**CLAIMS**

1. A kit, comprising:
   - a cartridge configured to be removably coupled to an instrument configured to rotate the cartridge about a rotation axis and detect a plurality of target cells within a sample, the cartridge comprising:
     - an inlet portion defining an inlet reservoir configured to contain the sample;
     - a separation portion including a first surface and a second surface defining a separation chamber, the separation chamber being configured to be fluidically coupled to the inlet reservoir such that at least a portion of the sample can pass from the inlet reservoir to the separation chamber when the cartridge is rotated; and
     - a detection portion defining a detection chamber, the detection portion including a detection surface that forms a boundary of the detection chamber, the detection chamber being fluidically coupled to the separation chamber such that at least the plurality of target cells can pass through the separation chamber and into the detection chamber, the detection surface and the first surface of the separation portion forming a non-zero detection angle, the detection surface being configured to capture the plurality of target cells;
   - a density medium having a density of between 1.01 g/cm$^3$ and 1.13 g/cm$^3$; and
   - a staining reagent formulated to bind to and enhance detection of the plurality of target cells.
2. The kit of claim 1, further comprising a dilution reagent.
3. The kit of any one of claims 1 to 2, wherein the detection angle between the detection surface and the first surface of the separation portion is between about 1 degree and about 8 degrees; and the detection surface includes a surface modification to enhance adhesion of the plurality of target cells.
4. The kit of any one of claims 1 to 3, wherein the first surface of the separation portion and the detection surface are monolithically constructed; and the detection angle is about 2 degrees.
5. The kit of any one of claims 1 to 4, wherein the density medium is stored within a prefilled, sealed container that is separate from the cartridge and has a volume of less than fifty percent of a volume of the cartridge and/or wherein the density medium comprises any of an antifoaming agent, a wetting agent, a dispersant, or an emulsifier.

6. The kit of any one of claims 2 to 5, wherein the dilution reagent is stored with a prefilled container that is separate from the cartridge, the dilution reagent comprising any of an antifoaming agent, a wetting agent, a dispersant, or an emulsifier.

7. A method of detecting a concentration of a plurality of target cells within a sample, the method comprising:

- transferring a density medium from a container into a cartridge, the cartridge comprising an inlet portion, a separation portion and a detection portion, the inlet portion defining an inlet reservoir, the separation portion including a first surface and a second surface defining a separation chamber, the separation chamber being fluidically coupled to the inlet reservoir, the detection portion including a detection surface that forms a boundary of a detection chamber, the detection chamber being fluidically coupled to the separation chamber, the detection surface and the first surface of the separation portion forming a non-zero detection angle, the detection surface configured to capture the plurality of target cells; and the transferring being performed such that the density medium is contained within the separation chamber, the density medium having a density greater than a density of a first portion of the sample and less than a density of a second portion of the sample, the second portion of the sample containing the plurality of target cells;
- conveying the sample into the inlet reservoir;
- rotating the cartridge within an instrument at a rotation speed and for a rotation duration sufficient to cause a) the second portion of the sample to pass from the inlet reservoir through the density medium in the separation chamber and into the detection chamber and b) the plurality of target cells to be captured on the detection surface;
- receiving, via a detector of the instrument, a signal indicating a quantity of the plurality of target cells captured on the detection surface; and
- determining, based on the signal, the concentration of the plurality of target cells in the sample.

8. The method of claim 7, wherein the instrument determines the concentration of the plurality of target cells within a lower limit of 10^3 colony forming units (CFU) per milliliter (mL) and an upper limit of 10^9 CFU per mL.

9. The method of any one of claims 7 to 8, further comprising:

- conveying a dilution reagent into the cartridge, at least one of the dilution reagent or the density medium comprising any of an antifoaming agent, a wetting agent, a dispersant, or an emulsifier.

10. The method of claim 9, wherein at least one of the dilution reagent or the density medium comprises a poloxamer.

11. The method of any one of claims 9 to 10, wherein the conveying the dilution reagent includes mixing the dilution reagent with the sample and conveying the dilution reagent and the sample into the inlet reservoir of the cartridge in the same operation.

12. The method of any one of claims 7 to 11, wherein the density medium has a density of between 1.05 grams per cubic centimeter and 1.09 grams per cubic centimeter.

13. The method of any one of claims 7 to 12, wherein the sample is a blood sample or a urine sample.

14. The method of any one of claims 7 to 13, wherein the plurality of target cells is a plurality of bacteria cells.

15. A method of determining susceptibility of a plurality of target cells to a treatment protocol, the method comprising:

- conveying a first portion of a sample containing the plurality of target cells into a cartridge, the cartridge comprising a separation portion and a detection portion, the separation portion including a first surface and a second surface defining a separation chamber, the detection portion including a detection surface that forms a boundary defining a detection chamber, the detection chamber being fluidically coupled to the separation chamber, the detection surface and the first surface of the separation portion forming a non-zero detection angle, the detection surface configured to capture the plurality of target cells;
- actuating a first instrument to cause the first instrument to:
  - rotate the cartridge at a rotation speed sufficient to cause a) the first portion of the sample to be conveyed through the separation chamber and into the detection chamber and b) the plurality of target cells to be captured on the detection surface;
  - receive, via a detector of the first instrument, a signal indicating a quantity of the plurality of target cells captured on the detection surface; and
  - determine, based on the signal, the concentration of the plurality of target cells in the first portion of the sample;

- processing, based on the concentration of the plurality of target cells within the first portion of the sample, a second portion of the sample;
- conveying, after the processing, the second portion of the sample into a reaction chamber; and
- actuating a second instrument to perform a susceptibility assay on the second portion of the sample to determine susceptibility of the plurality of target cells to the treatment protocol.

16. An apparatus, comprising:
- a cartridge configured to be removably coupled to a rotation element configured to rotate the cartridge about a rotation axis to capture a plurality of target cells within a sample, the cartridge comprising:
  - an inlet portion defining an inlet reservoir configured to contain the sample;
  - a separation portion including a first surface and a second surface defining a separation chamber, the separation portion configured to contain a density medium having a density greater than a density of a first portion of the sample and less than a density of a second portion of the sample, the second portion including the plurality of target cells, the separation chamber configured to be fluidically coupled to the inlet reservoir such that at least the second portion of the sample can pass from the inlet reservoir to the separation chamber when the cartridge is rotated; and
  - a detection portion including a detection surface that forms a boundary of a detection chamber, the detection chamber fluidically coupled to the separation chamber such that at least the plurality of target cells can pass through the density medium and into the detection chamber, the detection surface being nonparallel to at least one of the first surface or the second surface such that the plurality of target cells impinge on the detection surface when passing into the detection chamber, the detection surface configured to capture the plurality of target cells; and
- a dilution reagent, wherein at least one of the dilution reagent or the density medium comprise any of an antifoaming agent, a wetting agent, a dispersant, or an emulsifier.

17. The apparatus of claim 16, wherein the first surface of the separation portion and the detection surface form a detection angle of between about 1 degree and about 8 degrees.

18. The apparatus of any one of claims 16 to 17, wherein the first surface of the separation portion and the detection surface are monolithically constructed.

19. The apparatus of any one of claims 16 to 17 wherein the cartridge defines a radial axis that intersects the rotation axis; the first surface of the separation portion and the detection surface are monolithically constructed; and the detection angle is along the radial axis and within a cross-sectional plane defined by the radial axis and the rotation axis.

20. The apparatus of any one of claims 16 to 19, wherein the inlet portion defines an opening through which the sample can be conveyed into the inlet reservoir; and the detection surface is angled in a downward direction with respect to the opening.

21. The apparatus of any one of claims 16 to 20, wherein a ratio of a volume of the separation chamber and a volume of the detection chamber is at least about 2.0.

22. The apparatus of any one of claims 16 to 21, wherein a distance between the first surface of the separation portion and the second surface of the separation portion define a thickness of the separation chamber, the thickness being less than about 0.6 mm.

23. The apparatus of any one of claims 16 to 22, further comprising the density medium, the density medium having a density of between 1.01 $g/cm^3$ and 1.13 $g/cm^3$.

24. The apparatus of claim 23, wherein the separation portion defines a density medium reservoir within which the density medium is contained.

25. The apparatus of any one of claims 16 to 24, wherein at least one of the dilution reagent or the density medium comprises a poloxamer and wherein the poloxamer contains poly(ethylene oxide) (PEO) and poly(propylene oxide) (PPO).

26. The apparatus of any one of claims 16 to 25, further comprising a staining reagent, the staining reagent formulated to bind to and enhance detection of the plurality of target cells.