Claims

1. A system for operating a microfluidic device, the system comprising:

a first surface configured to operatively couple with a microfluidic device; and

a lid configured to retain the microfluidic device on the first surface, the lid comprising:

a first lid portion having a first fluid port configured to flow fluidic medium into and/or out of a first fluid inlet/outlet of the microfluidic device; and

a second lid portion having a second fluid port configured to flow fluidic medium into and/or out of a second fluid inlet/outlet of the microfluidic device,

wherein the second lid portion is separable from the first lid portion and movable between a closed position in which the second fluid port of the second lid portion is operatively coupled with the second fluid inlet/outlet of the microfluidic device and an open position in which a portion of the microfluidic device that contains the second fluid inlet/outlet is exposed.

2. The system of claim 1, wherein the first lid portion retains the microfluidic device on the first surface when the second lid portion is in the open position.

3. The system of claim 1, wherein the first fluid port of the first lid portion remains operatively coupled with the first fluid inlet/outlet of the microfluidic device when the second lid portion is in the open position.

4. The system of claim 3, wherein the first fluid port of the first lid portion is connected to a pump configured to remove fluid from the microfluidic device.

5. The system of claim 3, wherein the first lid portion further comprises a first fluid line connected to the first fluid port and wherein the second lid portion further comprises a second fluid line connected to the second fluid port.

6. The system of claim 1, wherein the lid further comprises a hinge configured to move the second lid portion between the open position and the closed position.

7. The system of claim 1, wherein the lid further comprises a latch configured to releasably hold the second lid portion in the closed position.

8. The system of claim 1, further comprising an insert configured to flow fluidic medium into the second fluid inlet/outlet of the microfluidic device when the second lid portion is in the open position.

9. The system of claim 8, wherein the insert is configured to interface with the first lid portion.

10. The system of claim 8, wherein the insert contains a fluid well configured to fluidically communicate with the second fluid inlet/outlet of the microfluidic device.

11. The system of claim 10, wherein the fluid well is configured to hold a fluid sample of about 25 microliters or less.

12. The system of claim 1, wherein the first surface comprises a support containing a socket configured to receive and interface with the microfluidic device.

13. The system of claim 12, further comprising an electrical signal generation subsystem configured to apply a biasing voltage across a pair of electrodes in the microfluidic device when the microfluidic device is operatively coupled with the support.

14. The system of claim 12, further comprising a thermal control subsystem configured to regulate a temperature of the microfluidic device when the microfluidic device is operatively coupled with the support.

15. The system of claim 12, further comprising a light modulating subsystem configured to emit structured light onto the microfluidic device when the microfluidic device is operatively coupled with the support.

16. The system of claim 15, wherein the first surface, the support, and/or the light modulating subsystem is/are configured to be mounted on a light microscope.

17. The system of claim 15, wherein the first surface, the support, and/or said light modulating subsystem are integral components of a light microscope.

18. The system of claim 5, further comprising at least one flow controller operatively coupled with one or both of the first and second fluid lines.

19. The system of claim 18, wherein the at least one flow controller comprises a first thermally-controlled flow controller operatively coupled with the first fluid line and/or the second fluid line, to selectively allow fluid to flow therethrough.

20. A microscope configured for operating a microfluidic device, said microscope comprising:

the support according to claim 12;

a light modulating subsystem configured to emit structured light; and

an optical train,

wherein when the microfluidic device is held by, and operatively coupled with, the support, the optical train is configured to:

(1) focus structured light emitted by the light modulating subsystem onto at least a first region of the microfluidic device,

(2) focus unstructured light emitted by an unstructured light source onto at least a second region of the microfluidic device, and

(3) capture reflected and/or emitted light from the microfluidic device and direct the captured light to a detector.

21. A method for analyzing a fluid sample, the method comprising:

connecting a microfluidic device to a system for operating the microfluidic device, wherein the system comprises:

a first surface configured to operatively couple with a microfluidic device; and

a lid configured to retain the microfluidic device on the first surface, the lid comprising:

a first lid portion having a first fluid port configured to flow fluidic medium into and/or out of a first fluid inlet/outlet of the microfluidic device; and

a second lid portion having a second fluid port configured to flow fluidic medium into and/or out of a second fluid inlet/outlet of the microfluidic device,

wherein the second lid portion is separable from the first lid portion and movable between a closed position in which the second fluid port of the second portion of the cover is operatively coupled with the second fluid inlet/outlet of the microfluidic device and an open position in which a portion of the microfluidic device that contains the second fluid inlet/outlet is exposed;

moving the second lid portion from the closed position to the open position, thereby exposing the second fluid inlet/outlet of the microfluidic device;

providing a fluid sample containing biological micro-objects in fluidic communication with the second fluid inlet/outlet of the microfluidic device;

applying suction to the first fluid line, thereby pulling at least a portion of the fluid sample into the microfluidic device; and

processing biological micro-objects in the at least a portion of the fluid sample that is pulled into the microfluidic device.

22. The method of claim 21, further comprising:

placing an insert in the location previously occupied by the second lid portion in the closed position, the insert containing a fluid well configured to fluidically communicate with the second fluid inlet/outlet of the microfluidic device;

wherein providing the fluid sample comprises introducing the fluid sample into the fluid well of the insert.

23. The method of claim 21, wherein the system comprises the microscope of claim 20.

24. The method of claim 21, wherein the suction is applied sufficient to pull a volume of about 2 microliters to about 10 microliters of the fluid sample into the microfluidic device.

25. The method of claim 21, wherein the microfluidic device comprises a flow region having a plurality of microfluidic channels and wherein the method results in an imported biological micro-object density of at least about 4x10^6 in the plurality of microfluidic channels.

26. The method of claim 25, wherein the method results in a coefficient of variation, CV, of the imported biological micro-object density in the plurality of microfluidic channels of less than about 20%.