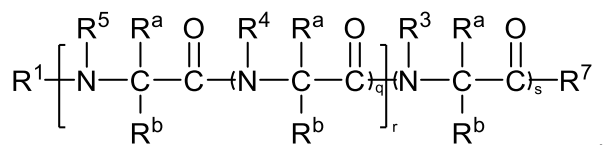


2. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 1, wherein m is 0; n is 0; s is an integer from 1 to 5; t is 0; r is an integer from 1 to 5; o is 0; q is 2; and p is 1, and having a structure:



3. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 2, wherein:

R^1 is H;

each R^3 independently is C_8 - C_{24} alkyl;

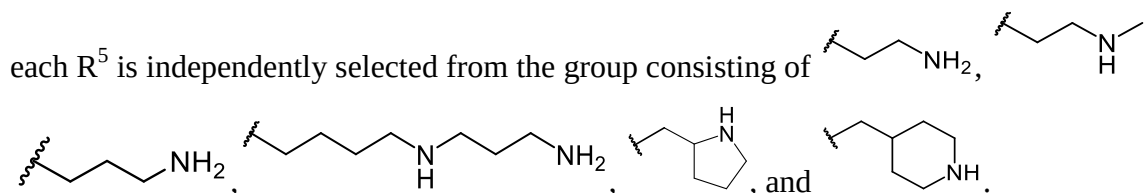
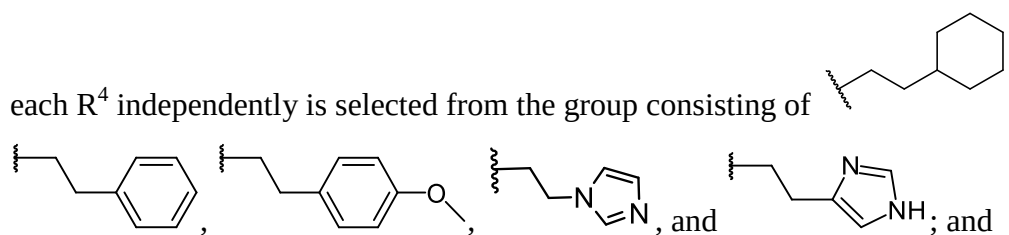
each R^4 is independently a neutral spacer moiety that is a C_1 - C_4 -alkyl substituted by cycloalkyl, heterocyclalkyl, alkylaryl, arylalkyl, alkylheteroaryl, heteroarylalkyl, alkoxy, alkoxyalkyl, or hydroxyalkyl, wherein each cycloalkyl, heterocyclalkyl, alkylaryl, arylalkyl, alkylheteroaryl, heteroarylalkyl, alkoxy, alkoxyalkyl, or hydroxyalkyl is optionally substituted with one or more substituents -OH, halo, or alkoxy;

each R^5 is independently selected from the group consisting of aminoalkyl, alkylaminoalkyl, aminoalkylaminoalkyl, guanidinoalkyl, N-heterocyclalkyl, and N-heteroaryl;

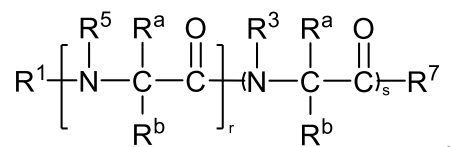
R^7 is NH_2 ; and

each of R^a and R^b is H.

4. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 2, wherein



5. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 1, wherein m is 0; n is 0; s is an integer from 1 to 5; t is 0; r is an integer from 2 to 10; o is 0; q is 0; and p is 1, and having a structure:



6. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 5, wherein

R^1 is H;

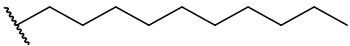
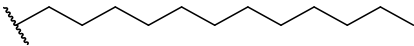
each R^3 independently is C_8 - C_{24} alkyl;

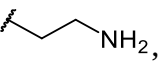
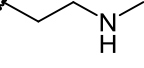
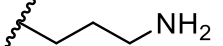
each R^5 is independently selected from the group consisting of aminoalkyl, alkylaminoalkyl, aminoalkylaminoalkyl, guanidinoalkyl, N-heterocyclalkyl, and N-heteroaryl;

R^7 is NH_2 ; and

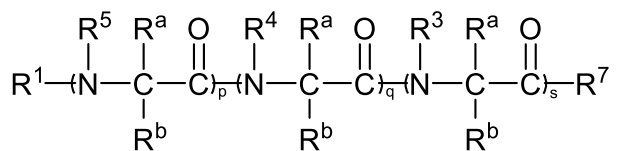
each of R^a and R^b is H.

7. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 5, wherein

each R^3 independently is  or ; and

each R^5 is independently selected from the group consisting of , , and .

8. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 1, wherein m is 0; n is 0; s is 3 or 4; t is 0; r is 1; o is 0; q is 2; and p is 2, and having a structure:



9. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 8, wherein:

R¹ is H or alkyl;

each R³ independently is C₈-C₂₄alkyl;

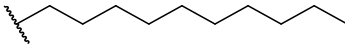
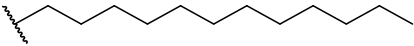
each R⁴ is independently a neutral spacer moiety that is a C₁-C₄-alkyl substituted by cycloalkyl, heterocyclalkyl, alkylaryl, arylalkyl, alkylheteroaryl, heteroarylalkyl, alkoxy, alkoxyalkyl, or hydroxyalkyl, wherein each cycloalkyl, heterocyclalkyl, alkylaryl, arylalkyl, alkylheteroaryl, heteroarylalkyl, alkoxy, alkoxyalkyl, or hydroxyalkyl is optionally substituted with one or more substituents –OH, halo, or alkoxy;

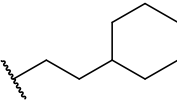
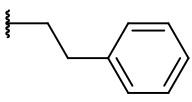
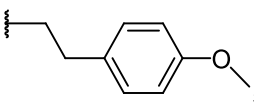
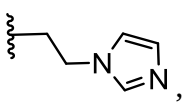
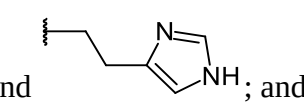
each R⁵ is independently selected from the group consisting of aminoalkyl, alkylaminoalkyl, aminoalkylaminoalkyl, guanidinoalkyl, N-heterocyclalkyl, N-heteroaryl, hydroxyalkyl, hydroxyether, alkoxyalkyl, and hydroxylheteroalkyl;

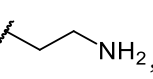
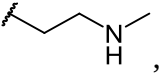
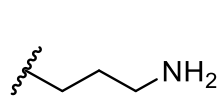
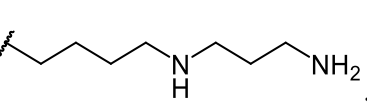
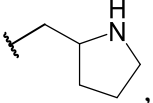
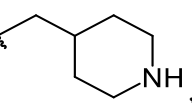
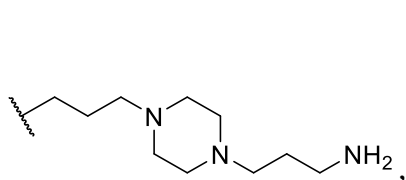
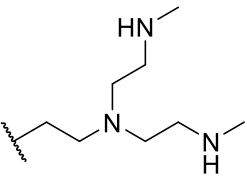
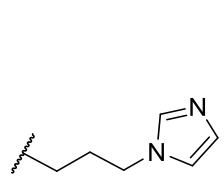
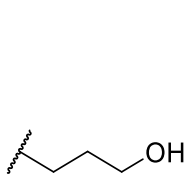
R⁷ is NH₂; and

each of R^a and R^b is H.

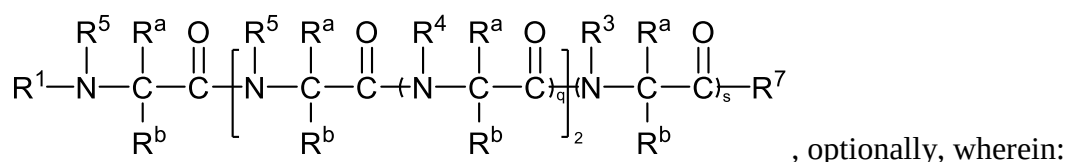
10. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 8, wherein:

each R³ independently is  or  ;

each R⁴ independently is selected from the group consisting of , , , , and ; and

each R⁵ is independently selected from the group consisting of , , , , , , , , , and .

11. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 1, wherein m is 0; n is 0; s is 3 or 4; t is 0; r is 3; o is 0; q is 2; and p is 1, and having a structure:



R^1 is H or alkyl;

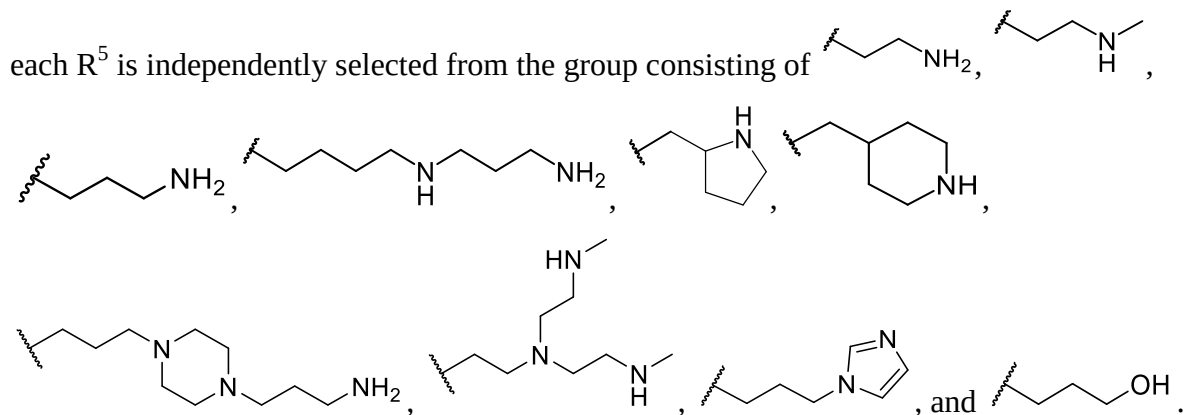
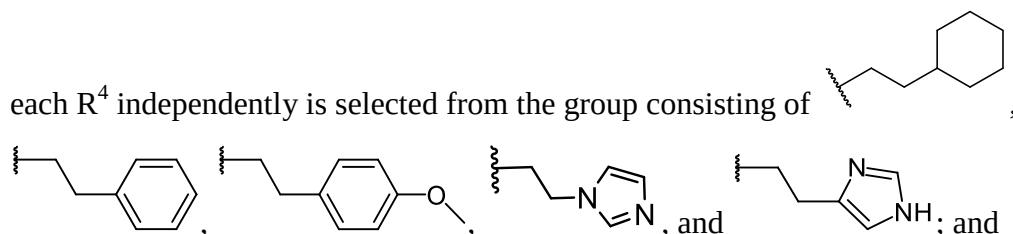
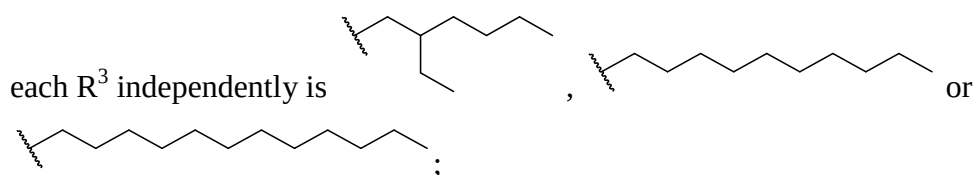
each R^3 independently is C_8-C_{24} alkyl;

each R^4 is independently a neutral spacer moiety that is a C_1-C_4 -alkyl substituted by cycloalkyl, heterocyclalkyl, alkylaryl, arylalkyl, alkylheteroaryl, heteroarylalkyl, alkoxy, alkoxyalkyl, or hydroxyalkyl, wherein each cycloalkyl, heterocyclalkyl, alkylaryl, arylalkyl, alkylheteroaryl, heteroarylalkyl, alkoxy, alkoxyalkyl, or hydroxyalkyl is optionally substituted with one or more substituents $-OH$, halo, or alkoxy;

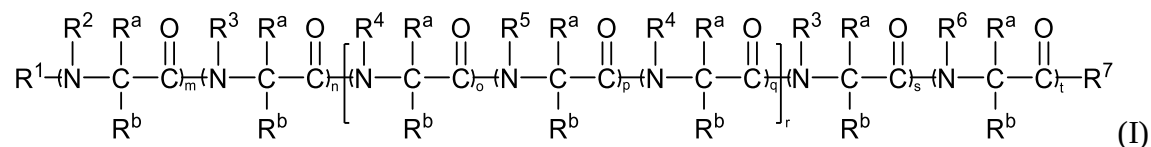
each R^5 is independently selected from the group consisting of aminoalkyl, alkylaminoalkyl, aminoalkylaminoalkyl, guanidinoalkyl, N-heterocyclalkyl, and N-heteroaryl, hydroxyalkyl, hydroxyether, alkoxyalkyl, and hydroxylheteroalkyl;

R^7 is NH_2 ; and

each of R^a and R^b is H, optionally, wherein:



12. A tertiary amino lipidated and PEGylated peptide compound of formula (I) or salt thereof:



wherein:

m is an integer from 0 to 10;

n is an integer from 0 to 5;

s is an integer from 0 to 10;

t is an integer from 0 to 5;

wherein at least one of m and t is nonzero, and wherein at least one of n and s is nonzero;

r is an integer from 1 to 20;

each o is independently an integer 0, 1, or 2;

each q is independently an integer 0, 1, or 2;

each p is independently an integer 1 or 2;

R^1 is -H, alkyl, alkylaryl, -COR^{1a} or a lipid moiety,

wherein R^{1a} is -H, -OH, alkyl, aryl, alkylaryl, -O-alkyl, or -O-alkylaryl;

each R^2 is independently an ethylene glycol moiety of the formula

-CH₂CH₂O(CH₂CH₂O)_uCH₃, and wherein each u is independently an integer from 2 to 200;

each R^3 is independently a lipid moiety;

each R^4 is independently a neutral spacer moiety or a lipid moiety;

each R^5 is independently a cationic moiety;

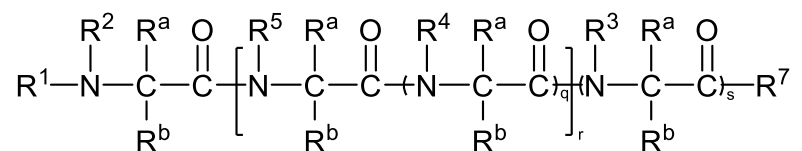
each R^6 is independently an ethylene glycol moiety of the formula

-CH₂CH₂O(CH₂CH₂O)_vCH₃, and wherein each v is independently an integer from 2 to 200;

R^7 is -H, alkyl, acyl, -OH, -OR^{7a}, -NH₂, -NHR^{7a}, or a lipid moiety, wherein R^{7a} is alkyl, acyl, or a lipid moiety; and

each R^a and R^b is independently -H, C₁-C₄-alkyl, or a side chain moiety found on a naturally- or non-naturally-occurring amino acid.

13. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 12, wherein m is 1; n is 0; s is 3 or 4; t is 0; r is 1 or 2; o is 0; q is 2; and p is 1, and having a structure:



14. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 13, wherein:

R^1 is H;

R^2 is an ethylene glycol moiety of the formula $-\text{CH}_2\text{CH}_2\text{O}(\text{CH}_2\text{CH}_2\text{O})_u\text{CH}_3$, and wherein each u is independently an integer from 2 to 50;

each R^3 independently is $\text{C}_8\text{-C}_{24}\text{alkyl}$;

each R^4 is independently a neutral spacer moiety that is a $\text{C}_1\text{-C}_4\text{-alkyl}$ substituted by cycloalkyl, heterocyclalkyl, alkylaryl, arylalkyl, alkylheteroaryl, heteroarylalkyl, alkoxy, alkoxyalkyl, or hydroxyalkyl, wherein each cycloalkyl, heterocyclalkyl, alkylaryl, arylalkyl, alkylheteroaryl, heteroarylalkyl, alkoxy, alkoxyalkyl, or hydroxyalkyl is optionally substituted with one or more substituents $-\text{OH}$, halo, or alkoxy;

each R^5 is independently selected from the group consisting of aminoalkyl, alkylaminoalkyl, aminoalkylaminoalkyl, guanidinoalkyl, N-heterocyclalkyl, and N-heteroaryl, hydroxyalkyl, hydroxyether, alkoxyalkyl, and hydroxylheteroalkyl;

R^7 is NH_2 ; and

each of R^a and R^b is H.

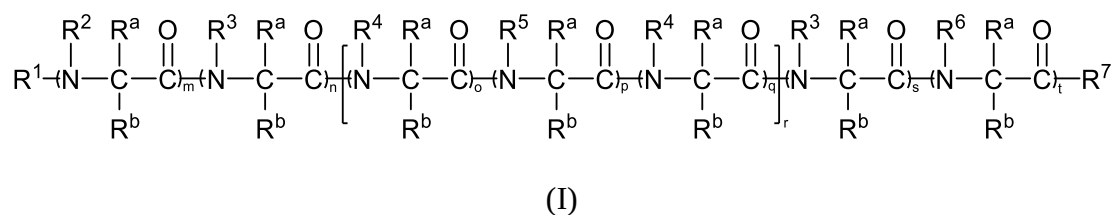
15. A complex comprising one or more of the tertiary amino lipidated and/or PEGylated cationic peptide compounds of claim 1, complexed to a polyanionic compound optionally, optionally wherein the polyanionic compound comprises a nucleic acid, optionally wherein the polyanionic compound comprises a nucleic acid and wherein the nucleic acid is an mRNA encoding a polypeptide, optionally wherein the polyanionic compound comprises a nucleic acid and wherein the complex comprises at least one of the tertiary amino lipidated and/or PEGylated cationic peptide and the nucleic acid at a mass ratio of between 0.5:1 and 50:1, optionally wherein the complex comprises: the one or more tertiary amino lipidated and/or PEGylated cationic peptide compounds, a nucleic acid, a phospholipid, a structural lipid, and a PEG lipid.

16. A method of delivering a polyanionic compound to a cell comprising contacting the cell with the complex of claim 15, optionally wherein the polyanionic compound comprises a nucleic acid which is the mRNA encoding a polypeptide and the cell expresses the polypeptide after being contacted with the complex.

17. A method of forming the complex of claim 15, comprising contacting the tertiary amino lipidated and/or PEGylated cationic peptide compound with the polyanionic compound.

18. A compound selected from the compounds listed in Table 1A.

19. A tertiary amino lipidated and/or PEGylated cationic peptide compound of formula (I) or a salt thereof:



of claim 1 wherein:

m is 0;

n is 0;

s is an integer from 1 to 5;

t is 0;

r is 1;

each o is 0;

each q is 0;

each p is 1;

R¹ is -H;

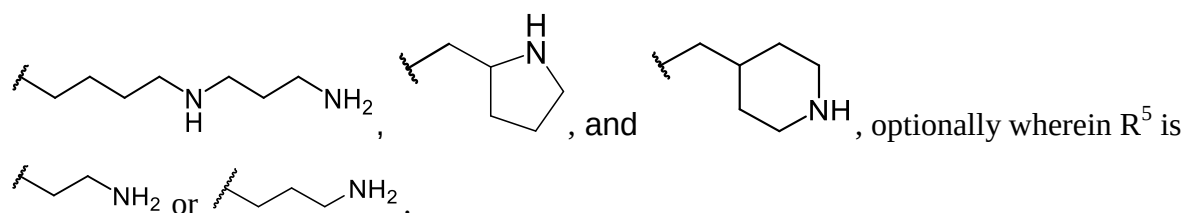
each R³ is independently selected from C₈-C₂₄alkyl;

R⁵ is selected from aminoalkyl, alkylaminoalkyl, aminoalkylaminoalkyl, guanidinoalkyl, N-heterocyclalkyl, N-heteroaryl, hydroxyalkyl, hydroxyether, alkoxyalkyl, and hydroxylheteroalkyl;

each R^a and R^b are independently -H, C₁-C₄-alkyl, or a side chain moiety found on a naturally- or non-naturally-occurring amino acid, optionally wherein each R³ is independently C₈-C₁₂ alkyl, optionally wherein each R³ is independently selected from the

20. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 19, wherein R⁵ is aminoalkyl, alkylaminoalkyl, aminoalkylaminoalkyl, guanidinoalkyl,

from the group consisting of: , , , ,



21. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 19, wherein R^a and R^b are –H.

22. A complex comprising one or more of the tertiary amino lipidated and/or PEGylated cationic peptide compounds of claim 19, complexed to a polyanionic compound, optionally wherein the polyanionic compound comprises a nucleic acid, optionally wherein the polyanionic compound comprises a nucleic acid and wherein the nucleic acid is an mRNA encoding a polypeptide, optionally wherein the polyanionic compound comprises a nucleic acid and wherein the complex comprises at least one of the tertiary amino lipidated and/or PEGylated cationic peptide and the nucleic acid at a mass ratio of between 0.5:1 and 50:1.

23. The complex of claim 19, wherein the complex comprises: the one or more tertiary amino lipidated and/or PEGylated cationic peptide compounds, a nucleic acid, a phospholipid, a structural lipid, and a PEG lipid.

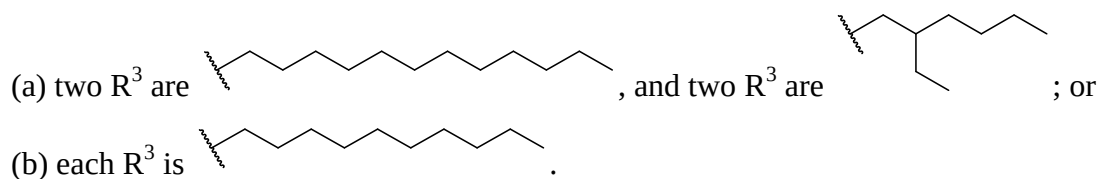
24. A method of delivering a polyanionic compound to a cell comprising contacting the cell with the complex of claim 22.

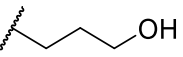
25. The method of claim 24, wherein the polyanionic compound comprises the nucleic acid which is the mRNA encoding a polypeptide and the cell expresses the polypeptide after being contacted with the complex.

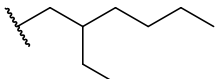
26. A method of forming the complex of claim 22, comprising contacting the tertiary amino lipidated and/or PEGylated cationic peptide compound with the polyanionic compound.

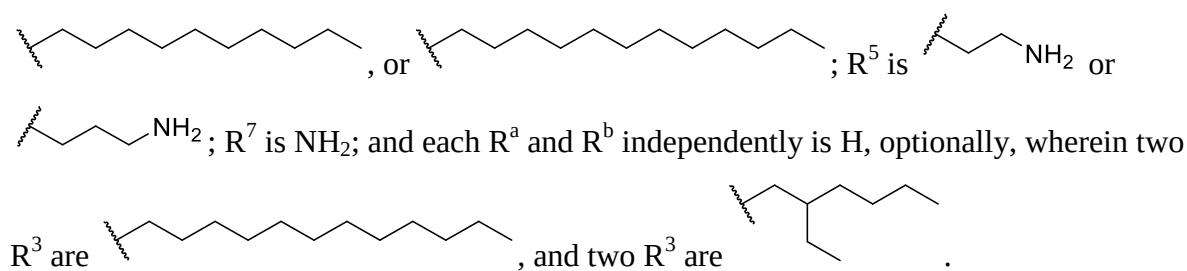
27. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 19, wherein R⁷ is NH₂.

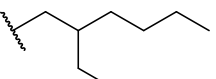
28. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 19, wherein s is 4 and:

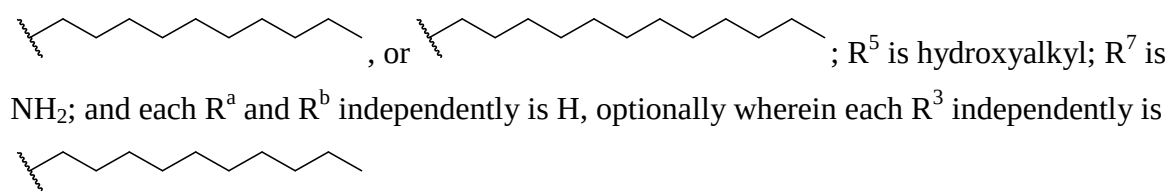


29. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 19, wherein R⁵ is hydroxyalkyl, hydroxyether, alkoxyalkyl, or hydroxylheteroalkyl, optionally wherein R⁵ is hydroxyalkyl, optionally wherein R⁵ is .

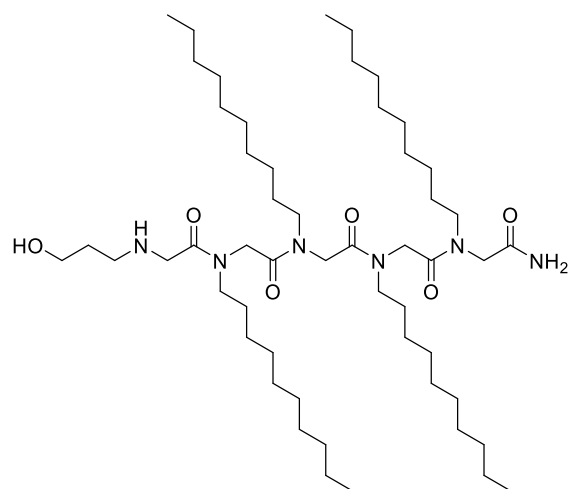
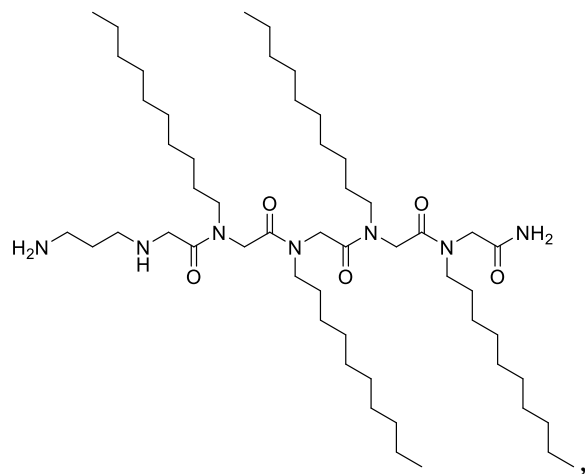
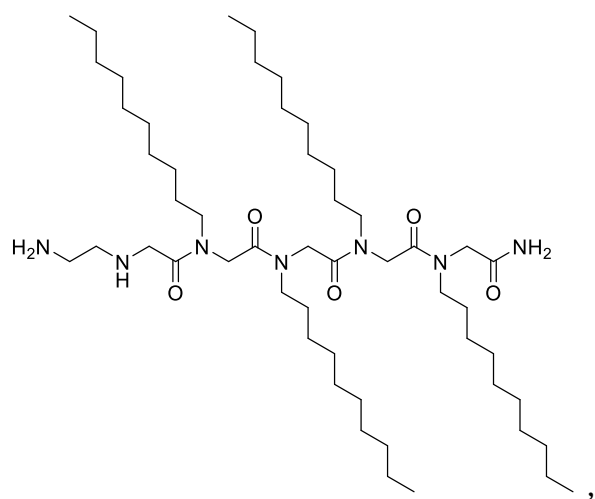
30. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 19, wherein s is 4; each R³ independently is ,



31. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 19, wherein s is 4; each R³ independently is ,



32. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 19, wherein the compound of formula (I) is



or