CLAIMS

1. A fluidic device configured to drive movement of fluid under centrifugal force, the fluidic device comprising:

a central region about a central rotational axis of the device and a peripheral region extending radially outwards from the central region;

a fluid reservoir provided in the central region of the device for receiving a fluid sample, the fluid reservoir in communication with at least one fluidic system, the at least one fluidic system extending radially outwards from the fluid reservoir into the peripheral region of the device; the or each fluidic system comprising:

a fluid analysis chamber configured to retain a portion of a fluid sample for analysis;

a fluidic channel arrangement configured to enable fluid communication between the fluid reservoir and the fluid analysis chamber, wherein movement of the fluid sample through the fluidic channel arrangement is driven by centrifugal force arising from rotational motion of the device about the central rotational axis; and

a first valve mechanism configured to prevent fluid flow through a portion of the fluidic channel arrangement when the speed of rotation of the device is less than a first predetermined value, wherein the first valve mechanism is arranged between the fluid reservoir and the analysis chamber.

2. The fluidic device of claim 1, wherein the fluidic channel arrangement comprises:

a separation chamber configured to remove unwanted particles from the fluid sample prior to the fluid sample entering the analysis chamber; and

a first fluidic channel extending radially outwardly from the fluid reservoir to the separation chamber and communicating with the separation chamber through a wall in a radially outer region of the separation chamber.

3. The fluidic device of claim 2, wherein the separation chamber has a depth (d) defining the height between a base of the separation chamber and the top of the separation chamber, and the first fluidic channel is arranged to communicate with the separation chamber at or proximate the base of the separation chamber.

4. The fluidic device of claim 2 or claim 3, wherein the fluidic channel arrangement comprises:

a second fluidic channel configured for fluid communication between the separation chamber and the fluid analysis chamber,

and wherein the first valve mechanism is located in the flow path of the second fluidic channel between the separation chamber and the analysis chamber.

5. The fluidic device of claim 4, wherein the second fluidic channel comprises a pair of channel arms configured to enable fluid flow in substantially antiparallel directions, and wherein the first valve mechanism is located in the flow path between the two channel arms.

6. The fluidic device of claim 4 or claim 5, wherein the second fluidic channel comprises a first channel arm for fluid communication between the separation chamber and the first valve mechanism, the first channel arm extending radially inwardly from the separation chamber to the first valve mechanism and communicating with the separation chamber through a wall in a radially inner region of the separation chamber.

7. The fluidic device of any of claims 4 to 6, wherein the second fluidic channel comprises a second channel arm for fluid communication between the first valve mechanism and the analysis chamber, the second channel arm extending radially outwardly from the first valve mechanism to the analysis chamber.

8. The fluidic device of any of claims 5 to 7, wherein the internal corners of the channel arms are rounded, in use to reduce wicking of fluid along the channels in a direction counter to centrifugal forces acting on the fluid.

9. The fluidic device of any preceding claim, wherein the first valve mechanism is located radially inwardly of the separation chamber and/or the fluid analysis chamber.

10. The fluidic device of any preceding claim, wherein the first valve mechanism defines a chamber for receiving a predetermined quantity of gas, the chamber having a maximum dimensions in x, y and z axes, wherein the x axis defines a radial direction, the y axis defines a direction perpendicular to the x axis in a radial plane, and the z axis defines a direction perpendicular to both the x and y axes parallel to the axis of rotation, and wherein the first valve mechanism has a largest dimension in the z axis.

11. The fluidic device of any preceding claim, wherein the first valve mechanism is arranged circumferentially around and adjacent the fluid reservoir.

12. The fluidic device of any of claims 2 to 11, wherein the fluid analysis chamber is arranged radially outwards of the separation chamber; preferably, wherein the fluid analysis chamber is the radially outermost element of the fluidic system.

13. The fluidic device of any preceding claim, wherein the fluid analysis chamber is cylindrical having a substantially circular cross section in an axial plane of the device.

14. The fluidics device of any preceding claim, wherein one or more of the fluidics systems contains in a region thereof at least one drug in a form suitable for dissolution in the fluid sample.

15. The fluidic device of any preceding claim, wherein the fluidic channel arrangement further comprises a third fluidic channel, the third fluidic channel arranged to extend between the fluid analysis chamber and a second valve mechanism, and wherein the second valve mechanism is located radially inwardly of the analysis chamber.

16. The fluidics device of any preceding claim, wherein at least one fluidics system contains at least one drug to be assayed against the fluid sample, wherein the drug is provided in the fluid analysis chamber, in a first drug retention chamber located between the first valve mechanism and the fluid analysis chamber, or in a second drug retention chamber located between the second valve mechanism and the fluid analysis chamber.

17. The fluidic device of any of claims 14 to 16, comprising:

at least one fluidic system containing the antibiotic Amoxicillin;

at least one fluidic system containing the antibiotic combination Amoxicillin / clavulanic acid;

at least one fluidic system containing the antibiotic Cefalexin;

at least one fluidic system containing the antibiotic Ciprofloxacin;

at least one fluidic system containing the antibiotic Ertapenem;

at least one fluidic system containing the antibiotic Fosfomycin;

at least one fluidic system containing the antibiotic Levofloxacin;

at least one fluidic system containing the antibiotic Mecillinam;

at least one fluidic system containing the antibiotic Nitrofurantoin;

at least one fluidic system containing the antibiotic Trimethoprim; and/or

at least one fluidic system containing the antibiotic combination Trimethoprim / sulfamethoxazole; and optionally:

at least one fluidic system that doesn't contain an antibiotic and/or at least one fluidic system that contains an effective amount of a bactericidal agent.

18. The fluidic device of claim 17, wherein a plurality of fluidic systems contain one of the antibiotics or antibiotic combinations, and wherein each microsystem of the plurality of microsystems contains a different predetermined quantity of the antibiotic or antibiotic combination such that, in use, a predetermined different concentration of the antibiotic is generated in a fluid sample within each analysis chamber respectively of the plurality of fluidic systems.

19. The fluidic device of any preceding claim, further comprising a bacterial growth media configured to promote growth of bacteria potentially present in the fluid sample when mixed with the fluid sample; the growth media provided in the fluid reservoir or in a growth media compartment that is in fluid communication with the fluid reservoir.

20. The fluidic device of claim 19, wherein the growth media is provided in a growth media compartment that is in fluid communication with the fluid reservoir via a filter element or membrane.

21. The fluidic device of claim 19 or claim 20, further comprising a sample receiving well for receiving fluid sample to be transferred into the fluid reservoir and the at least one fluidic system.

22. The fluidic device of any preceding claim, wherein the central region of the fluidic device comprises a sample receiving well for receiving a fluid sample, and wherein the sample receiving well is communicable with the fluid reservoir via a growth media compartment containing a growth media and a filter element arranged, in use, to filter the mixture of fluid sample and growth media before it enters the fluid reservoir.

23. The fluidic device of claim 21 or claim 22, which further comprises a cap for enclosing the sample receiving well, and wherein the sample receiving well is formed within an upstanding neck portion of the central region of the device, the neck portion being provided with a securing feature for engagement with a complementary securing feature of the cap.

24. The fluidic device of claim 23, wherein the cap has a top wall and an outer annular perimeter wall downstanding from the top wall, wherein the inner surface of the outer perimeter wall is provided with a screw-thread for engagement with the complementary screw-thread of the neck portion of the fluidic device.

25. The fluidic device of claim 23 or claim 24, wherein the cap further comprises a cylindrical plunger element downstanding from the top wall of the cap and arranged radially inside the outer annular perimeter wall; wherein the outer annular surface of the plunger element is configured to match the inner annular surface of the sample receiving well so as to displace a predetermined volume of fluid from the sample receiving well when the cap is engaged with the neck of the fluidic device.

26. The fluidic device of any of claims 21 to 25, wherein a breakable seal element is provided between the sample receiving well and the growth media compartment.

27. The fluidic device of claim 26 when dependent on any of claims 23 to 25, further comprising one or more projections arranged radially inside and downstanding from the cap and configured to: (i) pierce the seal element between the sample receiving well and the growth media compartment to allow fluid communication between the sample receiving well and the growth media compartment; and/or (ii) stir and/or mix a fluid sample with the growth media to improve dissolution of the growth media with fluid sample in use.

28. The fluidic device of claim 27, further comprising a collar element engageable between the neck of the device and the cap, and configured to limit the depth of engagement between the cap and the neck such that the one or more projections cannot pierce the seal element with the collar element in place.

29. The fluidic device of any of claims 21 to 28, comprising a funnel element configured to guide fluid sample into the top of the sample receiving well.

30. The fluidic device of any of claims 23 to 29, wherein the neck portion is formed of an outer annular wall and an inner annular wall, the inner annular wall defining at least a portion of the sample receiving well and the outer annular wall being provided with the securing feature for engagement with the complementary securing feature of the cap.

31. The fluidic device of claim 30, wherein the space between the outer annular wall and the inner annular wall of the neck portion defines an annular chamber or is divided into a plurality of radially segmented chambers by a plurality of radially spaced walls or ribs.

32. The fluidic device of claim 31, wherein the annular chamber or at least one of the radially segmented chambers is an overflow chamber, the overflow chamber in fluid communication with the sample receiving well via at least one overflow aperture, the overflow aperture arranged such that a predefined maximum volume of fluid sample can be received in the sample receiving well before the fluid sample in the sample receiving well reaches the (height of the) at least one overflow aperture.

33. The fluidic device of claim 31 or claim 32, wherein at least one of the radially segmented chambers is a gas release chamber, the gas release chamber in fluid communication with the fluid reservoir via at least one lower gas release aperture, the lower gas release aperture communicating with a lower region of the gas release chamber, and arranged such that as the fluid reservoir is filled with fluid sample from the sample receiving well, gas within the fluid reservoir may be expelled upwards into the at least one gas release chamber.

34. The fluidic device of any of claims 23 to 33, wherein one or more orifices is provided through the top of the cap; preferably, wherein the one or more orifices is covered by a hydrophobic filter or membrane to allow gas pressure to equalise between the inside of the device and the atmosphere.

35. The fluidic device of any preceding claim, which comprises a main body and a base, wherein the fluid reservoir and the at least one fluidic system is defined within the main body of the device, and the base is connectable with the main body to define the lower surface of the fluid reservoir and fluidic systems.

36. The fluidic device of claim 35, wherein the base is a film configured to be secured to the main body of the device by an adhesive or by heat sealing.

37. The fluidic device of any preceding claim, which comprises an antibiotic sensitivity panel comprising a plurality of antibiotics; preferably wherein the plurality of antibiotics are in amounts selected from one or more of the antibiotic amounts disclosed in Tables 1 or 2 or Table 3.

38. The fluidic device of any preceding claim, which comprises an antibiotic sensitivity panel according to the CLSI standard and/or the EUCAST standard as defined in Table 3.

39. An apparatus comprising:

the fluidic device of any preceding claim;

a driving mechanism for driving rotational motion of the fluidic device about the rotational axis of the fluidic device; and

a controller executing machine readable code to cause the driving mechanism to control flow of the fluid sample from the fluid reservoir to the or each analysis chamber.

40. The apparatus of claim 39, further comprising an optical apparatus, the optical apparatus comprising:

a light source configured to emit an incident beam of light and illuminate the fluid sample in the or each fluid analysis chamber; and

a photodetector configured to detect scattered light exiting the or each fluid analysis chamber.

41. The apparatus of claim 40, further comprising a sample container carousel arranged to engage the container and configured to bring the or each fluid analysis chamber periodically into and out of alignment with the incident beam of light from the light source of the optical apparatus.

42. The apparatus of claim 40 or claim 41, further comprising at least one processor configured to analyse the detected scattered light to determine one or more properties of the fluid sample contained in the or each fluid analysis chamber.

43. The apparatus of claim 42, wherein the property that is determined is selected from: a relative amount of bacteria; a relative concentration of bacteria; a change in the relative amount of bacteria as a function of time; a change in the relative concentration of bacteria as a function of time; a qualitative amount of bacteria; a qualitative concentration of bacteria; an actual amount of bacteria; a change in the relative amount of bacteria as a function of time; or an actual concentration of bacteria present in the fluid sample in the analysis chamber as a function of time.

44. A method of moving a fluid sample from a fluid reservoir through a fluidic system formed in a fluidic device, the fluidic system comprising a fluid analysis chamber, and a fluidic channel arrangement configured to enable fluid communication between the fluid reservoir and the fluid analysis chamber, the method comprising:

rotating, by a driving mechanism, the fluidic device about a rotational axis at a first rotational speed and for a first duration to generate a first centrifugal force sufficient to drive flow of the fluid sample from the fluid reservoir into a first portion of the fluidic channel arrangement;

preventing, by a valve mechanism, onward flow of the fluid sample from the first portion of the fluidic channel arrangement into a second portion of the fluidic channel arrangement via pressure exerted by the valve mechanism in opposition to the first centrifugal force; and

rotating, by the driving mechanism, the fluidic device about the rotational axis at a second higher rotational speed and for a second duration to generate a second centrifugal force sufficient to overcome the pressure of the valve mechanism and drive flow of the fluid sample into the second portion of the fluidic channel arrangement and thereby into the fluid analysis chamber.