Systems and Methods for Biological Analysis

FIELD OF THE DISCLOSURE

[0001] The present invention relates generally to systems, devices, and methods for observing, testing, and/or analyzing one or more biological samples, and more specifically to systems, devices, and methods for observing, testing, and/or analyzing an array of biological samples.

BACKGROUND

[0002] Generally, there is a need to increasingly automate biological analysis systems to increase efficiency. For example, advances in automated biological sample processing instruments allow for quicker and more efficient analysis of samples.

[0003] There is also an increasing need to provide biological analysis systems with designs that cater to user needs, such as ease of install, ease of use, minimal necessary lab space.

SUMMARY OF THE DISCLOSURE

[0004] In accordance with the present disclosure, a biological analysis system is provided. The system comprises a sample block assembly comprising a sample block configured to accommodate a sample holder, the sample holder configured to receive a plurality of samples. The system further can comprise a control system configured to cycle the plurality of samples through a series of temperatures, and a tray configured to reversibly slide the sample block assembly from a closed to an open position to allow user access to the plurality of sample holders.

[0005] In an aspect of the present invention, a biological analysis system is provided. The system comprises a block assembly comprising a sample block having a plurality of block wells, the sample block configured to accommodate a sample holder. The system can further comprise

an optical system configured to deliver excitation light to the block wells. The system can further comprise a heated cover comprising a lower plate, a heater, and an upper plate having a plurality of upper plate apertures. The lower plate can have a mating surface for mating with an upper surface of the sample holder, the mating surface having a plurality of lower plate apertures each aligned with an associated one of the plurality of block wells to allow excitation light to pass to the block wells.

[0006] In another aspect of the present invention, a biological analysis system is provided. The system comprises a plurality of system modules, the modules comprising a detector module, an emission module, an excitation module, and a base module. The plurality of system modules can be configured to be reversibly connected to form a first biological analysis device type.

[0007] In accordance with the present disclosure, a biological analysis system is provided. The system comprises an instrument and a calibration system for calibrating the instrument. The instrument can comprise a block assembly comprising a sample block configured to accommodate a sample holder having a plurality of reaction sites, and an optical system capable of imaging florescence emission from a plurality of reaction sites. The calibration system can comprise a region-of-interest (ROI) calibrator configured to determine reaction site positions in an image. The calibration system can also comprise a pure dye calibrator configured to determine the contribution of a fluorescent dye used in each reaction site by comparing a raw spectrum of the fluorescent dye to a pure spectrum calibration data of the fluorescent dye. The calibration system can further comprise an instrument normalization calibrator configured to determine a filter normalization factor. The calibration system can even further comprise an RNase P validator configured to validate the instrument is capable of distinguishing between two different quantities of sample. The calibration system can also comprise a display engine configured to display calibration results.

[0008] Additional aspects, features, and advantages of the present invention are set forth in the following description and claims, particularly when considered in conjunction with the accompanying drawings in which like parts bear like reference numbers.

Claims:

1. A biological analysis system comprising:

a block assembly comprising a sample block having a plurality of block wells, the sample block configured to accommodate a sample holder;

an optical system configured to deliver excitation light to the block wells; and

a heated cover comprising:

a lower plate having a mating surface for mating with an upper surface of the sample holder, the mating surface having a plurality of lower plate apertures each aligned with an associated one of the plurality of block wells to allow excitation light to pass to the block wells;

a heater; and

an upper plate having a plurality of upper plate apertures.

2. The biological analysis device of Claim 1, wherein the heated cover further comprises a position sensor configured to detect when the heated cover has provided a defined pressure to the upper surface of the sample holder.

3. The biological analysis device of Claim 2, wherein the position sensor is an optical sensor.

4. The biological analysis device of Claim 1, wherein the heater cover further comprises a spring assembly, the spring assembly comprising a tab, the spring assembly configured to engage the upper surface of the sample holder when the heated cover is moved downward onto the sample holder, wherein the tab is configured to block emitted light from the position sensor to stop the downward movement of the heated cover.

5. A biological analysis system comprising:

a plurality of system modules, the modules comprising:

a detector module;

an emission module;

an excitation module; and

a base module;

the plurality of system modules configured to be reversibly connected to form a first biological analysis device type.

6. The biological analysis system of Claim 5, wherein at least one of the modules is a module for a second biological analysis device type.

7. The biological analysis system of Claim 5, wherein the detector module comprises an emission sensor.

8. The biological analysis system of Claim 5, wherein the detector module comprises an emission detector.

9. The biological analysis system of Claim 5, wherein the excitation module comprises an excitation source.

10. The biological analysis system of Claim 5, wherein the excitation module comprises a folding mirror.

11. The biological analysis system of Claim 5, wherein the base module comprises a sample block.

12. The biological analysis system of Claim 5, wherein the base module comprises a folding mirror.

13. The biological analysis system of Claim 5, wherein the base module comprises a heated cover.

14. The biological analysis system of Claim 5, wherein the base module comprises a control system.