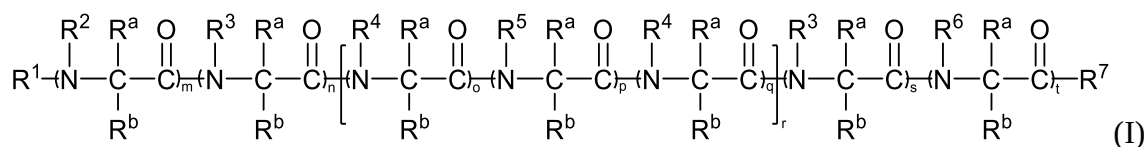


What is claimed is:

1. A tertiary amino lipidated and/or PEGylated cationic peptide compound of formula (I) or a 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 5;

t is an integer from 0 to 10;

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

r is an integer from 1 to 20;

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

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

each p_i is independently an integer 1 or 2;

R¹ is -H, alkyl, alkylaryl, or -COR^{1a} or a lipid moiety,

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

each R² 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 R³ is independently a lipid moiety;

each R⁴ is independently a neutral spacer moiety or a lipid moiety;

each R⁵ is independently hydroxyalkyl, hydroxyether, alkoxyalkyl, or hydroxylheteroalkyl;

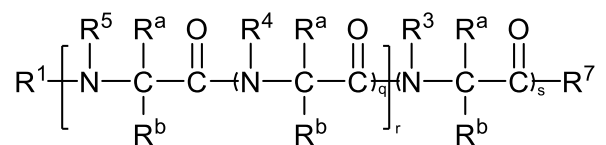
each R⁶ is independently an ethylene glycol moiety of the formula

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

R⁷ is -H, alkyl, acyl, -OH, -OR^{7a}, -NH₂, or -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, or C₁-C₄-alkyl.

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;

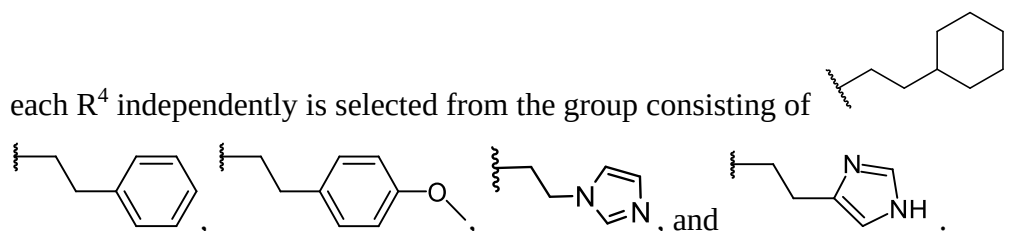
each R^3 independently is C_8 - C_{24} alkyl;

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;

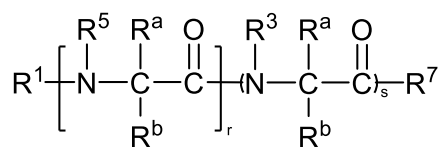
R^7 is NH_2 ; and

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

R¹ is H;

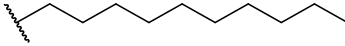
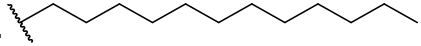
each R³ independently is C₈-C₂₄alkyl;

each R⁵ is independently selected from the group consisting of hydroxyalkyl, hydroxyether, alkoxyalkyl, or hydroxylheteroalkyl;

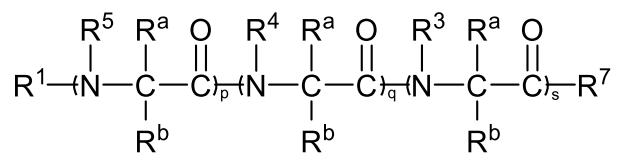
R⁷ is NH₂; and

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 R³ independently is  or .

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;

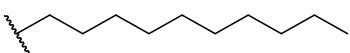
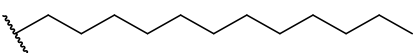
each R³ independently is C₈-C₂₄alkyl;

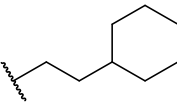
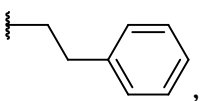
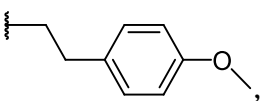
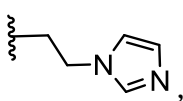
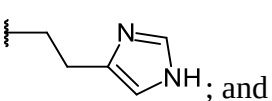
each R⁴ is independently a neutral spacer moiety that is a C₁-C₄-alkyl substituted by cycloalkyl, heterocyclalkyl, alkylaryl, arylalkyl, alkylheteroaryl, heteroarylalkyl, alkoxy, alkoxyalkyl, or hydroxyalkyl, wherein each cycloalkyl, heterocyclalkyl, alkylaryl, arylalkyl, alkylheteroaryl, heteroarylalkyl,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

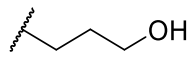
R⁷ is NH₂; and

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

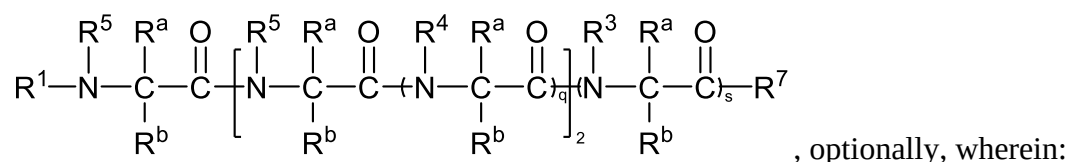
10. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 8, wherein:

each R³ independently is  or  ;

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

each R⁵ is independently  .

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:

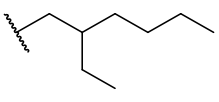
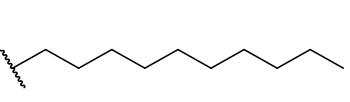
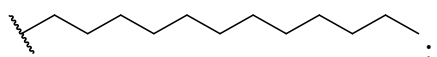


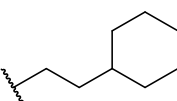
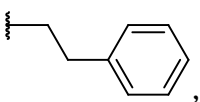
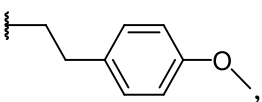
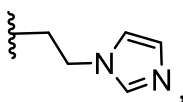
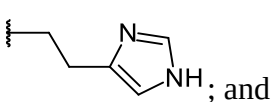
R¹ is H or alkyl;

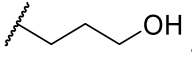
each R³ independently is C₈-C₂₄alkyl;

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; and

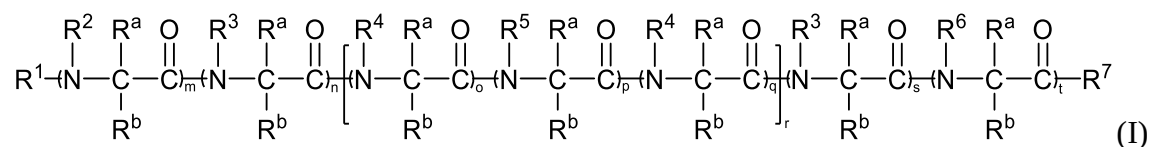
each of R^a and R^b is H, optionally, wherein:

each R³ independently is  ,  or  ;

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

each R⁵ is independently .

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;

R¹ 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 R² 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 R³ is independently a lipid moiety;

each R⁴ is independently a neutral spacer moiety or a lipid moiety;

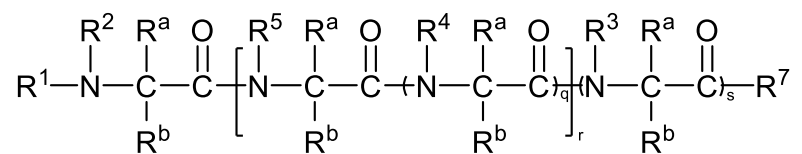
each R⁵ is independently hydroxyalkyl, hydroxyether, alkoxyalkyl, or hydroxylheteroalkyl;

each R⁶ is independently an ethylene glycol moiety of the formula -CH₂CH₂O(CH₂CH₂O)_vCH₃, and wherein each *v* is independently an integer from 2 to 200;

R⁷ 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:

R¹ is H;

R² is an ethylene glycol moiety of the formula –CH₂CH₂O(CH₂CH₂O)_uCH₃, and wherein each u is independently an integer from 2 to 50;

each R³ independently is C₈-C₂₄alkyl;

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

R⁷ is NH₂; and

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

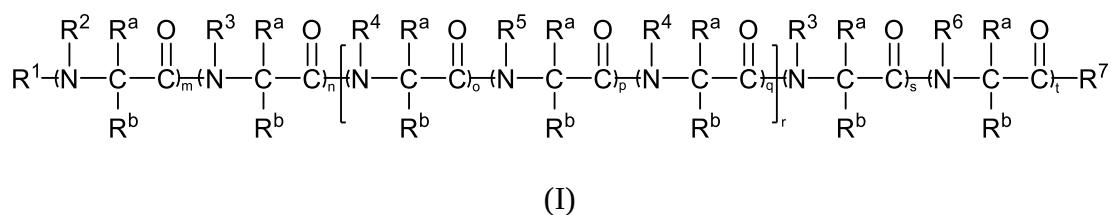
15. A complex comprising one or more of the tertiary amino lipidated and/or PEGylated cationic peptide compounds of claim 1, complexed to a polyanionic compound optionally, optionally wherein the polyanionic compound comprises a nucleic acid, optionally wherein the polyanionic compound comprises a nucleic 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. The complex of claim 15 for use in delivering a polyanionic compound to a cell, 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;

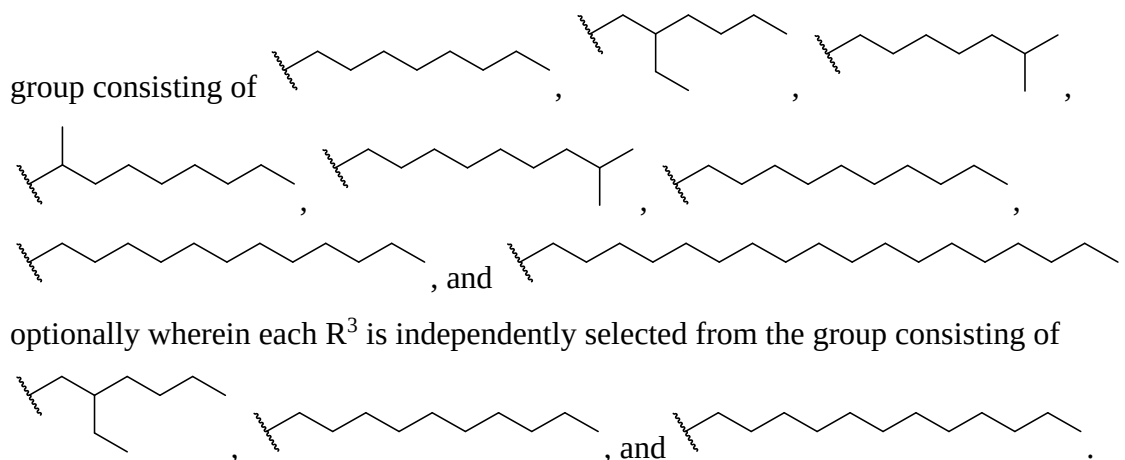
R¹ is -H;

each R³ is independently selected from C₈-C₂₄alkyl;

R⁵ is selected from hydroxyalkyl, hydroxyether, alkoxyalkyl, and hydroxylheteroalkyl;

R⁷ 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 are independently -H, or C_1 - C_4 -alkyl, optionally wherein each R^3 is independently C_8 - C_{12} alkyl, optionally wherein each R^3 is independently selected from the



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

21. 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.

22. The complex of claim 21, 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.

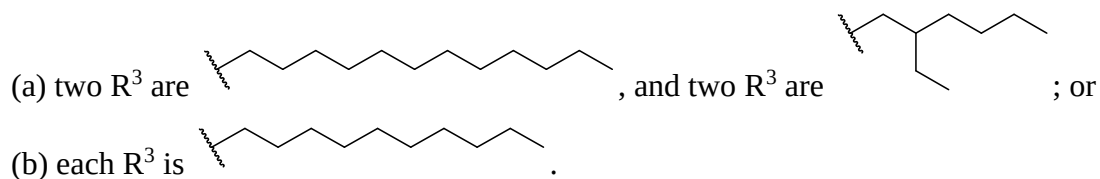
23. The complex of claim 22 for use in delivering a polyanionic compound to a cell.

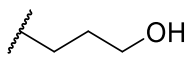
24. The complex for use of claim 23 wherein the polyanionic compound comprises the nucleic acid which is the mRNA encoding a polypeptide and the cell expresses the polypeptide after being contacted with the complex.

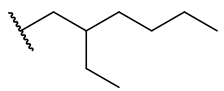
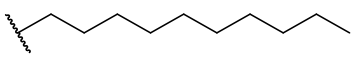
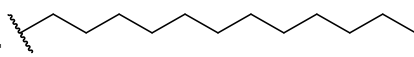
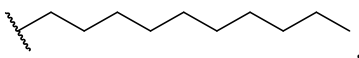
25. A method of forming the complex of claim 21, comprising contacting the tertiary amino lipidated and/or PEGylated cationic peptide compound with the polyanionic compound.

26. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 19, wherein R^7 is NH_2 .

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



28. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 19, wherein R^5 is hydroxyalkyl, hydroxyether, alkoxyalkyl, or hydroxylheteroalkyl, optionally wherein R^5 is hydroxyalkyl, optionally wherein R^5 is .

29. The tertiary amino lipidated and/or PEGylated cationic peptide compound of claim 19, wherein s is 4; each R^3 independently is , , or ; R^5 is hydroxyalkyl; R^7 is NH_2 ; and each R^a and R^b independently is H, optionally wherein each R^3 independently is .