each of m^2 and n^2 is an integer from 0 to 1000, provided that the sum of $m^2 + n^2$ is greater than 5;

the symbol "/" indicates that the units separated thereby are linked randomly or in any order;

R^{3a} and R^{3b} are each independently a methylene or ethylene group;

each instance of R^{13} is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

A^1 and A^2 are each independently a group of formula

$$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2{}_2 ;$$

$$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2{}_2]_2;$$

$$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2{}_2][—(CH_2)_{q4}—NR^2—]_{r2}R^2\}; \text{ or}$$

$$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2{}_2]_2\}_2,$$

B1 and B2 are each independently

$$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2\text{-}(CH_2)_{s1}\text{-}R^4\text{-}R^5;$$

$$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2\text{-}(CH_2)_{s2}\text{-}R^4\text{-}R^5]_2;$$

$$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2{}_2][—(CH_2)_{q4}—NR^2—]_{r2}(CH_2)_{s3}\text{-}R^4\text{-}R^5\};$$

$$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2\text{-}(CH_2)_{s4}\text{-}R^4\text{-}R^5]_2\}_2;$$

$$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2\text{-}CH_2\text{-}CHOH\text{-}R^5;$$

$$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2\text{-}CH_2\text{-}CHOH\text{-}R^5]_2;$$

$$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2{}_2][—(CH_2)_{q4}—NR^2—]_{r2}\text{-}CH_2\text{-}CHOH\text{-}R^5\};$$

$$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2\text{-}CH_2\text{-}CHOH\text{-}R^5]_2\}_2;$$

$$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2\text{-}(CH_2)_{s1}\text{-}R^5;$$

$$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2\text{-}(CH_2)_{s2}\text{-}R^5]_2;$$

$$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2{}_2][—(CH_2)_{q4}—NR^2—]_{r2}(CH_2)_{s3}\text{-}R^5\};$$

$$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2\text{-}(CH_2)_{s4}\text{-}R^5]_2\}_2;$$

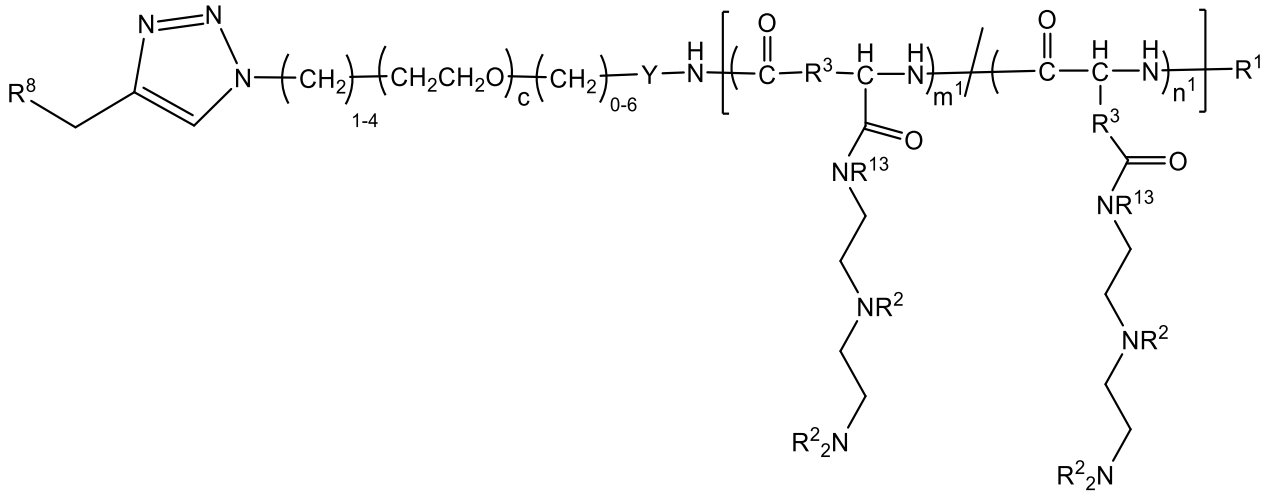
$$—(CH_2)_{p1}—[N\{(CH_2)_{s1}\text{-}R^4\text{-}R^5\}—(CH_2)_{q1}—]_{r1}NR^2{}_2; \text{ or}$$

$$—(CH_2)_{p1}—[N\{(CH_2)_{s1}\text{-}R^5\}—(CH_2)_{q1}—]_{r1}NR^2{}_2,$$

wherein p1 to p4, q1 to q6, r1 and r2, and s1 to s4 are each independently an integer of 1 to 5; each instance of R^2 is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group; each instance of R^4 is independently -C(O)O-, -C(O)NH-, or -S(O)(O)-; and each instance of R^5 is independently a substituted or unsubstituted alkyl group, cycloalkyl group, alkenyl group, cycloalkenyl group, aryl group, heteroalkyl group, heterocyclic group, or combination thereof optionally comprising from 1

to 8 (e.g., 2 to 8) secondary or tertiary amines or a substituent comprising a tissue-specific or cell-specific targeting moiety.

[0005] Also provided is a polymer of Formula 2:



wherein:

each of m^1 and n^1 is an integer from 0 to 1000, provided that the sum of m^1 and n^1 is 10 to 2000;

c is an integer from 0 to 50;

Y is optionally present and is a cleavable linker;

R^1 is hydrogen, an aryl group, a heterocyclic group (e.g., aromatic or non-aromatic), a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group, or a C_1-C_{12} linear or branched alkyl group optionally substituted with one or more substituents, such as one or more amines;

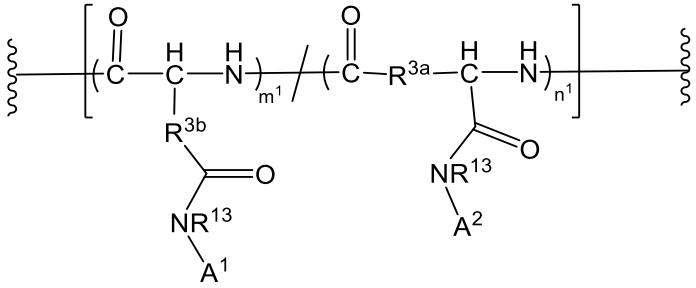
each instance of R^2 is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

R^8 is a is a tissue-specific or cell-specific targeting moiety; and

each instance of R^{13} is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group.

[0006] The disclosure also provides a composition comprising a structure of Formula 1 and/or a polymer of Formula 2, and a nucleic acid and/or polypeptide. Further provided is a method of preparing a polymer comprising a structure of Formula 1 or a polymer of Formula 2, as well as methods of using the polymers and compositions comprising same, for example, to deliver a nucleic acid or protein to a cell.

[0006a] In another aspect, there is provided a method of preparing a polymer as described herein, the method comprising modifying at least a portion of groups A^1 and/or A^2 of a polymer comprising a structure of Formula 3:



wherein:

each of m^1 and n^1 is an integer from 0 to 1000, provided that $m^1 + n^1$ is greater than 5;

the symbol "/" indicates that the units separated thereby are linked randomly or in any order;

R^{3a} and R^{3b} are each independently a methylene or ethylene group;

each instance of R^{13} is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

A^1 and A^2 are each independently a group of formula

$$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2_2 ;$$

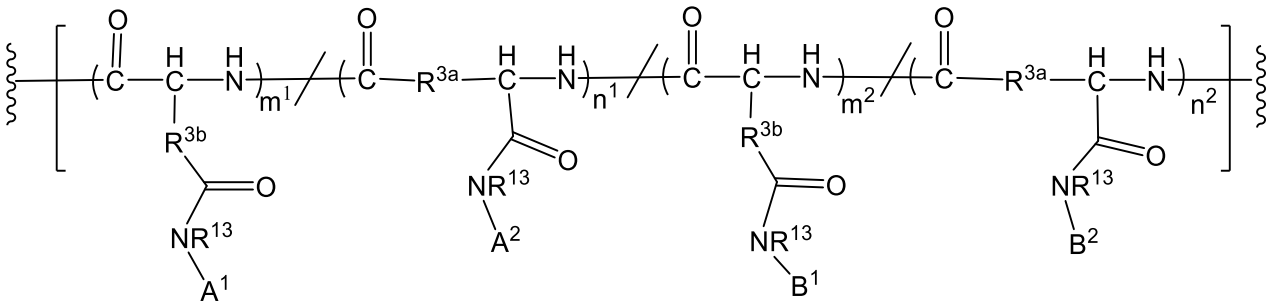
$$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2_2]_2;$$

$$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2_2][—(CH_2)_{q4}—NR^2—]r_2R^2\}; \text{ or}$$

$$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2_2]_2\}_2,$$

wherein p1 to p4, q1 to q6, and r1 and r2 are each independently an integer of 1 to 5; and each instance of R^2 is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group,

to produce a polymer comprising a structure of Formula 1:



wherein:

each of m^1 and n^1 is an integer from 0 to 1000;

each of m^2 and n^2 is an integer from 0 to 1000, provided that the sum of $m^2 + n^2$ is greater than 5;

the symbol "/" indicates that the units separated thereby are linked randomly or in any order; R^{3a} and R^{3b} are each independently a methylene or ethylene group;

each instance of R^{13} is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

A^1 and A^2 are each independently a group of formula

$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2_2$;

$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2_2]_2$;

$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2_2][—(CH_2)_{q4}—NR^2—]_{r2}R^2\}$; or

$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2_2]_2\}_2$,

B^1 and B^2 are each independently

$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2$-$(CH_2)_{s1}$-$R^4$-$R^5$;

$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2$-$(CH_2)_{s2}$-$R^4$-$R^5]_2$;

$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2_2][—(CH_2)_{q4}—NR^2—]_{r2}(CH_2)_{s3}$-$R^4$-$R^5\}$;

$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2$-$(CH_2)_{s4}$-$R^4$-$R^5]_2\}_2$;

$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2$-$CH_2$-CHOH-$R^5$;

$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2$-$CH_2$-CHOH-$R^5]_2$;

$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2_2][—(CH_2)_{q4}—NR^2—]_{r2}$-$CH_2$-CHOH-$R^5\}$;

$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2$-$CH_2$-CHOH-$R^5]_2\}_2$;

$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2$-$(CH_2)_{s1}$-$R^5$;

$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2$-$(CH_2)_{s2}$-$R^5]_2$;

$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2_2][—(CH_2)_{q4}—NR^2—]_{r2}(CH_2)_{s3}$-$R^5\}$;

$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2$-$(CH_2)_{s4}$-$R^5]_2\}_2$;

$—(CH_2)_{p1}—[N\{(CH_2)_{s1}$-$R^4$-$R^5\}—(CH_2)_{q1}—]_{r1}NR^2_2$; or

$—(CH_2)_{p1}—[N\{(CH_2)_{s1}$-$R^5\}—(CH_2)_{q1}—]_{r1}NR^2_2$,

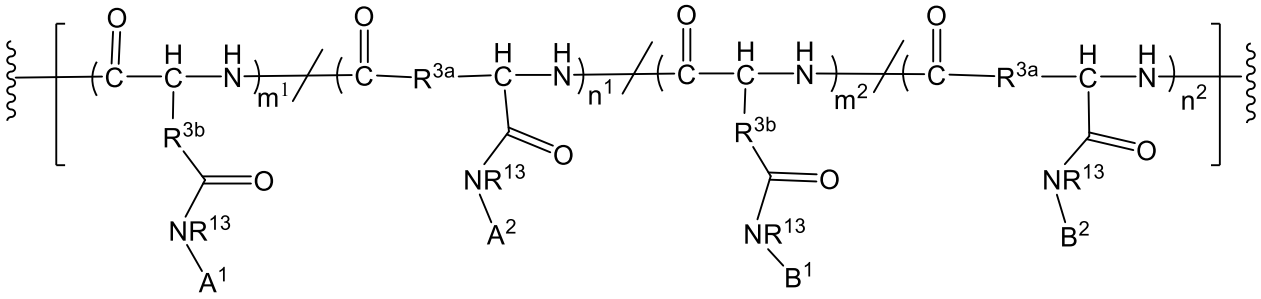
wherein p1 to p4, q1 to q6, r1 and r2, and s1 to s4 are each independently an integer of 1 to 5; each instance of R^2 is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group; each instance of R^4 is independently -C(O)O-, -C(O)NH-, or -S(O)(O)-; and each instance of R^5 is independently an alkyl group, cycloalkyl group, alkenyl group, cycloalkenyl group, aryl group, heteroalkyl group, heterocyclic group, or combination thereof optionally comprising from 1 to 8 secondary or tertiary amines or a substituent comprising a tissue-specific or cell-specific targeting moiety.

[0006b] In yet another aspect, there is provided a composition comprising a polymer as described herein and a nucleic acid and/or polypeptide.

[0006c] In a further aspect, there is provided a method of delivering a nucleic acid and/or polypeptide to a cell, the method comprising administering the composition as described herein to the cell.

CLAIM(S):

1. A polymer comprising a structure of Formula 1:



wherein:

each of m^1 and n^1 is an integer from 0 to 1000;

each of m^2 and n^2 is an integer from 0 to 1000, provided that the sum of $m^2 + n^2$ is greater than 5;

the symbol "/" indicates that the units separated thereby are linked randomly or in any order;

R^{3a} and R^{3b} are each independently a methylene or ethylene group;

each instance of R^{13} is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

A^1 and A^2 are each independently a group of formula

—$(CH_2)_{p1}$—[NR^2—$(CH_2)_{q1}$—]$_{r1}$$NR^2_2$;

—$(CH_2)_{p2}$—N[—$(CH_2)_{q2}$—NR^2_2]$_2$;

—$(CH_2)_{p3}$—N{[—$(CH_2)_{q3}$—NR^2_2][—$(CH_2)_{q4}$—NR^2—]$_{r2}$$R^2$}; or

—$(CH_2)_{p4}$—N{—$(CH_2)_{q5}$—N[—$(CH_2)_{q6}$—NR^2_2]$_2$}$_2$,

B^1 and B^2 are each independently

—$(CH_2)_{p1}$—[NR^2—$(CH_2)_{q1}$—]$_{r1}$$NR^2$-$(CH_2)_{s1}$-$R^4$-$R^5$;

—$(CH_2)_{p2}$—N[—$(CH_2)_{q2}$—NR^2-$(CH_2)_{s2}$-R^4-R^5]$_2$;

—$(CH_2)_{p3}$—N{[—$(CH_2)_{q3}$—NR^2_2][—$(CH_2)_{q4}$—NR^2—]$_{r2}$$(CH_2)_{s3}$-$R^4$-$R^5$};

—$(CH_2)_{p4}$—N{—$(CH_2)_{q5}$—N[—$(CH_2)_{q6}$—NR^2-$(CH_2)_{s4}$-R^4-R^5]$_2$}$_2$;

—$(CH_2)_{p1}$—[NR^2—$(CH_2)_{q1}$—]$_{r1}$$NR^2$-$CH_2$-CHOH-$R^5$;

—$(CH_2)_{p2}$—N[—$(CH_2)_{q2}$—NR^2-CH_2-CHOH-R^5]$_2$;

—$(CH_2)_{p3}$—N{[—$(CH_2)_{q3}$—NR^2_2][—$(CH_2)_{q4}$—NR^2—]$_{r2}$-CH_2-CHOH-R^5};

—$(CH_2)_{p4}$—N{—$(CH_2)_{q5}$—N[—$(CH_2)_{q6}$—NR^2-CH_2-CHOH-R^5]$_2$}$_2$;

—$(CH_2)_{p1}$—[NR^2—$(CH_2)_{q1}$—]$_{r1}$$NR^2$-$(CH_2)_{s1}$-$R^5$;

—$(CH_2)_{p2}$—N[—$(CH_2)_{q2}$—NR^2-$(CH_2)_{s2}$-R^5]$_2$;

—$(CH_2)_{p3}$—N{[—$(CH_2)_{q3}$—NR^2_2][—$(CH_2)_{q4}$—NR^2—]$_{r2}$$(CH_2)_{s3}$-$R^5$};

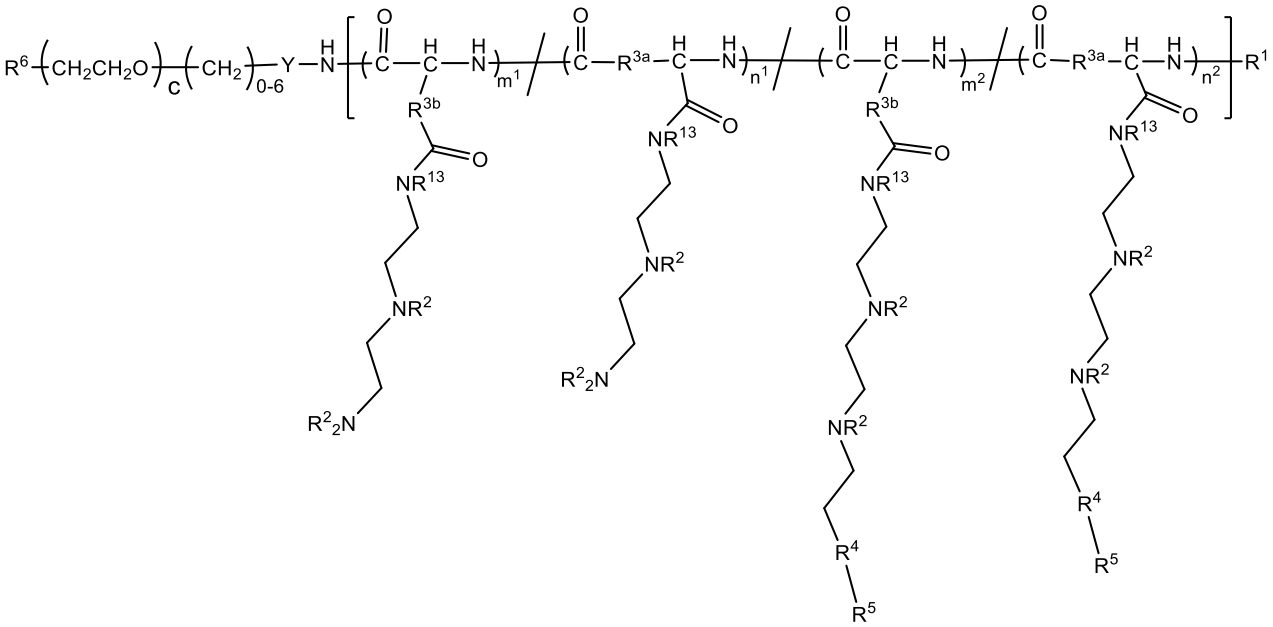
—$(CH_2)_{p4}$—N{—$(CH_2)_{q5}$—N[—$(CH_2)_{q6}$—NR^2-$(CH_2)_{s4}$-R^5]$_2$}$_2$;

—$(CH_2)_{p1}$—[N{$(CH_2)_{s1}$-R^4-R^5}—$(CH_2)_{q1}$—]$_{r1}$$NR^2_2$; or

—$(CH_2)_{p1}$—[N{$(CH_2)_{s1}$-R^5}—$(CH_2)_{q1}$—]$_{r1}$$NR^2_2$,

wherein p1 to p4, q1 to q6, r1 and r2, and s1 to s4 are each independently an integer of 1 to 5; each instance of R^2 is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group; each instance of R^4 is independently -C(O)O-, -C(O)NH-, or -S(O)(O)-; and each instance of R^5 is independently an alkyl group, cycloalkyl group, alkenyl group, cycloalkenyl group, aryl group, heteroalkyl group, heterocyclic group, or combination thereof optionally comprising from 1 to 8 secondary or tertiary amines or a substituent comprising a tissue-specific or cell-specific targeting moiety.

2. The polymer of claim 1 having the structure of Formula 1A:



wherein

c is an integer from 0 to 50;

Y is optionally present and is a cleavable linker;

each of m^1 and n^1 is an integer from 0 to 1000;

each of m^2 and n^2 is an integer from 0 to 1000, provided that the sum of m^2 + n^2 is greater than 5;

the symbol "/" indicates that the units separated thereby are linked randomly or in any order;

R^1 is hydrogen, an aryl group, a heterocyclic group, a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group, or a C_1-C_{12} linear or branched alkyl group optionally substituted with one or more substituents;

each instance of R^2 is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

R^{3a} and R^{3a} are each independently a methylene or ethylene group;

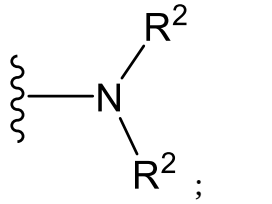
each instance of R^{13} is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

each instance of R^4 is —C(O)O—, —C(O)NH—, or —S(O)(O)—;

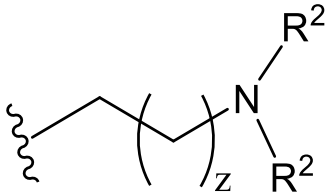
each instance of R^5 is independently an alkyl group, cycloalkyl group, alkenyl group, cycloalkenyl group, aryl group, heteroalkyl group, heterocyclic group, or combination thereof optionally comprising from 1 to 8 secondary or tertiary amines or a substituent comprising a tissue-specific or cell-specific targeting moiety; and

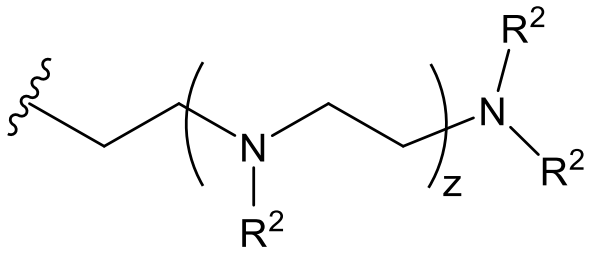
R^6 is hydrogen, an amino group, an aryl group, a heterocyclic group, a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group, a C_1-C_{12} linear or branched alkyl group optionally substituted with one or more amines; or a tissue-specific or cell-specific targeting moiety.

3. The polymer of claim 1 or 2, wherein each R^5 is independently:

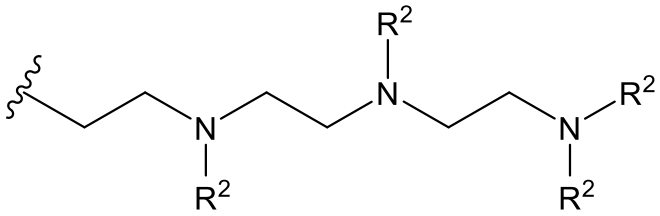


;

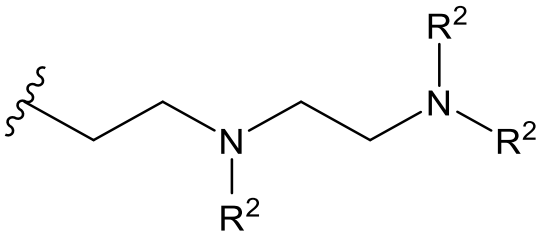




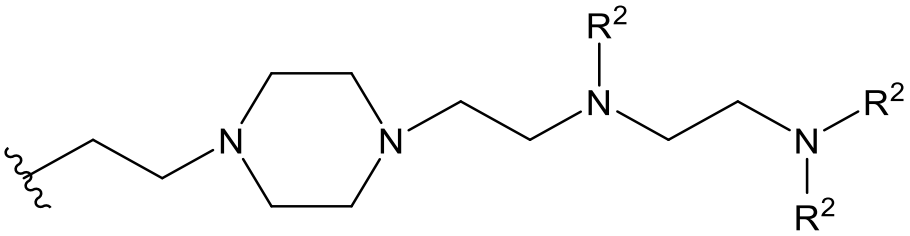
;



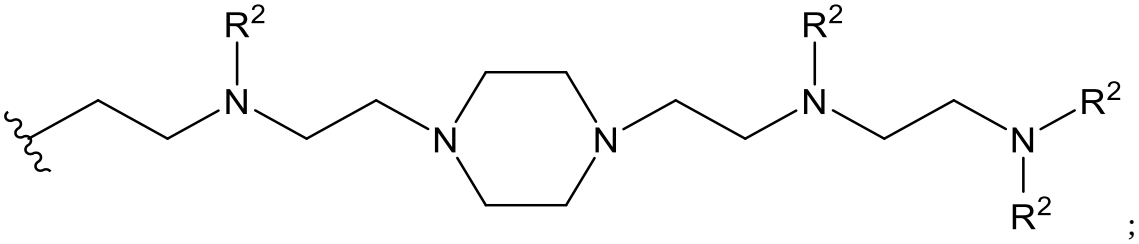
;



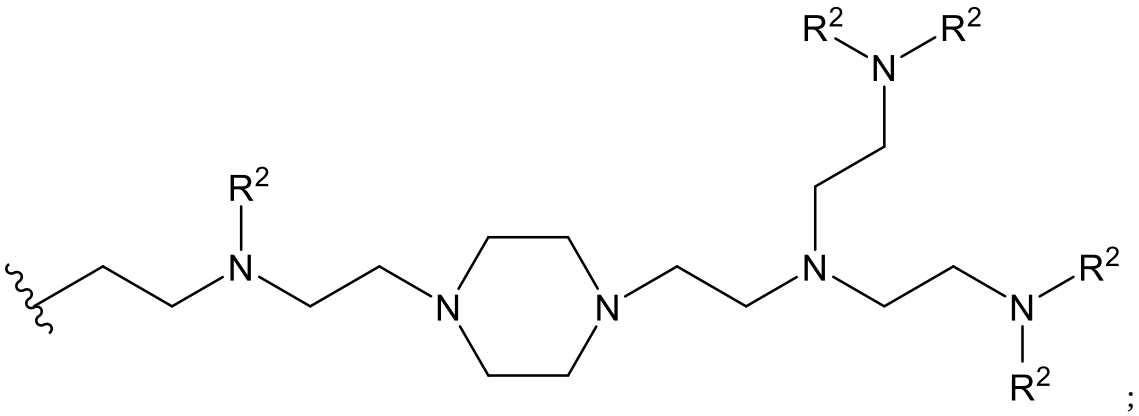
;



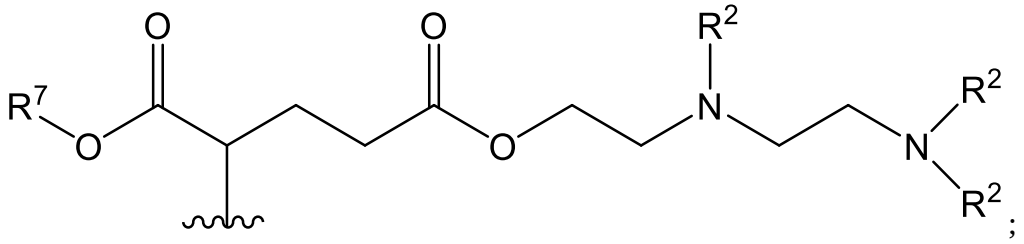
;



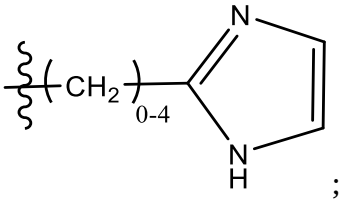
;



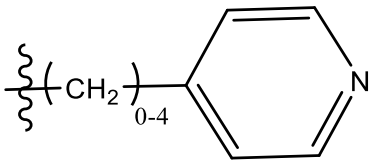
;



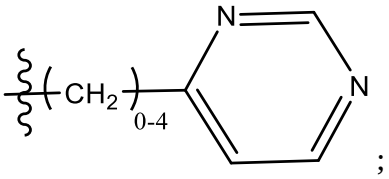
;



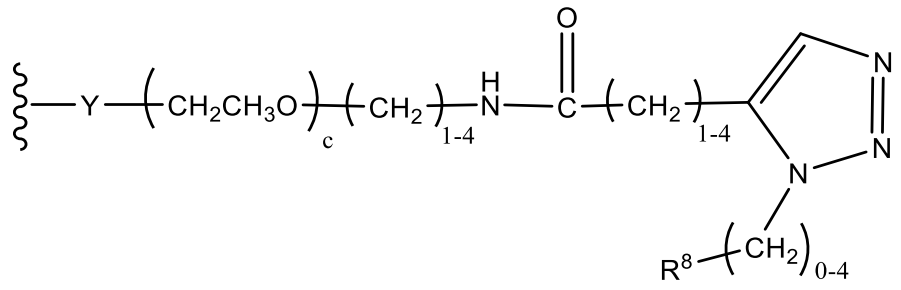
;



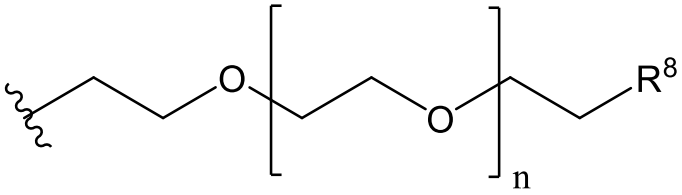
;



;



; and



,

wherein

each instance of R^2 is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

R^7 is a C_1-C_{50} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group optionally substituted with one or more amines; C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group

z is an integer from 1 to 5;

c is an integer from 0 to 50;

Y is optionally present and is a cleavable linker;

n is an integer from 0 to 50; and

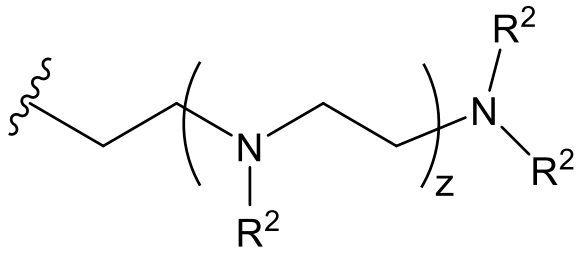
R^8 is a tissue-specific or cell-specific targeting moiety.

4. The polymer of any of claims 1-3, wherein each of A^1 and A^2 is a group of formula —$(CH_2)_{p1}$—[NH—$(CH_2)_{q1}$—]$_{r1}NH_2$, and each of B^1 and B^2 is a group of formula—$(CH_2)_{p1}$—[NH—$(CH_2)_{q1}$—]$_{r1}$NH-$(CH_2)_2$-R^4-R^5.

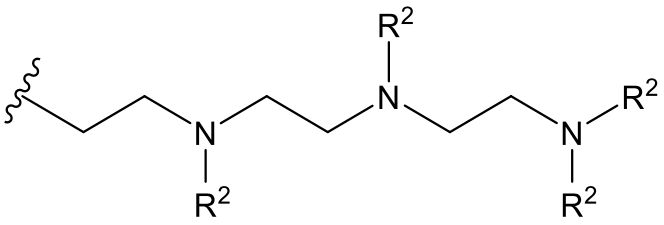
5. The polymer of any of claims 1-4, wherein each of A^1 and A^2 is a group of formula –$(CH_2)_2$-NH-$(CH_2)_2$-NH_2, and each of B^1 and B^2 is a group of formula–$(CH_2)_2$-NH-$(CH_2)_2$-NH-$(CH_2)_2$-R^4-R^5.

6. The polymer of any of claims 1-5, wherein R^4 is –C(O)-O-.

7. The polymer of any of claims 1-6, wherein R^5 is



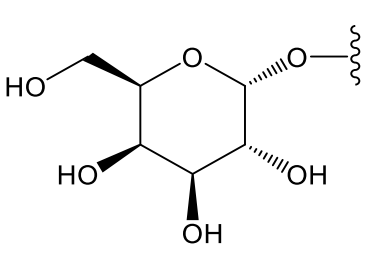
or



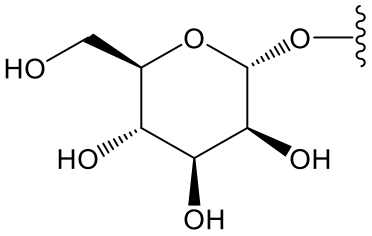
.

8. A polymer of any of claims 1-7, wherein the ratio of $(m^1+n^1)/(m^2+n^2)$ is about 20 or less, and, optionally, about 0.2 or more.

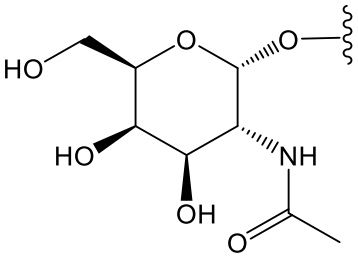
9. The polymer of any one of claims 1-6 or 8, wherein the tissue-specific or cell-specific targeting moiety is:



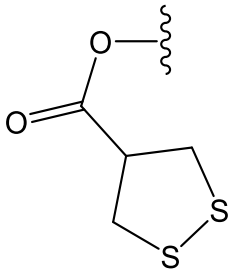
alpha-d-galactose ;



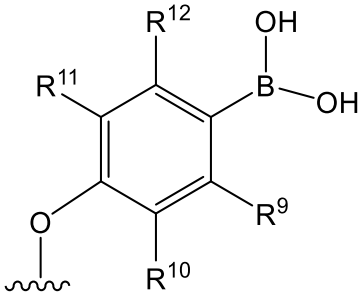
alpha-d-mannose ;



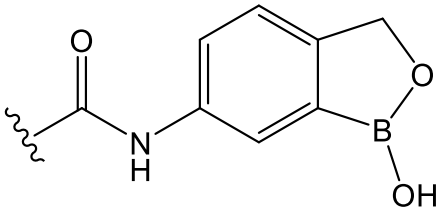
N-acetylgalactosamine ;



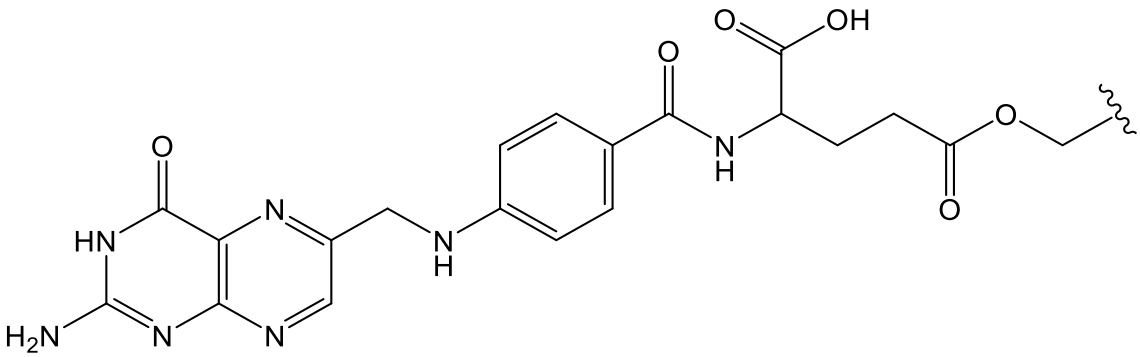
Asparagusic acid ;



Phenylboronic acid ;



; or

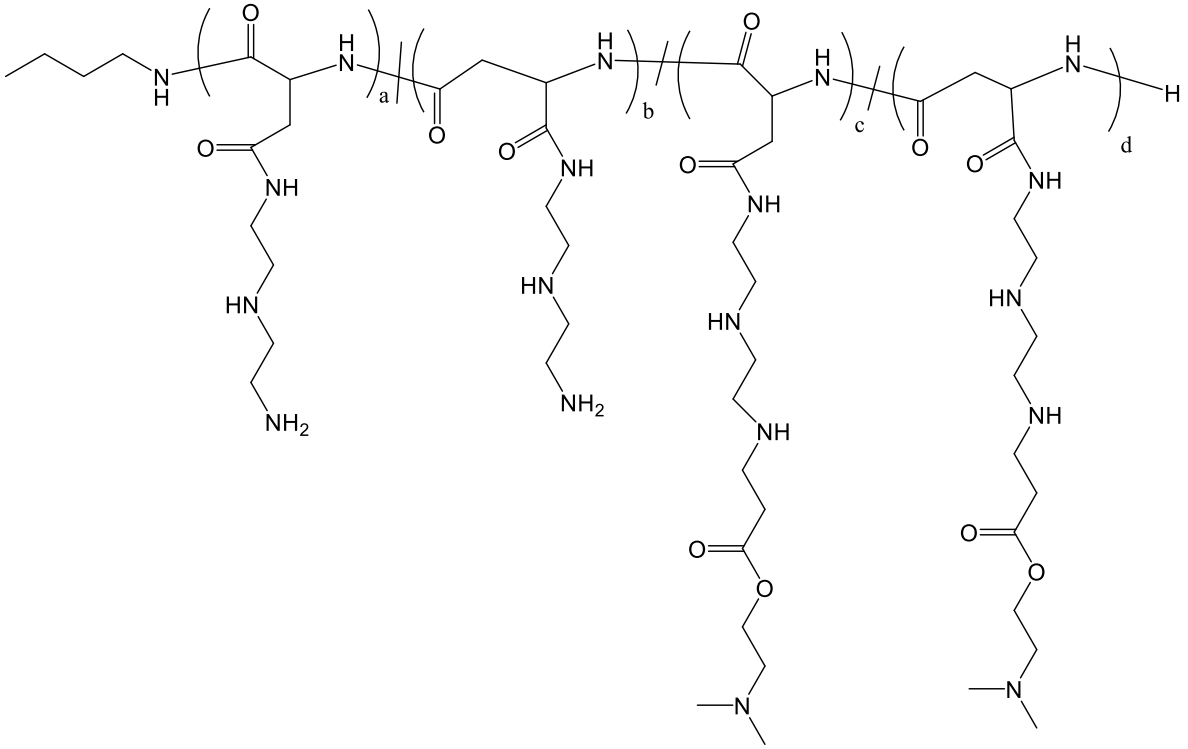


folic acid ,

wherein each of R^9, R^{10}, R^{11}, and R^{12} is independently hydrogen, halogen, C_1-C_4 alkyl, or C_1-C_4 alkoxy, optionally substituted with one or more amino groups.

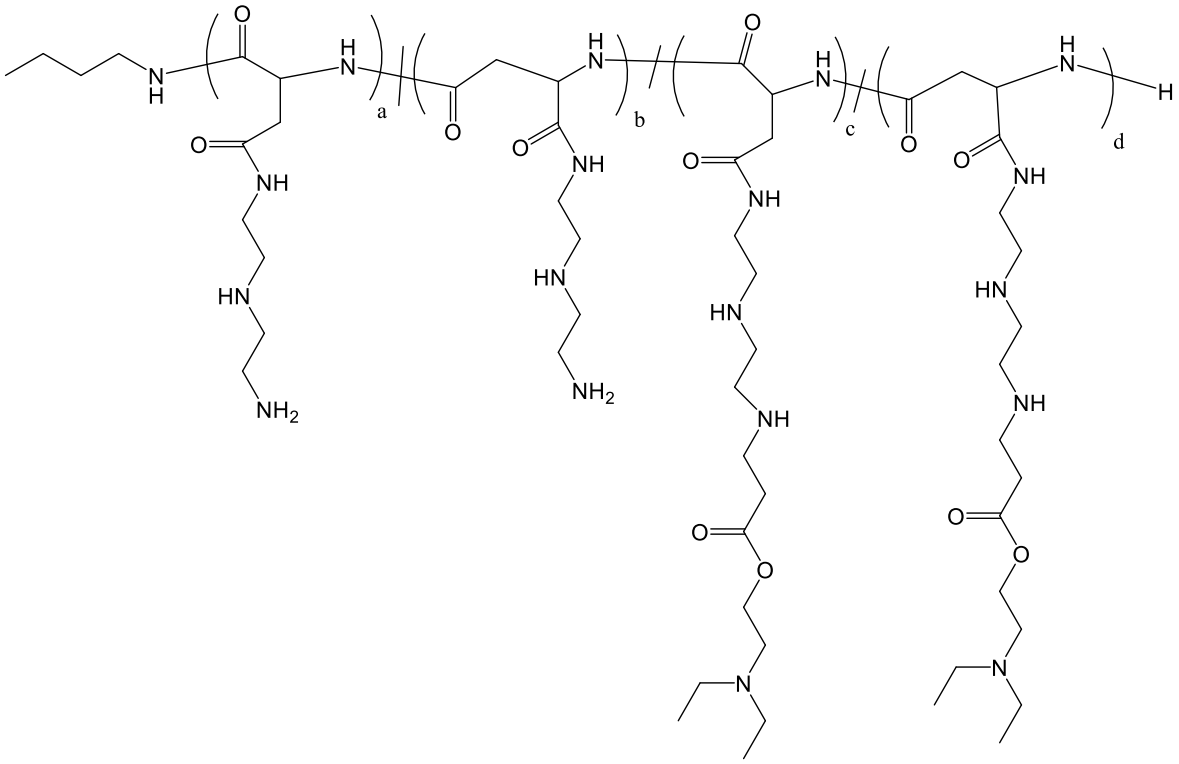
10. The polymer of any of claims 1-9, wherein the polymer is a cationic polymer.

11. The polymer of claim 1 having the formula:



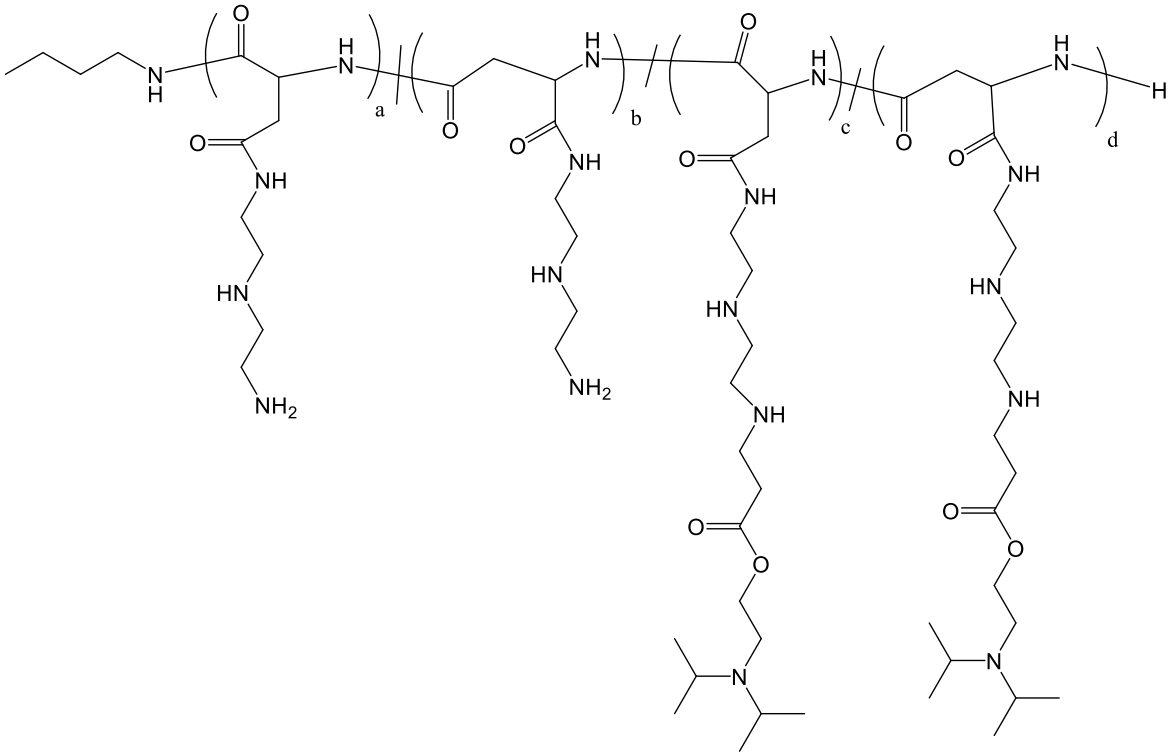
Polymer 1

,



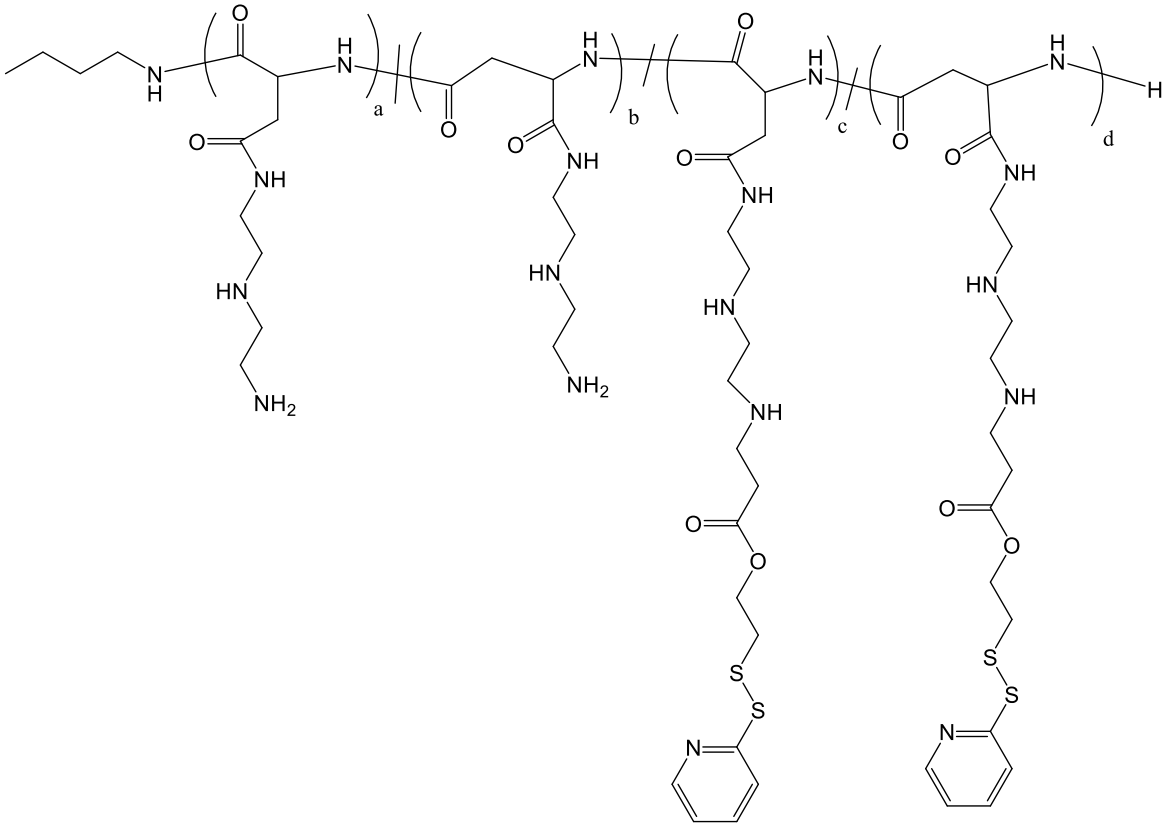
Polymer 2

,



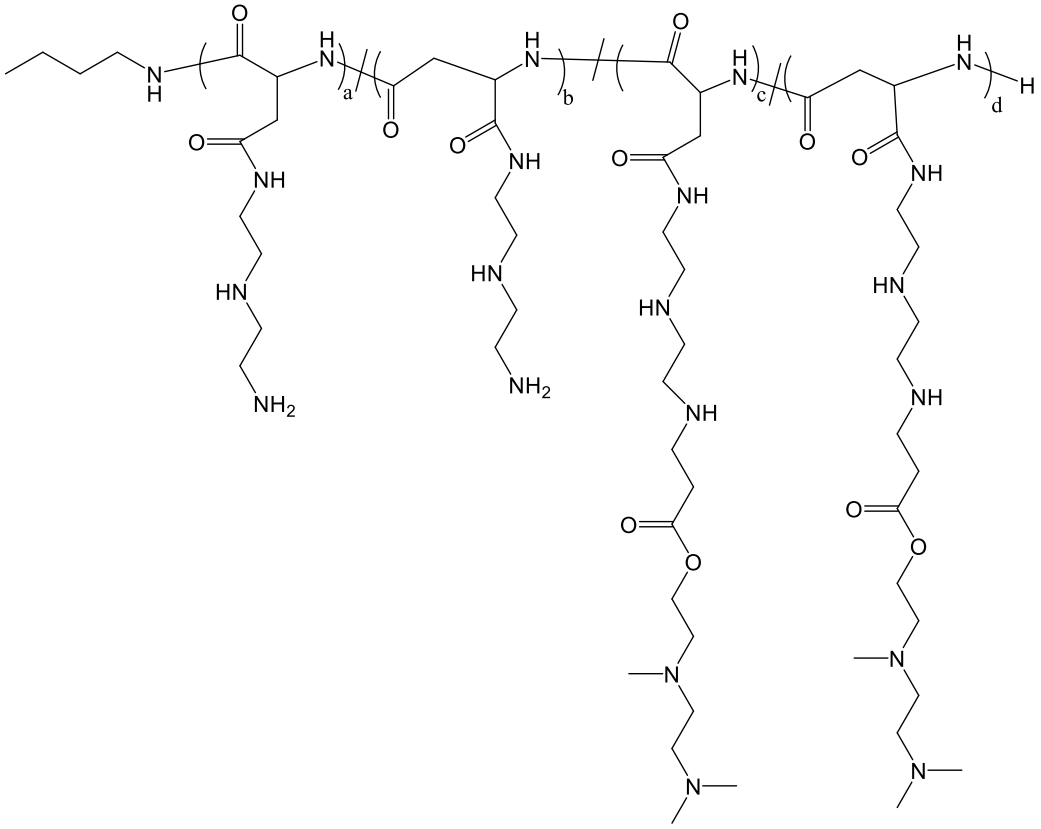
Polymer 3

,



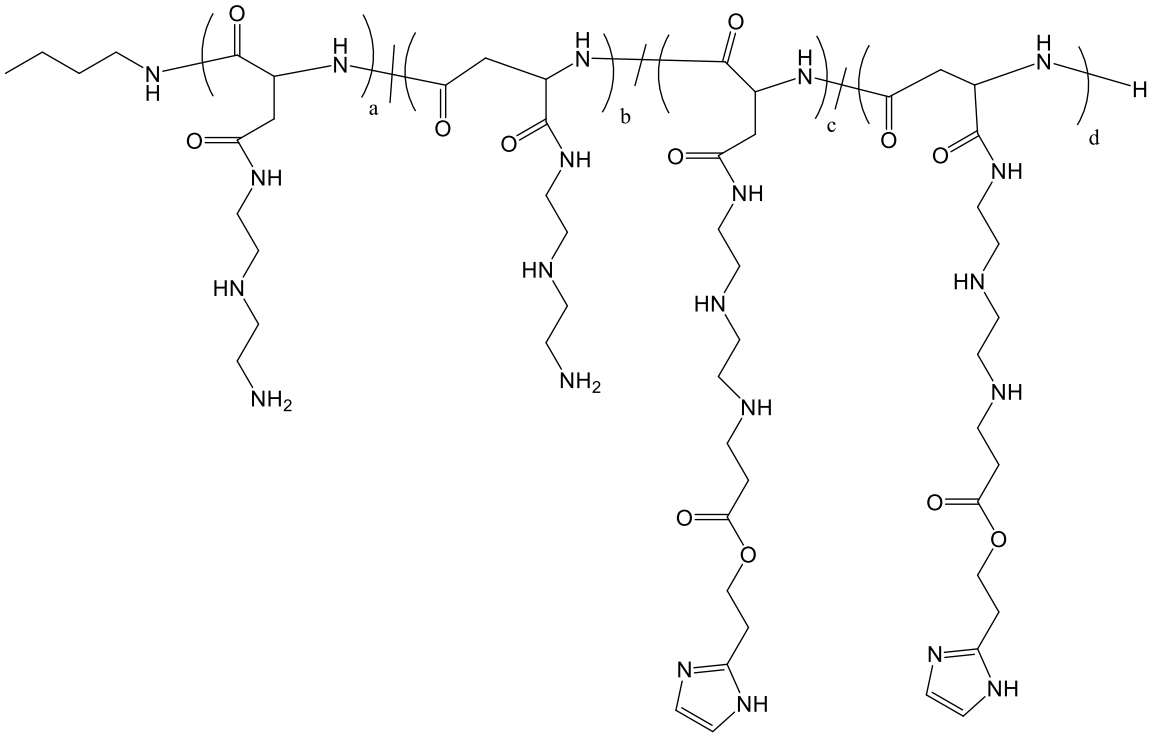
Polymer 4

,



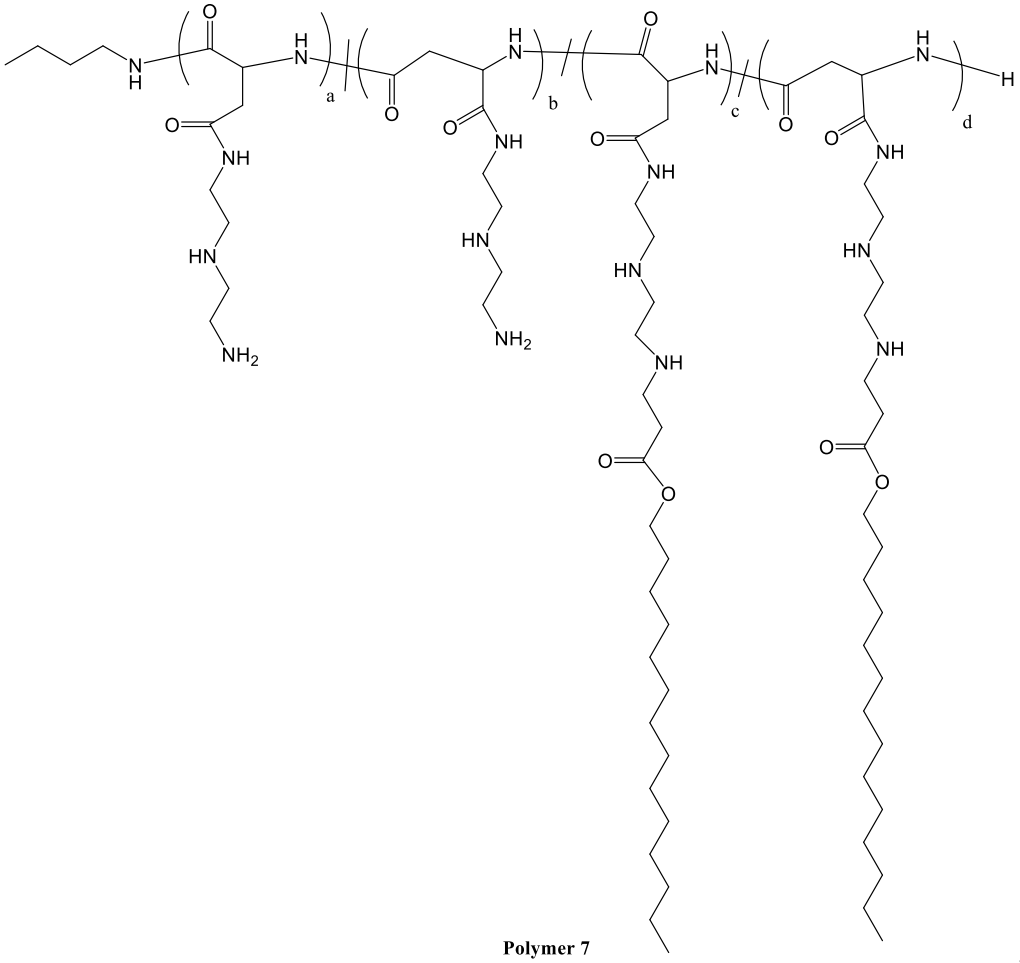
Polymer 5

,



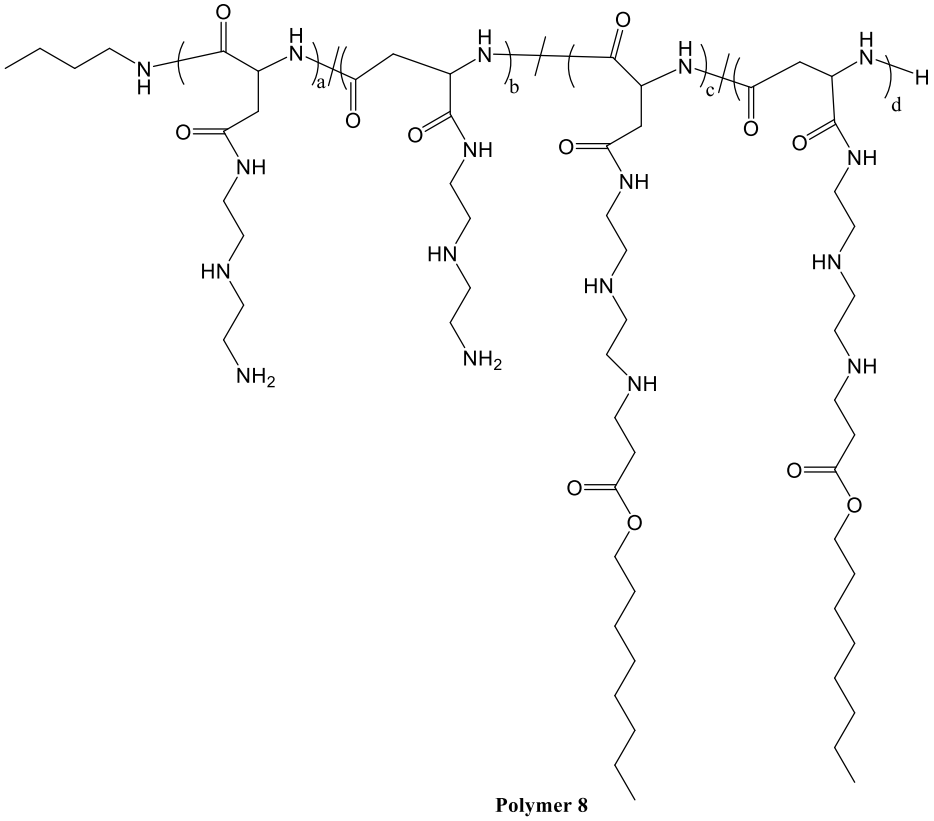
Polymer 6

,



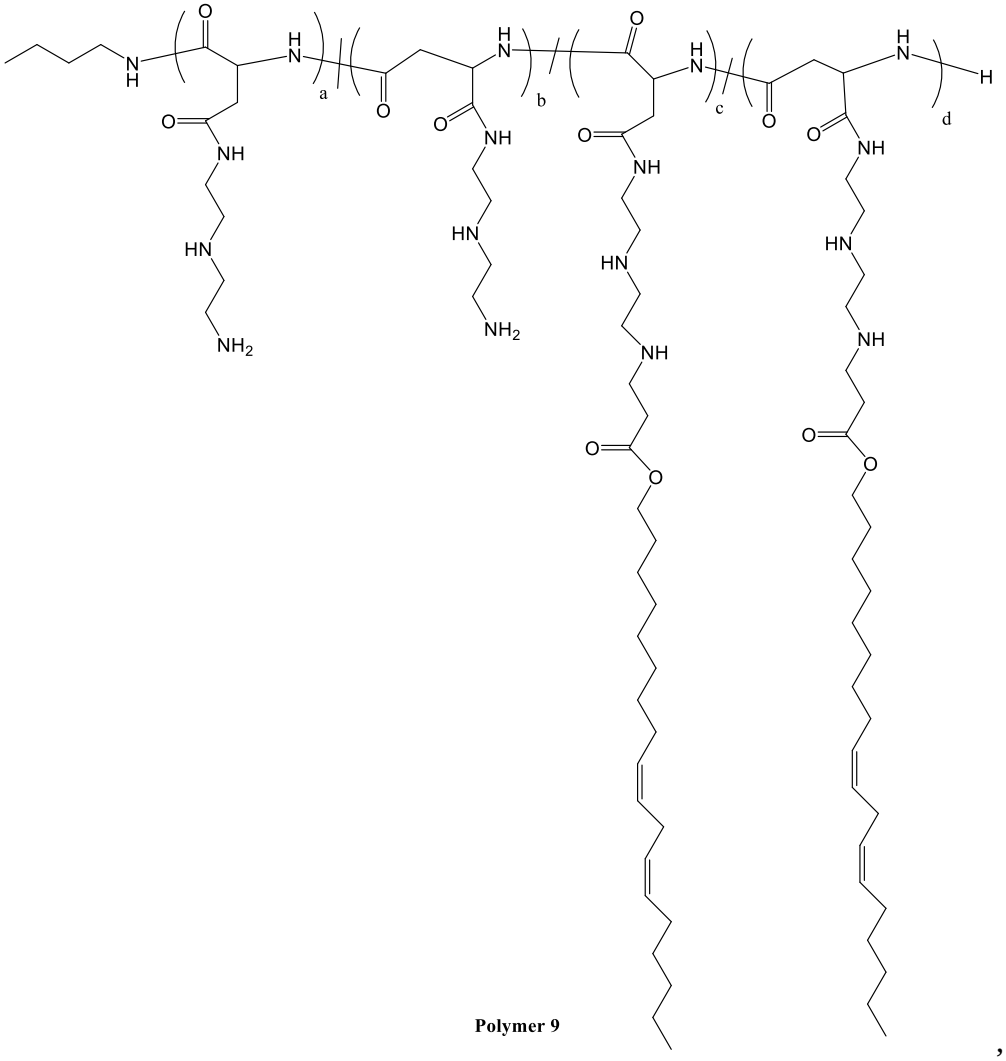
Polymer 7

,



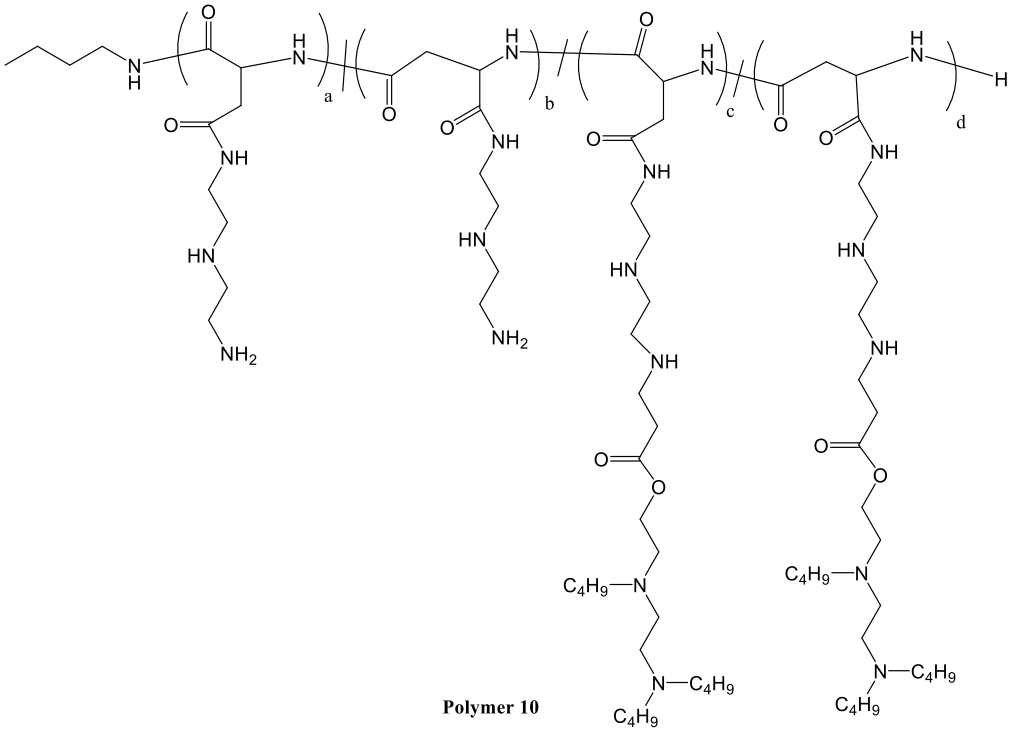
Polymer 8

,



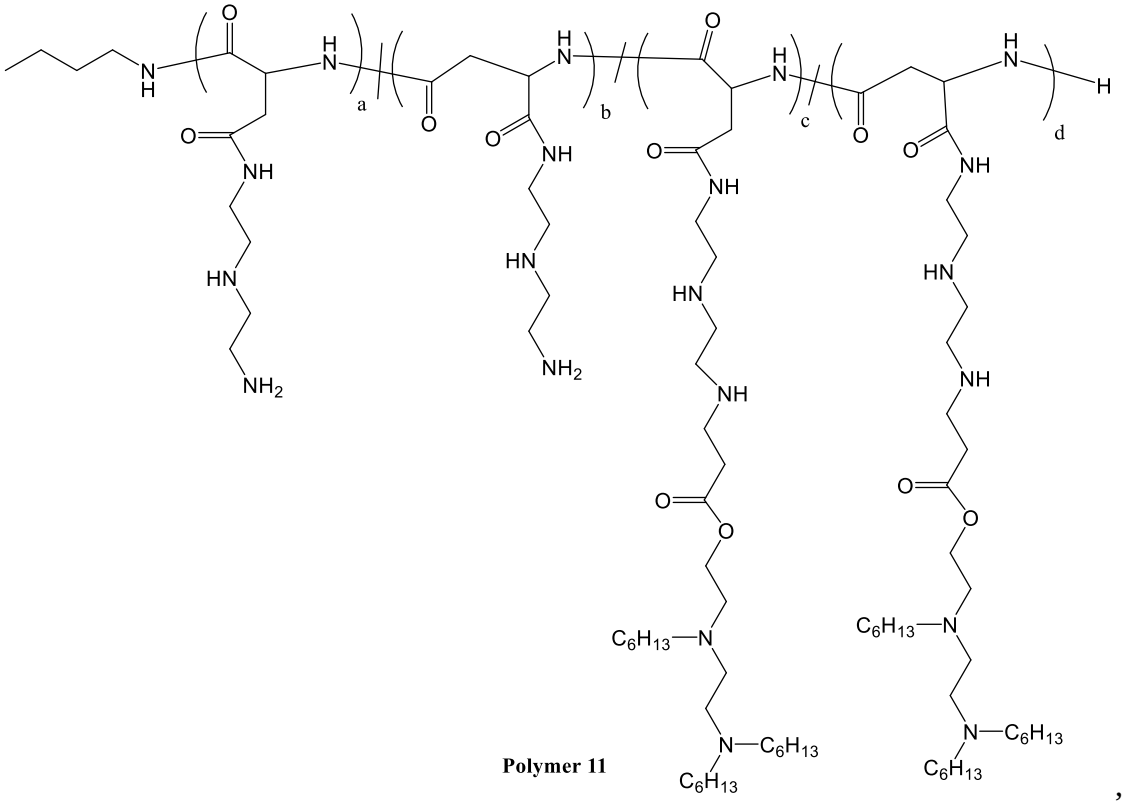
Polymer 9

,



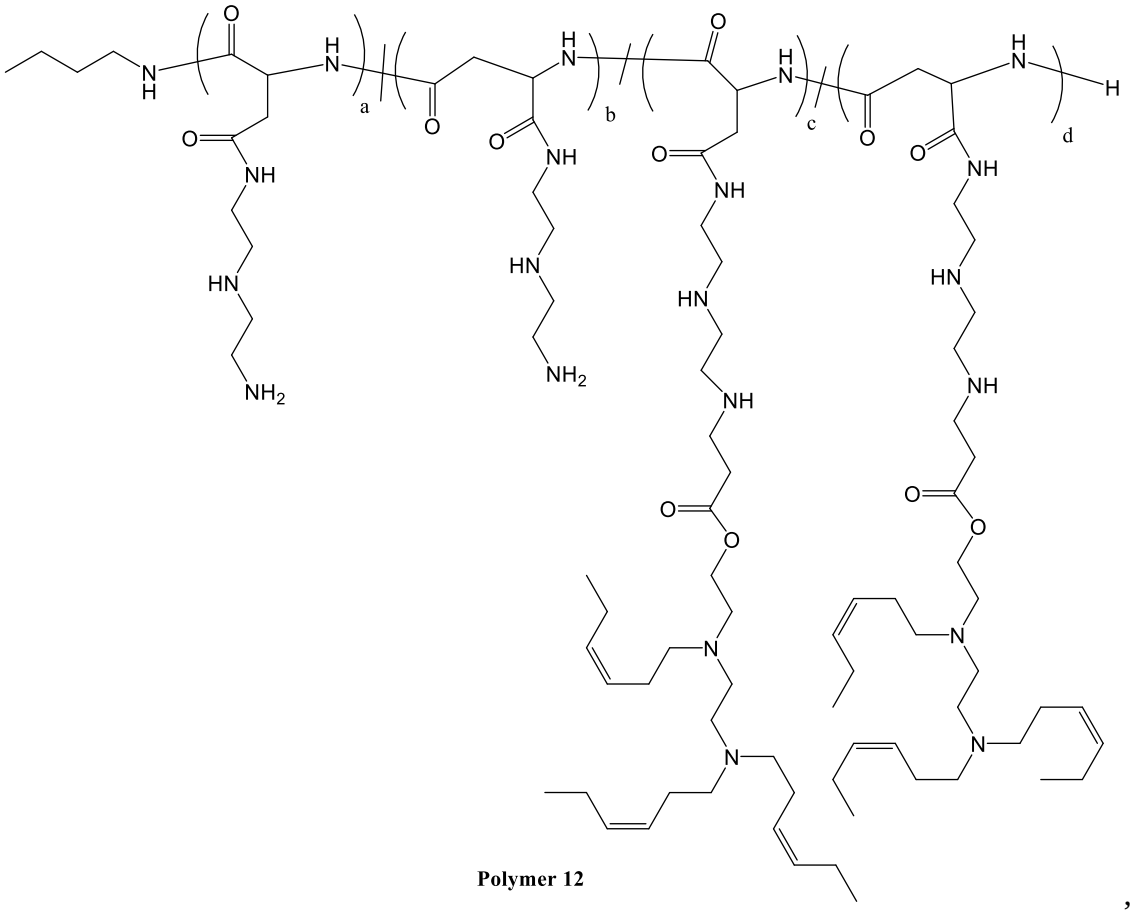
Polymer 10

,



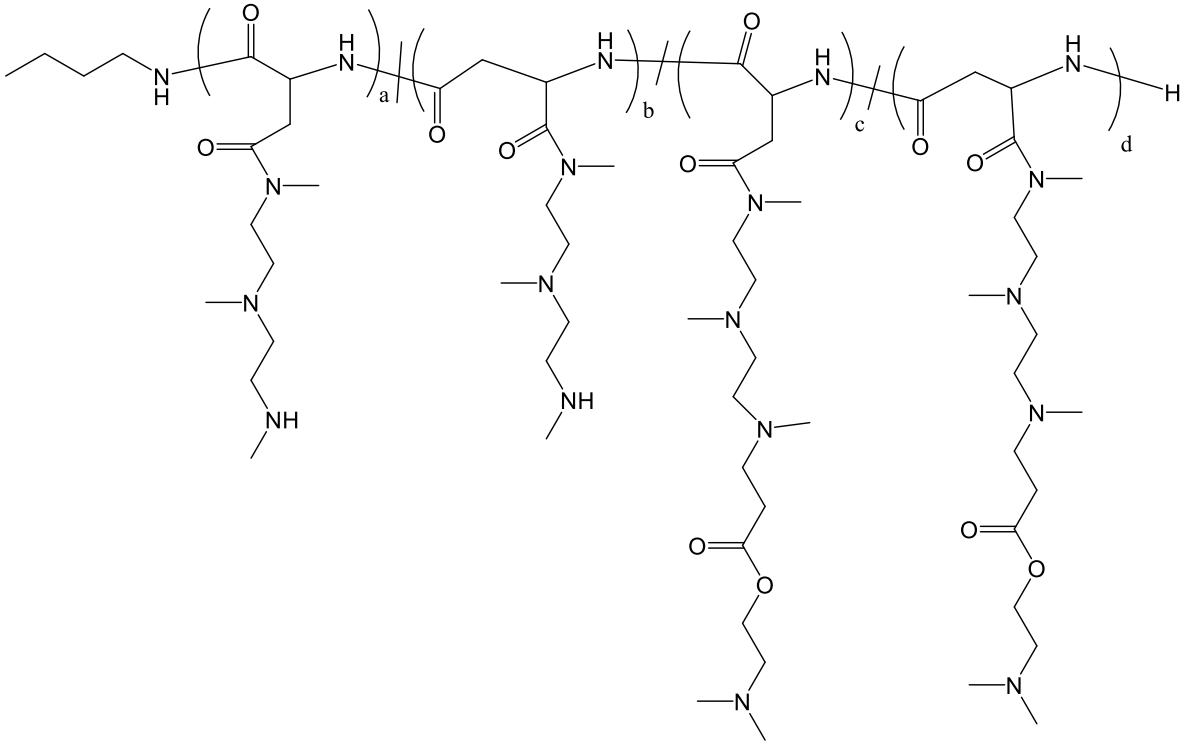
Polymer 11

,



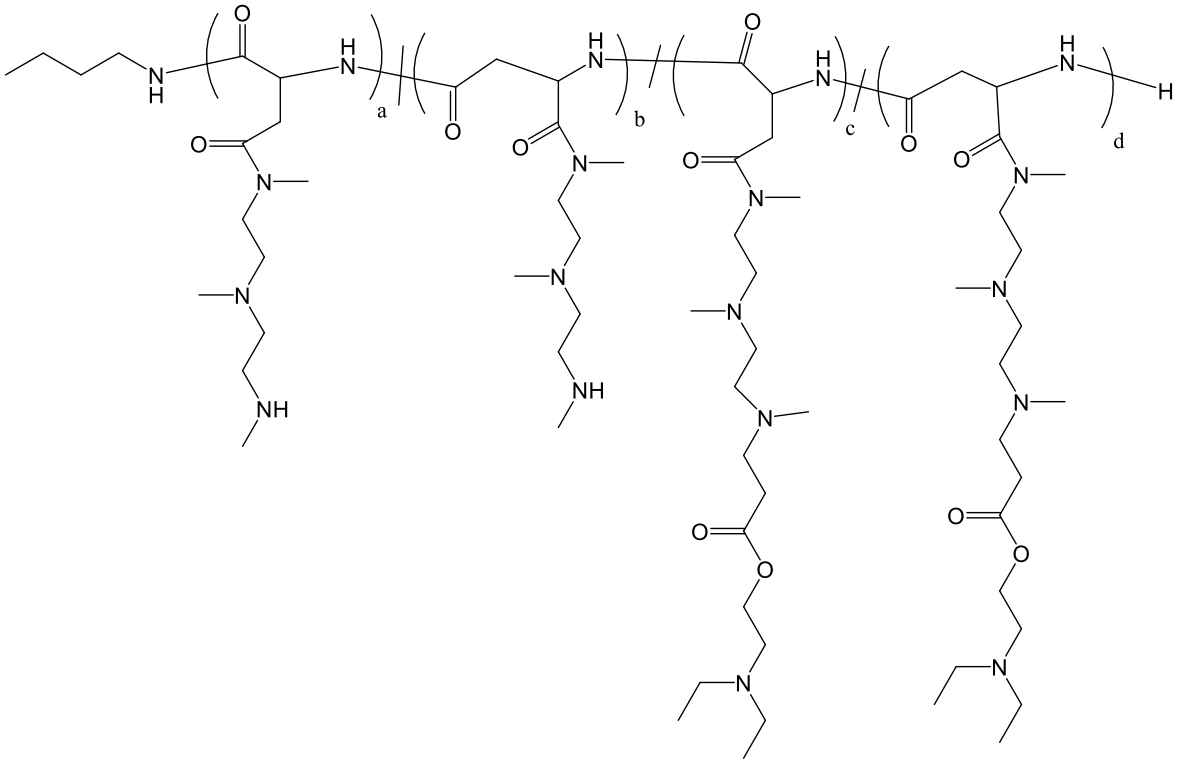
Polymer 12

,



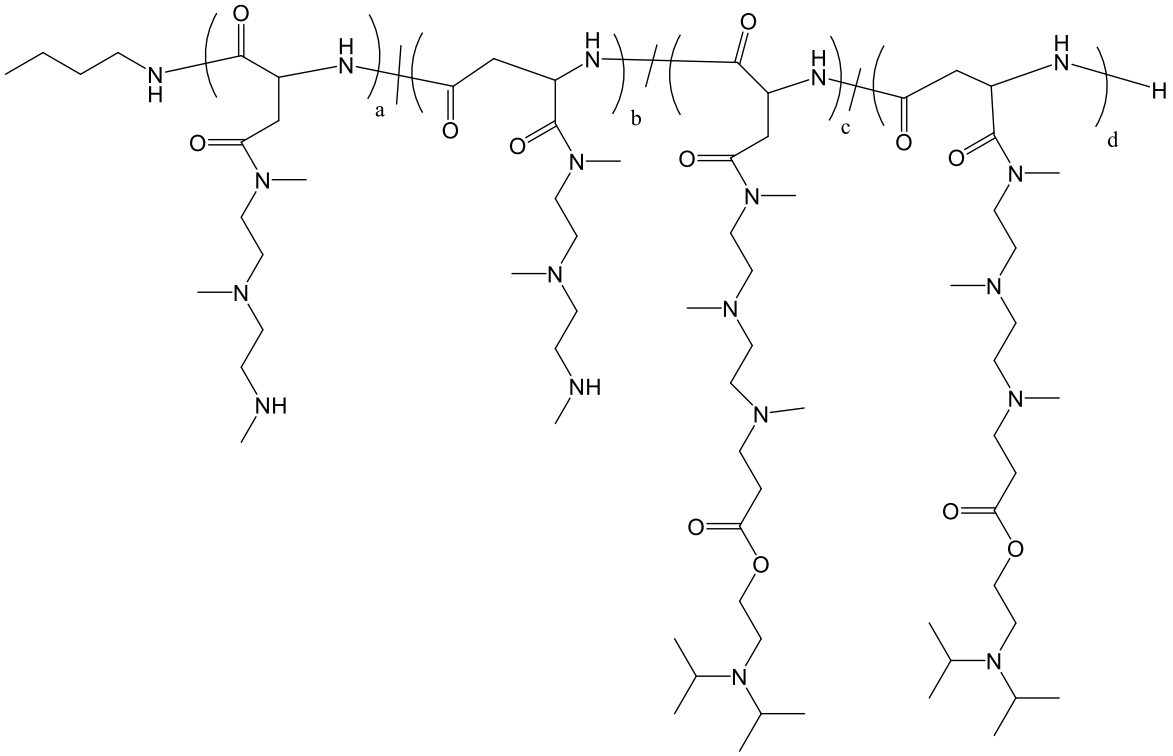
Polymer 13

,



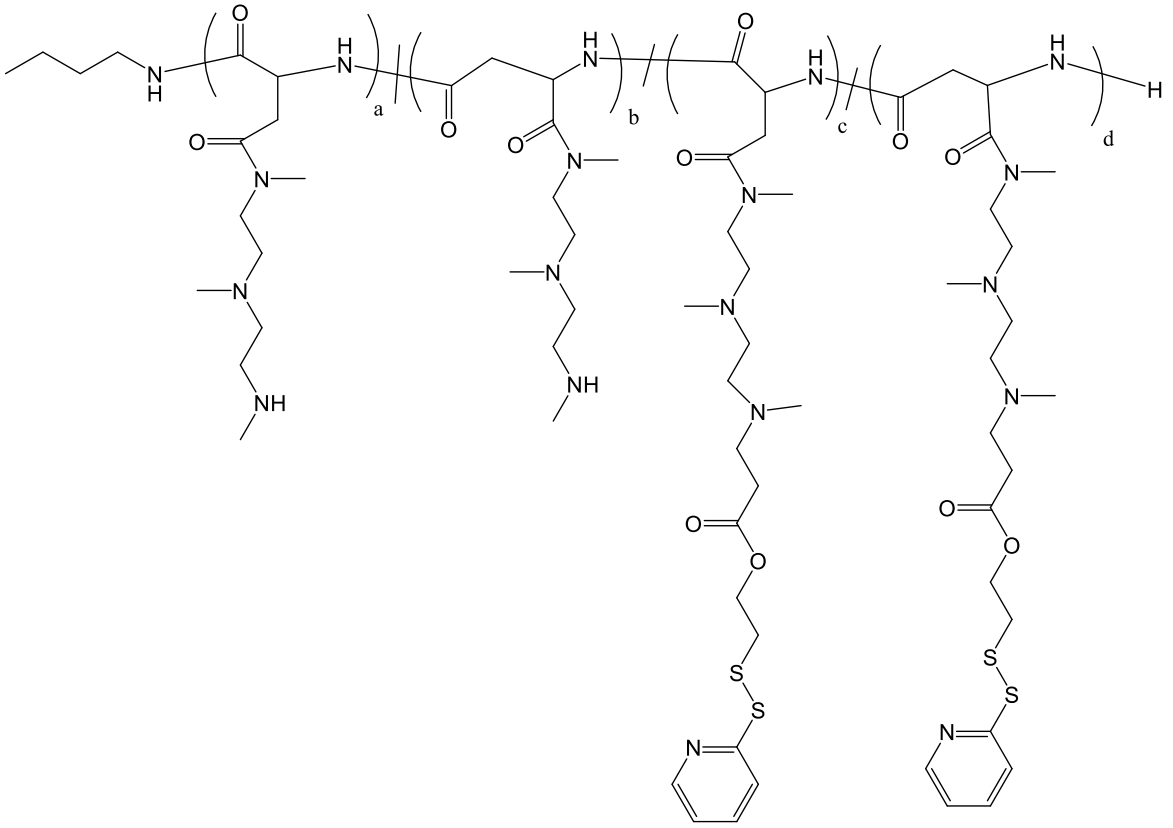
Polymer 14

,



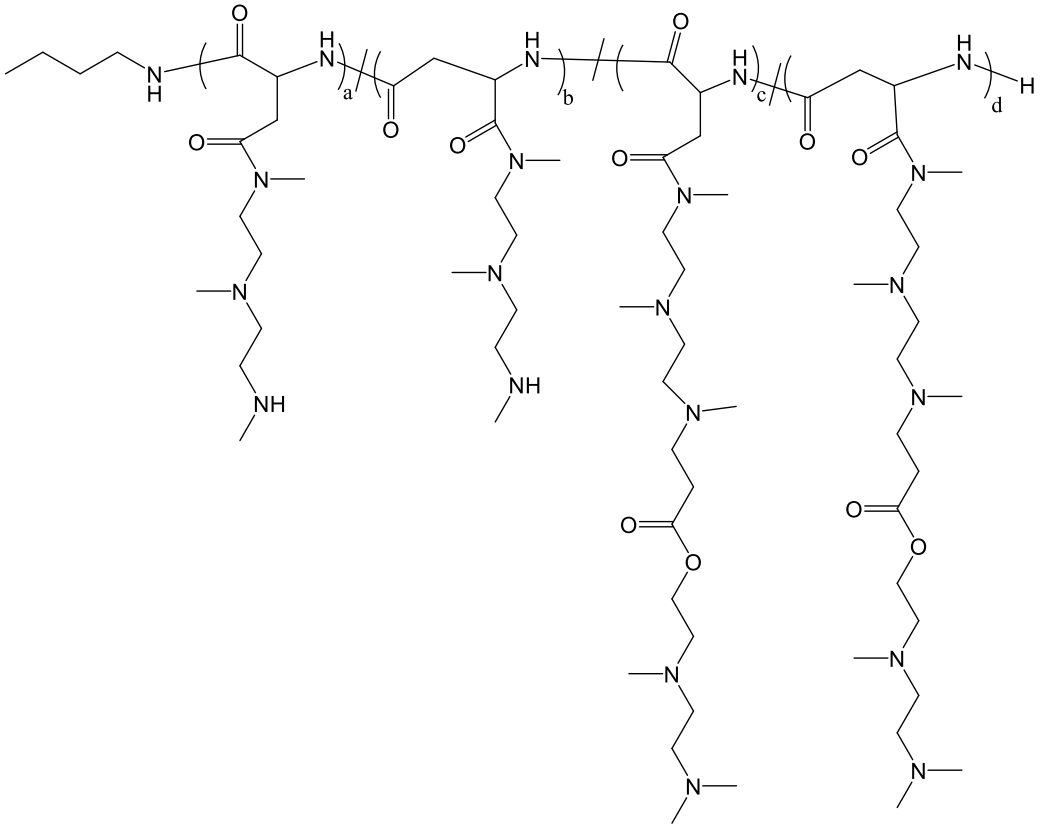
Polymer 15

,



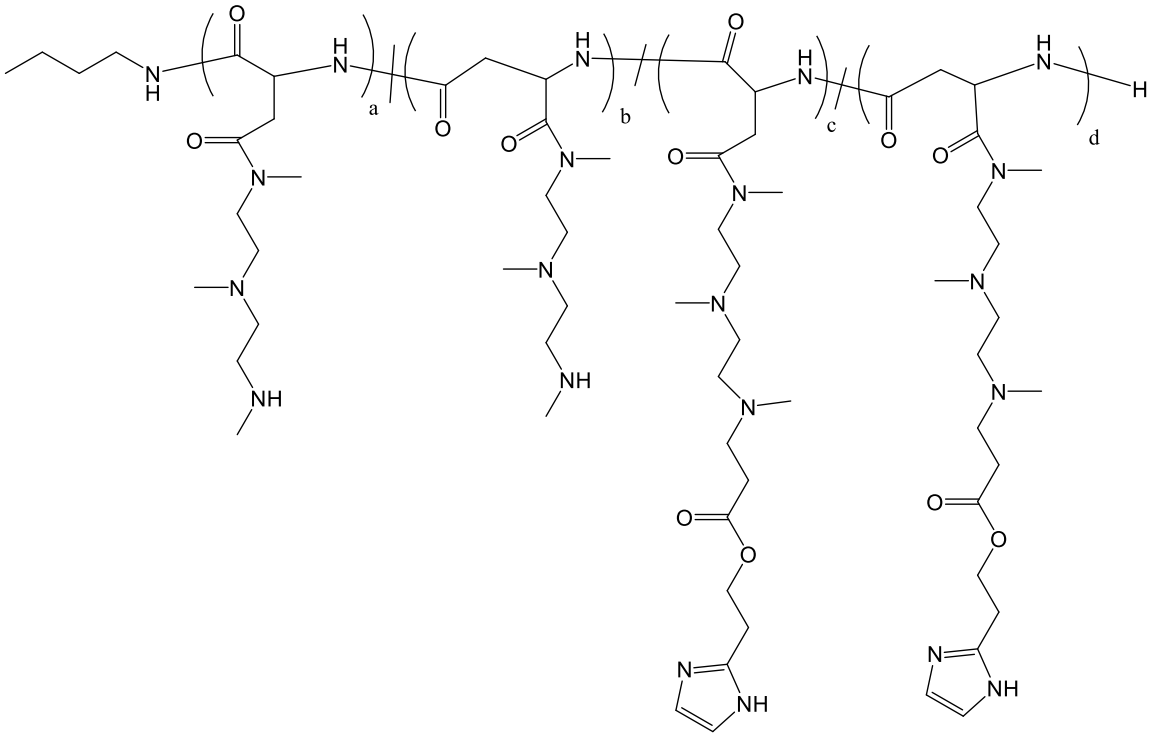
Polymer 16

,



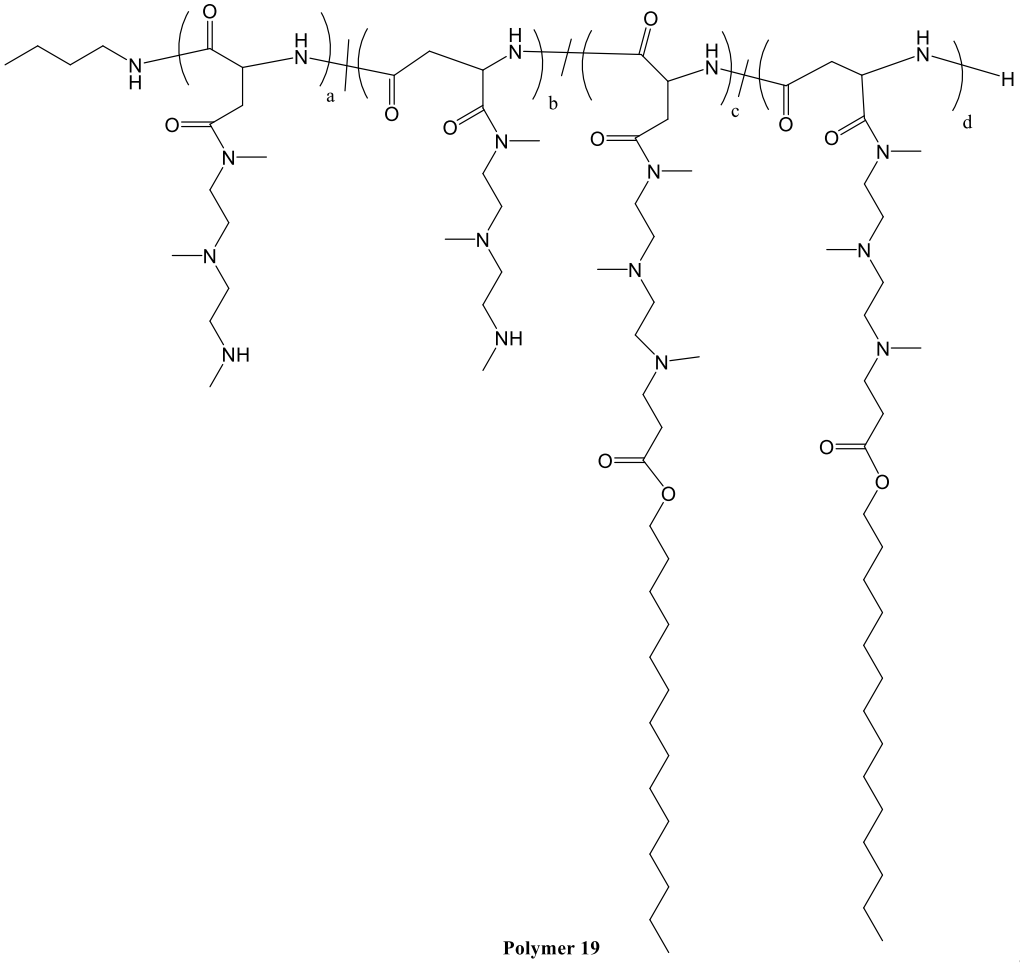
Polymer 17

,



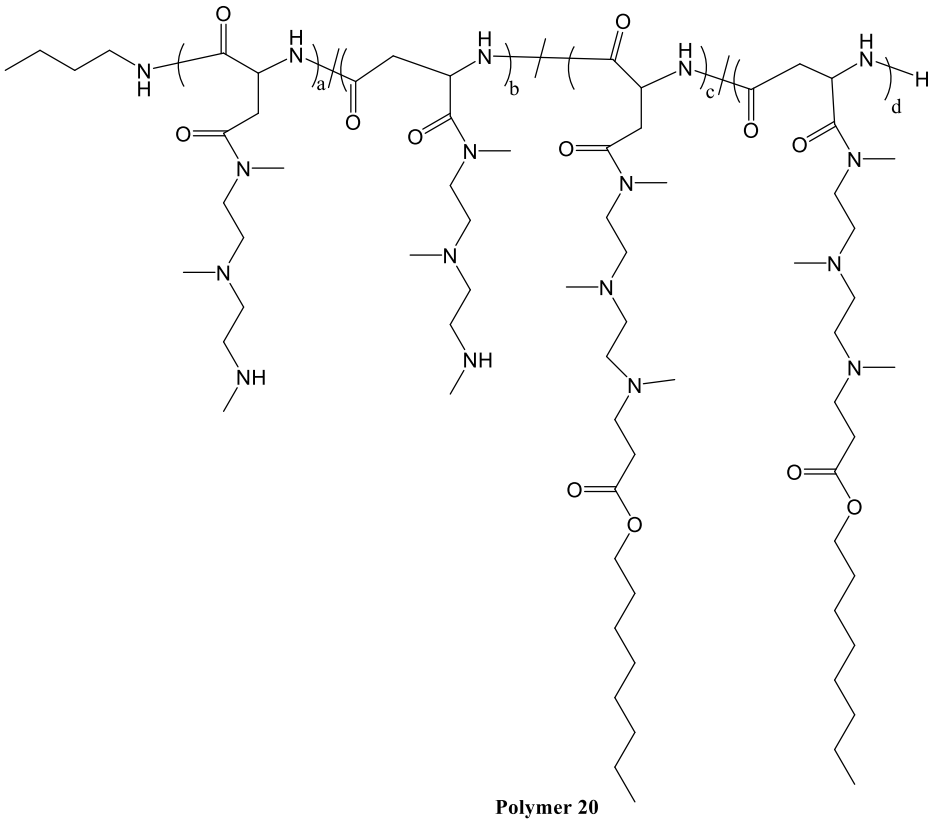
Polymer 18

,



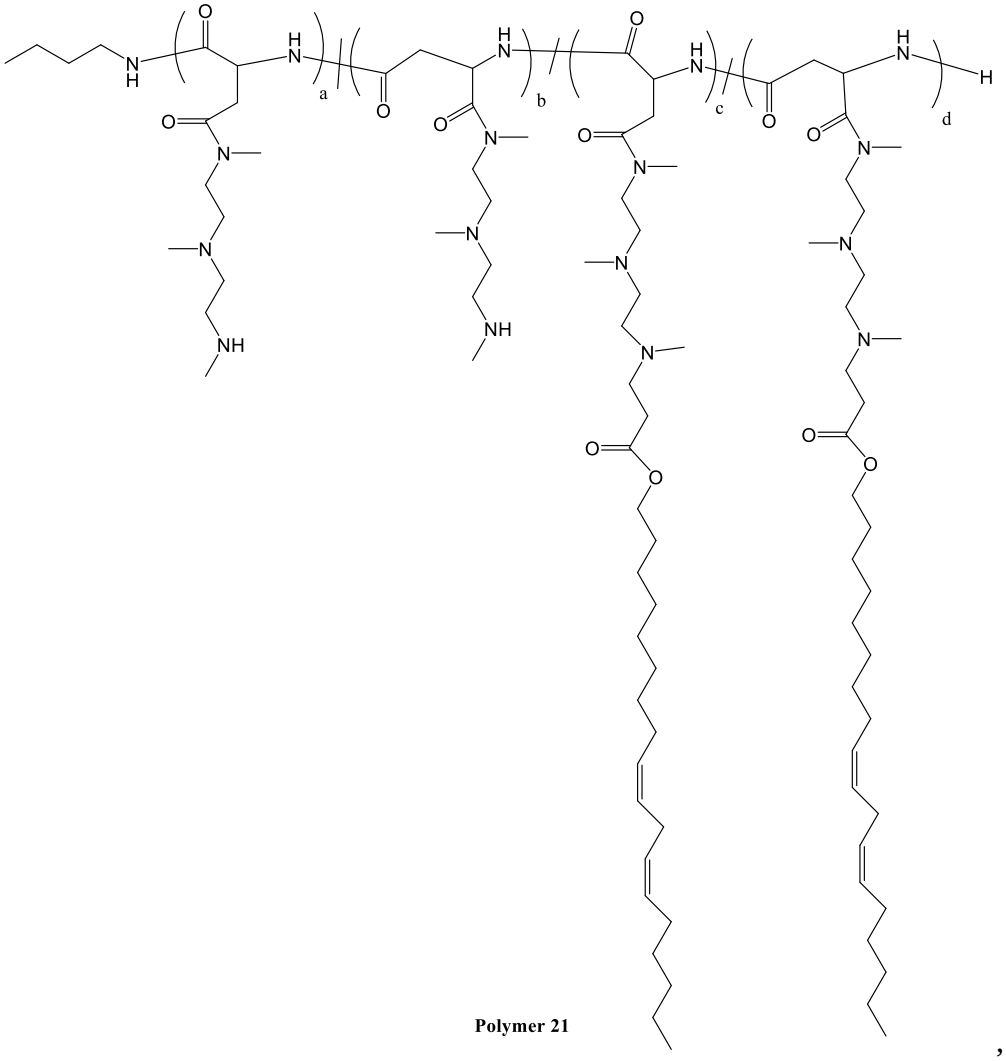
Polymer 19

,



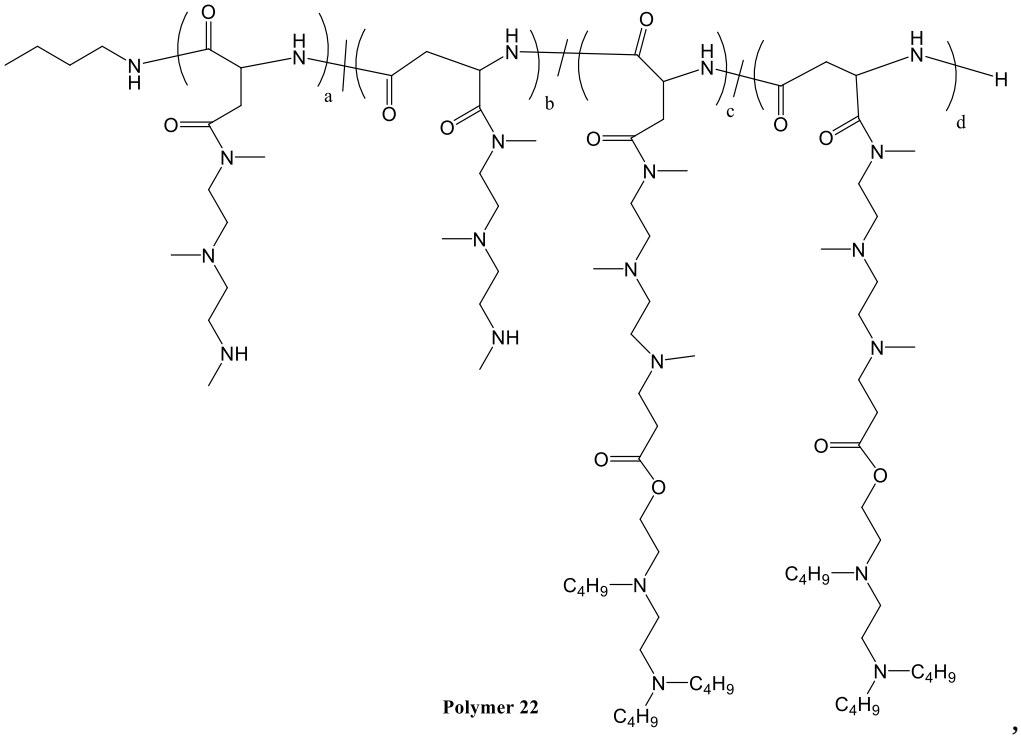
Polymer 20

,



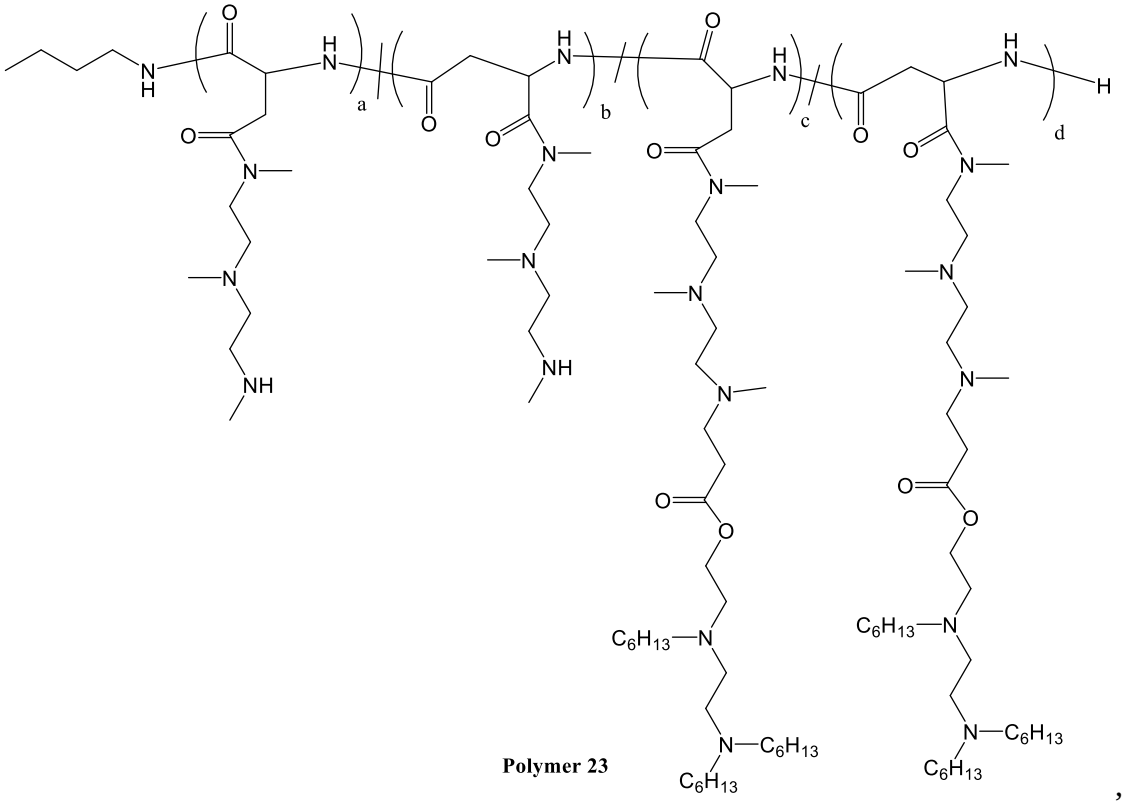
Polymer 21

,



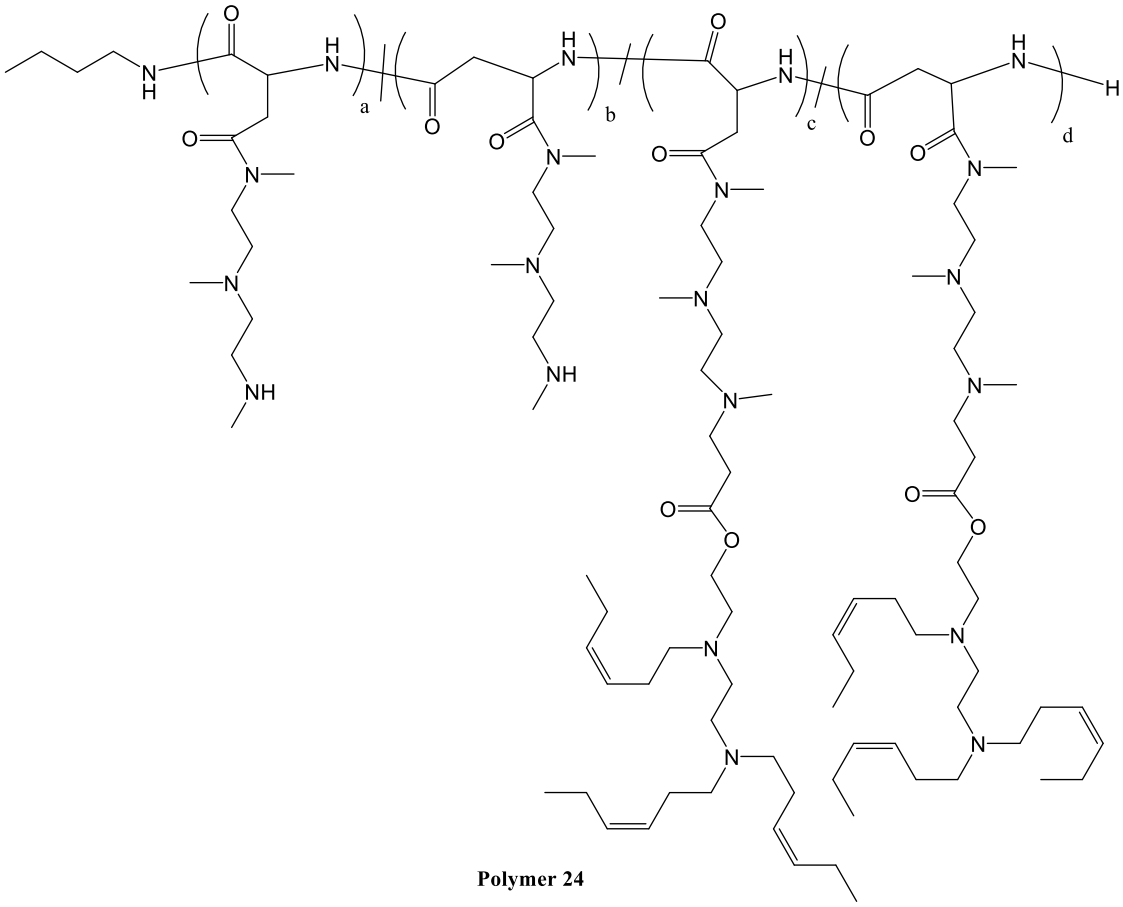
Polymer 22

,



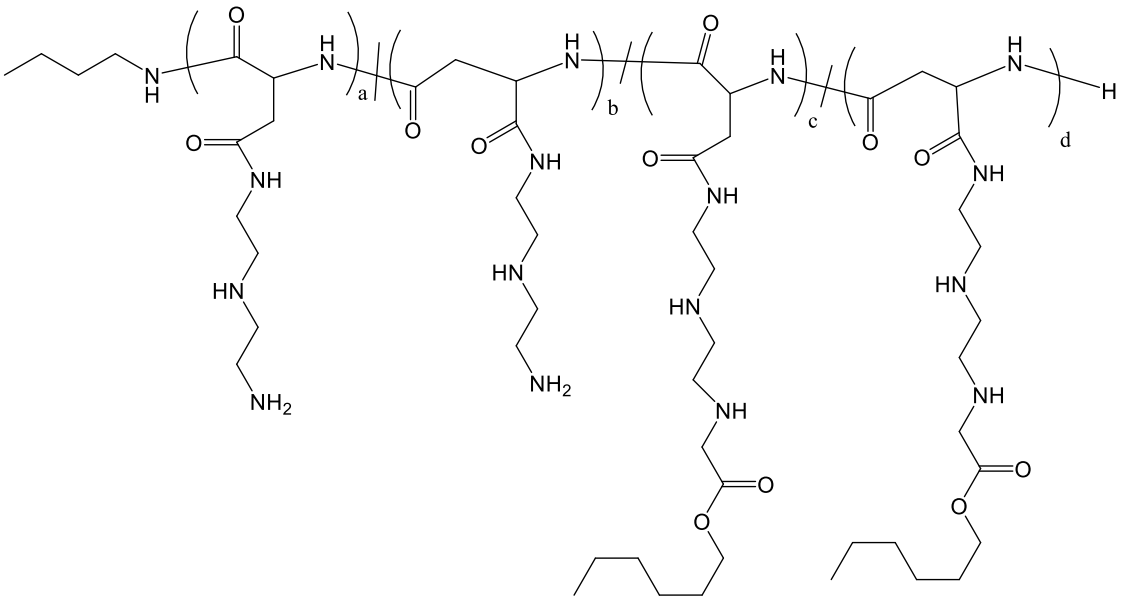
Polymer 23

,



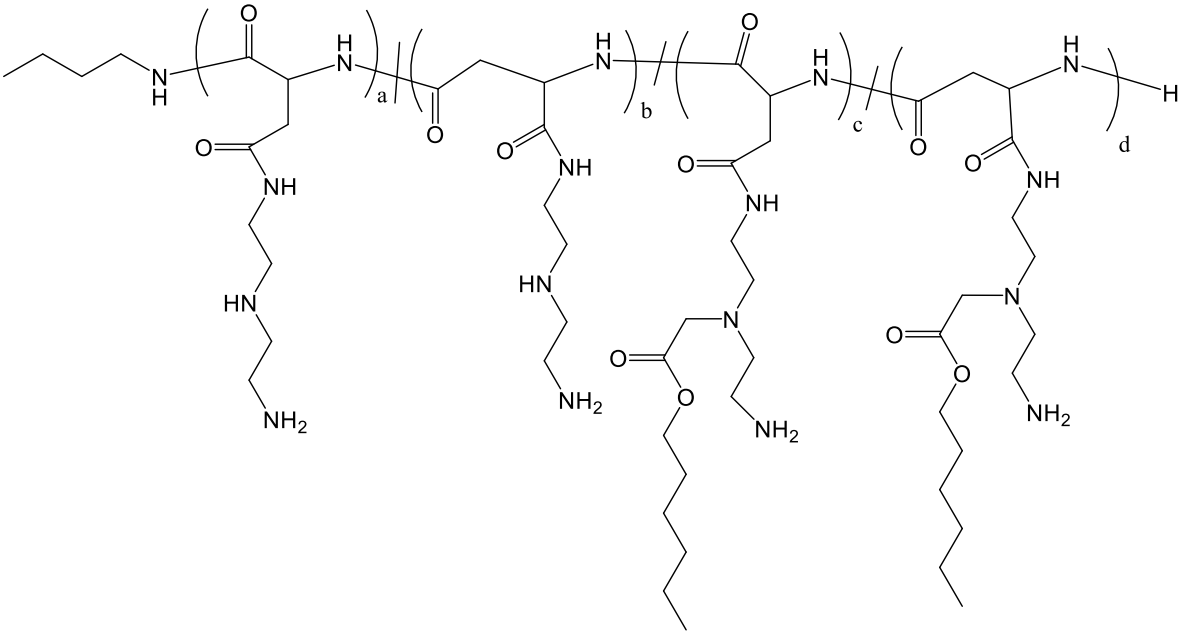
Polymer 24

,



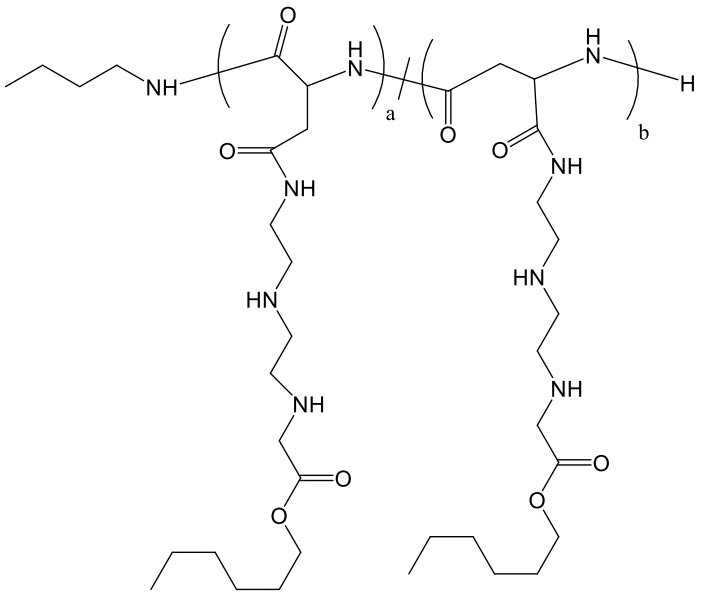
Polymer 28

, or



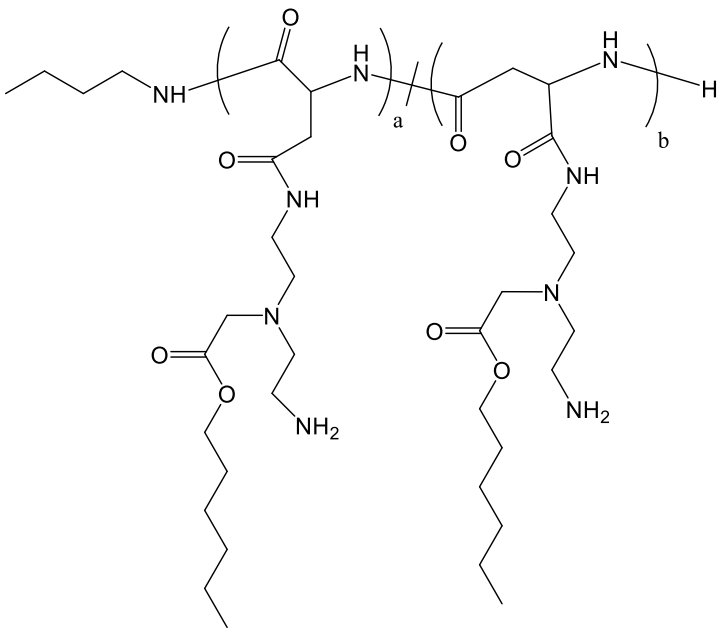
Polymer 29

,wherein (a+b) is from about 0 to about 75 and (c+d) is from about 5 to about 80, or



Polymer 37

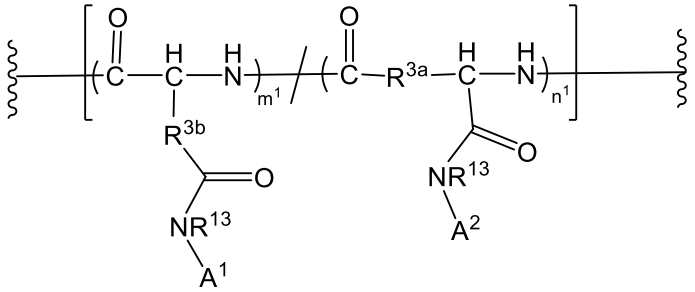
, or



Polymer 38

wherein (a+b) is from about 5 to about 160.

12. A method of preparing a polymer of any one of claims 1-11, the method comprising modifying at least a portion of groups A^1 and/or A^2 of a polymer comprising a structure of Formula 3:



wherein:

each of m^1 and n^1 is an integer from 0 to 1000, provided that $m^1 + n^1$ is greater than 5;

the symbol "/" indicates that the units separated thereby are linked randomly or in any order;

R^{3a} and R^{3b} are each independently a methylene or ethylene group;

each instance of R^{13} is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

A^1 and A^2 are each independently a group of formula

—$(CH_2)_{p1}$—[NR^2—$(CH_2)_{q1}$—]$_{r1}NR^2_2$;

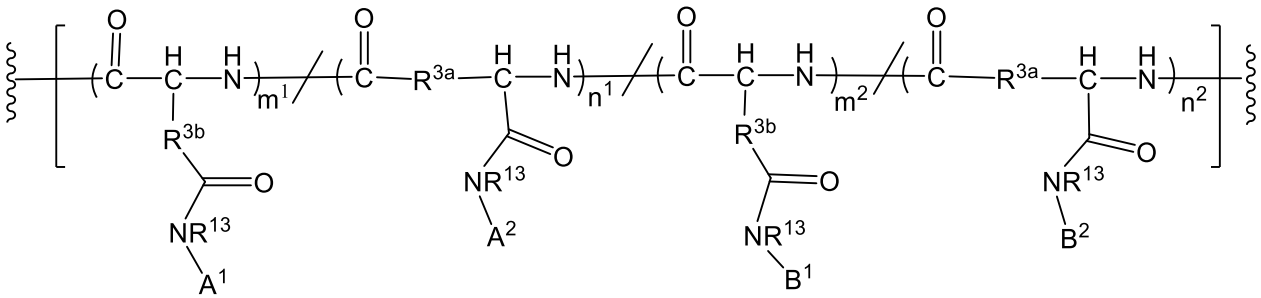
—$(CH_2)_{p2}$—N[—$(CH_2)_{q2}$—NR^2_2]$_2$;

—$(CH_2)_{p3}$—N{[—$(CH_2)_{q3}$—NR^2_2][—$(CH_2)_{q4}$—NR^2—]r_2R^2}; or

—$(CH_2)_{p4}$—N{—$(CH_2)_{q5}$—N[—$(CH_2)_{q6}$—NR^2_2]$_2$}$_2$,

wherein p1 to p4, q1 to q6, and r1 and r2 are each independently an integer of 1 to 5; and each instance of R^2 is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group,

to produce a polymer comprising a structure of Formula 1:



wherein:

each of m^1 and n^1 is an integer from 0 to 1000;

each of m^2 and n^2 is an integer from 0 to 1000, provided that the sum of $m^2 + n^2$ is greater than 5;

the symbol "/" indicates that the units separated thereby are linked randomly or in any order;

R^{3a} and R^{3b} are each independently a methylene or ethylene group;

each instance of R^{13} is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

A^1 and A^2 are each independently a group of formula

$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2{}_2$;

$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2{}_2]_2$;

$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2{}_2][—(CH_2)_{q4}—NR^2—]_{r2}R^2\}$; or

$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2{}_2]_2\}_2$,

B^1 and B^2 are each independently

$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2\text{-}(CH_2)_{s1}\text{-}R^4\text{-}R^5$;

$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2\text{-}(CH_2)_{s2}\text{-}R^4\text{-}R^5]_2$;

$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2{}_2][—(CH_2)_{q4}—NR^2—]_{r2}(CH_2)_{s3}\text{-}R^4\text{-}R^5\}$;

$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2\text{-}(CH_2)_{s4}\text{-}R^4\text{-}R^5]_2\}_2$;

$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2\text{-}CH_2\text{-}CHOH\text{-}R^5$;

$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2\text{-}CH_2\text{-}CHOH\text{-}R^5]_2$;

$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2{}_2][—(CH_2)_{q4}—NR^2—]_{r2}\text{-}CH_2\text{-}CHOH\text{-}R^5\}$;

$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2\text{-}CH_2\text{-}CHOH\text{-}R^5]_2\}_2$;

$—(CH_2)_{p1}—[NR^2—(CH_2)_{q1}—]_{r1}NR^2\text{-}(CH_2)_{s1}\text{-}R^5$;

$—(CH_2)_{p2}—N[—(CH_2)_{q2}—NR^2\text{-}(CH_2)_{s2}\text{-}R^5]_2$;

$—(CH_2)_{p3}—N\{[—(CH_2)_{q3}—NR^2{}_2][—(CH_2)_{q4}—NR^2—]_{r2}(CH_2)_{s3}\text{-}R^5\}$;

$—(CH_2)_{p4}—N\{—(CH_2)_{q5}—N[—(CH_2)_{q6}—NR^2\text{-}(CH_2)_{s4}\text{-}R^5]_2\}_2$;

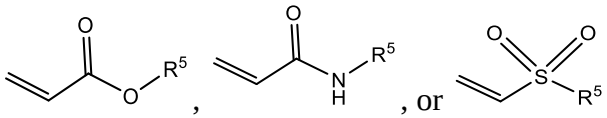
$—(CH_2)_{p1}—[N\{(CH_2)_{s1}\text{-}R^4\text{-}R^5\}—(CH_2)_{q1}—]_{r1}NR^2{}_2$; or

$—(CH_2)_{p1}—[N\{(CH_2)_{s1}\text{-}R^5\}—(CH_2)_{q1}—]_{r1}NR^2{}_2$,

wherein p1 to p4, q1 to q6, r1 and r2, and s1 to s4 are each independently an integer of 1 to 5; each instance of R^2 is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group; each instance of R^4 is independently -C(O)O-, -C(O)NH-, or -S(O)(O)-; and each instance of R^5 is independently an alkyl group, cycloalkyl group, alkenyl group, cycloalkenyl group, aryl group, heteroalkyl group, heterocyclic group, or combination thereof optionally comprising from 1 to 8 secondary or tertiary amines or a substituent comprising a tissue-specific or cell-specific targeting moiety.

13. The method of claim 12, wherein group A^1 and/or A^2 of the polymer comprising a structure of Formula 3 are modified by a Michael addition reaction between the polymer comprising the structure of Formula 3 and an acrylate, an acrylamide, a vinyl sulfone, or a combination thereof.

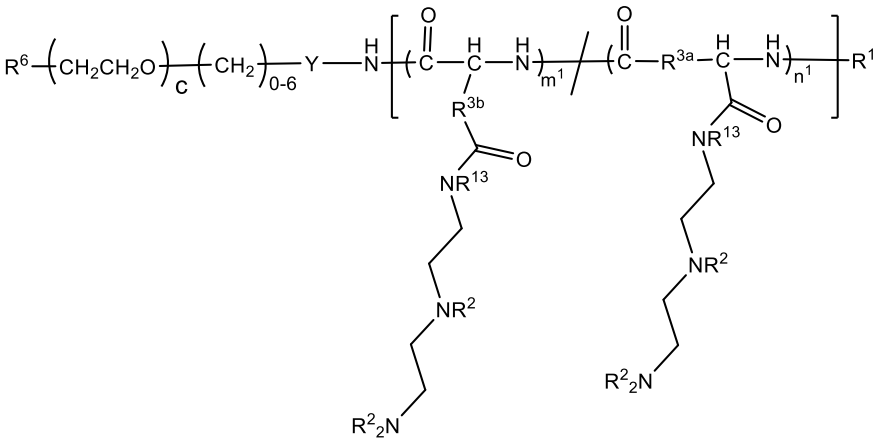
14. The method of claim 13, wherein the acrylate, acrylamide, or vinyl sulfone is of the formula:



, , or

wherein R^5 is an alkyl group, cycloalkyl group, alkenyl group, cycloalkenyl group, aryl group, heteroalkyl group, heterocyclic group, or combination thereof optionally comprising from 1 to 8 secondary or tertiary amines or a substituent comprising a tissue-specific or cell-specific targeting moiety.

15. The method of any one of claims 12-14, wherein the polymer comprising the structure of Formula 3 is a polymer of Formula 3A:



wherein,

c is an integer from 0 to 50;

Y is optionally present and is a cleavable linker;

each of m^1 and n^1 is an integer from 0 to 1000; provided that the sum of $m^1 + n^1$ is greater than 5;

the symbol "/" indicates that the units separated thereby are linked randomly or in any order;

R^1 is hydrogen, an aryl group, a heterocyclic group, a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group, or a C_1-C_{12} linear or branched alkyl group optionally substituted with one or more substituents;

each instance of R^2 is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

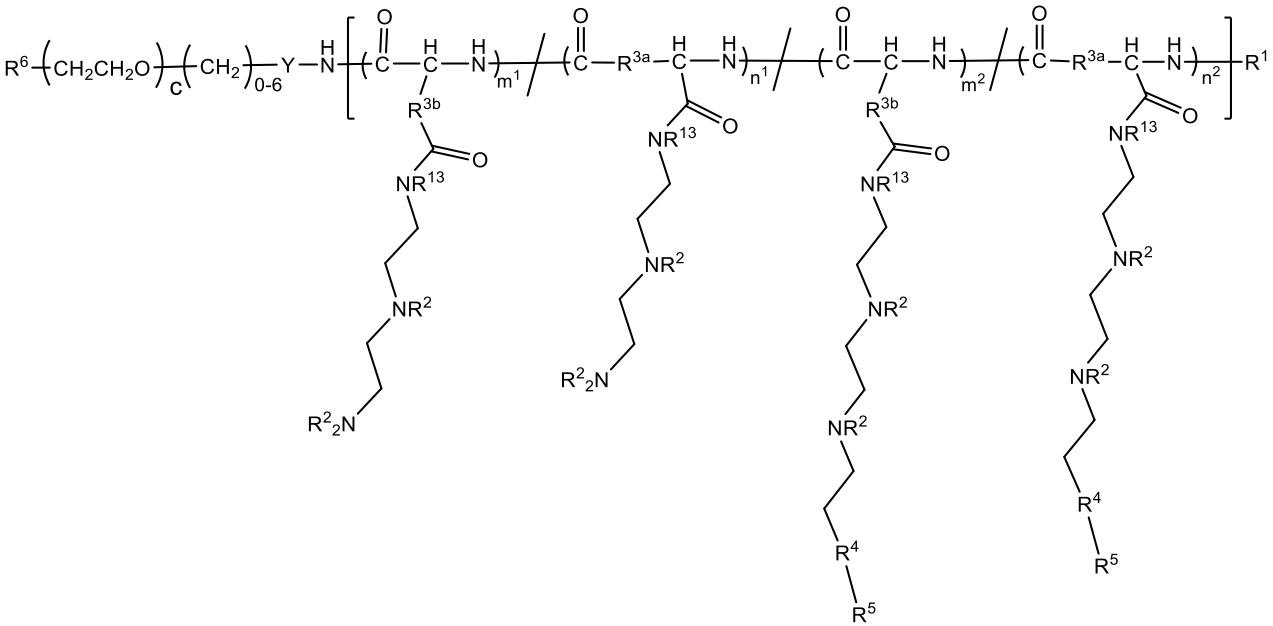
R^{3a} and R^{3a} are each independently a methylene or ethylene group; and

R^6 is hydrogen, an amino group, an aryl group, a heterocyclic group, a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group, a C_1-C_{12} linear or branched alkyl group optionally substituted with one or more amines; or a tissue-specific or cell-specific targeting moiety;

each instance of R^{13} is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

and

the polymer comprising a structure of Formula 1 is a polymer of Formula 1A:



wherein

c is an integer from 0 to 50;

Y is optionally present and is a cleavable linker;

each of m^1 and n^1 is an integer from 0 to 1000;

each of m^2 and n^2 is an integer from 0 to 1000, provided that the sum of $m^2 + n^2$ is greater than 5;

the symbol "/" indicates that the units separated thereby are linked randomly or in any order;

R^1 is hydrogen, an aryl group, a heterocyclic group, a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group, or a C_1-C_{12} linear or branched alkyl group optionally substituted with one or more substituents;

each instance of R^2 is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group;

R^{3a} and R^{3a} are each independently a methylene or ethylene group;

each instance of R^4 is —C(O)O—, —C(O)NH—, or —S(O)(O)—;

each instance of R^5 is independently an alkyl group, cycloalkyl group, alkenyl group, cycloalkenyl group, aryl group, heteroalkyl group, heterocyclic group, or combination thereof optionally comprising from 1 to 8 secondary or tertiary amines or a substituent comprising a tissue-specific or cell-specific targeting moiety;

R^6 is hydrogen, an amino group, an aryl group, a heterocyclic group, a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group, a C_1-C_{12} linear or branched alkyl group optionally substituted with one or more amines; or a tissue-specific or cell-specific targeting moiety; and

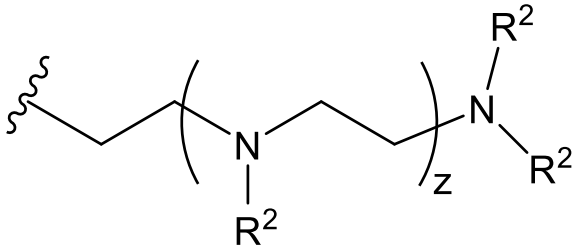
each instance of R^{13} is independently hydrogen or a C_1-C_{12} alkyl group, alkenyl group, cycloalkyl group, or cycloalkenyl group.

16. The method of any of claims 12-15, wherein each of A1 and A2 is a group of formula —$(CH_2)_{p1}$—[NH—$(CH_2)_{q1}$—]$_{r1}$$NH_2$, and each of B^1 and B^2 is a group of formula—$(CH_2)_{p1}$—[NH—$(CH_2)_{q1}$—]$_{r1}$NH-$(CH_2)_2$-R^4-R^5

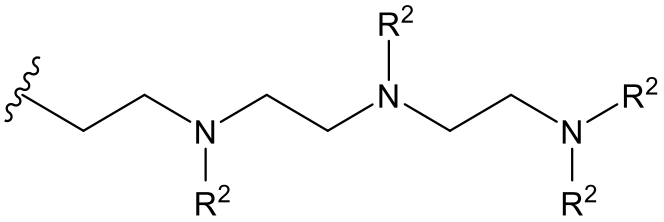
17. The method of any of claims 12-16, wherein each of A^1 and A^2 is a group of formula –$(CH_2)_2$-NH-$(CH_2)_2$-NH_2, and each of B^1 and B^2 is a group of formula–$(CH_2)_2$-NH-$(CH_2)_2$-NH-$(CH_2)_2$-R^4-R^5.

18. The method of any one of claims 12-17, wherein R^4 is –C(O)-O-.

19. The method of any one of claims 12-18, wherein R^5 is



or



.

20. The method of any of claims 12-19, wherein a sufficient number of A^1 and/or A^2 groups of the polymer comprising the structure of Formula 3 are modified to provide a polymer comprising a structure of Formula 1 in which the ratio of $(m^1+n^1)/(m^2+n^2)$ is about 20 or less, and, optionally, about 0.2 or more.

21. A composition comprising a polymer of any one of claims 1-11 and a nucleic acid and/or polypeptide.

22. The composition of claim 21, wherein the composition comprises a guide nucleic acid and/or donor nucleic acid.

23. The composition of claim 21 or 22, wherein the composition comprises an endonuclease.

24. The composition of claim 23, wherein the composition comprises an RNA-guided endonuclease or nucleic acid encoding same.

25. The composition of claim 24, wherein the RNA-guided endonuclease is Cas9, Cpf1, or a combination thereof.

26. The composition of any one of claims 21-25, wherein the composition comprises a DNA recombinase.

27. The composition of claim 26, wherein the DNA recombinase is Cre recombinase.

28. The composition of any one of claims 21-27, wherein the composition comprises a zinc finger nuclease.

29. The composition of any one of claims 21-28, wherein the composition comprises a transcription activator-like effector nuclease.

30. The composition of any one of claims 21-29, wherein the composition comprises an siRNA or dsRNA.

31. The composition of any one of claims 21-29, wherein the composition comprises a nanoparticle comprising the polymer of any of claims 1-9 and the nucleic acid or polypeptide.

32. The composition of any one of claims 21-30, wherein the composition comprises a second polymer that comprises polyethylene oxide.

33. A method of delivering a nucleic acid and/or polypeptide to a cell, the method comprising administering the composition of any one of claims 21-32 to the cell.

34. The method of claim 33, wherein the cell is in a subject and the composition is administered to the subject.

35. The method of claim 33 or 34, wherein the polymer comprises a tissue-specific targeting moiety that localizes the polymer to tissues of the peripheral nervous system, the central nervous system, liver, muscle, lung, bone, or the eye of the subject.

36. The method of claim 35, wherein the polymer comprises a targeting moiety that preferentially binds to tumor cells.

37. The method of any of claims 33-36, wherein the composition comprises one or more of an RNA guided endonuclease or nucleic acid encoding same, a guide nucleic acid, and a donor nucleic acid, and the composition facilitates editing of a target gene in the cell.

38. The method of any of claims 33-37, wherein the cell is in a host, optionally a human, and the composition is delivered to the cell by administering the composition to the host.