~~WHAT IS CLAIMED IS:~~CLAIMS

1. A method for detecting different analytes, the method comprising: mixing different analytes with sensing probes, wherein at least some of the sensing probes are specific to respective ones of the analytes; respectively capturing the analytes by the sensing probes that are specific to those analytes; respectively coupling fluorophores to sensing probes that captured respective analytes; mixing the sensing probes with beads, wherein the beads are specific to respective ones of the sensing probes, and wherein the beads include different codes identifying the analytes to which those sensing probes are specific; respectively coupling the sensing probes to beads that are specific to those sensing probes; identifying the beads that are coupled to the sensing probes that captured analytes using at least fluorescence from the fluorophores coupled to those sensing probes; and identifying the analytes that are captured by the sensing probes coupled to the identified beads using at least the codes of those beads.

2. The method of claim 1, wherein each of the beads includes a first oligonucleotide having a sequence specific to one of the sensing probes, and wherein each of the sensing probes comprises a second oligonucleotide having a sequence that is complementary to the first oligonucleotide.

~~.~~

3. The method of claim 1 or claim 2, wherein the different codes comprise oligonucleotides having different sequences than one another.

4. The method of any one of claims 1 to 3, wherein at least one of the analytes comprises a nucleotide analyte.

5. The method of claim 4, wherein the sensing probe comprises an oligonucleotide sequence specific to hybridize to the nucleotide analyte~~.~~

~~6. The method of claim 4 or claim 5, ~~, optionally a) wherein the nucleotide analyte comprises a DNA analyte~~, ~~or~~

~~7. The method of claim 4 or claim 5,~~ b) wherein the nucleotide analyte comprises an RNA analyte.

~~8~~6. The method of any one of claims 1 to 4, wherein at least one of the analytes comprises a non-nucleotide analyte~~.~~

~~9. The method of claim 8,~~, optionally a) wherein the non-nucleotide analyte comprises a protein~~, .~~

~~10. The method of claim 8,~~ b) wherein the non-nucleotide analyte comprises a metabolite~~.~~

~~11. The method of claim 8 or claim 9,~~, c) wherein the sensing probe comprises an antibody selective to the non-nucleotide analyte~~.~~

~~12. The method of any one of claims 8 to 10, ~~, or d) wherein the sensing probe comprises an ap-tamer selective to the non-nucleotide analyte.

~~13~~7. The method of any one of claims 1 to ~~12~~6, wherein the different analytes comprise a plurality of nucleotide analytes and a plurality of non-nucleotide analytes, further comprising at least one of:~~.~~

~~14. The method of any one of claims 1 to 13,~~(i) wherein the fluorophores are coupled to the sensing probes after the analytes are captured by the sensing probes~~,.~~

~~15. The method of any one of claims 1 to 14,~~
(ii) wherein the fluorophores are coupled to the sensing probes before the sensing probes are coupled to the beads~~.~~

~~16. The method of any one of claims 1 to 14,~~,
(iii) wherein the fluorophores are coupled to the sensing probes after the sensing probes are coupled to the beads~~.~~

~~17. The method of any one of claims 1 to 16, ~~,

(iv) wherein providing the fluorophores comprises coupling multiple fluorophores to the analytes.

18. The method of claim 17, , optionally wherein coupling multiple fluorophores to the analytes comprises using a hybridization chain reaction (HCR).

198. A system for detecting a plurality of different analytes, the system comprising: sensing probes that are specific to respective ones of the different analytes; beads that are specific to respective ones of the sensing probes and that include different codes respectively identifying the analytes to which those sensing probes are specific; fluorophores to respectively couple to sensing probes that capture analytes; and detection circuitry to identify beads that are coupled to the sensing probes that capture analytes, and to identify the analytes that are captured by the sensing probes coupled to those beads using at least the codes of those beads.

209. The system of claim 198, further comprising at least one of

a) wherein each of the beads includes a first oligonucleotide having a sequence specific to one of the sensing probes, and wherein each of the sensing probes comprises a second oligonucleotide having a sequence that is complementary to the first oligonucleotide.

21. The system of claim 19 or claim 20, ,

b) wherein the different codes comprise oligonucleotides having different sequences than one another.

22. The system of any one of claims 19 to 21, ,

c) wherein at least one of the analytes comprises a nucleotide analyte.

23. The system of claim 22, , optionally wherein the sensing probe comprises an oligonucleotide sequence specific to hybridize to the nucleotide analyte.

24. The system of claim 22 or claim 23,, optionally

i) wherein the nucleotide analyte comprises a DNA analyte.

25. The system of claim 22 or claim 23,, or

ii) wherein the nucleotide analyte comprises an RNA analyte.

~~26~~10. The system of any one of claims ~~19 to 22~~8 or 9, wherein at least one of the analytes comprises a non-nucleotide analyte~~.~~

~~27. The system of claim 26,~~ , optionally

i) wherein the non-nucleotide analyte comprises a protein~~.~~

~~28. The system of claim 26,~~

ii) wherein the non-nucleotide analyte comprises a metabolite~~.~~

~~29. The system of claim 26 or claim 27,~~

iii) wherein the sensing probe comprises an antibody selective to the non-nucleotide analyte~~.~~

~~30. The system of any one of claims 26 to 28,~~

iv) wherein the sensing probe comprises an ~~ap~~tamer selective to the non-nucleotide analyte~~.~~

~~31. The system of any one of claims 19 to 30,~~

v) wherein the different analytes comprise a plurality of nucleotide analytes and a plurality of non-nucleotide analytes~~.~~

~~32. The system of any one of claims 19 to 31,~~

vi) wherein the fluorophores are coupled to the sensing probes after the analytes are captured by the sensing probes~~.~~

~~33. The system of any one of claims 19 to 32,~~

vii) wherein the fluorophores are coupled to the sensing probes before the sensing probes are coupled to the beads~~.~~

~~34. The system of any one of claims 19 to 32,~~

viii) wherein the fluorophores are coupled to the sensing probes after the sensing probes are coupled to the beads~~.~~

~~35. The system of any one of claims 19 to 34, ~~, or

ix) wherein multiple fluorophores are coupled to the analytes~~.~~

~~36. The system of claim 35,~~, optionally wherein the multiple fluorophores are coupled to the analytes using a hybridization chain reaction (HCR).

~~37~~11. A method for identifying target nucleic acids, comprising:

(a) hybridizing a plurality of probes to a plurality of nucleic acids comprising the target nucleic acids, wherein each probe comprises a 3' end capable of hybridizing to a target nucleic acid and a 5' end capable of hybridizing to a capture probe;

(b) extending the hybridized probes with a blocked nucleotide;

(c) removing the plurality of nucleic acids and non-extended probes from the extended probes; and

(d) hybridizing the extended probes to a plurality of capture probes immobilized on a surface.

~~38~~12. The method of claim ~~37~~11, wherein (a) - (c) are performed in solution~~.~~

~~39. The method of claim 37 or claim 38, ~~,

optionally further comprising repeating (a) and (b)~~.~~

~~40. The method of any one of claims 37 to 39, ~~,

optionally wherein the blocked nucleotide comprises a detectable label~~.~~

~~41. The method of claim 40, ~~, optionally wherein the label comprises a fluorophore~~.~~

~~42. The method of any one of claims 37 to 41, ~~,

optionally wherein (b) comprises polymerase extension~~.~~

~~43. The method of any one of claims 37 to 42, ~~,

optionally wherein (b) comprises ligase extension~~.~~

~~44. The method of any one of claims 37 to 43, ,~~
optionally wherein (c) comprises enzymatic degradation~~.~~

~~45. The method of any one of claims 37 to 44,~~,
optionally wherein (c) comprises contacting the plurality of nucleic acids and the non-extended probes with a 3' to 5' exonuclease~~.~~ and

~~46. The method of claim 45,~~,
optionally wherein the 3' to 5' exonuclease is selected from the group consisting of Exonuclease I, Thermolabile Exonuclease I, Exonuclease T, Exonuclease III, and Klenow I fragment~~.~~

~~47. The method of any one of claims 37 to 46,~~, optionally wherein the probes each comprise a 5' end resistant to enzymatic degradation~~.~~

~~48. The method of claim 47, ,~~
optionally wherein the 5' end resistant to enzymatic degradation comprises a phosphorothioate bond~~.~~

~~49. The method of claim 47 or claim 48, ,~~ optionally wherein (c) comprises contacting the plurality of nucleic acids with a 5' to 3' exonuclease~~.~~

~~50. The method of claim 49,~~, optionally wherein the 5' to 3' exonuclease is selected from the group consisting of RecJf, T7 Exonuclease, truncated Exonuclease VIII, Lambda Exonuclease, T5 Exonuclease, Exonuclease VII, Exonuclease V, and Nuclease BAL-31~~.~~

~~51. The method of any one of claims 37 to 50, ,~~
optionally wherein a plurality of beads comprise the surface~~.~~

~~52. The method of any one of claims 37 to 51,~~, optionally wherein the surface comprises a planar surface~~.~~

~~53. The method of any one of claims 37 to 52,~~,

optionally wherein a flow cell comprises the surface.

54. The method of any one of claims 37 to 53,
optionally wherein (d) further comprises amplifying a signal from the hybridized extended probes.

55. The method of any one of claims 37 to 54, ,
optionally wherein (d) further comprises identifying the location of the hybridized extended probes on the surface.

56. The method of any one of claims 37 to 55, ,
optionally wherein the capture probes are different from each other.

57. The method of any one of claims 37 to 56, optionally wherein the plurality of capture probes comprise a decoded array of capture probes.

58. The method of any one of claims 37 to 57, , optionally further comprising decoding the location of the capture probes on the surface.

59. The method of any one of claims 37 to 58, ,
optionally wherein the plurality of capture probes each comprise a primer binding site and a decode polynucleotide.

60. The method of claim 59, optionally wherein decoding comprises: hybridizing a sequencing primer to the primer binding site, extending the hybridized primer, and identifying the decode polynucleotide.

61. The method of any one of claims 37 to 60,
optionally wherein the plurality of nucleic acids comprises genomic DNA.

62. The method of any one of claims 37 to 61, , optionally wherein the target nucleic acids comprise a single nucleotide polymorphism (SNP).

6313. A system for identifying target nucleic acids, comprising: an extension solution comprising: a plurality of nucleic acids comprising the target nucleic acids, a plurality

of probes, wherein each probe comprises a 3' end capable of hybridizing to a target nucleic acid and a 5' end capable of hybridizing to a capture probe, a plurality of blocked nucleotides, an extension enzyme; a degradation solution comprising a 3' to 5' exonuclease; an array of capture probes immobilized on a surface; and a detector to identify the location of an extended probe hybridized to a capture probe on the surface.

~~64~~14. The system of claim ~~63~~13, wherein a flow cell comprise the array of capture probes immobilized on a surface.

15~~65~~. A system for identifying target nucleic acids, comprising: a flow cell comprising a surface, an inlet for adding solutions to the surface, and an outlet for removing solutions from the surface, wherein an array of capture probes is immobilized on the surface; an extension solution in contact with the inlet, the extension solution comprising: a plurality of nucleic acids comprising the target nucleic acids, a plurality of probes, wherein each probe comprises a 3' end capable of hybridizing to a target nucleic acid and a 5' end capable of hybridizing to a capture probe, a plurality of blocked nucleotides, an extension enzyme; a degradation solution comprising a 3' to 5' exonuclease; and a detector to identify the location of an extended probe hybridized to a capture probe on the surface.

~~66~~16. The system of any one of claims ~~63~~ 13 to ~~65~~15, wherein the blocked nucleotide comprises a detectable label.~~.~~

~~67. The system of claim 30, wherein the label comprises a fluorophore.~~

~~68. The system of any one of claims 63 to 67,~~ optionally wherein the extension enzyme comprises a polymerase~~.~~

~~69. The system of any one of claims 63 to 68,~~ , optionally wherein the extension enzyme comprises a ligase~~.~~

~~70. The system of any one of claims 63 to 69,~~ optionally wherein the 3' to 5' exonuclease is selected from the group consisting of Exonuclease I, Thermolabile Exonuclease I, Exonuclease T, Exonuclease III, and Klenow I fragment~~.~~

~~71. The system of any one of claims 63 to 70, ~~, optionally wherein the probes each comprise a 5' end resistant to enzymatic degradation~~.~~

~~72. The system of claim 71,~~, optionally wherein the 5' end resistant to enzymatic degradation comprises a phosphorothioate bond~~.~~

~~73. The system of claim 71 or claim 72, ~~, optionally wherein the degradation solution further comprises a 5' to 3' exonuclease~~.~~

~~74. The system of claim 73, ~~, optionally wherein the 5' to 3' exonuclease is selected from the group consisting of RecJf, T7 Exonuclease, truncated Exonuclease VIII, Lambda Exonuclease, T5 Exonuclease, Exonuclease VII, Exonuclease V, and Nuclease BAL-31~~.~~

~~75. The system of any one of claims 63 to 74,~~, optionally wherein the surface comprises a plurality of beads~~.~~

~~76. The system of any one of claims 63 to 75, ~~, optionally wherein the capture probes are different from each other~~.~~

~~77. The system of any one of claims 63 to 76,~~, optionally wherein the plurality of capture probes comprise a decoded array of capture probes~~.~~

~~78. The system of any one of claims 63 to 77,~~, optionally wherein the plurality of capture probes each comprise a primer binding site and a decode polynucleotide~~.~~

~~79. The system of any one of claims 63 to 78, ~~, optionally wherein the plurality of nucleic acids comprises genomic DNA~~.~~

~~80. The system of any one of claims 63 to 79,~~, optionally wherein the target nucleic acids comprise a single nucleotide polymorphism (SNP).

~~81~~17. A method for detecting an element, the method comprising: coupling an element to a substrate; coupling a plurality of fluorophores to the element; and detecting the element using at least fluorescence from the plurality of fluorophores.

~~82~~18. The method of claim ~~81~~17, wherein the element comprises an analyte~~.~~

~~83. The method of claim 82, ~~, optionally wherein the analyte is coupled to a sensing probe~~.~~

~~84. The method of claim 83,~~, optionally wherein the analyte is coupled to the substrate via the sensing probe~~.~~

~~85. The method of claim 83 or claim 84,~~, optionally wherein the plurality of fluorophores is coupled to the element via the sensing probe~~.~~

~~86. The method of claim 83 or claim 84, ~~, optionally wherein the plurality of fluorophores is coupled to the element via the substrate~~.~~

~~87. The method of any one of claims 81 to 86,~~, optionally wherein the plurality of fluorophores is coupled to the element before the element is coupled to the substrate~~.~~

~~88. The method of any one of claims 81 to 87,~~, optionally wherein the plurality of fluorophores is coupled to the element after the element is coupled to the substrate~~.~~

~~89. The method of any one of claims 81 to 88,~~, optionally wherein the substrate comprises a bead~~.~~

~~90. The method of any one of claims 81 to 89,~~, optionally wherein the plurality of fluorophores is coupled to the element using rolling circle amplification~~.~~

~~91. The method of claim 90, ~~, optionally wherein the rolling circle amplification generates an elongated, repeated sequence, and wherein the plurality of fluorophores is coupled to respective, repeated portions of that sequence~~.~~

~~92. The method of claim 91, ~~, optionally wherein the fluorophores are coupled to DNA intercalators, wherein the DNA intercalators couple to the elongated, repeated sequence~~.~~

~~93. The method of claim 91,~~, optionally wherein oligonucleotides comprising fluorophores and quenchers are hybridized to the repeated portions.

~~94~~19. The method of ~~any one of claims 81 to 89~~claim 17, wherein the element is coupled to a trigger oligonucleotide to which a plurality of fluorescently labeled hairpins self-assemble~~.~~

~~95. The method of any one of claims 81 to 89,~~, optionally wherein the element is coupled to a trigger oligonucleotide comprising a first trigger sequence A' and a second trigger sequence B', and wherein coupling the plurality of fluorophores to the element comprises contacting the trigger oligonucleotide with a plurality of first oligonucleotide hairpins and a plurality of second oligonucleotide hairpins, wherein each of the first oligonucleotide hairpins includes a first fluorophore, a single-stranded toehold sequence A complementary to first trigger sequence A', a first stem sequence B complementary to second trigger sequence B', a second stem sequence B' that is temporarily hybridized to first stem sequence B, and a single- stranded loop sequence C' disposed between the first stem sequence B and the second stem sequence B'; and wherein each of the second oligonucleotide hairpins comprises a second fluorophore, a single-stranded toehold sequence C complementary to single-stranded loop sequence C', a first stem sequence B complementary to second trigger sequence B', a second stem sequence B' that is temporarily hybridized to first stem sequence B, and a single-stranded loop sequence A' disposed between the first stem sequence B and the second stem sequence B'~~.~~

~~96. The method of claim 95, ~~, optionally wherein responsive to hybridization of the single- stranded toehold sequence A of one of the first oligonucleotide hairpins to first trigger sequence A' of the trigger oligonucleotide: the second stem sequence B' of that first oligonucleotide hairpin dehybridizes from the first stem sequence B of that first oligonucleotide hairpin; the single- stranded toehold sequence C of one of the second oligonucleotide hairpins hybridizes to the single-stranded loop sequence of that first oligonucleotide hairpin; and the second stem sequence B' of that second

oligonucleotide hairpin dehybridizes from the first stem sequence B of that second oligonucleotide hairpin~~.~~

~~97. The method of claim 96,~~, optionally wherein responsive to hybridization of the single- stranded toehold sequence A of another one of the first oligonucleotide hairpins to single-stranded loop sequence A' of that second oligonucleotide hairpin: the second stem sequence B' of that first oligonucleotide hairpin dehybridizes from the first stem sequence B of that first oligonucleotide hairpin; the single- stranded toehold sequence C of another one of the second oligonucleotide hairpins hybridizes to the single- stranded loop sequence of that first oligonucleotide hairpin; and the second stem sequence B' of that second oligonucleotide hairpin dehybridizes from the first stem sequence B of that second oligonucleotide hairpin.

~~98~~20. The method of ~~any one of~~ claim~~s 81 to 89~~17, wherein the element is coupled to an oligonucleotide primer, and wherein coupling the plurality of fluorophores to the element comprises: hybridizing an amplification template to the oligonucleotide primer; and extending the oligonucleotide primer, using at least the amplification template, with a plurality of fluorescently labeled nucleotides to generate an extended strand comprising the plurality of fluorophore~~s.~~

~~99. The method of claim 98, ~~, optionally wherein at least one of the fluorophores is different than at least one other of the fluorophore~~s.~~

~~100. The method of claim 98 or claim 99, ~~, optionally further comprising dehybridizing the amplification template and forming the extended strand into a hairpin structure~~.~~

~~101. The method of any one of claims 81 to 89,~~, optionally wherein the element is coupled to an oligonucleotide primer, and wherein coupling the plurality of fluorophores to the element comprises: hybridizing an amplification template to the oligonucleotide primer; extending the oligonucleotide primer, using at least the amplification template, with a plurality of nucleotides that are respectively coupled to additional oligonucleotide primers; hybridizing additional amplification templates to the additional nucleotide primers; and extending the additional nucleotide primers, using at least the additional amplification templates, with a plurality of nucleotides

that is either respectively coupled to fluorophores or is respectively coupled to further additional oligonucleotide primers~~.~~

~~102. The method of claim 101,~~, optionally further comprising hybridizing further additional amplification templates to the further nucleotide primers; and extending the additional nucleotide primers, using at least the additional amplification templates, with a plurality of nucleotides that are either respectively coupled to fluorophores or are respectively coupled to still further additional oligonucleotide primers~~.~~

~~103. The method of any one of claims 81 to 89,~~, optionally wherein the element is coupled to a DNA origami comprising the plurality of fluorophores~~.~~

~~104. The method of claim 103, ~~, optionally wherein the DNA origami comprises a combination of different fluorophores~~.~~

~~105. The method of claim 103 or claim 104, ~~, optionally wherein the element is coupled to the DNA origami via copper(I)-catalyzed click reaction, strain-promoted azide-alkyne cycloaddition, hybridization of an oligonucleotide to a complementary oligonucleotide, biotin- strep tavidin interaction, NTA-His-Tag interaction, or Spytag-Spycatcher interaction.

~~106~~21. The method of ~~any one of~~ claim~~s 81 to 89~~17, wherein the element is coupled to an oligonucleotide, wherein the oligonucleotide comprises the plurality of fluorophores~~.~~

~~107. The method of claim 106,~~, optionally wherein the oligonucleotide comprises a hairpin~~.~~

~~108. The method of claim 106 or claim 107,~~, optionally wherein the oligonucleotide further comprises a radical scavenger~~.~~

~~109. The method of any one of claims 81 to 89,~~, optionally wherein the element is directly coupled to a first oligonucleotide, and the first oligonucleotide is hybridized to a second oligonucleotide that comprises the plurality of fluorophores.

~~110~~22. A method for detecting a nucleotide, the method comprising: adding the nucleotide to a first polynucleotide using at least a sequence of a second polynucleotide, wherein the added nucleotide includes a first moiety; coupling a label to the added nucleotide by reacting the first moiety with a second moiety of the label, wherein the label comprises a plurality of fluorophores; and detecting the added nucleotide using at least fluorescence from the plurality of fluorophores.

~~111~~23. A method for detecting a nucleotide, the method comprising: adding the nucleotide to a first polynucleotide using at least a sequence of a second polynucleotide, wherein the added nucleotide is coupled to a label comprising a plurality of fluorophores; and detecting the added nucleotide using at least fluorescence from the plurality of fluorophores.

~~112~~24. A method for detecting a nucleotide, the method comprising: adding the nucleotide to a first polynucleotide using at least a sequence of a second polynucleotide, wherein the added nucleotide includes a first moiety; coupling a label to the added nucleotide by reacting the first moiety with a second moiety of the label; coupling multiple fluorophores to the coupled label; and detecting the added nucleotide using at least fluorescence from the plurality of fluorophores.

~~113~~25. A composition, comprising: a substrate; an oligonucleotide coupled to the substrate; a nucleotide coupled to the oligonucleotide; a moiety coupled to the nucleotide; a label coupled to the moiety, wherein the label comprises a plurality of fluorophores; and detection circuitry configured to detect the nucleotide using at least fluorescence from the plurality of fluorophores.