CASE AND CASE HOLDER FOR BIOLOGICAL SAMPLES AND CORRESPONDING METHOD OF USE

Background of the Invention

Field of the Invention

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.

Description of the Related Art

Systems for biological and biochemical reactions have been used to monitor, measure, and/or analyze such reactions in real time and during post-run or end-point analysis. Such systems may include optical reader, which are commonly used in sequencing, genotyping, polymerase chain reaction (PCR), and other biochemical reactions to monitor the progress and provide quantitative data. For example, an optical excitation beam may be used in real-time PCR (qPCR) reactions to illuminate hybridization probes or molecular beacons to provide fluorescent signals indicative of the amount of a target gene or other nucleotide sequence. In addition, end-point optical reader may be used to provide data after reactions have completed, such as for digital PCR (dPCR) analysis. Increasing demands to provide greater numbers of reactions per test or experiment have resulted in instruments that are able to conduct ever higher numbers of reactions simultaneously.

The increase in the number sample sites in a test or experiment has led to microtiter plates and other sample formats that provide ever smaller sample volumes. In addition, techniques such as digital PCR (dPCR) have increased the demand for smaller sample volumes that contain either zero or one target nucleotide sequence in all or the majority of a large number of test samples. There is a need for systems and sample formats that will provide reliable data in a high-density sample format.

Summary of Invention

A first aspect of the present invention provides a system for processing a plurality of biological samples, comprising:

a support configured to hold a case comprising:

a base;

a cover disposed over at least a portion of the base, the base and the cover together forming an inner chamber;

a substrate located within the inner chamber, the substrate comprising a first surface, an opposing second surface opposite the first surface, and a plurality of through-holes disposed between the surfaces, the plurality of through-holes containing one or more biological samples; and

a sealing fluid disposed within the inner chamber and covering the surfaces of the substrate; and

a temperature controller configured to maintain or control a temperature of at least one of the support, the case, the base, the substrate, the cover, the sealing fluid, or the one or more biological samples during an assay or reaction on the one or more biological samples;

wherein the support is configured to maintain at least one of the surfaces of substrate at a positive angle relative to a horizontal plane during the assay or reaction.

A second aspect of the present invention provides a method of processing a plurality of biological samples, comprising:

providing a case comprising:

a base;

a cover disposed over at least a portion of the base, the base and the cover together forming an inner chamber;

a substrate located within the inner chamber, the substrate comprising a first surface, an opposing second surface opposite the first surface, and a plurality of through-holes disposed between the surfaces, the plurality of through-holes containing one or more biological samples;

a sealing fluid disposed within the inner chamber and covering the surfaces of the substrate;

placing the base in thermal contact with a temperature controller;

performing an assay or reaction on the one or more biological samples while maintaining or controlling a temperature of at least one of the support, the case, the base, the substrate, the cover, the sealing fluid, or the one or more biological samples;

maintaining the surfaces of substrate at a positive angle relative to a horizontal plane while performing the assay or reaction.

A third aspect of the present invention provides a system for processing a plurality of biological samples, comprising:

a support configured to hold a case comprising:

an inner chamber; and

a substrate located within the inner chamber, the substrate containing a plurality of isolated reaction sites containing one or more biological samples; and

a temperature controller configured to maintain or control a temperature of at least one of the support, the case, or the one or more biological samples during an assay or reaction on the one or more biological samples;

wherein the support is configured to maintain at least one of the surfaces of substrate at a positive angle relative to a horizontal plane during the assay or reaction.

A fourth aspect of the present invention provides a method of processing a plurality of biological samples, comprising:

providing a case comprising:

an inner chamber; and

a substrate located within the inner chamber, the substrate containing a plurality of isolated reaction sites containing one or more biological samples; and

placing the base in thermal contact with a temperature controller;

performing an assay or reaction on the one or more biological samples while maintaining or controlling a temperature of at least one of the support, the case, or the one or more biological samples;

maintaining the surfaces of substrate at a positive angle relative to a horizontal plane while performing the assay or reaction.

Brief Description of the Drawings

Embodiments of the present invention may be better understood from the following detailed description when read in conjunction with the accompanying drawings. Such embodiments, which are for illustrative purposes only, depict novel and non-obvious aspects of the invention. The drawings include the following figures: