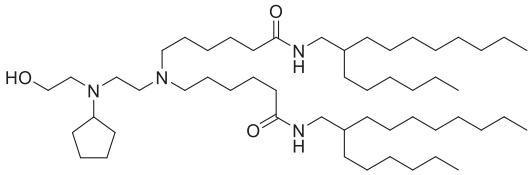
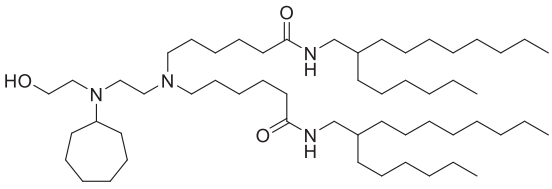
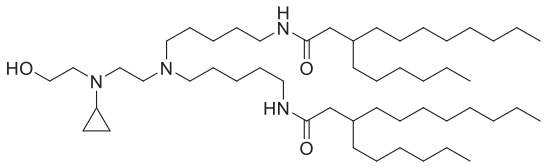
 Compound 55	 Compound 56
 Compound 57	 Compound 58
 Compound 59	 Compound 60
 Compound 61	 Compound 62
 Compound 63	 Compound 64

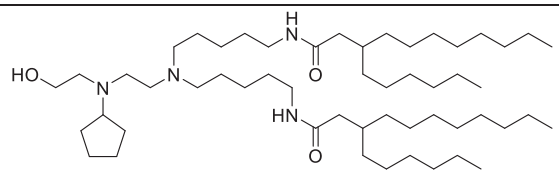
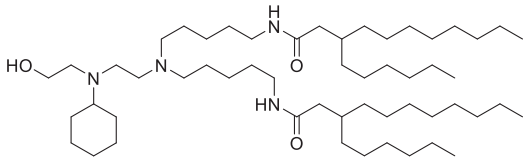
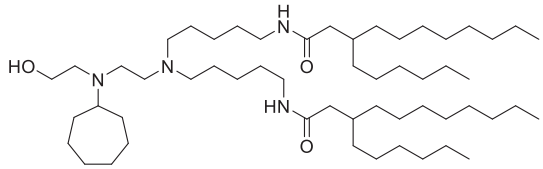
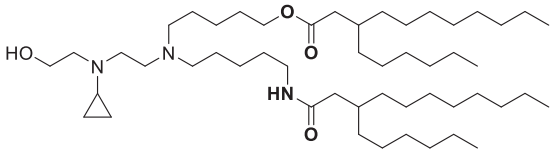
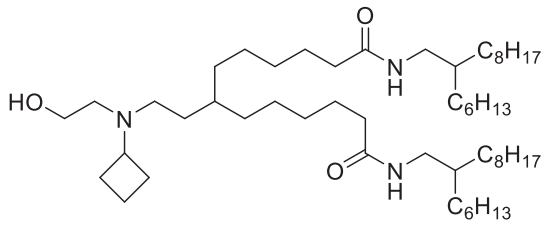
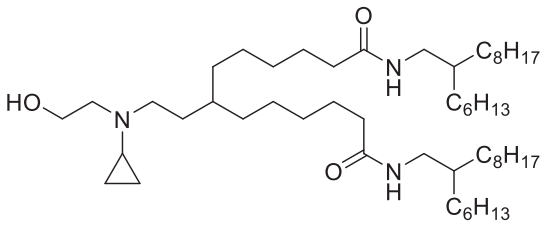
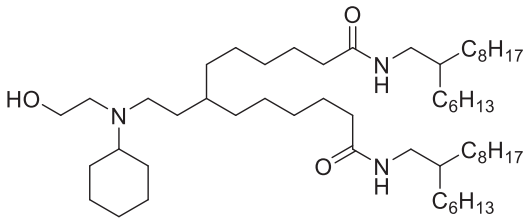
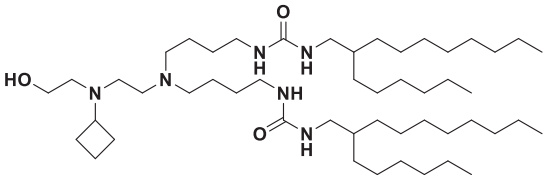
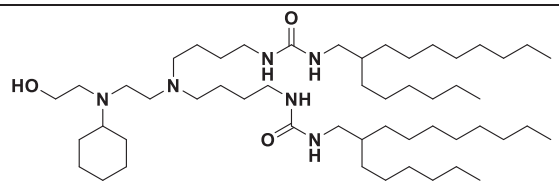
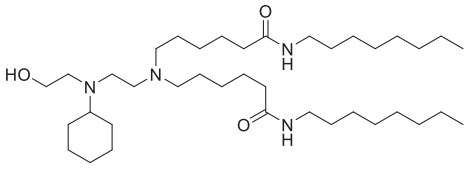
 Compound 65	 Compound 66
 Compound 67	 Compound 68
 Compound 69	 Compound 70
 Compound 71	 Compound 72
 Compound 73	 Compound 74

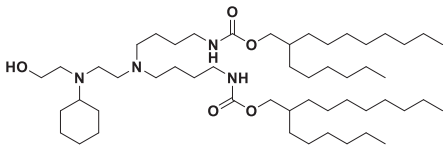
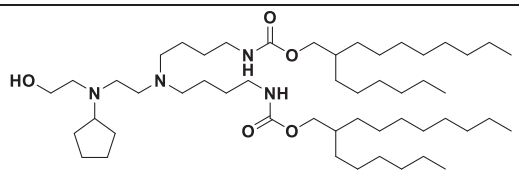
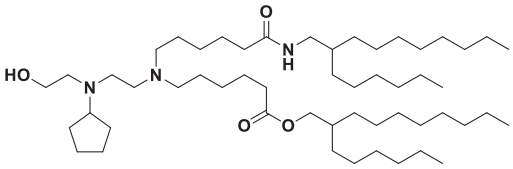
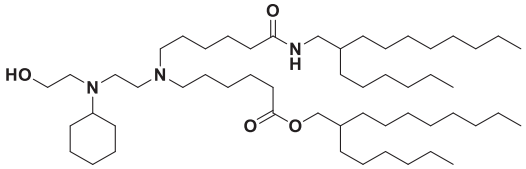
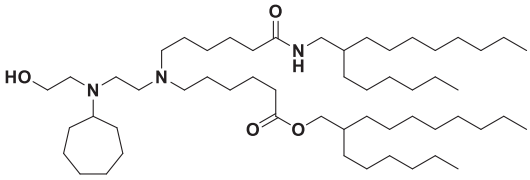
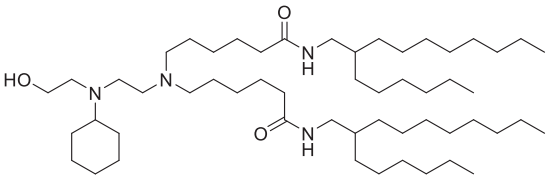
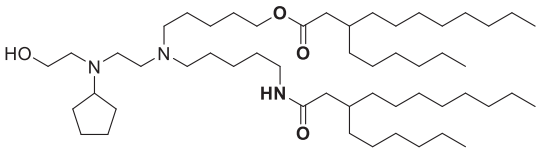
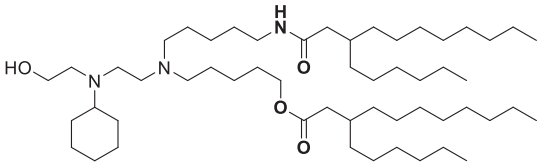
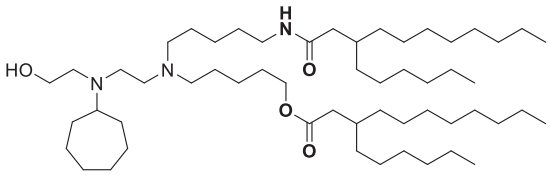
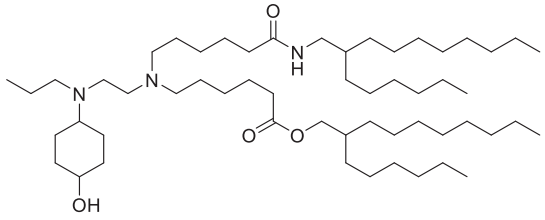
 Compound 75	 Compound 76
 Compound 77	 Compound 78
 Compound 79	 Compound 80
 Compound 81	 Compound 82

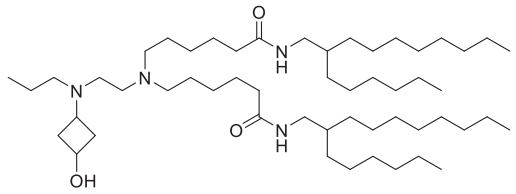
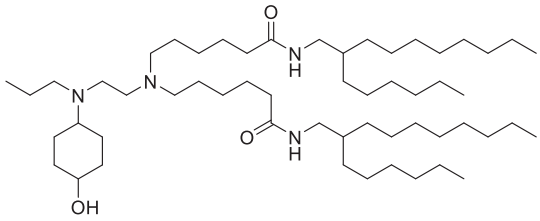
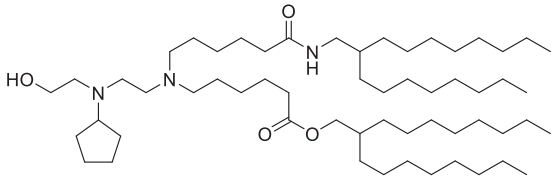
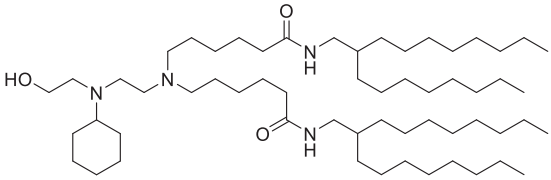
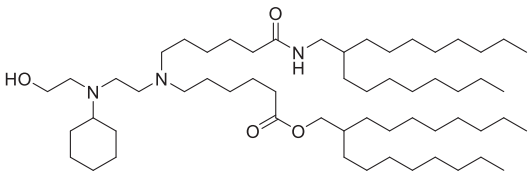
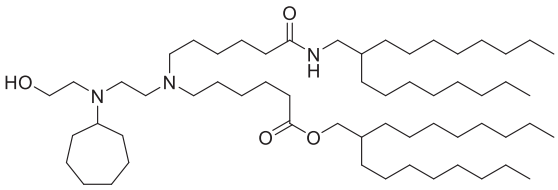
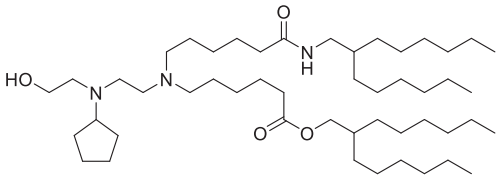
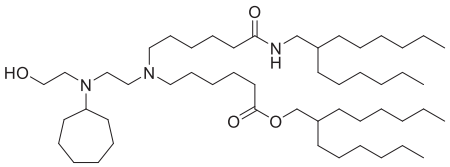
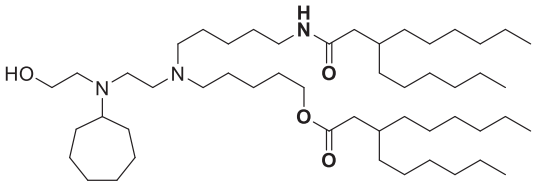
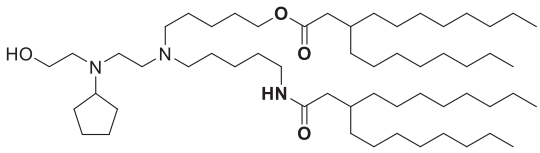
 Compound 83	 Compound 84
 Compound 85	 Compound 86
 Compound 87	 Compound 88
 Compound 89	 Compound 90
 Compound 91	 Compound 92

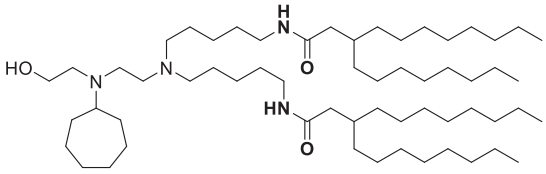
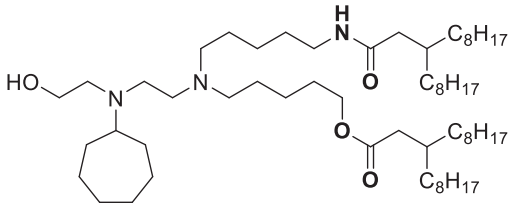
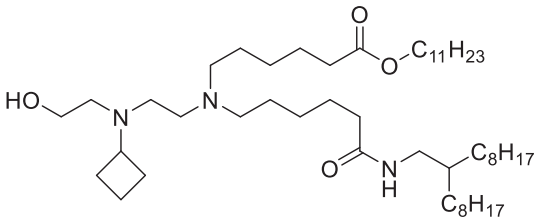
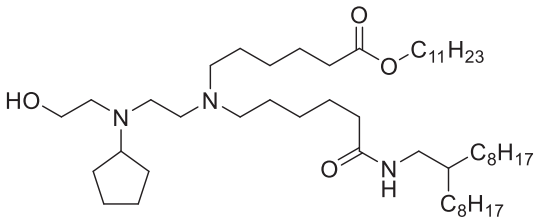
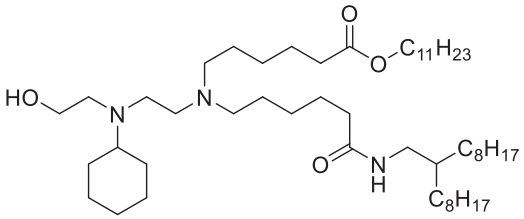
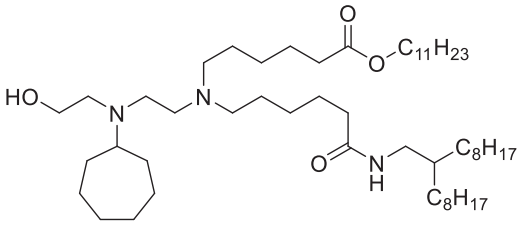
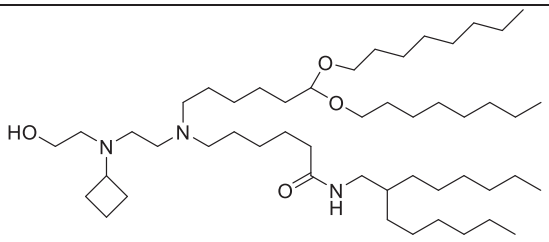
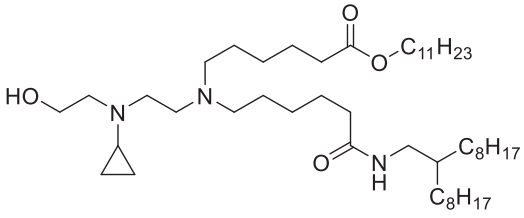
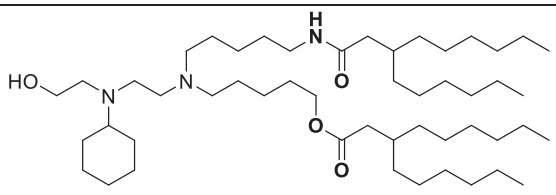
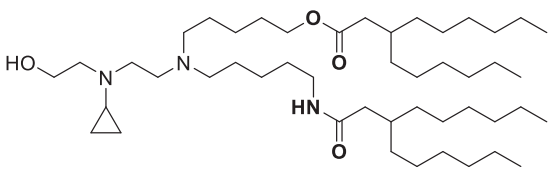
 Compound 93	 Compound 94
 Compound 95	 Compound 96
 Compound 97	 Compound 98
 Compound 99	 Compound 101
 Compound 102	 Compound 103

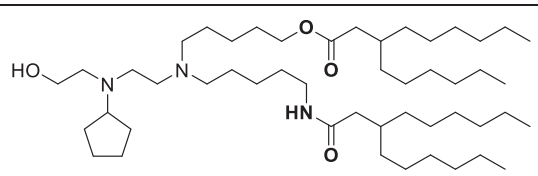
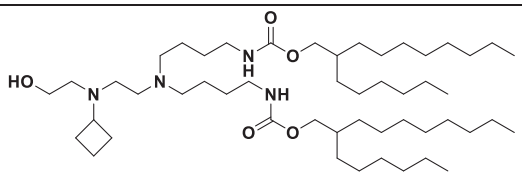
 Compound 104	 Compound 105
 Compound 106	 Compound 107
 Compound 108	 Compound 109
 Compound 110	 Compound 111
 Compound 112	 Compound 113

 Compound 114	 Compound 115
 Compound 116	 Compound 117
 Compound 118	 Compound 119
 Compound 120	 Compound 121
 Compound 122	 Compound 123

 Compound 124	 Compound 125
 Compound 126	 Compound 127
 Compound 128	 Compound 129
 Compound 130	 Compound 131
 Compound 132	 Compound 133

 Compound 134	 Compound 135
 Compound 136	 Compound 137
 Compound 138	 Compound 139
 Compound 140	 Compound 141
 Compound 142	 Compound 143

 Compound 144	 Compound 145
 Compound 146	 Compound 147
 Compound 148	 Compound 149
 Compound 150	 Compound 151
 Compound 152	 Compound 153

	
Compound 154	Compound 155

or a pharmaceutically acceptable salt, prodrug or stereoisomer thereof.

22. A composition comprising the compound of any one of claims 1 to 21, and a therapeutic or prophylactic agent.

23. The composition of claim 22, further comprising one or more of the following:

(i) further comprising structural lipids, preferably wherein the one or more structural lipids is DSPC,

(ii) further comprising a steroid, preferably wherein the steroid is cholesterol,

(iii) further comprising one or more polymer conjugated lipids, preferably wherein the polymer conjugated lipids is DMG-PEG2000 or DMPE-PEG2000.

24. The composition of claim 23, wherein the therapeutic or prophylactic agent comprises at least one mRNA encoding an antigen or a fragment or epitope thereof, preferably wherein the mRNA is either monocistronic mRNA or multicistronic mRNA, or wherein the mRNA encodes a pathogenic antigen, more preferably wherein the antigen is a tumor associated antigen.

25. The composition of claim 23 or 24, wherein the mRNA comprises one or more functional nucleotide analog, preferably wherein the functional nucleotide analog is one or more selected from selected from pseudouridine, 1-methyl-pseudouridine and 5-methylcytosine.

26. The composition of any one of claims 22 to 25, wherein the composition is a nanoparticle.

27. A lipid nanoparticle comprising the compound of any one of claims 1 to 0, or the composition of any one of claims 22 to 25.

28. A pharmaceutical composition comprising the compound of any one of claims 1 to 21, the composition of any one of claims 22 to 25, or the lipid nanoparticle of claim 27, and a pharmaceutically acceptable excipient or diluent.