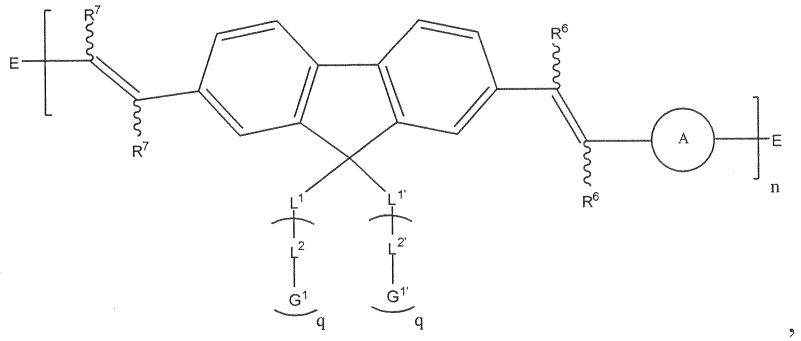
CLAIMS

What is claimed is:

1. A polymer represented the following formula:



,

wherein:

E, for each occurrence, is independently ethynyl, $-N_3$, a trialkylsiloxy or an aryl group optionally substituted with a reactive group or a pendent reactive group capable of undergoing chain extension, conjugation, or crosslinking;

A is an aryl or a heteroaryl, optionally substituted with one or more substituents selected from halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, a C6-C18 (hetero)aryl group and an ethylene glycol polymer; wherein the substituents for ring A are not ammonium group;

L^1, $L^{1'}$, L^2 and $L^{2'}$ are each independently a covalent bond, a C1-C12 alkylene, a C3-C12 cycloalkylene, a C2-C12 alkenylene, a C2-C12 alkynylene, a (C6-C18)aryl(C1-C12)alkylene, a (C6-C18)aryl(C2-C12)alkenylene, a (C6-C18)aryl(C1-C12)alkynylene, a C6-C18 arylene group, $-Y_1-[O-Y_2]_p-$,$-O-Y_1-[O-Y_2]_p-$ wherein each C1-C12 alkylene, C3-C12 cycloalkylene, (C6-C18)aryl(C1-C12)alkylene, or C6-C18 arylene group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, $-Y_1-[O-Y_2]_p-$ or $-O-Y_1-[O-Y_2]_p-$;

q is 0 or an integer from 1 to 8;

p is 0 or an integer from 1 to 24;

Y_1 and Y_2 are each independently a covalent bond, or a C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene, wherein each C1-12 alkylene group, C3-C12 cycloalkylene, C6-C18 (hetero)arylene, (C6-C18)aryl(C1-C12)alkylene is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

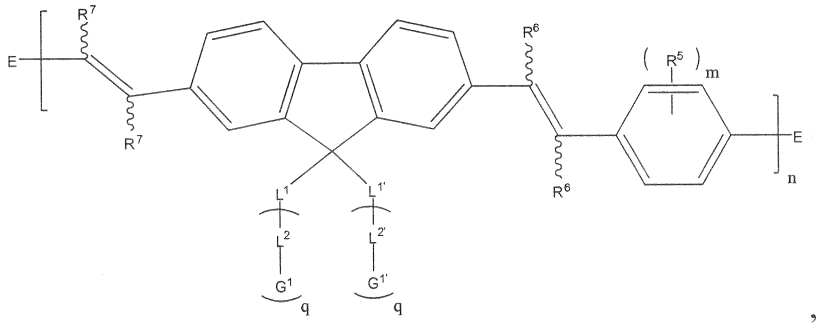
each R^6 and R^7 is independently hydrogen, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group, wherein each C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, cyano, or C2-C12 (hetero)alkynl;

G^1 and $G^{1'}$ are each independently, ethynyl, $-N_3$, hydrogen, C1-C6 alkyl, -OH, -OR, -COOH, -SH, -SR, $-SHR^+$, $-SR_2^+$, $-SO_3^-$, $-PO_4^-$, -Br, $-NH_2$, -NHR, $-NR_2$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$, wherein each R is independently a C1-C6 alkyl and $-SHR^+$, SR_2^+, $-SO_3^-$, $-PO_4^-$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$ each optionally has an associated counterion; and

n is an integer from 1 to about 1,000.

2. The polymer of Claim 1, wherein two or more repeat units are covalently cross-linked via one or more groups G^1 or $G^{1'}$.

3. The polymer of Claim 1, comprising a repeat unit represented by the following formula:



,

wherein:

each R^5 is independently a halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy,

C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino or a C6-C18 (hetero)aryl group, and wherein each C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino or a C6-C18 (hetero)aryl group is further optionally substituted with one or more one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl group; and

m is 0 or an integer from 1 to 4.

4. The polymer of Claim 3, wherein G^1 and $G^{1'}$, are each independently, $-SHR^+$, $-SR_2^+$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$.

5. The polymer of Claim 3, wherein G^1 and $G^{1'}$, are each independently, $-SHR^+$, $-SR_2^+$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$ with an associated counterion.

6. The polymer of Claim 5, wherein each R^6 and each R^7 is hydrogen.

7. The polymer of Claim 6, wherein each R^5 is hydrogen.

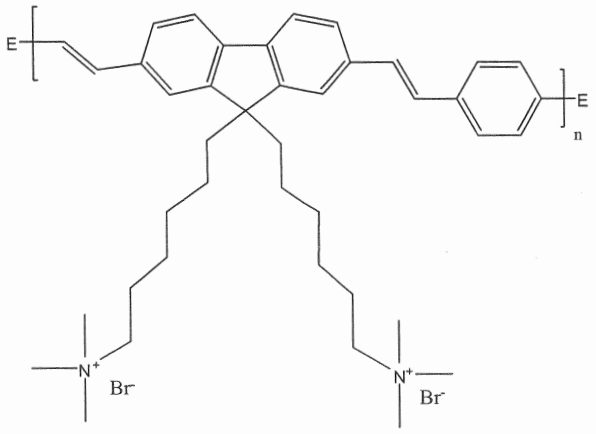
8. The polymer of Claim 5, wherein L^1 and $L^{1'}$, are each independently, a C1-C12 alkylene or $-Y_1-[O-Y_2]_p-$.

9. The polymer of Claim 8, wherein L^1 and $L^{1'}$, are each independently $-Y_1-[O-Y_2]_p-$, and Y_1 and Y_2 are each independently, a C1-C12 alkylene.

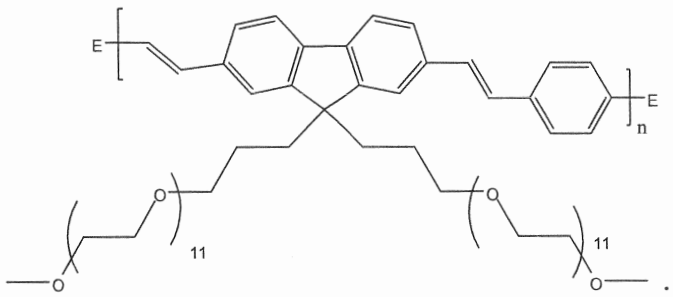
10. The polymer of Claim 8, wherein L^1 and $L^{1'}$, are each independently a C1-C12 alkylene.

11. The polymer of Claim 10, wherein G^1 and $G^{1'}$, are each independently $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$.

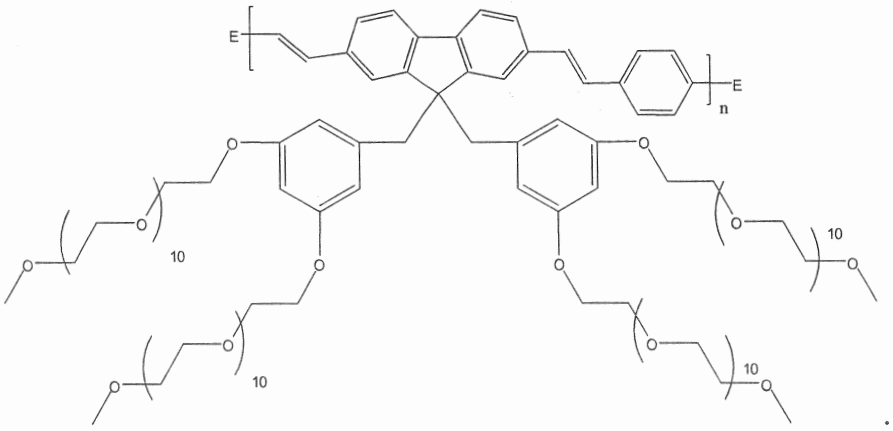
12. The polymer of Claim 11, comprising a repeat unit represented by the following formula:



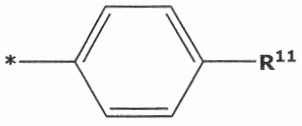
13. The polymer of Claim 3, comprising a repeat unit represented by the following formula:



14. The polymer of Claim 3, comprising a repeat unit represented by the following formula:



15. The polymer of Claim 1, wherein E, for each occurrence, is independently represented by formula (VI):



wherein R^{11} is a halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, C6-C18 (hetero)aryl group, $-[O-CH_2-CH_2]_t-Z$, or (C1-C12)alkoxy-X;

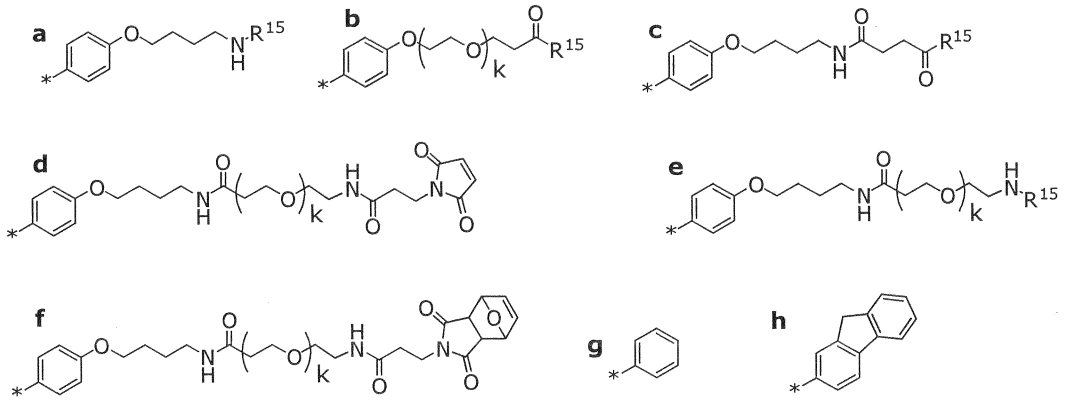
Z is –OH or –COOH;

X is $–NH_2$, –NHCOOH, $–NHCOOC(CH_3)_3$, –NHCO(C3-C12)cycloalkyl(C1-C4)alkyl-*N*-maleimide; or $–NHCO[CH_2-CH_2-O]_sNH_2$;

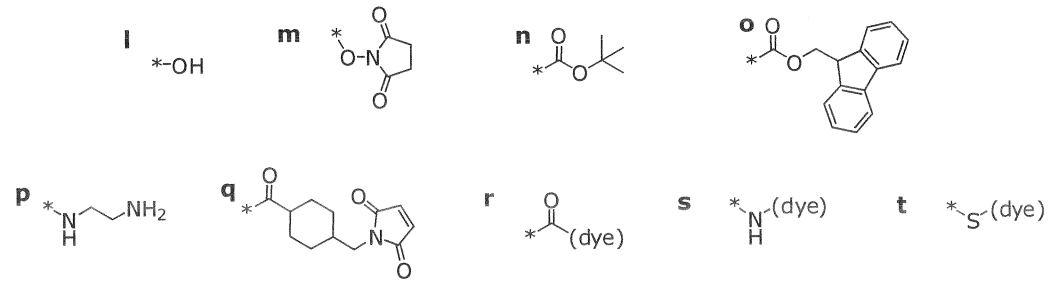
t is an integer from 1 to 20; and

s is an integer from 1 to 8.

16. The polymer of Claim 1, wherein E, for each occurrence, is independently selected from the group consisting of a-h having the structure



wherein k = 2, 4, 8, 12 or 24 and R^{15} is selected from the group consisting of l-t having the structure:



,

wherein (dye) is an organic dye with covalent linker.

17. A method of detecting an analyte, comprising:

contacting an analyte with a cognate ligand under conditions which promote binding of the analyte to the cognate ligand;

contacting the analyte bound to the cognate ligand with a polymer of Claim 1 under conditions that promote binding of the polymer to the analyte;

exciting a fluorescent signal in the polymer bound to the analyte; and

detecting the fluorescent signal emitted by the polymer.

18. The method of Claim 17, wherein the analyte is a nucleic acid, a peptide, a protein, a peptide-nucleic acid (PNA), a lipid, a polysaccharide, a liposaccharide, a lipoprotein, or a glycoprotein.

19. The method of Claim 18, wherein the analyte is fluorescently labeled.

20. The method of Claim 18, wherein the analyte is a nucleic acid, a protein or a peptide.

21. The method of Claim 18, wherein the analyte is a nucleic acid or a PNA, and wherein the cognate ligand is a nucleic acid.

22. The method of Claim 21, wherein the cognate ligand is attached to a solid support material.

23. The method of Claim 22, wherein the solid support material comprises beads selected from the group consisting of polymer beads, polystyrene beads, silica beads, metal magnetic beads, inorganic nanoparticles, metal nanoparticles and a combination thereof.

24. The method of Claim 22, wherein the solid support material is disposed on a substrate.

25. The method of Claim 24, wherein the substrate is glass, silicon, plastics or polymers.

26. The method of Claim 24, wherein the substrate comprises wells, and wherein the solid support material is disposed within one or more wells.

27. A device for detecting an analyte, comprising:

a substrate;

a solid support material disposed on the substrate;

a ligand, attached to the solid support material, said ligand being cognate to an analyte being detected; and

a polymer of Claim 1, capable of binding to the analyte bound to the cognate ligand.

28. The device of Claim 27, wherein the substrate comprises wells, and wherein the solid support is disposed within one or more wells.

29. A kit for detecting an analyte, comprising:

a substrate;

a solid support material;

a ligand capable of being attached to the solid support material, said ligand being cognate to an analyte being detected; and

a polymer of Claim 1, capable of binding to the analyte bound to the cognate ligand.

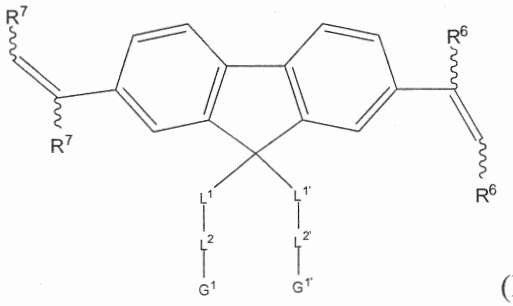
30. The kit of Claim 29, wherein the substrate comprises wells for disposing the solid support materials within one or more wells.

31. A method of preparing a polymer represented by formula (I), comprising reacting a compound of formula (II)



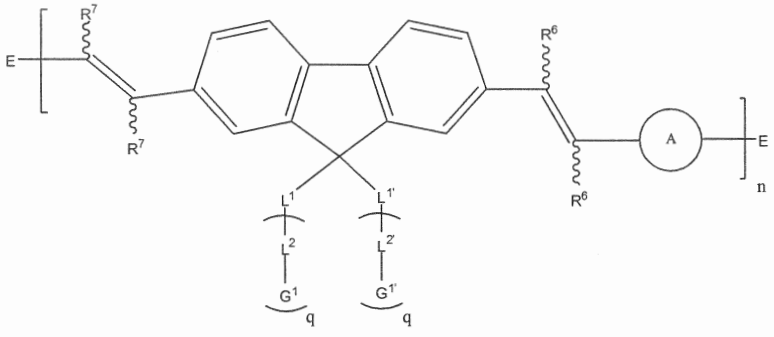
(II),

with a compound of formula (III)



(III),

thereby producing a polymer represented by the following formula:



(I),

wherein:

E, for each occurrence, is independently a trialkylsiloxy or an aryl group optionally substituted with a reactive group or a pendent reactive group capable of undergoing chain extension, conjugation, or crosslinking;

A is an aryl or a heteroaryl, optionally substituted with one or more substituents selected from halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, a C6-C18 (hetero)aryl group and an ethylene glycol polymer; wherein the substituents for ring A are not ammonium group;

L^1, $L^{1'}$, L^2 and $L^{2'}$ are each independently a covalent bond, a C1-C12 alkylene, a C3-C12 cycloalkylene, a C2-C12 alkenylene, a C2-C12 alkynylene, a (C6-C18)aryl(C1-C12)alkylene, a (C6-C18)aryl(C2-C12)alkenylene, a (C6-C18)aryl(C1-C12)alkynylene, a C6-C18 arylene group, $-Y_1-[O-Y_2]_p-$,$-O-Y_1-[O-Y_2]_p-$ wherein each C1-C12 alkylene, C3-C12 cycloalkylene, (C6-C18)aryl(C1-C12)alkylene, or C6-C18 arylene group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, $-Y_1-[O-Y_2]_p-$ or $-O-Y_1-[O-Y_2]_p-$;

q is 0 or an integer from 1 to 8;

p is 0 or an integer from 1 to 24;

Y_1 and Y_2 are each independently a covalent bond, or a C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene, wherein each C1-12 alkylene group, C3-C12 cycloalkylene, C6-C18 (hetero)arylene, (C6-C18)aryl(C1-C12)alkylene is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

each R^6 and R^7 is independently hydrogen, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group, wherein each C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group is optionally substituted with one or more halogen, hydroxyl,

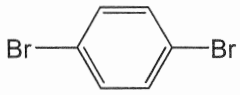
C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, cyano, or C2-C12 (hetero)alkynl;

G^1 and $G^{1'}$ are each independently, hydrogen, C1-C6 alkyl, -OH, -OR, -COOH, -SH, -SR, $-SHR^+$, $-SR_2^+$, $-SO_3^-$, $-PO_4^-$, -Br, $-NH_2$, -NHR, $-NR_2$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$, wherein each R is independently a C1-C6 alkyl and $-SHR^+$, SR_2^+, $-SO_3^-$, $-PO_4^-$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$ each optionally has an associated counterion; and

n is an integer from 1 to about 1,000.

32. The method of Claim 31, wherein:

the compound of formula (II) is represented by the following formula



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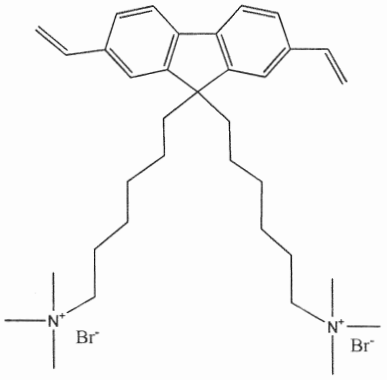
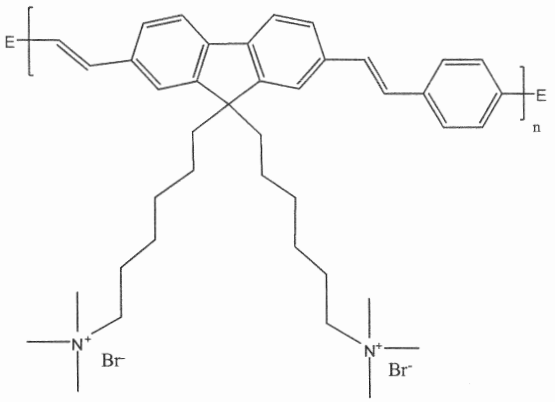
the compound of formula (III) is represented by the following formula



, and

the polymer of formula (I) comprises a repeat unit represented by the following formula



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33. The method of Claim 31, wherein the compound of formula (II) is reacted with the compound formula (III) in the presence of an amine.

34. The method of Claim 33, wherein the compound of formula (II) is reacted with the compound formula (III) at a temperature between 20 °C to 150 °C.

35. The method of Claim 33, wherein the amine is a primary amine, secondary amine or a tertiary amine.

36. The method of Claim 33, wherein G^1 or $G^{1'}$ are both $-NHR_2^+$ or $-NR_3^+$, wherein R is a C1-C3 alkyl.

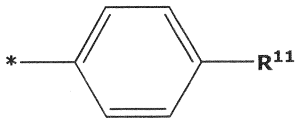
37. The polymer of Claim 1, wherein G^1 and $G^{1'}$ are the same.

38. The polymer of Claim 1, wherein G^1 and $G^{1'}$ are different.

39. The polymer of Claim 37, wherein G^1 and $G^{1'}$ are both $-NMe_3Br$ or $-N(CHMe_2)_2$.

40. The polymer of Claim 38, wherein G^1 and $G^{1'}$ are each independently $-NMe_3Br$ or $-N(CHMe_2)_2$.

41. The method of Claim 31, wherein E, for each occurrence, is independently represented by formula (VI):



wherein R^{11} is a halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, C6-C18 (hetero)aryl group, $-[O-CH_2-CH_2]_t-Z$, or (C1-C12)alkoxy-X;

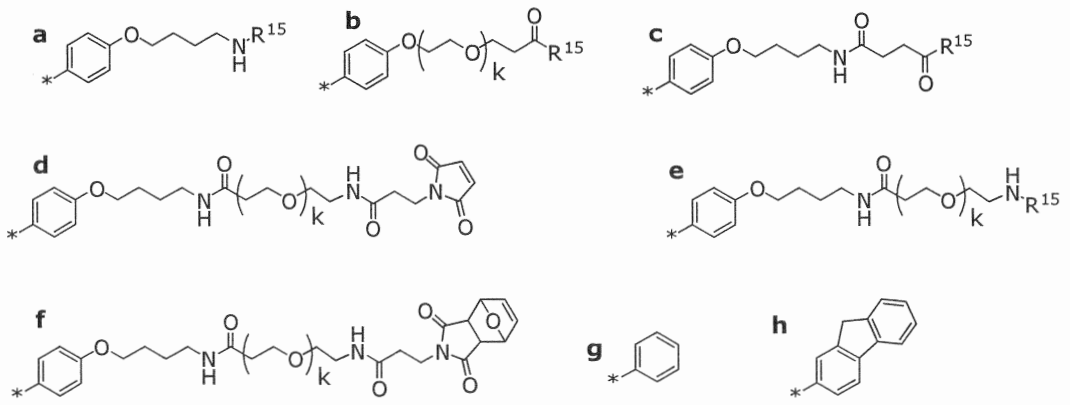
Z is –OH or –COOH;

X is $-NH_2$, –NHCOOH, $-NHCOOC(CH_3)_3$, –NHCO(C3-C12)cycloalkyl(C1-C4)alkyl-*N*-maleimide; or $-NHCO[CH_2-CH_2-O]_sNH_2$;

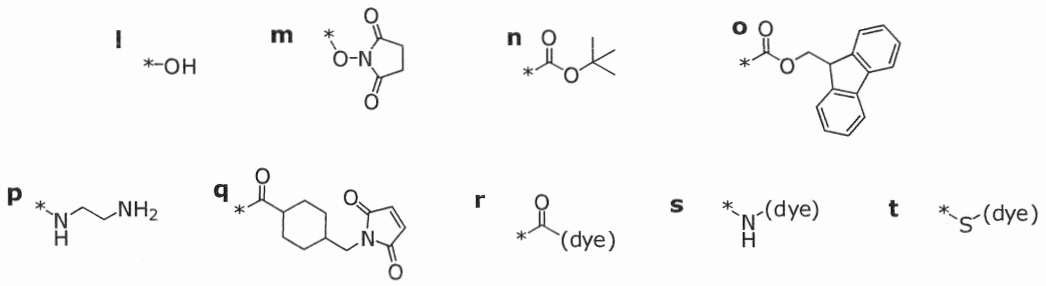
t is an integer from 1 to 20; and

s is an integer from 1 to 8.

42. The method of Claim 31, wherein E, for each occurrence, is independently selected from the group consisting of a-h having the structure



wherein k = 2, 4, 8, 12 or 24 and R^{15} is selected from the group consisting of l-t having the structure:



* = covalent attachment

where (dye) is an organic dye with covalent linker.

43. A method of detecting an analyte, comprising:

contacting an analyte with a cognate ligand under conditions which promote binding of the analyte to the cognate ligand;

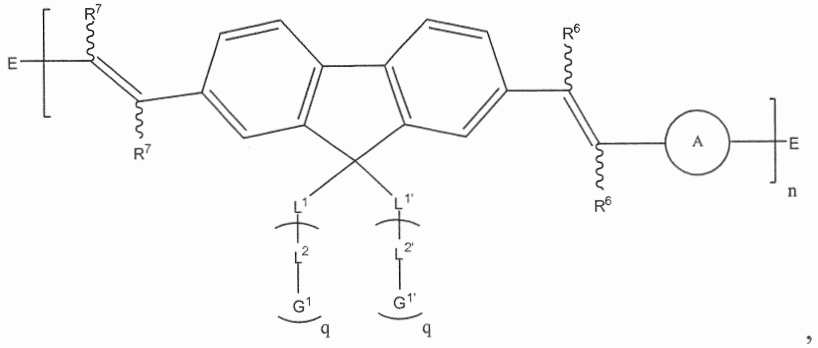
contacting the analyte bound to the cognate ligand with a polymer under conditions that promote binding of the polymer to the analyte;

exciting a fluorescent signal in the polymer bound to the analyte; and

detecting the fluorescent signal emitted by the polymer,

wherein the cognate ligand is optionally attached to a solid support material; and

wherein the polymer comprises a repeat unit represented by the following formula:



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wherein:

E, for each occurrence, is independently a trialkylsiloxy or an aryl group optionally substituted with a reactive group or a pendent reactive group capable of undergoing chain extension, conjugation, or crosslinking;

A is an aryl or a heteroaryl, optionally substituted with one or more substituents selected from halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, a C6-C18 (hetero)aryl group and an ethylene glycol polymer; wherein the substituents for ring A are not ammonium group;

L^1, $L^{1'}$, L^2 and $L^{2'}$ are each independently a covalent bond, a C1-C12 alkylene, a C3-C12 cycloalkylene, a C2-C12 alkenylene, a C2-C12 alkynylene, a (C6-C18)aryl(C1-C12)alkylene, a (C6-C18)aryl(C2-C12)alkenylene, a (C6-C18)aryl(C1-C12)alkynylene, a C6-C18 arylene group, $-Y_1-[O-Y_2]_p-$,$-O-Y_1-[O-Y_2]_p-$ wherein each C1-C12 alkylene, C3-C12 cycloalkylene, (C6-C18)aryl(C1-C12)alkylene, or C6-C18 arylene group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, $-Y_1-[O-Y_2]_p-$ or $-O-Y_1-[O-Y_2]_p-$;

q is 0 or an integer from 1 to 8;

p is 0 or an integer from 1 to 24;

Y_1 and Y_2 are each independently a covalent bond, or a C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene, wherein each C1-12 alkylene group, C3-C12 cycloalkylene, C6-

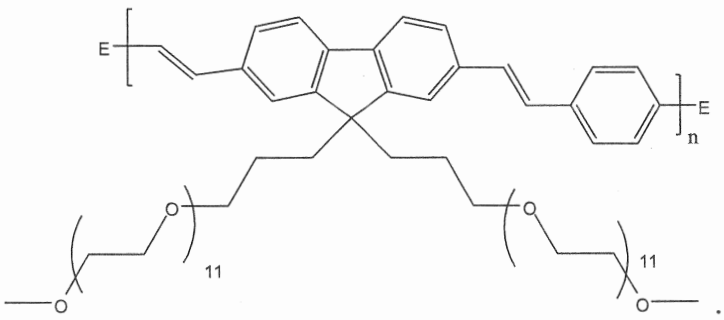
C18 (hetero)arylene, (C6-C18)aryl(C1-C12)alkylene is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

each R^6 and R^7 is independently hydrogen, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group, wherein each C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or C6-C18 (hetero)aryl group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, cyano, or C2-C12 (hetero)alkynl;

G^1 and $G^{1'}$ are each independently, hydrogen, C1-C6 alkyl, -OH, -OR, -COOH, -SH, -SR, $-SHR^+$, $-SR_2^+$, $-SO_3^-$, $-PO_4^-$, -Br, $-NH_2$, -NHR, $-NR_2$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$, wherein each R is independently a C1-C6 alkyl and $-SHR^+$, SR_2^+, $-SO_3^-$, $-PO_4^-$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$ each optionally has an associated counterion; and

n is an integer from 1 to about 1,000.

44. The method of Claim 43, comprising a repeat unit represented by the following formula:



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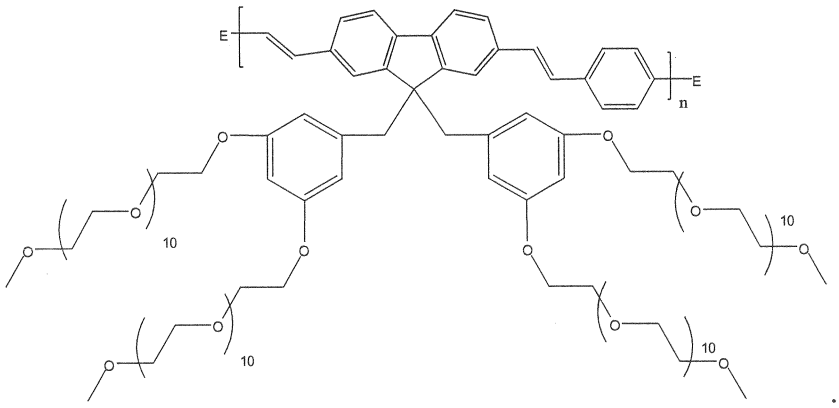
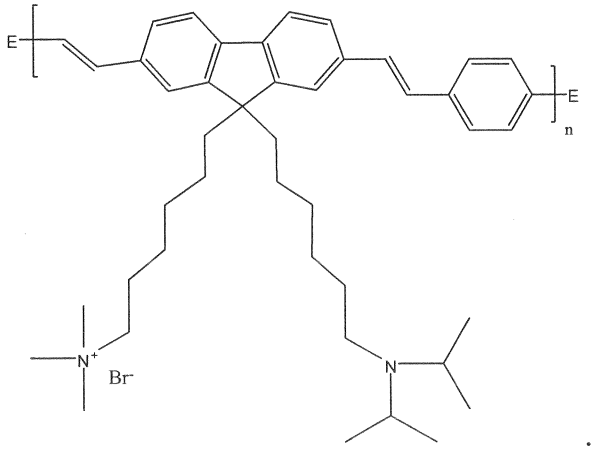
45. The method of claim 43, comprising a repeat unit represented by the following formula:

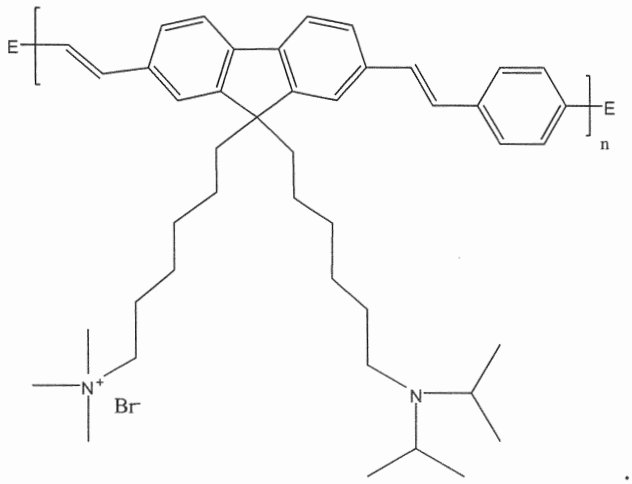


46. The polymer of claim 1, wherein the polymer is further conjugated to a primary antibody, secondary antibody, monoclonal antibody, polyclonal antibody, antibody fragment, streptavidin, or nucleic acid.

47. The polymer of claim 1, wherein the polymer comprises a repeat unit represented by the following formula:



48. The method of Claim 43, wherein the polymer comprises a repeat unit represented by the following formula:



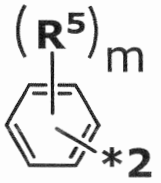
49. A method of conjugating a polymer to a dye or a biomolecule, comprising:

Modifying a dye or a biomolecule with a succinimidyl linker;

Modifying a polymer of claim 1 with a hydrazine linker; and

contacting and reacting the modified dye or a biomolecule with the modified polymer to produce a polymer conjugated to the dye or biomolecule.

50. The polymer of Claim 1, wherein A, for each occurrence, is independently represented by:



wherein each R^5 is independently a hydrogen, halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, C6-C18 (hetero)aryl group, $-[O-CH_2-CH_2]_t-Z$, or (C1-C12)alkoxy-X;

Z is –OH or –COOH;

X is $–NH_2$, –NHCOOH, $–NHCOOC(CH_3)_3$, –NHCO(C3-C12)cycloalkyl(C1-C4)alkyl-*N*-maleimide; or $–NHCO[CH_2-CH_2-O]_sNH_2$;

t is an integer from 1 to 20;

s is an integer from 1 to 8; m is 0 or an integer from 1 to 4; and

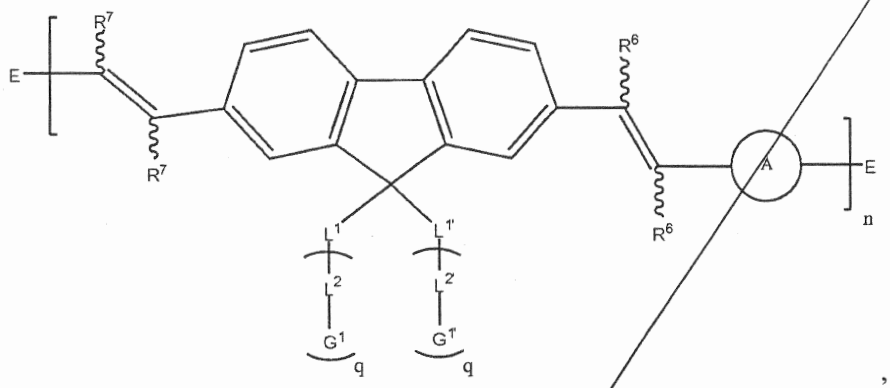
*= site for covalent attachment to unsaturated backbone.

51. The polymer of claim 1, wherein the polymer is further covalently attached to a dye, antibody, nucleic acid, substrate or biomolecule or combination thereof.

CLAIMS

What is claimed is:

1. A polymer represented the following formula:



wherein:

E, for each occurrence, is independently ethynyl, $-N_3$, halogen, hydrogen, vinylene group, a trialkylsiloxy or an aryl group optionally substituted with a reactive group or a pendent reactive group capable of undergoing chain extension, conjugation, or crosslinking;

A is an aryl or a heteroaryl, optionally substituted with one or more substituents selected from halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, a C6-C18 (hetero)aryl group and an ethylene glycol polymer; wherein the substituents for ring A are not ammonium group;

L^1, $L^{1'}$, L^2 and $L^{2'}$ are each independently a covalent bond, a C1-C12 alkylene, a C3-C12 cycloalkylene, a C2-C12 alkenylene, a C2-C12 alkynylene, a (C6-C18)aryl(C1-C12)alkylene, a (C6-C18)aryl(C2-C12)alkenylene, a (C6-C18)aryl(C1-C12)alkynylene, a C6-C18 arylene group, $-Y_1-[O-Y_2]_p$ -,$-O-Y_1-[O-Y_2]_p$ - wherein each C1-C12 alkylene, C3-C12 cycloalkylene, (C6-C18)aryl(C1-C12)alkylene, or C6-C18 arylene group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, $-Y_1-[O-Y_2]_p-$ or $-O-Y_1-[O-Y_2]_p-$;

q is 0 or an integer from 1 to 8;

p is 0 or an integer from 1 to 24;

Y_1 and Y_2 are each independently a covalent bond, or a C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene, wherein each C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

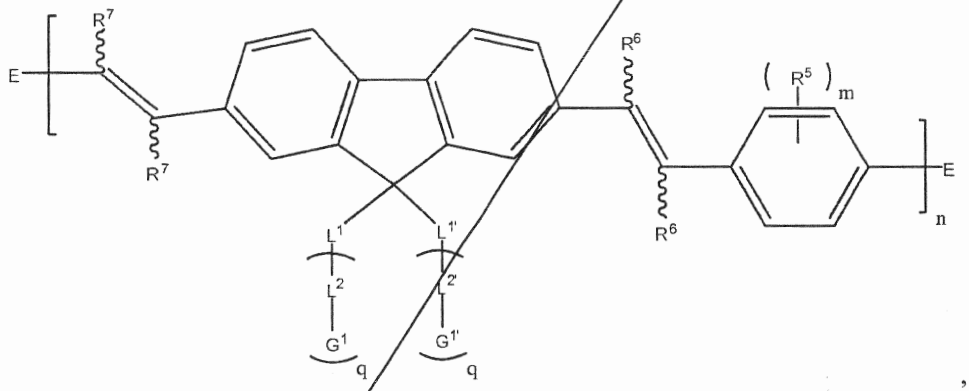
each R^6 and R^7 is independently hydrogen, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group, wherein each C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, cyano, or C2-C12 (hetero)alkynl;

G^1 and $G^{1'}$ are each independently, ethynyl, $-N_3$, hydrogen, C1-C6 alkyl, -OH, -COOH, -SH, -SR, $-SHR^+$, SR_2^+, $-SO_3^-$, $-PO_4^-$, Br, $-NH_2$, -NHR, $-NR_2$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$, wherein and each R is independently a C1-C6 alkyl and $-SHR^+$, SR_2^+, $-SO_3^-$, $-PO_4^-$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$ each optionally has an associated counterion; and

n is an integer from 1 to about 1,000.

2. The polymer of Claim 1, wherein two or more repeat units are covalently cross-linked via one or more groups G^1 or $G^{1'}$.

3. The polymer of Claim 1, comprising a repeat unit represented by the following formula:



,

wherein:

each R^5 is independently a halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino or a C6-C18 (hetero)aryl group, and wherein each C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino or a C6-C18 (hetero)aryl group is further optionally substituted with one or more one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl group; and

m is 0 or an integer from 1 to 4.

4. The polymer of Claim 3, wherein G^1 and $G^{1'}$, are each independently, $-SHR^+$, SR_2^+, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$.

5. The polymer of Claim 3, wherein G^1 and $G^{1'}$, are each independently, $-SHR^+$, SR_2^+, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$ with an associated counterion.

6. The polymer of Claim 5, wherein each R^6 and each R^7 is hydrogen.

7. The polymer of Claim 6, wherein each R^5 is hydrogen.

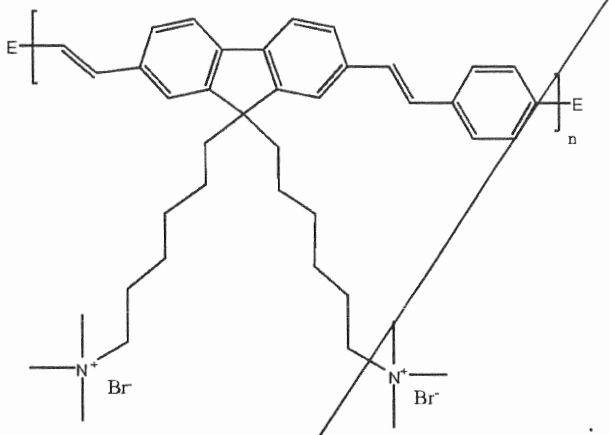
8. The polymer of Claim 5, wherein L^1 and $L^{1'}$, are each independently, a C1-C12 alkylene or $-Y_1-[O-Y_2]_p-$.

9. The polymer of Claim 8, wherein L^1 and $L^{1'}$, are each independently $-Y_1-[O-Y_2]_p-$, and Y_1 and Y_2 are each independently, a C1-C12 alkylene.

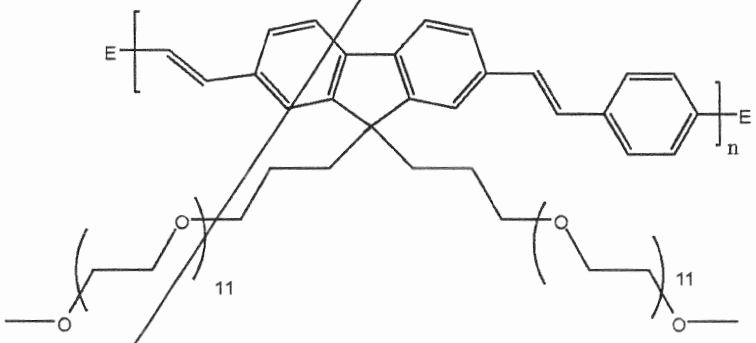
10. The polymer of Claim 8, wherein L^1 and $L^{1'}$, are each independently a C1-C12 alkylene.

11. The polymer of Claim 10, wherein G^1 and $G^{1'}$, are each independently $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$.

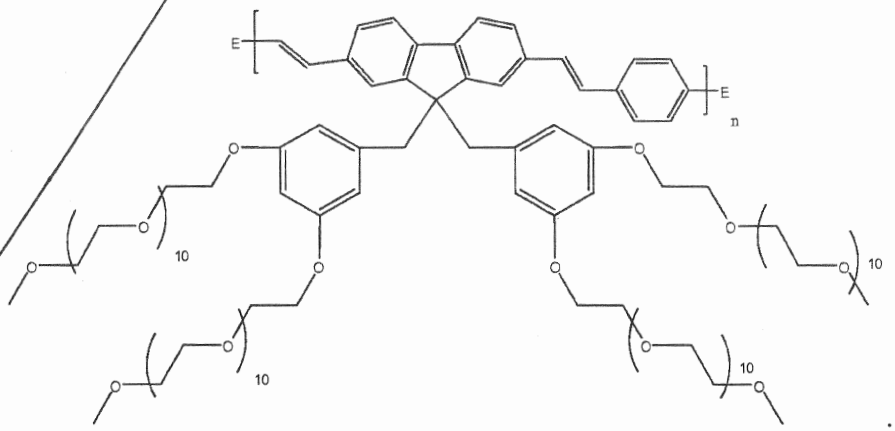
12. The polymer of Claim 11, comprising a repeat unit represented by the following formula:



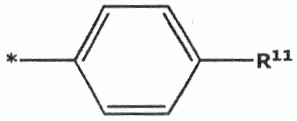
13. The polymer of Claim 3, comprising a repeat unit represented by the following formula:



14. The polymer of Claim 3, comprising a repeat unit represented by the following formula:



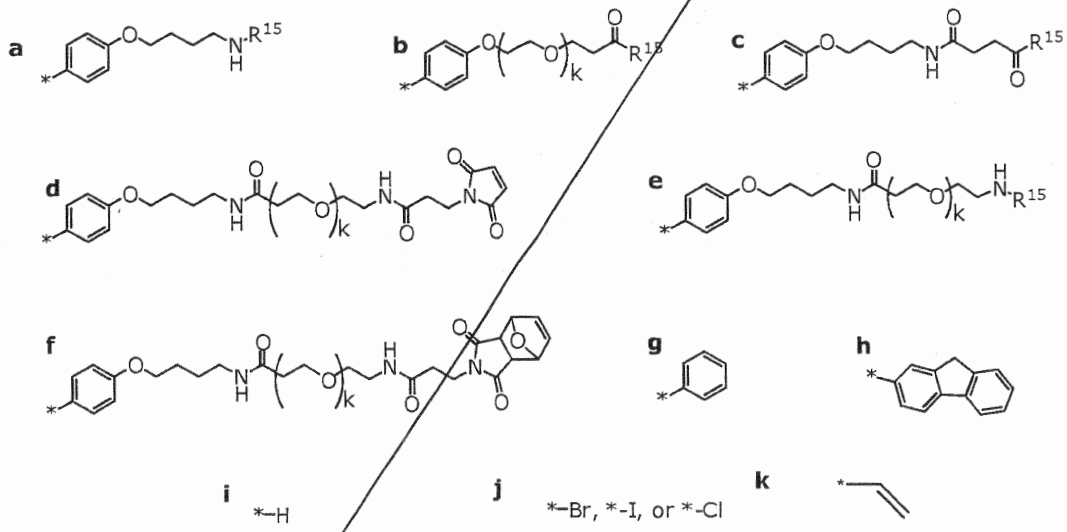
15. The polymer of Claim 1, wherein E, for each occurrence, is independently represented by formula (VI):



wherein R^{11} is a hydrogen, halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, C6-C18 (hetero)aryl group, -[O-CH_2-CH_2]$_q$-Z, or (C1-C12)alkoxy-X;

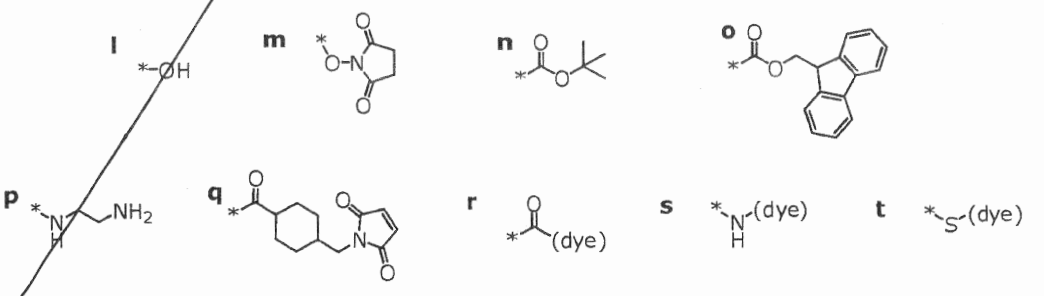
and wherein Z is –OH or –COOH; X is –NH_2, –NHCOOH, –NHCOOC$(CH_3)_3$, –NHCO(C3-C12)cycloalkyl(C1-C4)alkyl-*N*-maleimide; or –NHCO[CH_2-CH_2-O]$_k$$NH_2$; q is an integer from 1 to 20; and k is an integer from 1 to 8.

16. The polymer of Claim 1, wherein E, for each occurrence, is independently selected from the group consisting of a-k having the structure



*= site for covalent attachment

wherein k=2,4,8,12 or 24 and R^{15} is selected from the group consisting of l-t having the structure



* = covalent attachment

wherein (dye) is an organic dye with covalent linker.

17. A method of detecting an analyte, comprising:

contacting an analyte with a cognate ligand under conditions which promote binding of the analyte to the cognate ligand;

contacting the analyte bound to the cognate ligand with a polymer of Claim 1 under conditions that promote binding of the polymer to the analyte;

exciting a fluorescent signal in the polymer bound to the analyte; and

detecting the fluorescent signal emitted by the polymer.

18. The method of Claim 17, wherein the analyte is a nucleic acid, a peptide, a protein, a peptide-nucleic acid (PNA), a lipid, a polysaccharide, a liposaccharide, a lipoprotein, or a glycoprotein.

19. The method of Claim 18, wherein the analyte is fluorescently labeled.

20. The method of Claim 18, wherein the analyte is a nucleic acid, a protein or a peptide.

21. The method of Claim 18, wherein the analyte is a nucleic acid or a PNA, and wherein the cognate ligand is a nucleic acid.

22. The method of Claim 21, wherein the cognate ligand is attached to a solid support material.

23. The method of Claim 22, wherein the solid support material comprises beads selected from the group consisting of polymer beads, polystyrene beads, silica beads, metal magnetic beads, inorganic nanoparticles, metal nanoparticles and a combination thereof.

24. The method of Claim 22, wherein the solid support material is disposed on a substrate.

25. The method of Claim 24, wherein the substrate is glass, silicon, plastics or polymers.

26. The method of Claim 24, wherein the substrate comprises wells, and wherein the solid support material is disposed within one or more wells.

27. A device for detecting an analyte, comprising:

a substrate;

a solid support material disposed on the substrate;

a ligand, attached to the solid support material, said ligand being cognate to an analyte being detected; and

a polymer of Claim 1, capable of binding to the analyte bound to the cognate ligand.

28. The device of Claim 27, wherein the substrate comprises wells, and wherein the solid support is disposed within one or more wells.

29. A kit for detecting an analyte, comprising:

a substrate;

a solid support material;

a ligand capable of being attached to the solid support material, said ligand being cognate to an analyte being detected; and

a polymer of Claim 1, capable of binding to the analyte bound to the cognate ligand.

30. The kit of Claim 29, wherein the substrate comprises wells for disposing the solid support materials within one or more wells.

31. A method of detecting an analyte, comprising:

contacting an analyte with a cognate ligand under conditions which promote binding of the analyte to the cognate ligand;

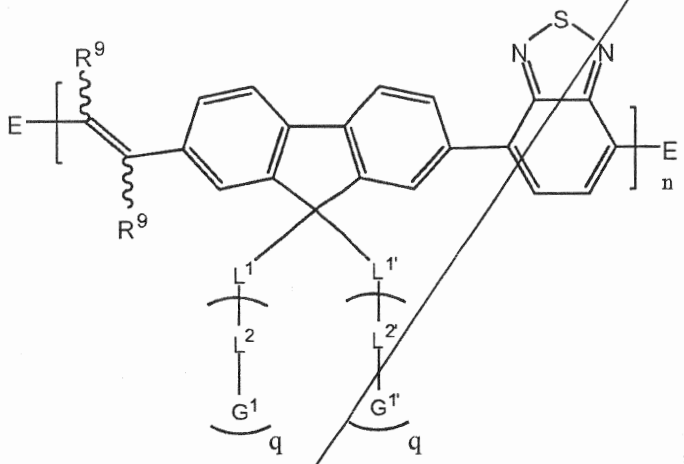
contacting the analyte bound to the cognate ligand with a polymer under conditions that promote binding of the polymer to the analyte;

exciting a fluorescent signal in the polymer bound to the analyte; and

detecting the fluorescent signal emitted by the polymer,

wherein the cognate ligand is attached to a solid support material, said solid support material including beads; and

wherein the polymer comprises a repeat unit represented by the following formula:



,

wherein:

E, for each occurrence, is independently halogen, hydrogen, vinylene group, a trialkylsiloxy or an aryl group optionally substituted with a reactive group or a pendent reactive group capable of undergoing chain extension, conjugation, or crosslinking;

L^1, $L^{1'}$, L^2 and $L^{2'}$ are each independently a covalent bond, a C1-C12 alkylene, a C3-C12 cycloalkylene, a C2-C12 alkenylene, a C2-C12 alkynylene, a (C6-C18)aryl(C1-C12)alkylene, a (C6-C18)aryl(C2-C12)alkenylene, a (C6-C18)aryl(C1-C12)alkynylene, a C6-C18 arylene group, $-Y_1-[O-Y_2]_p-$, $-O-Y_1-[O-Y_2]_p-$ wherein each C1-C12 alkylene, C3-C12 cycloalkylene, (C6-C18)aryl(C1-C12)alkylene, or C6-C18 arylene group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, $-Y_1-[O-Y_2]_p-$ or $-O-Y_1-[O-Y_2]_p-$;

q is 0 or an integer from 1 to 8;

p is 0 or an integer from 1 to 24;

Y_1 and Y_2 are each independently a covalent bond, or a C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene, wherein each C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

each R^9 is, independently, hydrogen, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group, wherein each C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

each G^1 and $G^{1'}$ are, independently, hydrogen, C1-C6 alkyl, -OH, -COOH, -SH, -SR, -SHR^+, SR_2^+, -SO_3^-, -PO_4^-, Br, -NH_2, -NHR, -NR_2, -NH_3^+, -NH_2R^+, -NHR_2^+ or -NR_3^+, wherein and each R is independently a C1-C6 alkyl and -SHR^+, SR_2^+, -SO_3^-, -PO_4^-, -NH_3^+, -NH_2R^+, -NHR_2^+ or -NR_3^+ each optionally has an associated counterion; and

n is an integer from 1 to about 1,000.

32. The method of Claim 31, wherein the solid support material include beads selected from the group consisting of polymer beads, polystyrene beads, silica beads, metal magnetic beads, inorganic nanoparticles, metal nanoparticles and a combination thereof.

33. The method of Claim 31, wherein two or more repeat units are covalently cross-linked via one or more groups G^1 or $G^{1'}$.

34. The method of Claim 31, wherein each group G^1 or $G^{1'}$ are independently, -SHR^+, SR_2^+, -NH_3^+, -NH_2R^+, -NHR_2^+ or -NR_3^+.

35. The method of Claim 34, wherein each group G^1 or $G^{1'}$ are independently, -SHR^+, SR_2^+, -NH_3^+, -NH_2R^+, -NHR_2^+ or -NR_3^+ with an associated counterion.

36. The method of Claim 35, wherein each R^9 is hydrogen.

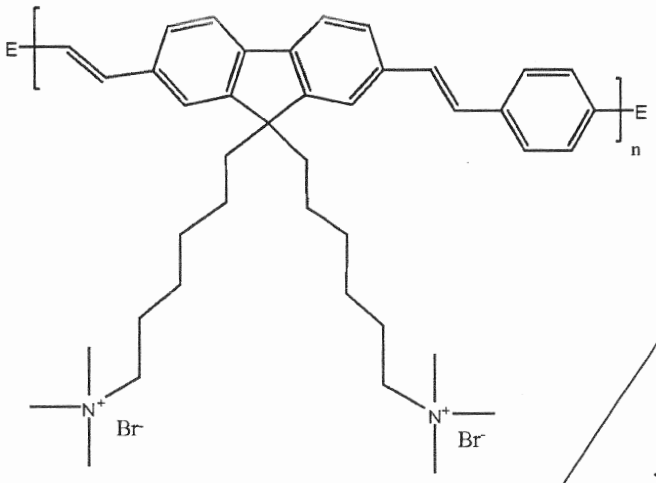
37. The method of Claim 36, wherein L^1 and $L^{1'}$, are each independently, a C1-C12 alkylene or -Y_1-$[O\text{-}Y_2]_p$-.

38. The method of Claim 37, wherein L^1 and $L^{1'}$, are each independently -Y_1-$[O\text{-}Y_2]_p$-, and Y_1 and Y_2 are each independently, a C1-C12 alkylene.

39. The method of Claim 37, wherein L^1 and $L^{1'}$, are each independently a C1-C12 alkylene.

40. The method of Claim 39, wherein each group G^1 or $G^{1'}$ are independently -NH_3^+, -NH_2R^+, -NHR_2^+ or -NR_3^+.

41. The method of Claim 40, wherein the polymer comprises a repeat unit represented by the following formula:



42. The method of Claim 31, wherein the analyte is a nucleic acid, a protein, a peptide-nucleic acid (PNA), a lipid, a polysaccharide, a liposaccharide, a lipoprotein, or a glycoprotein.

43. The method of Claim 42, wherein the analyte is a nucleic acid, a protein or a PNA.

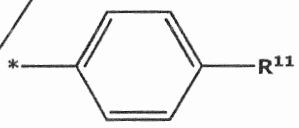
44. The method of Claim 43, wherein the analyte is a nucleic acid or a PNA, and wherein the cognate ligand is a nucleic acid.

45. The method of Claim 31, wherein the solid support material is disposed on a substrate.

46. The method of Claim 45, wherein the substrate is glass or silicon.

47. The method of Claim 46, wherein the substrate comprises wells, and wherein the solid support material is disposed within one or more wells.

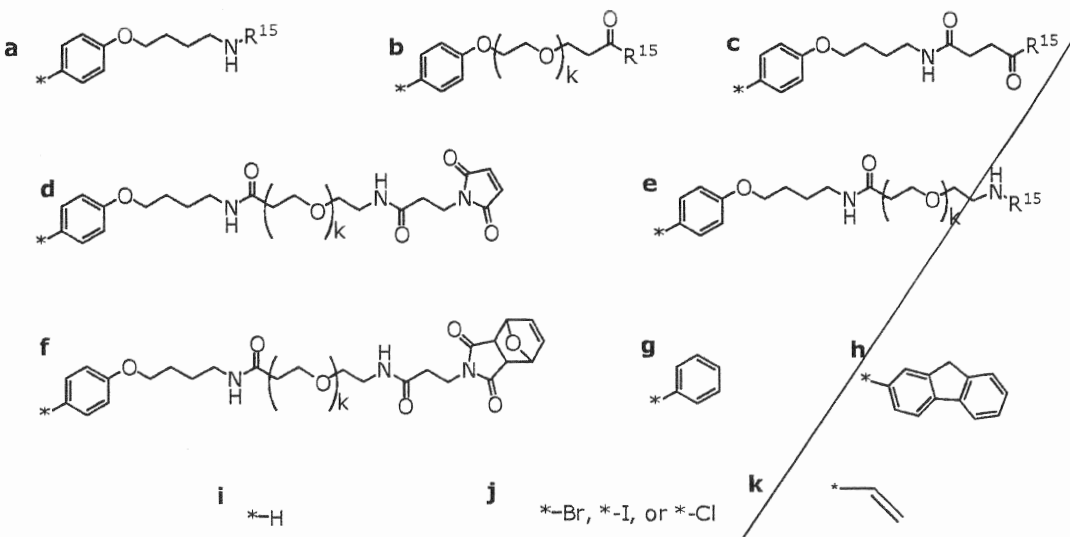
48. The method of Claim 31, wherein E, for each occurrence, is independently represented by formula (VI):



wherein R^{11} is a hydrogen, halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, C6-C18 (hetero)aryl group, $-[O-CH_2-CH_2]_q-Z$, or (C1-C12)alkoxy-X;

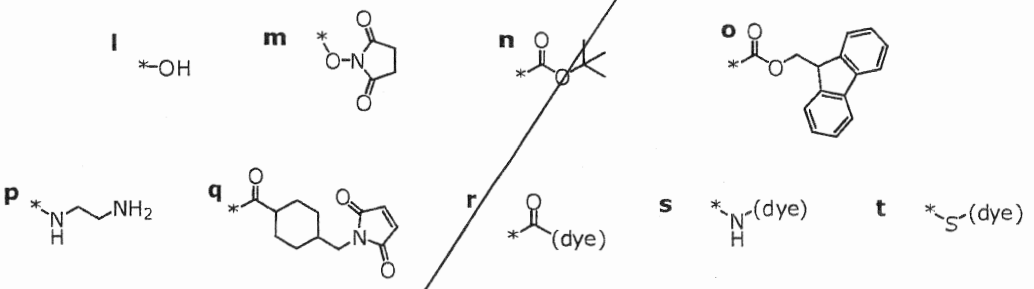
and wherein Z is –OH or –COOH; X is $–NH_2$, –NHCOOH, $–NHCOOC(CH_3)_3$, –NHCO(C3-C12)cycloalkyl(C1-C4)alkyl-*N*-maleimide; or $–NHCO[CH_2-CH_2-O]_kNH_2$; q is an integer from 1 to 20; and k is an integer from 1 to 8.

49. The method of Claim 31, wherein E, for each occurrence, is independently selected from the group consisting of a-k having the structure



*= site for covalent attachment

wherein k=2,4,8,12 or 24 and R^{15} is selected from the group consisting of l-t having the structure



* = covalent attachment

where (dye) is an organic dye with covalent linker.

50. A device for detecting an analyte, comprising:

a substrate;

a solid support material disposed on the substrate;

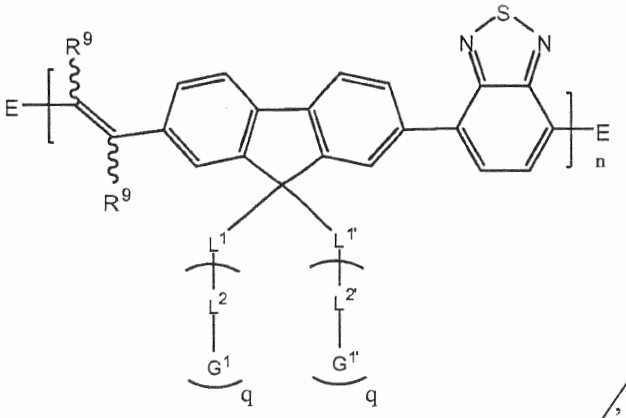
a ligand, attached to the solid support material, said ligand being cognate to an analyte being detected; and

a polymer capable of binding to the analyte bound to the cognate ligand,

wherein:

the cognate ligand is attached to a solid support material, said solid support material including beads; and

the polymer comprises a repeat unit represented by the following formula:



wherein:

EE, for each occurrence, is independently halogen, hydrogen, vinylene group, a trialkylsiloxy or an aryl group optionally substituted with a reactive group or a pendent reactive group capable of undergoing chain extension, conjugation, or crosslinking;

L^1, $L^{1'}$, L^2 and $L^{2'}$ are each independently a covalent bond, a C1-C12 alkylene, a C3-C12 cycloalkylene, a C2-C12 alkenylene, a C2-C12 alkynylene, a (C6-C18)aryl(C1-C12)alkylene, a (C6-C18)aryl(C2-C12)alkenylene, a (C6-C18)aryl(C1-C12)alkynylene, a C6-C18 arylene group, $-Y_1-[O-Y_2]_p$ -,$-O-Y_1-[O-Y_2]_p$ - wherein each C1-C12 alkylene, C3-C12 cycloalkylene, (C6-C18)aryl(C1-C12)alkylene, or C6-C18 arylene group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, $-Y_1-[O-Y_2]_p-$ or $-O-Y_1-[O-Y_2]_p-$;

q is 0 or an integer from 1 to 8;

p is 0 or an integer from 1 to 24;

Y_1 and Y_2 are each independently a covalent bond, or a C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene, wherein each C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

each R^9 is, independently, hydrogen, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group, wherein each C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

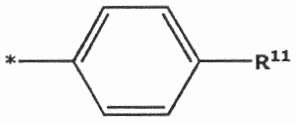
each G^2 and $G^{2'}$ are, independently, hydrogen, C1-C6 alkyl, -OH, -COOH, -SH, -SR, $-SHR^+$, SR_2^+, $-SO_3^-$, $-PO_4^-$, Br, $-NH_2$, -NHR, $-NR_2$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$, wherein and each R is independently a C1-C6 alkyl and $-SHR^+$, SR_2^+, $-SO_3^-$, $-PO_4^-$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$ each optionally has an associated counterion; and

n is an integer from 1 to about 1,000.

51. The device of Claim 50, wherein the solid support material includes beads selected from the group consisting of polystyrene beads, silica beads, metal magnetic beads, and a combination thereof.

52. The device of Claim 50, wherein the substrate comprises wells, and wherein the solid support material is disposed within one or more wells.

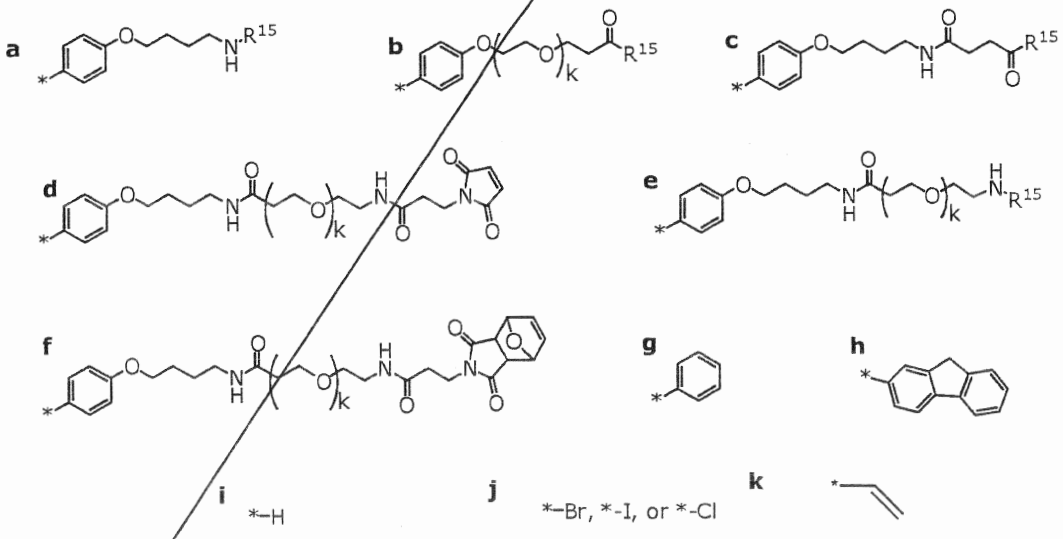
53. The device of Claim 50, wherein E, for each occurrence, is independently represented by formula (VI):



wherein R^{11} is a hydrogen, halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, C6-C18 (hetero)aryl group, -[O-CH_2-CH_2]$_q$-Z, or (C1-C12)alkoxy-X;

and wherein Z is –OH or –COOH; X is –NH_2, –NHCOOH, –NHCOOC$(CH_3)_3$, –NHCO(C3-C12)cycloalkyl(C1-C4)alkyl-*N*-maleimide; or –NHCO[CH_2-CH_2-O]$_k$$NH_2$; q is an integer from 1 to 20; and k is an integer from 1 to 8.

54. The device of Claim 50, wherein E, for each occurrence, is independently selected from the group consisting of a-k having the structure



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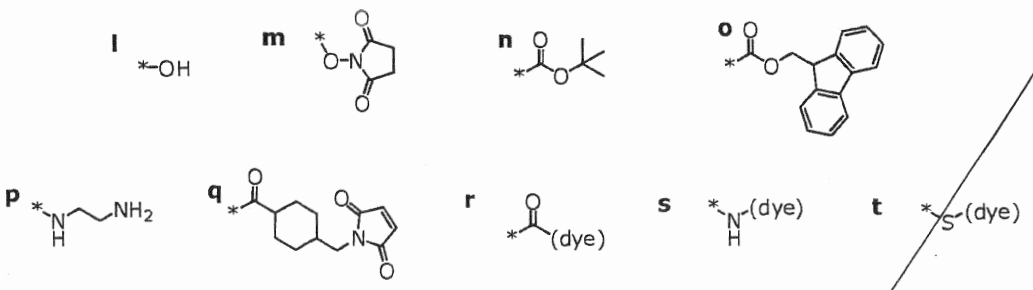
wherein k=2,4,8,12 or 24 and R^{15} is selected from the group consisting of l-t having the structure



where (dye) is an organic dye with covalent linker.

55. A kit for detecting an analyte, comprising:

a substrate;

a solid support material;

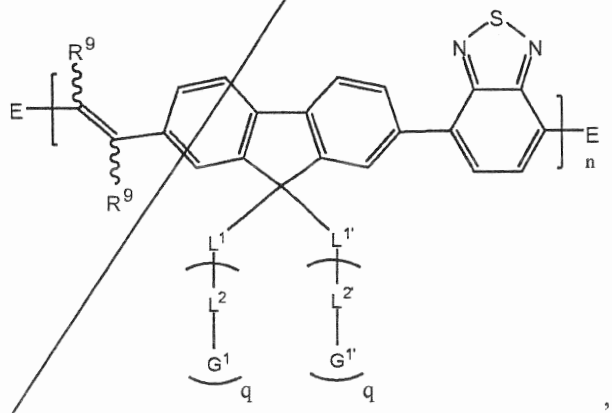
a ligand capable of being attached to the solid support material, said ligand being cognate to an analyte being detected; and

a polymer capable of binding to the analyte bound to the cognate ligand,

wherein:

the cognate ligand is attached to a solid support material, said solid support material including beads; and

the polymer comprises a repeat unit represented by the following formula:



wherein:

E, for each occurrence, is independently halogen, hydrogen, vinylene group, a trialkylsiloxy or an aryl group optionally substituted with a reactive group or a pendent reactive group capable of undergoing chain extension, conjugation, or crosslinking;

L^1, $L^{1'}$, L^2 and $L^{2'}$ are each independently a covalent bond, a C1-C12 alkylene, a C3-C12 cycloalkylene, a C2-C12 alkenylene, a C2-C12 alkynylene, a (C6-C18)aryl(C1-C12)alkylene, a (C6-C18)aryl(C2-C12)alkenylene, a (C6-C18)aryl(C1-C12)alkynylene, a C6-C18 arylene group, $-Y_1-[O-Y_2]_p$ -,$-O-Y_1-[O-Y_2]_p$ - wherein each C1-C12 alkylene, C3-C12 cycloalkylene, (C6-C18)aryl(C1-C12)alkylene, or C6-C18 arylene group is optionally substituted with one or more

halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, $-Y_1-[O-Y_2]_p-$ or $-O-Y_1-[O-Y_2]_p-$;

q is 0 or an integer from 1 to 8;

p is 0 or an integer from 1 to 24;

Y_1 and Y_2 are each independently a covalent bond, or a C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene, wherein each C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

each R^9 is, independently, hydrogen, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group, wherein each C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

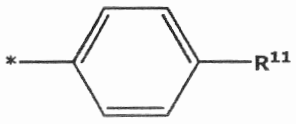
each G^2 and $G^{2'}$ are, independently, hydrogen, C1-C6 alkyl, -OH, -COOH, -SH, -SR, $-SHR^+$, SR_2^+, $-SO_3^-$, $-PO_4^-$, Br, $-NH_2$, -NHR, $-NR_2$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$, wherein and each R is independently a C1-C6 alkyl and $-SHR^+$, SR_2^+, $-SO_3^-$, $-PO_4^-$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$ each optionally has an associated counterion; and

n is an integer from 1 to about 1,000.

56. The kit of Claim 55, wherein the solid support material includes beads selected from the group consisting of polystyrene beads, silica beads, metal magnetic beads, and a combination thereof.

57. The kit of Claim 55, wherein the substrate comprises wells for disposing the solid support materials within one or more wells.

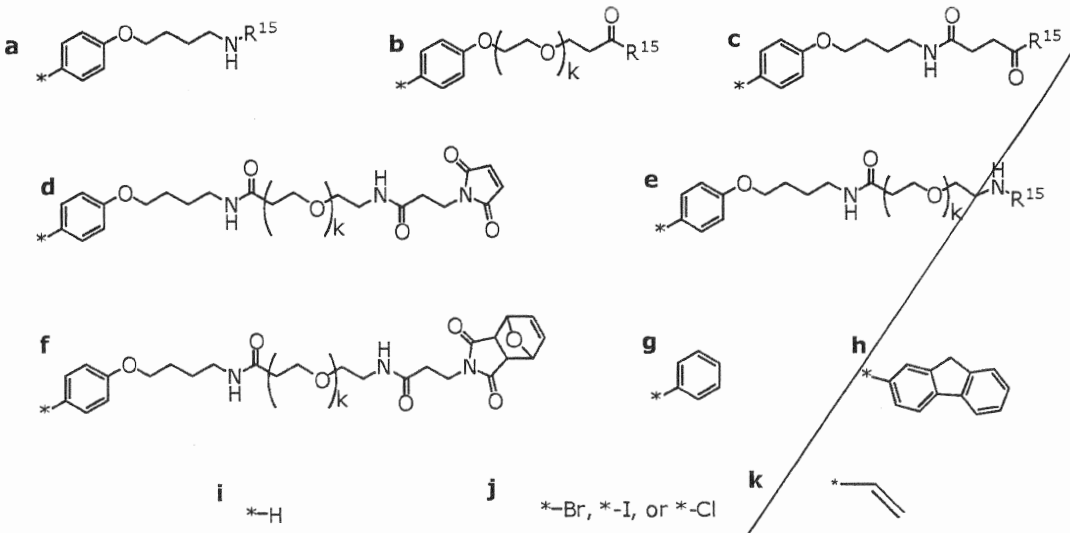
58. The kit of Claim 55, wherein E, for each occurrence, is independently represented by formula (VI):



wherein R^{11} is a hydrogen, halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, C6-C18 (hetero)aryl group, $-[O-CH_2-CH_2]_q-Z$, or (C1-C12)alkoxy-X;

and wherein Z is –OH or –COOH; X is $-NH_2$, –NHCOOH, $-NHCOOC(CH_3)_3$, –NHCO(C3-C12)cycloalkyl(C1-C4)alkyl-*N*-maleimide; or $-NHCO[CH_2-CH_2-O]_kNH_2$; q is an integer from 1 to 20; and k is an integer from 1 to 8.

59. The kit of Claim 55, wherein E, for each occurrence, is independently selected from the group consisting of a-k having the structure



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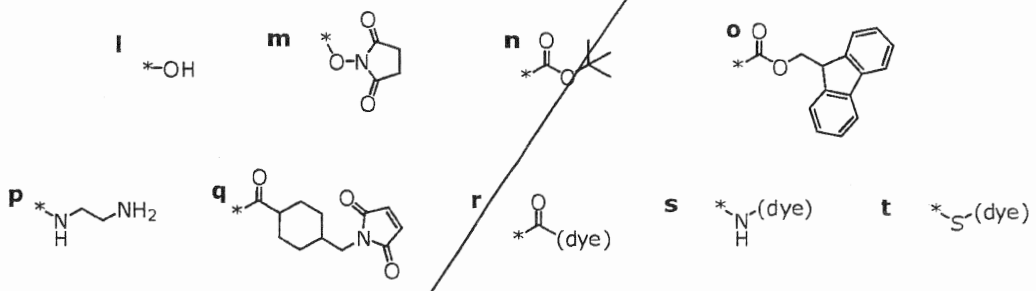
wherein k=2,4,8,12 or 24 and R^{15} is selected from the group consisting of l-t having the structure



* = covalent attachment

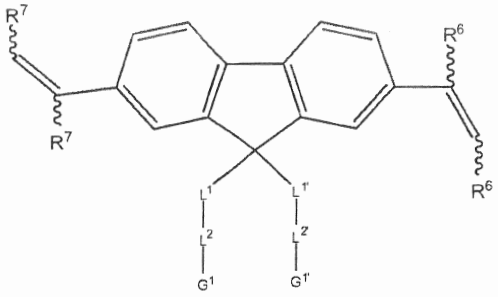
where (dye) is an organic dye with covalent linker.

60. A method of preparing a polymer represented by formula (I), comprising reacting a compound of formula (II)



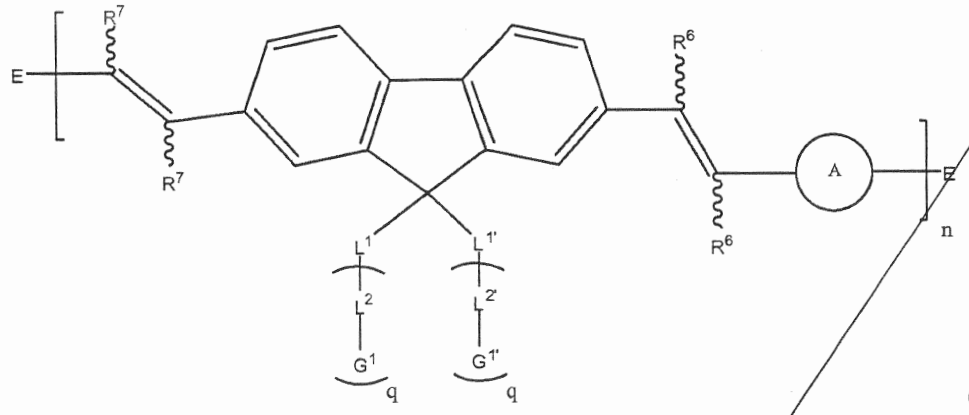
(II),

with a compound of formula (III)



(III),

thereby producing a polymer represented by the following formula:



(I),

wherein:

E, for each occurrence, is independently halogen, hydrogen, vinylene group, a trialkylsiloxy or an aryl group optionally substituted with a reactive group or a pendent reactive group capable of undergoing chain extension, conjugation, or crosslinking;

A is an aryl or a heteroaryl, optionally substituted with one or more substituents selected from halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, a C6-C18 (hetero)aryl group and an ethylene glycol polymer; wherein the substituents for ring A are not ammonium group;

L^1, $L^{1'}$, L^2 and $L^{2'}$ are each independently a covalent bond, a C1-C12 alkylene, a C3-C12 cycloalkylene, a C2-C12 alkenylene, a C2-C12 alkynylene, a (C6-C18)aryl(C1-C12)alkylene, a (C6-C18)aryl(C2-C12)alkenylene, a (C6-C18)aryl(C1-C12)alkynylene, a C6-C18 arylene group, $-Y_1-[O-Y_2]_p$ -,$-O-Y_1-[O-Y_2]_p$ - wherein each C1-C12 alkylene, C3-C12 cycloalkylene, (C6-C18)aryl(C1-C12)alkylene, or C6-C18 arylene group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, $-Y_1-[O-Y_2]_p-$ or $-O-Y_1-[O-Y_2]_p-$;

q is 0 or an integer from 1 to 8;

p is 0 or an integer from 1 to 24;

Y_1 and Y_2 are each independently a covalent bond, or a C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene, wherein each C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

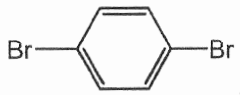
each R^6 and R^7 is independently hydrogen, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group, wherein each C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, cyano, or C2-C12 (hetero)alkynl;

G^1 and $G^{1'}$ are each independently, hydrogen, C1-C6 alkyl, -OH, -COOH, -SH, -SR, -SHR^+, SR_2^+, -SO_3^-, -PO_4^-, Br, -NH_2, -NHR, -NR_2, -NH_3^+, -NH_2R^+, -NHR_2^+ or -NR_3^+, wherein and each R is independently a C1-C6 alkyl and -SHR^+, SR_2^+, -SO_3^-, -PO_4^-, -NH_3^+, -NH_2R^+, -NHR_2^+ or -NR_3^+ each optionally has an associated counterion; and

n is an integer from 1 to about 1,000.

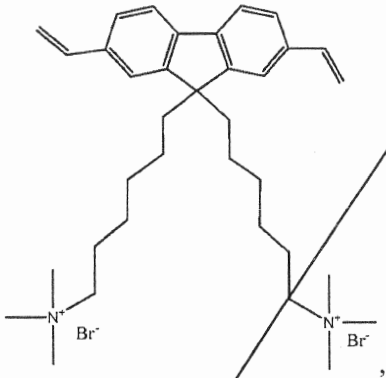
61. The method of Claim 60, wherein:

the compound of formula (II) is represented by the following formula



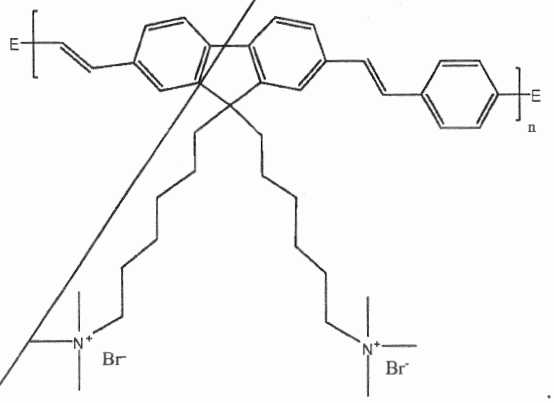
,

the compound of formula (III) is represented by the following formula



, and

the polymer of formula (I) comprises a repeat unit represented by the following formula



62. The method of Claim 60, wherein the compound of formula (II) is reacted with the compound formula (III) in the presence of an amine.

63. The method of Claim 62, wherein the compound of formula (II) is reacted with the compound formula (III) at a temperature between 20 °C to 150 °C.

64. The method of Claim 62, wherein the amine is a primary amine, secondary amine or a tertiary amine.

65. The method of Claim 62, wherein G^1 or $G^{1'}$ are both -NHR_2^+ or -NR_3^+, wherein R is a C1-C3 alkyl.

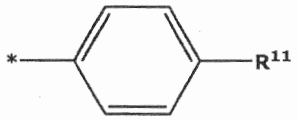
66. The polymer of Claim 1, wherein G^1 and $G^{1'}$ are the same.

67. The polymer of Claim 1, wherein G^1 and $G^{1'}$ are different.

68. The polymer of Claim 66, wherein G^1 and $G^{1'}$ are both $-NMe_3Br$ or $-N(CHMe_2)_2$.

69. The polymer of Claim 67, wherein G^1 and $G^{1'}$ are each independently $-NMe_3Br$ or $-N(CHMe_2)_2$.

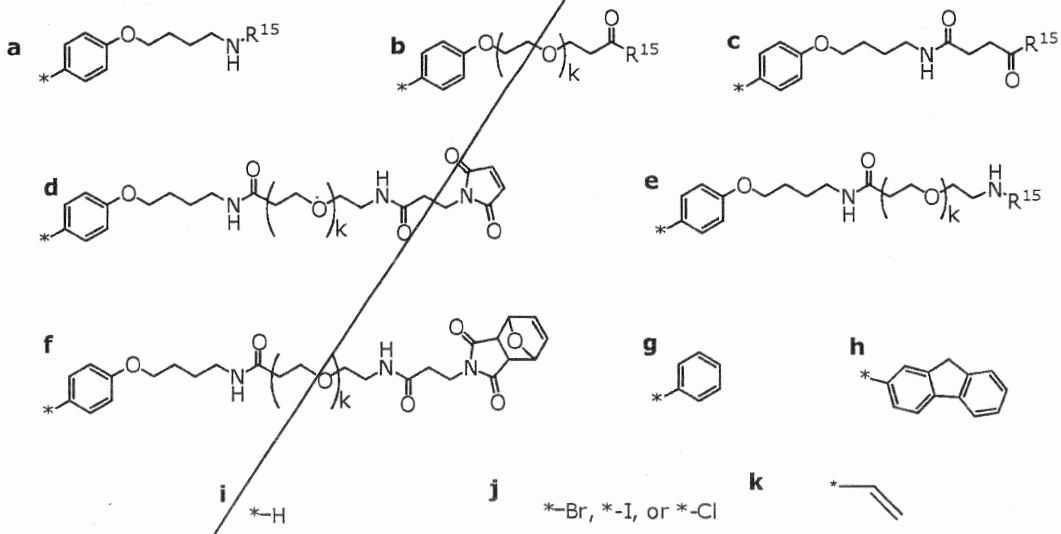
70. The method of Claim 60, wherein E, for each occurrence, is independently represented by formula (VI):



wherein R^{11} is a hydrogen, halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, C6-C18 (hetero)aryl group, $-[O-CH_2-CH_2]_q-Z$, or (C1-C12)alkoxy-X;

and wherein Z is –OH or –COOH; X is $–NH_2$, –NHCOOH, $–NHCOOC(CH_3)_3$, –NHCO(C3-C12)cycloalkyl(C1-C4)alkyl-*N*-maleimide; or $–NHCO[CH_2-CH_2-O]_kNH_2$; q is an integer from 1 to 20; and k is an integer from 1 to 8.

71. The method of Claim 60, wherein E, for each occurrence, is independently selected from the group consisting of a-k having the structure



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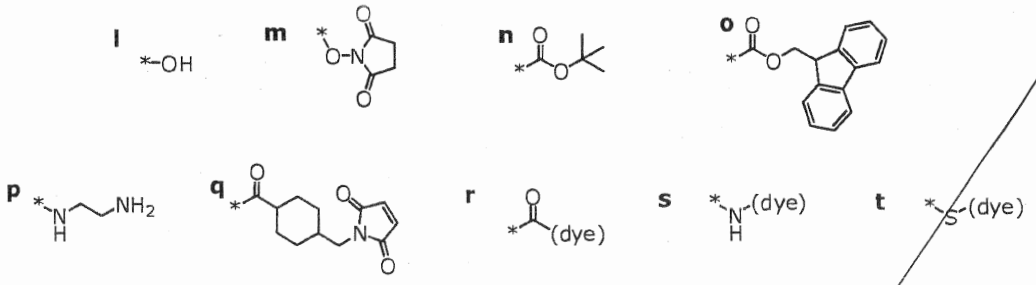
wherein k=2,4,8,12 or 24 and R^{15} is selected from the group consisting of l-t having the structure



where (dye) is an organic dye with covalent linker.

72. A method of detecting an analyte, comprising:

contacting an analyte with a cognate ligand under conditions which promote binding of the analyte to the cognate ligand;

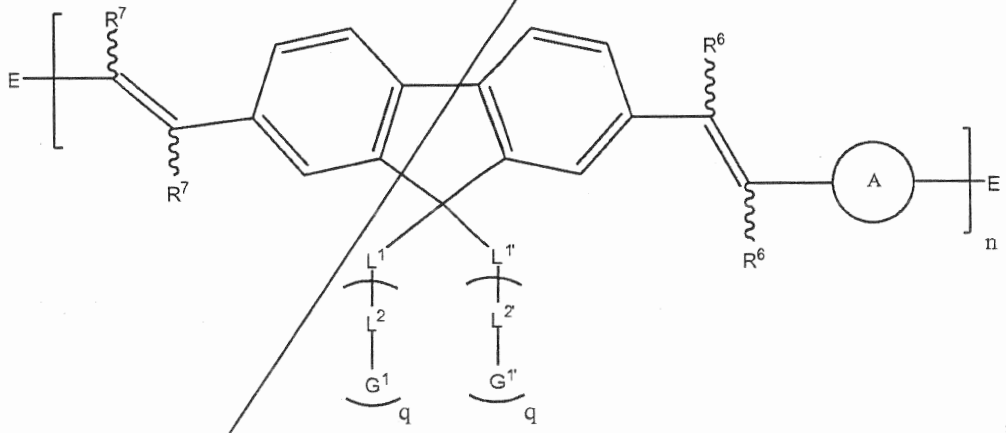
contacting the analyte bound to the cognate ligand with a polymer under conditions that promote binding of the polymer to the analyte;

exciting a fluorescent signal in the polymer bound to the analyte; and

detecting the fluorescent signal emitted by the polymer,

wherein the cognate ligand is optionally attached to a solid support material; and

wherein the polymer comprises a repeat unit represented by the following formula:



wherein:

E, for each occurrence, is independently halogen, hydrogen, vinylene group, a trialkylsiloxy or an aryl group optionally substituted with a reactive group or a pendent reactive group capable of undergoing chain extension, conjugation, or crosslinking;

A is an aryl or a heteroaryl, optionally substituted with one or more substituents selected from halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, a C6-C18 (hetero)aryl group and an ethylene glycol polymer; wherein the substituents for ring A are not ammonium group;

L^1, $L^{1'}$, L^2 and $L^{2'}$ are each independently a covalent bond, a C1-C12 alkylene, a C3-C12 cycloalkylene, a C2-C12 alkenylene, a C2-C12 alkynylene, a (C6-C18)aryl(C1-C12)alkylene, a (C6-C18)aryl(C2-C12)alkenylene, a (C6-C18)aryl(C1-C12)alkynylene, a C6-C18 arylene group, $-Y_1-[O-Y_2]_p$ -,$-O-Y_1-[O-Y_2]_p$ - wherein each C1-C12 alkylene, C3-C12 cycloalkylene, (C6-C18)aryl(C1-C12)alkylene, or C6-C18 arylene group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, $-Y_1-[O-Y_2]_p-$ or $-O-Y_1-[O-Y_2]_p-$;

q is 0 or an integer from 1 to 8;

p is 0 or an integer from 1 to 24;

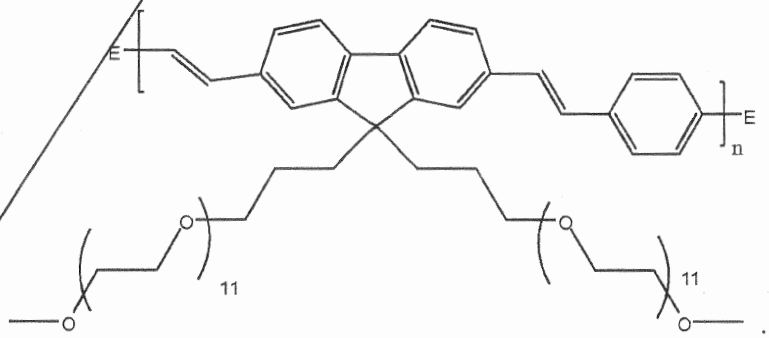
Y_1 and Y_2 are each independently a covalent bond, or a C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene, wherein each C1-12 alkylene group, a C3-C12 cycloalkylene, a C6-C18 (hetero)arylene, a (C6-C18)aryl(C1-C12)alkylene is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, or C1-C12 haloalkyl;

each R^6 and R^7 is independently hydrogen, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group, wherein each C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl or a C6-C18 (hetero)aryl group is optionally substituted with one or more halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkenyl, C2-C12 alkynyl group, C1-C12 alkoxy, C1-C12 haloalkyl, cyano, or C2-C12 (hetero)alkynl;

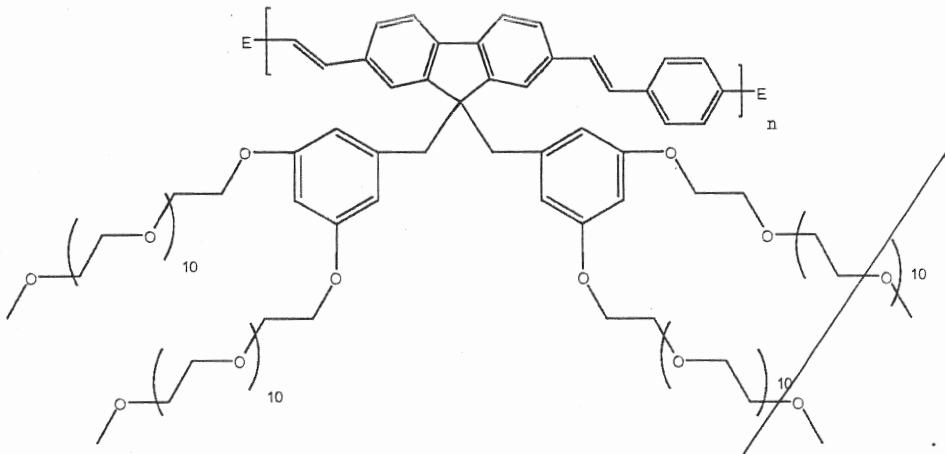
G^1 and $G^{1'}$ are each independently, hydrogen, C1-C6 alkyl, -OH, -COOH, -SH, -SR, $-SHR^+$, SR_2^+, $-SO_3^-$, $-PO_4^-$, Br, $-NH_2$, -NHR, $-NR_2$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$, wherein and each R is independently a C1-C6 alkyl and $-SHR^+$, SR_2^+, $-SO_3^-$, $-PO_4^-$, $-NH_3^+$, $-NH_2R^+$, $-NHR_2^+$ or $-NR_3^+$ each optionally has an associated counterion; and

n is an integer from 1 to about 1,000.

73. The method of Claim 78, comprising a repeat unit represented by the following formula:



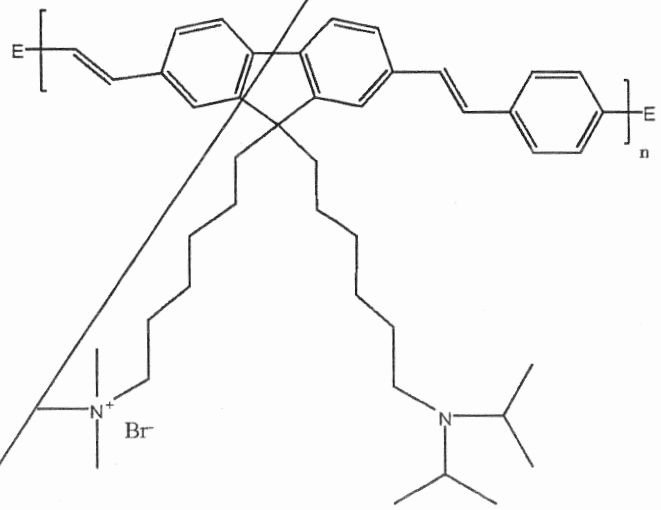
74. The method of claim 78, comprising a repeat unit represented by the following formula:



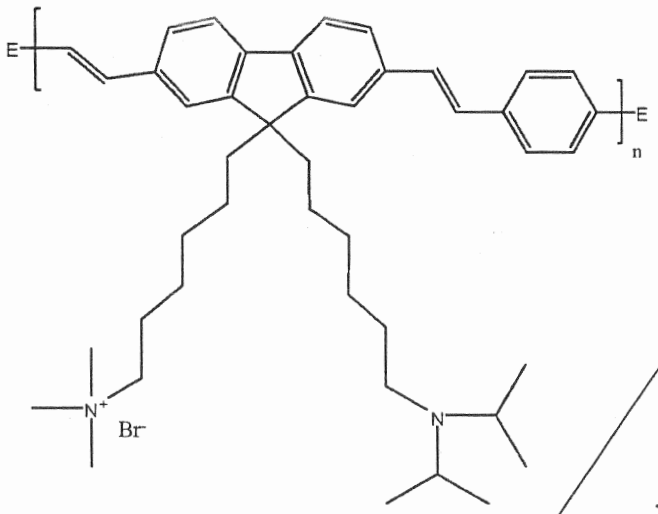
75. The polymer of claim 1, wherein the polymer is further conjugated to a a primary antibody, secondary antibody, monoclonal antibody, polyclonal antibody, antibody fragment, streptavidin, or nucleic acid.

76. The method of claim 31, wherein the polymer is a conjugated to a primary antibody, secondary antibody, monoclonal antibody, polyclonal antibody, antibody fragment, streptavidin, or nucleic acid.

77. The polymer of claim 1, wherein the polymer comprises a repeat unit represented by the following formula:



78. The method of Claim 31, wherein the polymer comprises a repeat unit represented by the following formula:



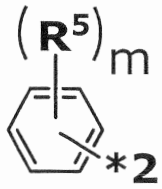
79. A method of conjugating a polymer to a dye or a biomolecule, comprising:

Modifying a dye or a biomolecule with a succinimidyl linker;

Modifying a polymer of claim 1 with a hydrazine linker; and

Contacting and reacting the modified dye or a biomolecule with the modified polymer to produce a polymer conjugated to the dye or biomolecule.

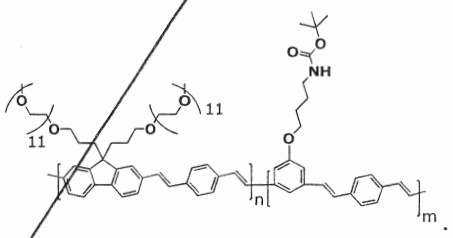
80. The polymer of Claim 1, wherein A, for each occurrence, is independently represented by:



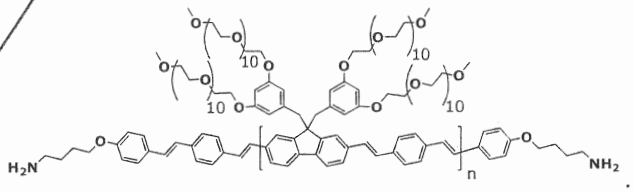
wherein each R^5 is independently a hydrogen, halogen, hydroxyl, C1-C12 alkyl, C2-C12 alkene, C2-C12 alkyne, C3-C12 cycloalkyl, C1-C12 haloalkyl, C1-C12 alkoxy, C6-C18 (hetero)aryloxy, C6-C18 (hetero)arylamino, C6-C18 (hetero)aryl group, $-[O-CH_2-CH_2]_q-Z$, or (C1-C12)alkoxy-X;

and wherein Z is –OH or –COOH; X is $–NH_2$, –NHCOOH, $–NHCOOC(CH_3)_3$, –NHCO(C3-C12)cycloalkyl(C1-C4)alkyl-*N*-maleimide; or $–NHCO[CH_2-CH_2-O]_kNH_2$; q is an integer from 1 to 20; k is an integer from 1 to 8; m is 0 or an integer from 1 to 4; and *= site for covalent attachment to unsaturated backbone.

81. The polymer of Claim 80, comprising a repeat unit represented by the following formula:



82. The polymer of Claim 15, comprising a repeat unit represented by the following formula:



83. The polymer of claim 1, wherein the polymer is further covalently attached to a dye, antibody, nucleic acid, substrate or biomolecule or combination thereof.