CLAIMS

Exemplary claims according to at least some of the disclosed embodiments:

1. A multi-sample analyte analysis method comprising:

labeling at least one target analyte in each of a plurality of individual samples with at least one unique label probe, wherein:

each unique label probe is configured to bind with a first specific binding agent of a respective target analyte for a respective sample, and each respective first specific binding agent comprises at least one of an antibody, aptamer, lectin, and nucleic acid probe configured to bind to a respective target analyte of a respective sample, and/or is labeled with at least one of a unique synthetic oligonucleotide probe, a protein nucleic acid (PNA) probe, and any other synthetic polynucleotide analog configured for identification of an associated respective sample;

combining the plurality of individual samples into a mixture; and

analyzing the combined sample via at least one of an immunoassay, a microfluidic assay, a PCR assay, and a sequencing assay, so as to determine whether any of the samples in the combined sample contain one or more target analyte of interest.

2. The method of claim 1, wherein the target analyte is selected from the group consisting of: a pathogen, a cell, genetic material, a protein, an analyte, and a molecule.

3. The method of claims 1 or 2, further comprising flowing the mixture within at least one fluidic channel/lane having arranged thereon or in fluid communication with at least one set of a plurality of spatially distinct capture zones.

4. The method of claim 3, wherein each zone is configured with at least one unique oligonucleotide- or PNA-probe complementary to a particular unique label probe of a specific target analyte of at least one specific sample so as to capture the specific target analyte of the at

least one specific sample, such that, each distinct capture zone is configured to capture a specific target analyte of the at least one specific sample.

5. The method of any of claims 1-4, further comprising washing each sample.

6. The method of claim 5, wherein washing is performed prior to combining the plurality of individual samples into the mixture.

7. The method of claims 5 or 6, wherein the labeled target analyte comprises biological cells, and the labeled target cells prior to washing being suspended in phosphate buffered saline or other compatible buffer.

8. The method of claim 7, wherein washing comprises centrifuging the labeled target analyte, removing supernatant, and re-suspending the labeled target analyte in phosphate buffered saline or other compatible buffer, wherein washing is performed once, twice, or three or more times.

9. The method of any of claims 1-8, further comprising flowing at least one target analyte labeled with one analyte specific fluorescent labeled agent across the set of capture zones.

10. The method of any of claims 1-9, wherein the mixture or the at least one labeled target analyte in each of the plurality of individual samples, is further labeled with at least one analyte specific fluorescent labeled agent prior to flowing the mixture across the set of capture zones, and/or prior to combining the individual samples into the mixture.

11. The method of claims 9 or 10, wherein each analyte specific fluorescent labeled agent of the plurality of individual samples is configured:

to bind with a respective specific target analyte of a respective sample, and comprises at least one of a fluorescent labeled antibody, aptamer, lectin, oligonucleotide probe, PNA probe, and any analyte specific reagent capable of binding to any portion of a respective specific target analyte.

12. The method of any of claims 8-11, wherein the at least one analyte specific fluorescent labeled probe is configured to bind with a respective specific target analyte of a respective sample.

13. The method of any of claims 1-12, further comprising exposing at least one set of capture zones of at least one channel/lane to at least one fluorescing wavelength of light/radiation, the wavelength configured to cause at least one analyte specific fluorescent labeled probe bound to a respective specific target analyte of a respective capture zone and sample to fluoresce.

14. The method of any of claims 1-12, further comprising exposing at least one set of capture zones of at least one channel/lane to a plurality of fluorescing wavelengths of light/radiation, each respective wavelength configured to cause a respective analyte specific fluorescent labeled probe bound to a respective specific target analyte of a respective capture zone and sample to fluoresce.

15. The method of any of claims 1-12, further comprising imaging at least one set of capture zones of at least one channel/lane to produce at least one image thereof.

16. The method of claim 15, wherein imaging at least one set of capture zones comprises producing at least one image for each wavelength exposed to the at least one set of capture zones.

17. The method of any of claims 1-16, further comprising analyzing the capture zones to determine a number of captured specific target analytes for each zone/sample.

18. The method of any of claims 15-16, further comprising analyzing the at least one image to determine a number of captured specific target analytes for each zone/sample.

19. The method of any of claims 1-18, further comprising treating each sample with a crosslinker.

20. The method of any of claims 5-19, further comprising treating each washed sample with a crosslinker.

21. The method of any of claims 1-20, wherein each respective first specific binding agent comprises an antibody, such that, antibody and target analyte form an antibody:target-analyte complex (ATAC), and after washing, the method further comprises crosslinking the ATAC.

22. The method of any of claims 19-21, wherein crosslinking is performed with a crosslinking agent.

23. The method of claim 22, wherein the crosslinking agent comprises glutaraldehyde or a homo or hetero-bifunctional cross-linking agent.

~~24. A multi-sample analyte analysis method comprising:~~

~~labeling at least one target analyte in each of a plurality of individual samples with at least one unique label probe, wherein:~~

each unique label probe is configured to bind with a first specific binding agent of a respective target analyte for a respective sample, and each respective first specific binding agent:

comprises at least one of an antibody, aptamer, lectin, and nucleic acid probe configured to bind to a respective target analyte of a respective sample, and/or is labeled with at least one of a unique synthetic oligonucleotide probe, a protein nucleic acid (PNA) probe, and any other synthetic polynucleotide analog configured for identification of an associated respective sample;

incubating each sample, wherein incubation optionally includes diluting each sample at least once prior to incubation; optionally washing each sample; optionally treating each washed sample with a crosslinker; combining the plurality of individual samples into a mixture; flowing the mixture within at least one fluidic channel/lane having arranged thereon or in fluid communication with at least one set of a plurality of spatially distinct capture zones, wherein:

each zone is configured with at least one unique oligonucleotide or PNA probe complementary to a particular unique label probe of a specific target analyte of at least one specific sample so as to capture the specific target analyte of the at least one specific sample, such that, each distinct capture zone is configured to capture a specific target analyte of the at least one specific sample; flowing at least one analyte specific fluorescent labeled probes across the set of capture zones, wherein each unique fluorescent labeled probe of the plurality is configured:

to bind with a respective specific target analyte of a respective sample, and

comprises at least one of a fluorescent labeled antibody, aptamer, lectin, oligonucleotide probe, PNA probe, and any analyte specific reagent capable of binding to any portion of a respective specific target analyte; exposing the set of capture zones to:

at least one fluorescing wavelength of light/radiation configured to cause at least one unique fluorescent labeled probe bound to a respective specific target analyte of a respective capture zone and sample to fluoresce; or a plurality of fluorescing wavelengths of light/radiation configured to cause respective analyte specific fluorescent labeled probes corresponding to a respective fluorescing wavelength and bound to a respective specific target analyte of a respective capture zone and sample to fluoresce; imaging at least one set of capture zones for at least one channel/lane during such fluorescing to produce at least one image thereof; and analyzing the at

~~least one image, or a plurality of image each corresponding to a specific fluorescing wavelength, to determine a number of captured specific target analytes for each zone/sample.~~

~~25. A single use, multiple sample analyte analysis cartridge device, or lane thereof, comprising:~~

~~optionally, a housing configured for insertion and removal from an assay system,~~

~~one or more fluidic channels/lanes, optionally arranged along at least a portion of the housing, each fluidic channel/lane configured to receive at least one flow,~~

~~wherein:~~

~~the at least one flow comprises a mixture of a plurality of individual samples,~~

~~each of the individual samples having specific target analytes therein labeled with a unique label probe,~~

~~each unique label probe is configured to bind with a first specific binding agent of a respective target analyte for a respective sample,~~

~~each respective first specific binding agent comprises at least one of an antibody, aptamer, lectin, and nucleic acid probe configured to bind to a respective target analyte of a respective sample, and/or is labeled with at least one of a unique synthetic oligonucleotide probe, a protein nucleic acid (PNA) probe, and any other synthetic polynucleotide analog configured for identification of an associated respective sample; and~~

~~at least one set of a plurality of spatially distinct capture zones arranged along at least one fluidic channel/lane,~~

~~each zone is configured with at least one unique oligonucleotide or PNA probe complementary to a particular unique label probe of a specific target analyte of at least one specific sample so as to capture the specific target analyte of the at least one specific sample, such that, each distinct capture zone is configured to capture a specific target analyte of the at least one specific sample.~~

~~26. The device of claim 25, further comprising a plurality of windows, each configured to view at least a portion of the set of the plurality of capture zones, or each respective window configured to view at least a portion of a respective capture zone of a set of capture zones.~~

~~27. The device of claim 26, wherein each window is arranged adjacent a respective capture zone.~~

~~28. The device of claim 25 or 26, wherein the cartridge is configured such that at least one of each set of capture zones and each capture zone can be imaged.~~

~~29. The device of claims 25 or 26, wherein the cartridge is configured such that at all sets of capture zones, and/or all captures zones are imaged.~~

~~30. The device of any of claims 25-29, further comprising incubating means configured to incubate at least one of the samples, incubate a plurality of the samples, or incubate all of the samples, prior to mixing with other samples.~~

~~31. The device of claim 30, wherein incubation includes diluting each sample at least once prior to incubation.~~

~~32. The device of any of claims 25-31, further comprising washing means configured to wash at least one sample, a plurality of the samples, or all samples.~~

~~33. The device of claim 32, wherein washing is performed prior to mixing.~~

~~34. The device of any of claims 25-33, wherein the cartridge is configured to include or receive at least one fluorescent labeling material or flow, respectively, comprising at least one analyte specific fluorescent labeled probes.~~

~~35. The device of claim 34, wherein each unique fluorescent labeled agent of the plurality of the samples is configured to bind with a respective specific target analyte of a respective sample.~~

~~36. The device of claims 34 or 35, wherein each analyte specific fluorescent labeled probe of the plurality of the samples comprises at least one of a fluorescent labeled antibody, aptamer, lectin, oligonucleotide probe, PNA probe, and any analyte specific reagent capable of binding to any portion of a respective specific target analyte.~~

~~37. The device of any of claims 25-36, wherein the cartridge is configured to receive at least one fluorescing wavelength of light/radiation configured to cause at least one unique fluorescent labeled probe bound to a respective specific target analyte of a respective capture zone and sample to fluoresce.~~

~~38. The device of any of claims 25-36, wherein the cartridge is configured to receive a plurality of the samples of fluorescing wavelengths of light/radiation, each respective wavelength configured to cause a respective analyte specific fluorescent labeled probe bound to a respective specific target analyte of a respective capture zone and sample to fluoresce.~~

~~39. The device of any of claims 25-38, wherein the cartridge is configured for imaging at least one set of capture zones, a plurality of capture zones, or all of the capture zones for at least one set of capture zones, a plurality of sets of capture zones, or all of sets of capture zones.~~

40. A single use, multiple-sample analyte analysis cartridge device, or lane thereof, comprising:

optionally a housing configured for insertion and removal from an assay system;

a plurality of fluidic channels/lanes optionally arranged along at least a portion of the housing, each fluidic channel/lane configured to receive at least one flow,

wherein:

the at least one flow comprises a mixture of a plurality of individual samples, and with each of the individual samples, having specific target analytes therein labeled with a unique label probe,

each unique label probe is configured to bind with a first specific binding agent of a respective target analyte for a respective sample, and

each respective first specific binding agent comprises at least one of an antibody, aptamer, lectin, and nucleic acid probe configured to bind to a respective target analyte of a respective sample, and/or is labeled with at least one of a unique synthetic oligonucleotide probe, a protein nucleic acid (PNA) probe, and any other synthetic polynucleotide analog configured for identification of an associated respective sample;

at least one set of a plurality of spatially distinct capture zones arranged along at least one fluidic channel/lane,

each zone is configured with at least one unique oligonucleotide or PNA probe complementary to a particular unique label probe of a specific target analyte of at least one specific sample so as to capture the specific target analyte of the at least one specific respective sample, such that, each distinct capture zone is configured to capture a specific target analyte of the at least one specific sample;

and

one or more windows, each being arranged adjacent a respective capture zone and configured to view at least a portion of a set of the plurality of capture zones, or each respective window configured to view at least a portion of a respective capture zone of a

~~set of capture zones, such that at least one of each set of capture zones and each capture zone can be imaged.~~

41. A multi-sample mixture assay system comprising:

a receiving area and/or housing configured for receiving a cartridge according to any of claims 25-40;

fluorescing means;

a processor; and

an imager;

wherein:

the cartridge is configured to flow a mixture through at least one of the fluidic channels/lanes,

the mixture comprises a plurality of individual samples; each sample is labeled with a unique label probe, such that each unique label probe is configured to bind with a first specific binding agent of a respective target analyte for a respective sample,

each respective first specific binding agent comprises at least one of an antibody, aptamer, lectin, and nucleic acid probe configured to bind to a respective target analyte of a respective sample, and/or is labeled with at least one of a unique synthetic oligonucleotide probe, a protein nucleic acid (PNA) probe, and any other synthetic polynucleotide analog configured for identification of an associated respective sample;

labeled target analytes of each sample binds to one and/or another of the capture zones of at least one set of capture zones of the at least one fluidic channels/lanes of the cartridge, each zone being configured with at least one unique oligonucleotide or PNA probe complementary to a particular unique label probe of a specific target analyte of at least one specific sample so as to capture the specific target analyte of the at least one specific sample; the system is configured to flow of a plurality of analyte specific fluorescent labeled probes across each set of capture zones, each analyte specific fluorescent labeled probe of the plurality is configured to bind with a respective specific target analyte of a respective sample, and comprises at least one of a fluorescent labeled antibody, aptamer, lectin,

oligonucleotide probe, PNA probe, and any analyte specific reagent capable of binding to any portion of a respective specific target analyte;

the fluorescing means exposes the capture zones of at least one set of capture zones to at least one fluorescing wavelength of light/radiation configured to cause at least one unique fluorescent labeled probe bound to a respective specific target analyte of a respective capture zone and sample to fluoresce; the imager images the at least one set of capture zones during such fluorescing to produce at least one image thereof, and the processor is configured with computer instructions operating thereon to at least one of control the assay system and analyze the at least one image to determine a number of captured specific target analytes for each zone/sample.

42. A multi-sample analyte analysis method comprising:

labeling at least one target analyte in each of a plurality of individual samples with a unique label probe and an analyte specific fluorescent labeled probe, wherein:

each unique label probe is configured to bind with a first specific binding agent of a respective target analyte for a respective sample, and each respective first specific binding agent:

comprises at least one of an antibody, aptamer, lectin, and nucleic acid probe configured to bind to a respective target analyte of a respective sample, and/or is labeled with at least one of a unique synthetic oligonucleotide probe, a protein nucleic acid (PNA) probe, and any other synthetic polynucleotide analog configured for identification of an associated respective sample; each unique fluorescent labeled probe of the plurality is configured:

to bind with a respective specific target analyte of a respective sample, and comprises at least one of a fluorescent labeled antibody, aptamer, lectin, oligonucleotide probe, PNA probe, and any analyte specific reagent capable of binding to any portion of a respective specific target analyte;

optionally incubating each sample, wherein incubation optionally includes diluting each sample at least once prior to incubation; optionally washing each sample; optionally treating each washed sample with a crosslinker; combining the plurality of individual samples into a mixture;

~~flowing the mixture within at least one fluidic channel/lane having arranged thereon or in fluid communication with at least one set of a plurality of spatially distinct capture zones, wherein:~~

~~each zone is configured with at least one unique oligonucleotide- or PNA-probe complementary to a particular unique label probe of a specific target analyte of a respective specific sample so as to capture the specific target analyte of the at least one specific sample, such that, each distinct capture zone is configured to capture a specific target analyte of the at least one specific sample; exposing the set of capture zones to at least one fluorescing wavelength of light/radiation configured to cause at least one unique fluorescent labeled probe bound to a respective specific target analyte of a respective capture zone and sample to fluoresce; imaging the set of capture zones during such fluorescing to produce at least one image thereof; and analyzing the at least one image to determine a number of captured specific target analytes for each zone/sample.~~

~~43. A multi-sample analyte analysis method comprising:~~

~~labeling at least one target analyte in each of a plurality of individual samples with at least one unique label probe, wherein:~~

~~each unique label probe is configured to bind with a first specific binding agent of a respective target analyte for a respective sample, and~~

~~each respective first specific binding agent:~~

~~comprises at least one of an antibody, aptamer, lectin, and nucleic acid probe configured to bind to a respective target analyte of a respective sample, and/or is labeled with at least one of a unique synthetic oligonucleotide probe, a protein nucleic acid (PNA) probe, and any other synthetic polynucleotide analog configured for identification of an associated respective sample;~~

~~combining the plurality of individual samples into a first mixture; and exposing the first mixture to a plurality of sets of capture particles, thereby forming a second mixture, wherein each set of capture particles is:~~

~~configured with at least one unique oligonucleotide- or PNA-probe complementary to a particular unique label probe of a specific target analyte of at least one specific sample so as to~~

~~capture the specific target analyte of the at least one specific sample, such that, each set of respective capture particles is configured to capture a specific target analyte of the at least one specific sample.~~

~~44. The method of claim 43, further comprising incubating each sample.~~

~~45. The method of claim 44, wherein incubating is performed prior to combining the plurality of individual samples into the first mixture.~~

~~46. The method of any of claims 44-45, wherein incubation includes diluting each sample at least once prior to incubation.~~

~~47. The method of any of claims 43-46, further comprising washing each sample.~~

~~48. The method of claim 47, wherein washing is performed prior to combining the plurality of individual samples into the first mixture.~~

~~49. The method of claims 47 or 48, wherein:~~

~~the labeled target analyte comprises biological cells, and the labeled target cells prior to washing being suspended in phosphate buffered saline or other compatible buffer.~~

~~50. The method of claim 49, wherein washing comprises:~~

~~centrifuging the labeled target analyte, removing supernatant, and re-suspending the labeled target analyte in phosphate buffered saline or other compatible buffer.~~

~~51. The method of any of claims 43-50, further comprising exposing at least one of the first mixture and the second mixture of the sets of capture particles to at least one analyte specific fluorescent labeled agent.~~

~~52. The method of claim 51, wherein each analyte specific fluorescent labeled probe of the plurality is configured:~~

~~to bind with a respective specific target analyte of a respective sample, and comprises at least one of a fluorescent labeled antibody, aptamer, lectin, oligonucleotide probe, PNA probe, and any analyte specific reagent capable of binding to any portion of a respective specific target analyte.~~

~~53. The method of claims 51 or 52, wherein the at least one analyte specific fluorescent labeled probe is configured to bind with a respective specific target analyte of a respective sample.~~

~~54. The method of any of claims 43-53, further comprising exposing second mixture to at least one fluorescing wavelength of light/radiation, the wavelength configured to cause at least one analyte specific fluorescent labeled probe bound to a respective specific target analyte of a respective set of capture particles to fluoresce.~~

~~55. The method of any of claims 43-54, further comprising exposing the second mixture, optionally via flow cytometry, to a plurality of fluorescing wavelengths of light/radiation, each respective wavelength configured to cause a respective analyte specific fluorescent labeled probe bound to a respective specific target analyte of a respective capture particle of at least one set of capture particles to fluoresce.~~

~~56. The method of any of claims 43-55, further comprising analyzing the capture particles of the second mixture to produce at least one result/data plot thereof.~~

~~57. The method of claim 56, wherein imaging the capture particles of the second mixture comprises producing at least one image for each wavelength exposed to the at least one set of capture zones.~~

~~58. The method of any of claims 43-57, further comprising analyzing the capture particles of the second mixture so as to determine a number of captured specific target analytes for each sample.~~

~~59. The method of claims 57 or 58, further comprising analyzing the at least one sample to determine the number of captured specific target analytes for each sample.~~

~~60. The method of any of claims 53-59, further comprising treating each sample with a crosslinker.~~

~~61. The method of any of claims 47-60, further comprising crosslinking each washed sample.~~

~~62. The method of claim 61, wherein each respective first binding agent comprises an antibody, such that, antibody and target analyte form an antibody:target analyte complex (ATAC), and after washing, the method further comprises crosslinking the ATAC.~~

~~63. The method of claim 61, wherein crosslinking is performed with a crosslinking agent.~~

64. The method of claim 63, wherein the crosslinking agent comprises glutaraldehyde or a homo or hetero-bifunctional cross-linking agent.

65. A multi-sample analyte analysis method comprising:

labeling at least one target analyte in each of a plurality of individual samples with at least one unique label probe, wherein:

each unique label probe is configured to bind with a first specific binding agent of a respective target analyte for a respective sample, and each respective first specific binding agent:

comprises at least one of an antibody, aptamer, lectin, and nucleic acid probe configured to bind to a respective target analyte of a respective sample, and/or is labeled with at least one of a unique synthetic oligonucleotide probe, a protein nucleic acid (PNA) probe, and any other synthetic polynucleotide analog configured for identification of an associated respective sample;

incubating each sample, wherein incubation optionally includes diluting each sample at least once prior to incubation; optionally washing each sample;

optionally treating each washed sample with a crosslinker; combining the plurality of individual samples into a first mixture; exposing the first mixture to at least one set of capture particles forming a second mixture, wherein:

each set of capture particles is configured with at least one unique oligonucleotide or PNA probe complementary to a particular unique label probe of a specific target analyte of at least one specific sample so as to capture the specific target analyte of the at least one specific sample, such that, each distinct set of capture particles is configured to capture a specific target analyte of the at least one specific sample; exposing at least one of the first mixture and second mixture to at least one analyte specific fluorescent labeled agent, wherein each unique fluorescent labeled probe of the plurality is configured:

to bind with a respective specific target analyte of at least one sample, and comprises at least one of a fluorescent labeled antibody, aptamer, lectin, oligonucleotide probe, PNA probe, and any analyte specific reagent capable of binding to any portion of a respective specific target analyte; exposing the second mixture, optionally via flow cytometry, to:

~~at least one fluorescing wavelength of light/radiation configured to cause at least one unique fluorescent labeled probe bound to a respective specific target analyte to fluoresce; or a plurality of fluorescing wavelengths of light/radiation configured to cause respective analyte specific fluorescent labeled probes corresponding to a respective fluorescing wavelength and bound to a respective specific target analyte to fluoresce; analysis of at least one set of the capture particles, optionally via flow cytometry, during such fluorescing to produce at least one data set thereof; and~~

~~analyzing the at least one data set, or a plurality of data sets, each corresponding to a specific fluorescing wavelength, to determine a number of at least one set of capture particles that have captured specific target analytes.~~

~~66. A multi-sample analyte analysis method comprising:~~

~~combining multiple individual samples into a combined/pooled sample, wherein each individual sample is labeled with a known analyte specific antibody;~~

~~pre-screening the combined sample via at least one of an immunoassay, a PCR assay, and a sequencing assay to determine if any of the combined samples contains a target analyte of interest;~~

~~and~~

~~upon such pre-screening indicating a positive results for the combined sample, flowing the combined sample over a plurality of distinct capture zones, each distinct capture zone being configured to capture a specific target analyte of the combined sample.~~

~~67. The method of any one of claims 1-66, wherein the method is performed in a ferrofluid-based microfluidic device.~~

~~68. The method of claim 67, further comprising one and/or another of the features, functionality, steps, structure, or clarifications contained in any of claims 1-67.~~

~~69. A method for performing a ferrofluid-based microfluidic fluorescence *in-situ* hybridization assay comprising:~~

~~preparing a first mixture of ferrofluid and a sample containing or suspected of containing a target analyte;~~

~~flowing the first mixture through a channel/lane comprising a capture region while applying a magnetic field, wherein the capture region comprises one or more binding agents which capture the target analyte;~~

~~flowing a second solution into the channel/lane, wherein the second solution comprises a labeled probe configured to hybridize with the target analyte;~~

~~raising the temperature of the channel/lane to the probe hybridization temperature;~~

~~allowing the probe to hybridize with the sample;~~

~~flowing the ferrofluid through the channel/lane to remove the unbound probe;~~

~~measuring for the presence or absence of the label.~~

~~70. A method for performing a ferrofluid-based microfluidic fluorescence *in-situ* hybridization assay comprising:~~

~~preparing a first mixture of ferrofluid and a sample containing or suspected of containing a target analyte;~~

~~combining at least the first mixture and a second mixture, wherein the second mixture comprises a labeled probe configured to hybridize with the target analyte, wherein the probe is allowed to hybridize with the target analyte at the probe hybridization temperature;~~

~~flowing the combined mixture through a channel/lane comprising a capture region while applying a magnetic field, wherein the capture region comprises one or more binding agents which capture the target analyte;~~

~~applying a magnetic field to flow the ferrofluid through the channel/lane to remove unbound probe;~~

~~measuring for the presence or absence of the label.~~

~~71. A method of fluorescence *in-situ* hybridization detection of an analyte in a sample comprising:~~

~~providing a sample comprising or suspected of comprising a target analyte;~~

~~providing a fluorescent label probe, wherein said fluorescent label probe comprises a binding sequence, configured to hybridize with the target analyte;~~

~~combining at least the sample, the fluorescent label probe, and a buffer to form a mixture;~~

~~incubating the mixture at the probe hybridization temperature;~~

~~adding the mixture to a ferrofluid-based microfluidic device;~~

~~flowing the ferrofluid and move the mixture toward a capture region applying a magnetic field, wherein the capture region comprises one or more binding agents which capture the target analyte, and a detector;~~

~~detecting the presence or absence of the target analyte.~~

~~72. The method of any one of the preceding claims 69-71, wherein the labeled probe is fluorescent.~~

~~73. The method of any one of the preceding claims 69-72, wherein the probe is a PNA-based probe.~~

~~74. The method of any one of the preceding claims 69-73, wherein the probe is an DNA-based probe.~~

~~75. The method of any one of the preceding claims 69-74, wherein the fluorescent label probe is non-fluorescent and is activated upon hybridizing with the target analyte.~~

~~76. The method of any one of the preceding claims 69-75, wherein the fluorescent label probe is quenched by a complementary sequence comprising a quenching moiety, wherein the complementary sequence is released upon the binding of the fluorescent label probe with the target analyte.~~

~~77. The method of any one of the preceding claims 69-74, wherein the fluorescent label probe comprises a quenching moiety which is released upon hybridizing with the target analyte.~~

~~78. The method of any one of the preceding claims 69-77, wherein the method further comprises the addition of a helper probe, which assists the hybridization of the fluorescent label probe with the target analyte.~~

~~79. The method of any one of the preceding claims 69-78, wherein the ferrofluid is a biologically compatible ferrofluid.~~

~~80. The method of any one of the preceding claims 69-79, wherein the ferrofluid is a biologically compatible PEGylated ferrofluid.~~

~~81. The method of any one of the preceding claims 69-80, wherein the ferrofluid is a biologically compatible surfactant stabilized ferrofluid.~~

~~82. The method of any one of the preceding claims 69-81, wherein the analyte is a bacterial cell, a yeast cell, a mold cell or spore, a parasite, or a parasite oocyst.~~

~~83. The method of any one of the preceding claims 69-82, wherein the analyte is a gram-positive bacterial cell.~~

~~84. The method of any one of the preceding claims 69-83, wherein the analyte is a gram-negative bacterial cell.~~

~~85. The method of any one of the preceding claims 69-84, wherein either the first mixture or second mixture contains Polymyxin B.~~

~~86. The method of any one of the preceding claims 69-85, wherein a quencher dye is used to decrease non-specific signal in the ferrofluid-based FISH assay.~~

~~87. The method of any one of the preceding claims 69-86, wherein a helper probe is added to the buffer.~~

~~88. The method of any one of claims 69-87, wherein the hybridization time is about 5 minutes or less, about 10 minutes or less, about 15 minutes or less, about 20 minutes or less, about 25 minutes or less, about 30 minutes or less, about 35 minutes or less, about 40 minutes or less, about 45 minutes or less, about 50 minutes or less, about 55 minutes or less, about 60 minutes or less.~~

~~89. The method of any one of claims 69-87, wherein the hybridization time is from about 5 minutes to about 60 minutes, from about 10 minutes to about 60 minutes, from about 15 minutes to about 60 minutes, from about 20 minutes to about 60 minutes, from about 25 minutes to about 60 minutes, from about 30 minutes to about 60 minutes, from about 35 minutes to about 60 minutes, from about 40 minutes to about 60 minutes, from about 45 minutes to about 60 minutes, from about 50 minutes to about 60 minutes, from about 55 minutes to about 60 minutes.~~

~~90. The method of any one of claims 69-87, wherein the hybridization time is from about 5 minutes to about 55 minutes, from about 10 minutes to about 55 minutes, from about 15 minutes to about 55 minutes, from about 20 minutes to about 55 minutes, from about 25 minutes to about 55 minutes, from about 30 minutes to about 55 minutes, from about 35 minutes to about 55 minutes, from about 40 minutes to about 55 minutes, from about 45 minutes to about 55 minutes, from about 50 minutes to about 55 minutes.~~

~~91. The method of any one of claims 69-87, wherein the hybridization time is from about 5 minutes to about 50 minutes, from about 10 minutes to about 50 minutes, from about 15 minutes to about 50 minutes, from about 20 minutes to about 50 minutes, from about 25 minutes to about 50 minutes, from about 30 minutes to about 50 minutes, from about 35 minutes to about 50 minutes, from about 40 minutes to about 50 minutes, from about 45 minutes to about 50 minutes.~~

~~92. The method of any one of claims 69-87, wherein the hybridization time is from about 5 minutes to about 45 minutes, from about 10 minutes to about 45 minutes, from about 15 minutes to about 45 minutes, from about 20 minutes to about 45 minutes, from about 25 minutes to about 45 minutes, from about 30 minutes to about 45 minutes, from about 35 minutes to about 45 minutes, from about 40 minutes to about 45 minutes.~~

~~93. The method of any one of claims 69-87, wherein the hybridization time is from about 5 minutes to about 40 minutes, from about 10 minutes to about 40 minutes, from about 15 minutes to about 40 minutes, from about 20 minutes to about 40 minutes, from about 25 minutes to about 40 minutes, from about 30 minutes to about 40 minutes, from about 35 minutes to about 40 minutes, from about 40 minutes to about 40 minutes, from about 45 minutes to about 40 minutes, from about 50 minutes to about 40 minutes, from about 55 minutes to about 40 minutes.~~

~~94. The method of any one of claims 69-87, wherein the hybridization time is from about 5 minutes to about 35 minutes, from about 10 minutes to about 35 minutes, from about 15 minutes to about 35 minutes, from about 20 minutes to about 35 minutes, from about 25 minutes to about 35 minutes, from about 30 minutes to about 35 minutes.~~

~~95. The method of any one of claims 69-87, wherein the hybridization time is from about 5 minutes to about 30 minutes, from about 10 minutes to about 30 minutes, from about 15 minutes to about 30 minutes, from about 20 minutes to about 30 minutes, from about 25 minutes to about 30 minutes.~~

~~96. The method of any one of claims 69-87, wherein the hybridization time is from about 5 minutes to about 25 minutes, from about 10 minutes to about 25 minutes, from about 15 minutes to about 25 minutes, from about 20 minutes to about 25 minutes.~~

~~97. The method of any one of claims 69-87, wherein the hybridization time is from about 5 minutes to about 20 minutes, from about 10 minutes to about 20 minutes, from about 15 minutes to about 20 minutes.~~

~~98. The method of any one of claims 69-87, wherein the hybridization time is from about 5 minutes to about 15 minutes, from about 10 minutes to about 15 minutes.~~

~~99. The method of any one of claims 69-87, wherein the hybridization time is from about 5 minutes to about 10 minutes.~~

~~100. The method of any one of claims 69-99, wherein the sample is incubated in media comprising glucose prior to analysis.~~

~~101. The method of any one of claims 69-100, wherein the sample is incubated in media comprising pyruvate prior to analysis.~~

~~102. The method of any one of claims 69-101, wherein the sample is incubated in media comprising a mixture of glucose and pyruvate prior to analysis.~~

~~103. The method of any one of claims 69-102, wherein the sample is incubated in media comprising 200 mM glucose and 20 mM pyruvate prior to analysis.~~

~~104. The method of any one of claims 69-103, wherein the sample is incubated in media for about 15 minutes, about 30 minutes, about 45 minutes, or about 60 minutes.~~

~~105. The method of any one of claims 69-104, wherein the sample is incubated in media at about 35°C, about 40°C, about 42°C, or about 45°C.~~

~~106. The method of any one of claims 69-105, wherein the sample is incubated in media comprising 200 mM glucose and 20 mM pyruvate for about 30 minutes at about 42°C prior to analysis.~~

~~107. A kit for performing a ferrofluid-based microfluidic fluorescent *in-situ* hybridization assay comprising:~~

~~a cartridge comprising a plurality of channels/lanes;~~

~~an inlet receiving a ferrofluid, biological cell mixture, and a label probe, the inlet in communication with at least one of the plurality of channels/lanes;~~

~~a magnetic field source arranged proximate to at least one of the inlet and the plurality of channels/lanes;~~

~~at least one capture region having one of more binding agents for capturing at least a first type of analyte, the at least one capture region arranged proximate to a first portion of at least one of the channels/lanes, wherein the first portion is downstream from the inlet;~~

~~a detection reagent comprising a fluorescent label probe, wherein said fluorescent label probe comprises a binding sequence, configured to hybridize with the target analyte.~~

~~108. The method of any one of claims 69-106, or kit of claim 107, used with any of the methods according to any one of claims 1-24 or 41-68 or with the cartridge of any one of claims 25-40.~~

~~109. A system, device, or method according to any of the disclosed embodiments.~~