substrate comprising a sample. The first retaining mechanism can be configured to retain the first substrate disposed in a first plane. The sample holder can further include a second member including a second retaining mechanism configured to retain a second substrate including a reagent medium disposed in a second plane. The sample holder can further includes an alignment mechanism connected to one or both of the first member and the second member. The alignment mechanism can be configured to align the first and second members along the first plane and/or the second plane such that the sample contacts at least a portion of the reagent medium when the first and second members are aligned and within a threshold distance along an axis orthogonal to the second plane. The adjustment mechanism may be configured to move the second member along the axis orthogonal to the second plane and/or move the first member along an axis orthogonal to the first plane. The first substrate and the second substrate may be positioned with a minimum spacing between the first substrate and the second substrate.

[0006a] In some variations, one or more features disclosed herein including the following features may optionally be included in any feasible combination. For example, the sample holder may further include a spacing member positioned between the first member and the second member and configured to maintain the minimum spacing between the first member and the second member. The spacing member may be further configured to maintain an approximately parallel arrangement of the first substrate and second substrate. The alignment mechanism may include a pin extending from the second member. The alignment mechanism may include an aperture in the first member, the aperture sized and configured to mate with the pin. The sample holder may further include a coupling member coupled to the first substrate and the second substrate and configured to inhibit movement between the first substrate and the second substrate. The coupling member may include a magnet. The first member may be further configured to retain a third substrate disposed in the first plane. The third substrate may include a second sample.

[0007] The first retaining mechanism may include one or more spring members configured to apply a force to the first substrate to maintain contact between the first substrate and the first member. The second retaining mechanism may include one or more spring members configured to apply a force to the second substrate to maintain contact between the second substrate and the second member. The adjustment mechanism may be coupled to the second member and may include a linear actuator configured to move the second member along the axis orthogonal to the second plane. The linear actuator may be configured to move the second member along the axis orthogonal to the second plane at a velocity of at least 0.1 mm/sec. The linear actuator may be configured to move the second member along the axis orthogonal to the second plane with an amount of force of at least 0.1 lbs. The second member may include a heater configured to heat the first substrate and/or the second substrate. The second member may further include an insulation gasket coupled to the heater. The first retaining mechanism may be configured to retain the first substrate in a fixed position with respect to the first plane.

[0008] In one aspect, a sample holder is provided. In an embodiment, the sample holder may include a first member including a first retaining mechanism configured to retain a first substrate comprising a sample. The first retaining mechanism may be configured to retain the first substrate disposed in a first plane. The sample may be disposed in a first region of the first substrate. The sample holder may also include a second member including a second retaining mechanism configured to retain a second substrate including a reagent medium disposed in a second plane and disposed in a second region of the second substrate. The sample holder may also include an alignment mechanism connected to one or both of the first member and the second member, and configured to align the first region with the second region along the first plane and/or the second plane such that the sample contacts at least a portion of the reagent medium when the first region and the second region are aligned and when the first substrate and the second substrate are separated by a threshold distance. The sample holder may further include an adjustment mechanism configured to move the second member along the axis orthogonal to the second plane. The sample holder may also include an image capture device configured to capture, responsive to the alignment and during a time when the sample is in contact with at least a portion of the reagent medium, an image of the first region and the second region; and a shuttle to which the image capture device is mounted, wherein the shuttle is configured to move the image capture device.

[0008a] In another aspect, there is provided a system for aligning a sample area with an array area, the system including: the above sample holder, and a computing device communicatively coupled to the image capture device and to the sample holder, the computing device comprising a display, a data processor, and a non-transitory computer readable storage medium storing computer readable and executable instructions, which when executed cause the data processor to adjust the location of the first substrate relative to the second substrate to cause all or the portion of the first region to be aligned with the second region.

[0009] In some variations, one or more features disclosed herein including the following features may optionally be included in any feasible combination. For example, the sample holder may include a spacing member positioned between the first member and the second member and configured to provide a minimum spacing between the first substrate and the second substrate. The spacing member may be further configured to maintain an approximately parallel arrangement of the first substrate and the second substrate. The image capture device may be positioned inferior to the second member. The image capture device may be disposed on a track configured to move the image capture device along the track. The first member may be further configured to retain a third substrate disposed in the first plane, the third substrate comprising a second sample disposed in a third region of the third substrate. The second substrate may include the reagent medium further disposed in a fourth region of the second substrate. The alignment mechanism may be further configured to optically align

CLAIMS

1. A sample holder, comprising:

a first member comprising a first retaining mechanism configured to retain a first substrate comprising a sample, the first retaining mechanism configured to retain the first substrate disposed in a first plane, the sample disposed in a first region of the first substrate;

a second member comprising a second retaining mechanism configured to retain a second substrate comprising a reagent medium disposed in a second plane and disposed in a second region of the second substrate;

an alignment mechanism connected to one or both of the first member and the second member, and configured to align the first region with the second region along the first plane and/or the second plane such that the sample contacts at least a portion of the reagent medium when the first region and the second region are aligned and when the first substrate and the second substrate are separated by a threshold distance;

an adjustment mechanism configured to move the second member along the axis orthogonal to the second plane;

an image capture device configured to capture, responsive to the alignment and during a time when the sample is in contact with at least a portion of the reagent medium, an image of the first region and the second region; and

a shuttle to which the image capture device is mounted, wherein the shuttle is configured to move the image capture device.

2. The sample holder of claim 1, further comprising an LED illumination source.

3. The sample holder of claims 1 or 2, wherein the image capture device is positioned below the second member.

4. The sample holder of any one of the preceding claims, wherein the alignment mechanism comprises a sensor configure to determine a threshold alignment of the first region with the second region.

5. The sample holder of any one of the preceding claims, further comprising a computing device configured to control the alignment mechanism, the adjustment mechanism, and/or the image capture device.

6. The sample holder of claim 5, wherein the computing device is configured to communicate with a user interface, the user interface configured to display information about the sample holder.

7. The sample holder of claim 6, wherein the computing device is configured to receive a user input from the user interface.

8. The sample holder of any one of the preceding claims, wherein the second member further comprises a spring mechanism configured to couple to at least a portion of abottom surface of the second substrate.

9. The sample holder of claim 8, wherein the second member further comprises a base configured to couple to the bottom surface of the second substrate and retain the second substrate on the second member, wherein the spring mechanism extends in a superior direction from the base.

10. The sample holder of any of claims 8 or 9, wherein the spring mechanism is configured to dispose the second substrate along the second plane at an angle different than the base.

11. The sample holder of any of the claims 8 to 10, wherein the adjustment mechanism configured to move the second member toward the first member such that the spring mechanism compresses so that the first substrate, the second substrate, and the base are substantially parallel.

12. The sample holder of any one of the preceding claims, wherein the adjustment mechanism is configured to move the second member toward the first member such that the first substrate contacts at least a portion of the reagent medium.

13. The sample holder of claim 12, wherein the adjustment mechanism is configured to move the second member toward the first member such that the first substrate contacting the at least a portion of the reagent medium urges the reagent medium in an opposite direction such that the reagent medium is displaced over the second substrate and/or the first substrate

as the second member moves toward the first member and the second substrate and the first substrate become substantially parallel.

14. A system for aligning a sample area with an array area, the system comprising:

the sample holder of any one of the preceding claims, and

a computing device communicatively coupled to the image capture device and to the sample holder, the computing device comprising a display, a data processor, and a non-transitory computer readable storage medium storing computer readable and executable instructions, which when executed cause the data processor to adjust the location of the first substrate relative to the second substrate to cause all or the portion of the first region to be aligned with the second region.