Claims

1. A method, comprising:

mixing with a sample a plurality of transduction particles associated with a target cell, the plurality of transduction particles engineered to include a nucleic acid molecule formulated to cause the target cell to produce a plurality of reporter molecules, the plurality of transduction particles formulated to bind to and deliver the nucleic acid molecule into the target cell, the plurality of transduction particles being non-replicative;

maintaining the sample and the plurality of transduction particles to express the plurality of reporter molecules when the target cell is present in the sample; and

receiving a signal associated with a quantity of the plurality of reporter molecules.

2. The method of claim 1, wherein a magnitude of the signal is independent from a quantity of the plurality of transduction particles above a predetermined quantity.

3. The method of claim 1, wherein the plurality of transduction particles is engineered to be incapable of lysogenic replication.

4. The method of claim 1, wherein the plurality of transduction particles is engineered to be incapable of lytic replication.

5. The method of claim 1, wherein the plurality of transduction particles is a viral vector devoid of a wild-type DNA capable of exhibiting wild-type viral functions associated with a virus from which the viral vector is derived.

6. The method of claim 1, wherein the plurality of transduction particles is devoid of a reporter molecule.

7. The method of claim 1, wherein the plurality of transduction particles is derived from a bacteriophage.

8. The method of claim 1, wherein the plurality of transduction particles include a structural protein of a virus and a nucleic acid molecule, the nucleic acid molecule including a reporter gene under the control of a promoter, and a site that is recognized by a virus

nucleic acid packaging system and that is suitable for packaging of the nucleic acid molecule within the virus structural protein.

9. The method of claim 8, wherein the nucleic acid molecule further includes an origin of replication suitable for propagation of the transduced nucleic acid molecule within a target cell.

10. The method of claim 9 wherein the nucleic acid molecule further includes a selectable marker suitable for selection within a target cell.

11. The method of claim 10 wherein the promoter is constitutive, inducible, or conditional.

12. The method of claim 1, wherein the target cell is a bacteria selected from the group consisting of Escherichia, Mycobacterium, Staphylococcus, Listeria, Clostridium, Enterococcus, Streptococcus, Helicobacter, Rickettsia, Haemophilus, Xenorhabdus, Acinetobacter, Bordetella, Pseudomonas, Aeromonas, Actinobacillus, Pasteurella, Vibrio, Legionella, Bacillus, Calothrix, Methanococcus, Stenotrophomonas, Chlamydia, Neisseria, Salmonella, Shigella, Campylobacter and Yersinia.

13. The method of claim 1, wherein the nucleic acid molecule is formulated to cause the target cell to produce the plurality of reporter molecules only when the target cell includes at least one of a drug resistance gene, a drug-susceptibility gene, a toxin, or a species-specific gene.

14. The method of claim 1, wherein a reporter molecule from the plurality of reporter molecules is any one of a bacterial luciferase, an eukaryotic luciferase, a fluorescent protein, an enzyme suitable for colorimetric detection, a protein suitable for immunodetection, a peptide suitable for immunodetection or a nucleic acid that function as an apatamer or that exhibits enzymatic activity.

15. The method of claim 1, wherein:

the sample is in a container that is fluidically isolated from a region outside of the container;

the plurality of transduction particles is maintained in fluidic isolation from the sample before the mixing; and

the mixing includes disposing the plurality of transduction particles into the sample while maintaining fluidic isolation between the region and the container.

16. The method of claim 1, wherein the maintaining includes maintaining the sample at a temperature of less than or equal to approximately 45 degrees Celsius for a time period of less than approximately four hours.

17. The method of claim 1, further comprising:

disposing a substance into the sample, the substance formulated to react with the plurality of reporter molecules to enhance the signal.

18. The method of claim 1, wherein:

the sample is in a container that is fluidically isolated from a region outside of the container;

the substance is maintained in fluidic isolation from the sample before the disposing; and

the disposing includes disposing the substance into the sample while maintaining fluidic isolation between the region and the container.

19. The method of claim 1, wherein the maintaining includes maintaining the sample for a time period such the quantity of the plurality of reporter molecules sufficient to produce the signal is produced independent from cell replication.

20. The method of claim 1, wherein the maintaining includes maintaining the sample for a time period such the quantity of the plurality of the reporter molecules sufficient to produce the signal is produced and is further enhanced due to cell replication

21. A method, comprising:

mixing with a sample a plurality of transduction particles associated with a target cell, the plurality of transduction particles engineered to include a nucleic acid molecule formulated to cause the target cell to produce a plurality of reporter molecules, the plurality of transduction particles being devoid of a wild-type DNA capable of exhibiting wild-type

viral functions associated with a virus from which the plurality of transduction particles is derived;

maintaining the sample and the plurality of transduction particles to express the plurality of reporter molecules is produced when the target cell is present in the sample; and

receiving a signal associated with a quantity of the plurality of reporter molecules, a magnitude of the signal being independent from a quantity of the plurality of transduction particles above a predetermined quantity.

22. The method of claim 21, wherein the plurality of transduction particles is devoid of a reporter molecule.

23. The method of claim 21, wherein the plurality of transduction particles is derived from a bacteriophage.

24. The method of claim 21, wherein:

the sample is in a container that is fluidically isolated from a region outside of the container, each of the mixing, the maintaining and the receiving performed while maintaining fluidic isolation between the region and the container.

25. The method of claim 21, wherein the sample is in a container that is fluidically isolated from a region outside of the container, the method further comprising:

disposing a substance into the sample while maintaining fluidic isolation between the region and the container, the substance formulated to react with the plurality of reporter molecules to enhance production of the signal, the substance being maintained in fluidic isolation from the sample before the disposing.

26. A method, comprising:

introducing into a sample a plurality of transduction particles associated with a target cell, the plurality of transduction particles engineered to include a nucleic acid molecule formulated to cause the target cell to produce a plurality of reporter molecules, the plurality of transduction particles being incapable of lysogenic replication;

maintaining the sample and the plurality of transduction particles to express the plurality of reporter molecules when the target cell is present in the sample; and

receiving a signal associated with a quantity of the plurality of reporter molecules, a magnitude of the signal being independent from a quantity of the plurality of transduction particles above a predetermined quantity.

27. The method of claim 26, wherein the plurality of transduction particles is engineered to be incapable of lytic replication.

28. The method of claim 26, wherein the maintaining includes maintaining the sample for a time period such that the quantity of the plurality of the reporter molecules sufficient to produce the signal is produced independent from cell replication.

29. An apparatus comprising:

a housing configured to be removably coupled to a reaction chamber, the housing defining a first reagent volume and a second reagent volume, the housing including a delivery portion defining a first pathway between the first reagent volume and the reaction chamber when the housing is coupled to the reaction chamber, the delivery portion defining a second pathway between the second reagent volume and the reaction chamber when the housing is coupled to the reaction chamber;

a first actuator having a plunger portion disposed within the first reagent volume, an engagement portion of the first actuator configured to be manipulated to move the plunger portion within the first reagent volume; and

a second actuator having a plunger portion movably disposed within the second reagent volume, an engagement portion of the second actuator configured to be manipulated to move the plunger portion of the second actuator within the second reagent volume, the engagement portion of the second actuator at least partially surrounding the engagement portion of the first actuator.

30. The apparatus of claim 29, wherein the second actuator defines a channel within which the engagement portion of the first actuator moves when the first actuator is manipulated to move the plunger portion of the first actuator.

31. The apparatus of claim 29, wherein the engagement portion of the second actuator defines an opening within which the engagement portion of the first actuator is disposed.

32. The apparatus of claim 29, wherein the plunger portion of the first actuator is configured to be moved independently of the movement of the plunger portion of the second actuator.

33. The apparatus of claim 29, wherein the plunger portion of the first actuator and a portion of the housing collectively define a seal to fluidically isolate the first reagent volume from a volume outside of the housing.

34. The apparatus of claim 29, wherein the housing includes a sidewall separating the second reagent volume from the first reagent volume.

35. The apparatus of claim 29, wherein a longitudinal axis of the plunger portion of the first actuator is offset from a longitudinal axis of the plunger portion of the second actuator.

36. The apparatus of claim 29, wherein the first pathway is separate from the second pathway.

37. The apparatus of claim 29, wherein the housing includes a puncturer disposed within the first reagent volume, the apparatus further comprising:

a reagent container disposed within the first reagent volume, the puncturer configured to puncture a portion of the reagent container when the plunger portion is moved within the first reagent volume.

38. The apparatus of claim 29, wherein:

the first reagent volume contains a viral vector associated with a target cell, the viral vector engineered to include a nucleic acid sequence formulated to cause the target cell to produce a plurality of reporter molecules; and

the second reagent volume includes a reagent formulated to react with the plurality of reporter molecules to enhance production of a signal.

39. The apparatus of claim 29, wherein the delivery portion includes an outlet that is disposed within the reaction chamber when the housing is coupled to the reaction chamber

a portion of the first module is disposed within the isolation chamber of the isolation module when the first module is coupled to the isolation module.

40. An apparatus comprising:

a housing configured to be removably coupled to a reaction chamber, the housing defining a reagent volume;

a delivery member coupled to the housing, the delivery member defining a pathway between the reagent volume and the reaction chamber when the housing is coupled to the reaction chamber, a first end portion of the delivery member disposed within the reagent volume, a second end portion of the delivery member disposed outside of the reagent volume; and

an actuator having a plunger portion disposed within the reagent volume, the plunger portion configured to be moved within the reagent volume along a longitudinal axis of the housing to produce a flow of a reagent from the reagent volume via the pathway,

the delivery member configured to direct the flow of the reagent exiting the second end portion of the delivery member in an exit direction nonparallel to the longitudinal axis of the housing.

41. The apparatus of claim 40, further comprising:

a puncturable member defining a portion of a boundary of the reagent volume, the first end portion of the delivery member including a puncturer configured to puncture the puncturable member when the plunger portion is moved within the reagent volume.

42. The apparatus of claim 40, further comprising:

a reagent container disposed within the reagent volume; and

a puncturer configured to puncture a portion of the reagent container when the plunger portion is moved within the reagent volume.

43. The apparatus of claim 40, further comprising:

the reagent disposed within the reagent volume, the reagent including at least one of a eukaryotic or a bacterial luciferase substrate.

44. The apparatus of claim 40, wherein:

the first end portion of the delivery member defines a first portion of the pathway; and

the second end portion of the delivery member defines a second portion of the pathway, a center line of the second portion of the pathway being angularly offset from a center line of the first portion of the pathway.

45. The apparatus of claim 40, wherein the exit direction and the longitudinal axis define an angle less than approximately thirty degrees.

46. The apparatus of claim 40, wherein the reagent volume is a first reagent volume, the reagent is a first reagent, the delivery member is a first delivery member, the plunger is a first plunger, the housing defining a second reagent volume, the apparatus further comprising:

a second delivery member coupled to the housing, the second delivery member defining a pathway between the second reagent volume and the reaction chamber when the housing is coupled to the reaction chamber; and

a second actuator having a plunger portion disposed within the second reagent volume, the plunger portion of the second actuator configured to be moved within the second reagent volume along a longitudinal axis of the housing to produce a flow of a second reagent from the second reagent volume via the pathway of the second delivery member,

a portion of the second actuator at least partially surrounding a portion of the first actuator.

47. The apparatus of claim 46, wherein the second actuator defines a channel within which the portion of the first actuator moves when the first actuator is manipulated to move the plunger portion of the first actuator.

48. An apparatus comprising:

a housing configured to be removably coupled to a reaction chamber, the housing defining a reagent volume;

a delivery member coupled to the housing, the delivery member defining a pathway between the reagent volume and the reaction chamber when the housing is coupled to the reaction chamber, a first end portion of the delivery member disposed within the reagent volume and defining a first portion of the pathway, a second end portion of the delivery member disposed outside of the housing and defining a second portion of the pathway, a center line of the second portion of the pathway being angularly offset from a center line of the first portion of the pathway; and

an actuator having a plunger portion disposed within the reagent volume, the plunger portion configured to be moved within the reagent volume along a longitudinal axis of the housing to produce a flow of a reagent from the reagent volume via the pathway.

49. The apparatus of claim 48, further comprising:

a puncturable member defining a portion of a boundary of the reagent volume, the first end portion of the delivery member including a puncturer configured to puncture the puncturable member when the plunger portion is moved within the reagent volume.

50. The apparatus of claim 48, wherein the center line of the second portion of the pathway and the center line of the first portion of the pathway define an angle between approximately fifteen degrees and approximately forty-five degrees.

51. The apparatus of claim 48, further comprising:

the reagent disposed within the reagent volume, the reagent including tridecanal.

52. A method, comprising:

placing a reaction chamber containing a sample in operable communication with a detector, the sample containing a plurality of reporter molecules;

conveying, via a delivery member, a reagent into the reaction chamber such that the reagent flows along a surface of the reaction chamber and into the sample, the reagent formulated to react with the plurality of reporter molecules to enhance the production of a signal associated with a quantity of the plurality of the reporter molecules; and

receiving the signal via the detector.

53. The method of claim 52, wherein the conveying includes conveying the reagent in a direction nonperpendicular to a surface of the sample.

54. The method of claim 52, wherein the conveying includes conveying the reagent at a flow rate of at least one milliliter per second.

55. The method of claim 52, wherein the conveying includes moving a plunger in a direction within a reagent volume, a first end portion of the delivery member disposed within the reagent volume, a second end portion of the delivery member disposed within the reaction

chamber, a flow of the reagent exiting the second end portion of the delivery member in an exit direction nonparallel to the direction.

56. The method of claim 52, further comprising:

maintaining a position of the reaction chamber between the conveying and the receiving.

57. The method of claim 52, wherein:

the reporter molecule is any one of a bacterial luciferase, an eukaryotic luciferase, a fluorescent protein, an enzyme suitable for colorimetric detection, a protein suitable for immunodetection, a peptide suitable for immunodetection or a nucleic acid that function as an apatamer or that exhibits enzymatic activity; and

the reagent includes tridecanal.

58. The method of claim 52, wherein the receiving is performed for less than sixty seconds after the conveying.

59. An apparatus, comprising:

a retention member configured to contact a first portion of a sample container to limit movement of the sample container, the sample container defining a reaction volume and a reagent volume;

an activation member configured to engage a second portion of the sample container to convey a reagent from the reagent volume into the reaction volume, the activation member movably coupled to the retention member; and

an actuator configured to move the activation member relative to the retention member between a first position, a second position and a third position, the retention member configured to be spaced apart from the first portion of the sample container when the activation member is in the first position, the activation member configured to be spaced apart from the second portion of the sample container and the retention member configured to contact the first portion of the sample container when the activation member is in the second position, the activation member configured to be engaged with the second portion of the sample container to convey the reagent and the retention member configured to contact with the first portion of the sample container when the activation member is in the third position.

60. The apparatus of claim 59, wherein:

the activation member is configured to move in a first direction; and

a surface of the actuation member is configured to engage a surface of the retention member such that the retention member moves in a second direction different from the first direction when the activation member is moved.

61. The apparatus of claim 59, wherein:

the activation member is configured to move in a first direction from the first position to the second position; and

the retention member is configured to rotate when the activation member is moved from the first position to the second position.

62. The apparatus of claim 59, further comprising:

a biasing member,

a surface of the activation member in contact with a surface of the retention member to maintain the retention member spaced apart from the first portion of the sample container when the activation member is in the first position,

the surface of the activation member spaced apart from the surface of the retention member such that the biasing member urges the retention member in contact with the first portion of the sample container when the activation member is in the second position.

63. The apparatus of claim 59, wherein:

the first portion of the sample container is a proximal end portion; and

the retention member includes a first gripper and a second gripper, the first gripper configured to contact a first side of the proximal end portion and the second gripper configured to contact a second side of the proximal end portion when the activation member is in each of the second position and the third position.

64. The apparatus of claim 59, wherein:

the retention member includes a first gripper and a second gripper, the first portion of the sample container is disposed between and in contact with the first gripper and the second gripper when the activation member is in the second position and the third position.

65. The apparatus of claim 59, wherein the activation member includes a plunger portion configured to move within the reagent volume when the activation member moves from the second position to the third position.

66. The apparatus of claim 59, wherein the activation member is a first activation member, the reagent is a first reagent, the reagent volume is a first reagent volume, the apparatus further comprising:

a second activation member configured to engage a third portion of the sample container to convey a second reagent from a second reagent volume of the sample container into the reaction volume, the second activation member movably coupled to the first activation member, the second activation member configured to contact the third portion of the sample container when the first activation member is in the first position, the second activation member configured to be spaced apart from the third portion of the sample container when the activation member is in the third position.

67. The apparatus of claim 66, wherein at least a portion of the second activation member is movably disposed within the first activation member.

68. An apparatus, comprising;

a retention assembly including a first gripper, a second gripper and a biasing member, the first gripper and the second gripper configured to contact a first portion of a sample container to limit movement of the sample container, the sample container defining a reaction volume and a reagent volume;

an activation member configured to engage a second portion of the sample container to convey a reagent from the reagent volume into the reaction volume, the activation member movably coupled to the retention assembly; and

an actuator configured to move the activation member relative to the retention assembly between a first position and a second position, a surface of the activation member in contact with a surface of the retention assembly to maintain the first gripper and the second gripper in an opened configuration when the activation member is in the first position, the surface of the activation member spaced apart from the surface of the retention assembly such that the biasing member urges the first gripper and the second gripper into a closed configuration when the activation member is in the second position, a plunger portion of the

activation member configured to move within the reagent volume when the activation member moves toward the second position.

69. The apparatus of claim 68, wherein:

the activation member is configured to move in a first direction from the first position to the second position; and

the first gripper moves in a second direction different from the first direction when the activation member is moved.

70. The apparatus of claim 68, wherein:

the activation member is configured to move in a first direction from the first position to the second position; and

the first gripper is configured to rotate when the activation member is moved from the first position towards the second position.

71. The apparatus of claim 68, wherein the activation member is a first activation member, the reagent is a first reagent, the reagent volume is a first reagent volume, the apparatus further comprising:

a second activation member configured to engage a third portion of the sample container to convey a second reagent from a second reagent volume of the sample container into the reaction volume, the second activation member movably coupled to the first activation member, the second activation member configured to contact the third portion of the sample container when the first activation member is in the first position, the second activation member being spaced apart from the third portion of the sample container when the activation member is in the second position.

72. The apparatus of claim 68, wherein at least a portion of the second activation member is movably disposed within the first activation member.

73. An apparatus, comprising:

a housing defining a channel configured to receive a sample container, the housing defining a detection volume configured to place the channel in communication with a detector, the housing including a first seal surface and a second seal surface, a first portion of the sample container and the first seal surface configured to isolate the detection volume from

a volume outside of the housing when a second portion of the sample container is disposed within the detection volume; and

a shutter having a portion movably disposed within the housing between a first shutter position and a second shutter position, a seal surface of the shutter and the second seal surface configured to isolate the detection volume from the channel of the housing when shutter is in the first shutter position, the channel of the housing being in communication with the detection volume when the shutter is in the second shutter position.

74. The apparatus of claim 73, wherein the first seal surface includes a gasket.

75. The apparatus of claim 73, wherein the shutter is in the first shutter position when the second end portion of the sample container within the channel outside of the detection volume, the shutter is in the second shutter position when the second end portion of the sample container within the detection volume.

76. The apparatus of claim 73, wherein the shutter includes an actuation surface configured to engage the second portion of the sample container to move the shutter from the first shutter position to the second shutter position.

77. The apparatus of claim 73, wherein the shutter includes a ramp configured to engage the second portion of the sample container when the second portion of the sample container moves within the channel towards detection volume to move the shutter towards the second shutter position.

78. The apparatus of claim 73, wherein the shutter is configured to translate within the housing in a direction offset a longitudinal axis of the channel.

79. The apparatus of claim 73, further comprising:

a biasing member configured to urge shutter towards the first shutter position.

80. The apparatus of claim 73, wherein the shutter defines a calibration port configured to receive a calibration light source, the calibration port in communication with the detection volume when the shutter is in the first shutter position, the calibration port being isolated from the detection volume when the shutter is in the second shutter position.

81. An apparatus, comprising:

a housing defining a channel configured to receive a sample container, the housing defining a detection volume configured to place the channel in communication with a detector, the housing including a seal surface; and

a shutter having a portion movably disposed within the housing between a first shutter position and a second shutter position, the shutter include a seal surface and an actuation portion, the actuation portion configured to engage a distal end portion of the sample container to move the shutter from the first shutter position to the second shutter position when the distal end portion of the container is moved towards the detection volume, the seal surface of the shutter and the seal surface of the housing configured to isolate the detection volume from the channel of the housing when shutter is in the first shutter position, the channel of the housing being in communication with the detection volume when the shutter is in the second shutter position.

82. The apparatus of claim 81, wherein:

the seal surface of the housing is a distal seal surface, the housing defining a proximal seal surface; and

a proximal end portion of the sample container and the proximal seal surface configured to isolate the detection volume from a volume outside of the housing when the distal end portion of the sample container is disposed within the detection volume.

83. The apparatus of claim 81, wherein the shutter is configured to translate within the housing in a direction offset a longitudinal axis of the channel.

84. The apparatus of claim 81, further comprising:

a biasing member configured to urge shutter towards the first shutter position.

85. The apparatus of claim 81, wherein the shutter defines a calibration port configured to receive a calibration light source, the calibration port in communication with the detection volume when the shutter is in the first shutter position, the calibration port being isolated from the detection volume when the shutter is in the second shutter position.

86. An apparatus, comprising:

a housing defining a channel configured to receive a sample container, the housing defining a detection volume configured to place the channel in communication with a detector, the housing including a seal surface; and

a shutter defining a calibration port configured to receive a calibration light source, the shutter movably disposed within the housing between a first shutter position and a second shutter position, a seal surface of the shutter and the seal surface of the housing configured to isolate the detection volume from the channel of the housing when shutter is in the first shutter position, the calibration port in communication with the detection volume when the shutter is in the first shutter position, the channel of the housing being in communication with the detection volume when the shutter is in the second shutter position, the calibration port being isolated from the detection volume when the shutter is in the second shutter position.

87. The apparatus of claim 86, wherein:

the seal surface of the housing is a distal seal surface, the housing defining a proximal seal surface; and

a proximal end portion of the sample container and the proximal seal surface configured to isolate the detection volume from a volume outside of the housing when a distal end portion of the sample container is disposed within the detection volume.

88. The apparatus of claim 86, wherein the shutter includes an actuation surface configured to engage a distal end portion of the sample container to move the shutter from the first shutter position to the second shutter position when the distal end portion of the container is moved towards the detection volume.

89. The apparatus of claim 86, wherein the shutter is configured to translate within the housing in a direction offset a longitudinal axis of the channel.

90. A method, comprising:

receiving a first signal associated with a magnitude of light emission in a detection volume, at a first time, the detection volume optically isolated from a channel by a movable shutter, the shutter disposed in a first position;

applying a force to a sample container at least partially disposed within a channel such that a distal end portion of the sample container moves the shutter from the first position to a second position and the distal end portion of the sample container is disposed within the

detection volume, the channel being in optical communication with the detection volume when the shutter is in the second shutter position; and

receiving, when the distal end portion of the sample container is in the detection volume, a second signal associated with a magnitude of light emission in the detection volume at a second time.

91. The method of claim 90, further comprising:

transmitting a light emission into the detection volume via a light channel defined by the shutter when the shutter is in the first position.

92. The method of claim 90, further comprising:

conveying, before the receiving the second signal, a reagent into the distal end portion of the sample container, the reagent formulated to react with a sample in the distal end portion of the sample container to produce a light emission.

CLAIMS

1. An apparatus, comprising:

   - a housing defining a channel configured to receive a sample container, the housing defining a detection volume configured to place the channel in communication with a detector, the housing including a first seal surface and a second seal surface, a first portion of the sample container and the first seal surface configured to isolate the detection volume from a volume outside of the housing when a second portion of the sample container is disposed within the detection volume; and
   - a shutter having a portion movably disposed within the housing between a first shutter position and a second shutter position, the shutter defining a port configured to receive at least one of a light source or a light guide, a seal surface of the shutter and the second seal surface configured to isolate the detection volume from the channel of the housing when shutter is in the first shutter position, the port in communication with the detection volume when the shutter is in the first shutter position, the channel of the housing being in communication with the detection volume when the shutter is in the second shutter position, the port being isolated from the detection volume when the shutter is in the second shutter position.

2. The apparatus of claim 1, wherein the first seal surface includes a gasket.

3. The apparatus of any one of claims 1 and 2, wherein the shutter is in the first shutter position when the second end portion of the sample container within the channel is outside of the detection volume, and the shutter is in the second shutter position when the second end portion of the sample container is within the detection volume.

4. The apparatus of any one of claims 1 to 3, wherein the shutter includes an actuation surface configured to engage the second portion of the sample container to move the shutter from the first shutter position to the second shutter position.

5. The apparatus of any one of claims 1 to 4, wherein the shutter includes a ramp configured to engage the second portion of the sample container when the second portion of the sample container moves within the channel towards detection volume to move the shutter towards the second shutter position.

6. The apparatus of any one of claims 1 to 5, wherein the shutter is configured to translate within the housing in a direction offset from a longitudinal axis of the channel.

7. The apparatus of any one of claims 1 to 6, further comprising: a biasing member configured to urge shutter towards the first shutter position.

8. The apparatus of any one of claims 1 to 7, wherein the shutter defines a mounting portion configured to be coupled to a biasing member.

9. The apparatus of any one of claims 1 to 8, wherein the shutter defines a biasing channel configured to receive a biasing member, the biasing member configured to urge shutter

towards the first shutter position in a direction offset from a longitudinal axis of the channel.

10. The apparatus of any one of claims 1 to 9, wherein the detection volume is configured to place the channel in communication with the detector via a detection window, the port in communication with the detection window when the shutter is in the first shutter position.

11. The apparatus of claim 10, wherein the detection window is aligned with a longitudinal axis of the channel.

12. The apparatus of any one of claims 1 to 11, wherein the shutter defines a passageway configured to receive at least the second portion of the sample container, the channel of the housing being aligned with the passageway to place the second portion of the container in communication with the detection volume when the shutter is in the second shutter position.

13. An apparatus, comprising:

    - a housing defining a channel configured to receive a sample container, the housing defining a detection volume configured to place the channel in communication with a detector, the housing including a seal surface; and
    - a shutter having a portion movably disposed within the housing between a first shutter position and a second shutter position, the shutter defining a port configured to receive at least one of a light source or a light guide, the port in communication with the detection volume when the shutter is in the first shutter position, the port being isolated from the detection volume when the shutter is in the second shutter position, the shutter including a seal surface and an actuation portion, the actuation portion configured to engage a distal end portion of the sample container to translate the shutter in a direction offset from a longitudinal axis of the channel from the first shutter position to the second shutter position when the distal end portion of the container is moved towards the detection volume, the seal surface of the shutter and the seal surface of the housing configured to isolate the detection volume from the channel of the housing when shutter is in the first shutter position, the seal surface of the shutter configured to maintain sliding contact with the seal surface of the housing when the shutter is moved from the first shutter position to the second shutter position, the channel of the housing being in communication with the detection volume when the shutter is in the second shutter position.

14. The apparatus of claim 13, wherein: the seal surface of the housing is a distal seal surface, the housing defining a proximal seal surface; and a proximal end portion of the sample container and the proximal seal surface configured to isolate the detection volume from a volume outside of the housing when the distal end portion of the sample container is disposed within the detection volume.

15. The apparatus of any one of claims 13 to 14, further comprising: a biasing member configured to urge shutter towards the first shutter position.

16. The apparatus of any one of claims 13 to 15, wherein the shutter defines a passageway configured to receive at least the distal end portion of the sample container, the channel of the housing being aligned with the passageway to place the distal end portion of the container in communication with the detection volume when the shutter is in the second shutter position.

17. The apparatus of any one of claims 13 to 16, wherein the detection volume is configured to place the channel in communication with the detector via a detection window, the detection window being aligned with the longitudinal axis of the channel.

18. An apparatus, comprising:

    - a housing defining a channel configured to receive a sample container, the housing including a detection window configured to place a distal end portion of the sample container in communication with a detector, the housing including a seal surface; and

    - a shutter defining a passageway configured to receive the distal end portion of the sample container therein, the shutter movably disposed within the housing between a first shutter position and a second shutter position, the shutter defining a port configured to receive at least one of a light source or a light guide, the port in communication with the detection window when the shutter is in the first shutter position, the port being isolated from the detection window when the shutter is in the second shutter position, a seal surface of the shutter and the seal surface of the housing configured to isolate the detection window from the channel of the housing and the passageway of the shutter when shutter is in the first shutter position, the channel of the housing being aligned with the passageway of the shutter such that the distal end portion of the sample container can be received within the passageway of the shutter to place the distal end portion of the sample container in communication with the detection window when the shutter is in the second shutter position.

19. The apparatus of claim 18, wherein: the seal surface of the housing is a distal seal surface, the housing defining a proximal seal surface; and a proximal end portion of the sample container and the proximal seal surface configured to isolate the detection window from a volume outside of the housing when the distal end portion of the sample container is disposed in communication with the detection window.

20. The apparatus of any one of claims 18 to 19, wherein the shutter includes an actuation surface configured to engage the distal end portion of the sample container to move the shutter from the first shutter position to the second shutter position when the distal end portion of the container is moved towards the detection window.

21. The apparatus of any one of claims 18 to 20, wherein the shutter is configured to translate within the housing in a direction offset from a longitudinal axis of the channel.

22. The apparatus of any one of claims 18 to 21, wherein the detection window is aligned with a longitudinal axis of the channel.

23. A method, comprising:

- coupling a housing of a reagent module to a reaction chamber to form a container assembly defining a fluid-tight seal, the reaction chamber containing a sample, the reagent module including a bottom surface;
- loading the container assembly into an instrument; and

actuating the instrument to:

- apply a force on the container assembly to
  (1) move an end portion of the reaction chamber into a detection volume of the instrument, and
  (2) place the bottom surface into contact with a gasket of the instrument to form a light-tight seal with a housing of the instrument;
- cause a detector of the instrument to receive, when the end portion of the reaction chamber is in the detection volume, an optical signal associated with a magnitude of light emission in the detection volume; and
- manipulate, during the receiving of the signal, an actuator of the reagent module to convey a reagent into the reaction chamber.

24. The method of claim 23, wherein the instrument is configured to maintain the force to maintain contact between the bottom surface and the gasket.

25. The method of any one of claims 23 to 24, wherein:
    - the force is a downwards force applied by a manipulator assembly; and
    - the manipulating the actuator of the reagent module by the instrument includes moving, by the manipulator assembly, the actuator from a first position to a second position.

26. The method of any one of claims 23 to 25, wherein when the end portion of the reaction chamber is moved into the detection volume a shutter of the instrument is moved from a first shutter position to a second shutter position, the detection volume being optically isolated from a channel of the housing by the shutter when the shutter is in the first shutter position.

27. The method of any one of claims 23 to 26, wherein the reagent includes at least one of a eukaryotic or a bacterial luciferase substrate.

28. The method of any one of claims 23 to 27, wherein the reagent includes tridecanal, the light emission being associated with a flash luminescence reaction.

29. The method of any one of claims 23 to 28, wherein the actuator is a second actuator, the reagent is a second reagent, the second reagent including tridecanal, the reagent module containing a first reagent including at least one of an antibiotic or a transduction particle engineered to include a nucleic acid molecule formulated to cause a target cell within the sample to produce a plurality of reporter molecules, wherein the actuating the instrument further causes the instrument to manipulate, before the receiving of the signal, a first actuator of the reagent module to convey the first reagent into the reaction chamber.

30. The method of any one of claims 23 to 28, wherein the reagent module includes a non-replicative, bacteriophage-based transduction particle formulated to cause a target cell within the sample to produce a reporter molecule, wherein the actuating the instrument further causes the instrument to manipulate, before the receiving of the signal, a first actuator of the reagent module to convey the transduction particle into the reaction chamber.

31. The method of any one of claims 23 to 30, wherein the reagent module includes a delivery member that defines a delivery path having a centerline that points towards a side wall of the reaction chamber such that when the reagent is conveyed into the reaction chamber, the reagent is propelled along the side wall and into the reaction chamber.

32. The method of any one of claims 23 to 31, wherein:

- the reagent module includes a reagent container containing the reagent,
- the manipulating the reagent module includes puncturing the reagent container to communicate the reagent into the reaction chamber.

33. The method of any one of claims 23 to 32, wherein the light emission is luminescence conveyed from the reaction chamber through a flat base of the reaction chamber.

34. The method of any one of claims 23 to 33, wherein the sample includes at least one of an antibiotic or a transduction particle engineered to include a nucleic acid molecule formulated to cause a target cell within the sample to produce a plurality of reporter molecules.

35. The method of any one of claims 23 to 34, further comprising removing from the instrument, after the signal is received, the reaction chamber coupled to the reagent module.

36. The method of any one of claims 23 to 35, wherein the instrument includes a manipulator assembly configured to produce the force to move the end portion of the reaction chamber and to manipulate an actuator of the reagent module.

37. The method of any one of claims 23 to 36, wherein:

- the reagent module includes a non-replicative, bacteriophage-based transduction particle formulated to cause a target cell within the sample to produce a reporter molecule associated with a luminescence reaction;
- the actuating the instrument further causes the instrument to manipulate, before the receiving of the signal, a first actuator of the reagent module to convey the transduction particle into the reaction chamber; and
- the reagent includes tridecanal formulated to catalyze the luminescence reaction.

38. The method of any one of claims 23 to 36, wherein:

- the reagent module includes a non-replicative, bacteriophage-based transduction particle formulated to cause a target cell within the sample to produce a reporter molecule associated with a luminescence reaction; and
- the actuating the instrument further causes the instrument to:

- manipulate, before the receiving of the signal, a first actuator of the reagent module to convey the transduction particle into the reaction chamber; and
- heat, after the transduction particle within the reaction chamber, the end portion of the reaction chamber.