Thus, there is a need in the art to improve the process of purifying biological samples without the need for expensive and highly specialized equipment.

## ~~BRIEF~~ SUMMARY

~~Embodiments~~ Examples of the present technology uses electric fields and/or gels, such as polyether compounds, to separate bioanalytes from a biological sample contained on a substrate. According to a first example of the technology, a method for separating bioanalytes comprises: providing a first well and a second well that are connected to each other via a micro channel. A fluid, such as a buffer, is provided in the first well into which the biological sample is placed. Magnetic beads, for example, magnetic particles based on polyvinyl alcohol (M-PVA Magnetic Beads) are then introduced into the first well. The surfaces of the M-PVA Magnetic Beads can be functionalized with many different groups and modified with individually tunable loadings. In one example, the M-PVA Magnetic Beads can be tuned to isolate nucleic acids in the biological sample, which may comprise blood.

The M-PVA Magnetic Beads isolate nucleic acids in the biological sample and draw the target molecules to the M-PVA Magnetic Beads. An electric field is then applied to the first well that interacts with negatively charged contaminates in the buffer. A magnet, external to the first well, is then brought in proximity to the first well. The magnet functions to attract the M-PVA Magnetic Beads such that, when the magnet is externally moved toward the microchannel, the M-PVA Magnetic Beads along with the target molecules attracted thereto, are pulled toward and into the microchannel. However, most of the negatively charged contaminates are maintained in the first well due to their interaction with the electric field. The magnet continues along its path in the microchannel toward the second well pulling the M-PVA Magnetic Beads and target molecules into the second well. The microchannel also contains a buffer and the movement of the M-PVA Magnetic Beads through the buffer in

in the first well, the second well and the microchannel. The method further comprises the steps of placing the biological sample into the first well, introducing magnetic beads into the first well and drawing target molecules within the biological sample to the magnetic beads. The method still further comprises the steps of applying an electric field to the first well, the electric field interacting with the contaminates, introducing a magnet generating a magnetic field into the vicinity of the first well, the magnet field interacting with the magnetic beads and moving the magnet toward the microchannel, the magnetic beads being drawn along with the movement of the magnet such that the magnetic beads and the target molecules are drawn into the microchannel. The method is provided such that the electric field acts on the contaminates so as to maintain the contaminates in the first well as the magnetic beads and target molecules move into the microchannel. Finally, the method comprises the step of moving the magnet toward the second well, the magnetic beads and target molecules being drawn along with the movement of the magnet such that the magnetic beads and target molecules are drawn into the second well. In one aspect, the present disclosure refers to a method for removing one or more contaminants from a biological sample, the method comprising: providing a first well and a second well connected to each other via a microchannel; placing the biological sample into the first well; introducing magnetic beads into the first well to attract target molecules within the biological sample; applying an electric field across the microchannel, the electric field adapted to interact with at least some of the one or more contaminants; introducing a magnet generating a magnetic field into the vicinity of the first well, the magnetic field interacting with the magnetic beads; and moving the magnetic beads into and through the microchannel and to the second well by moving the magnet; wherein, while moving the magnetic beads into and through the microchannel and to the second well by moving the magnet, the electric field acts on at least some of the one or more contaminants to maintain at least some of the one or more

contaminants in the microchannel as the magnetic beads and attracted target molecules move through the microchannel and to the second well.

In another example, a system for removing contaminants from a biological sample is provided comprising a first well adapted to contain a fluid and receive the biological sample, a second well adapted to contain a fluid and a microchannel extending between the first well and the second well. The system is provided such that magnetic beads are adapted to be introduced into the first well, the magnetic beads tuned to attract target molecules in the biological sample. The system further comprises a source of electrical power and two probes coupled to the source of electrical power, the two probes adapted to apply an electric field to the first well. The system is provided such that when electrical power is applied to the two probes, the two probes are adapted to generate and electric field there between with the contaminates interacting with the electric field. The system still further comprises a magnet adapted to be moved into the vicinity of the first well, the magnet is adapted to generate a magnetic field to interact with the magnetic beads. The system is

further provided such that the magnet is provided to be moved toward the microchannel so that the magnetic beads are drawn along with the movement of the magnet and into the microchannel. Additionally, the electric field is adapted to interact with the contaminates such that the contaminates are maintained in the first well and the magnet is adapted to move toward the second well such that the magnetic beads and target molecules are drawn into the second well. In another aspect, the present disclosure refers to a system for removing one or more contaminants from a biological sample, the system comprising: magnetic beads that are tuned to attract target molecules from the biological sample; a first well adapted to contain the biological sample and the magnetic beads; a second well adapted to contain the biological sample and the magnetic beads; a microchannel extending between the first well and the second well; a magnet adapted to be moved into the vicinity of the first well, the magnet adapted to generate a magnetic field to interact with the magnetic beads, the magnet further capable of moving the magnetic beads from the first well to the second well via the microchannel; a source of electrical power and two probes coupled thereto, the two probes adapted to apply an electric field across the microchannel when the source provides electrical power, such that when the magnetic beads are moved by the magnet from the first well to the second well via the microchannel, the electric field interacts with at least some of the one or more contaminants to maintain at least some of the one or more contaminants in the microchannel as the magnetic beads and attracted target molecules move from the first well to the second well.

The M-PVA Magnetic Beads isolate nucleic acids in the biological sample and draw the target molecules to the M-PVA Magnetic Beads. A magnet, external to the first well, is then brought in proximity to the first well. The magnet functions to attract the M-PVA Magnetic Beads such that, when the magnet is moved toward the microchannel, the M-PVA Magnetic Beads along with the target molecules attracted thereto, are pulled toward and into the microchannel. The microchannel is filled with a polyether compound, such as,

polyethylene glycol (PEG) also known as polyethylene oxide or polyoxyethylene depending on its molecular weight. The contaminates are negatively charged particles. When the negatively charged contaminates are drawn into the PEG, the PEG functions to block progression of those negatively charged species through the microchannel.

The magnet continues along its path in the microchannel toward the second well pulling the M-PVA Magnetic Beads and target molecules into the second well. By the time the M-PVA Magnetic Beads reach the second well, the target molecules are essentially free of contaminates, which have been shed in the PEG.

At this point, the M-PVA Magnetic Beads can be withdrawn from the second well with the target molecules still attached and placed into a chamber where the M-PVA Magnetic Beads can be de-tuned to shed the target molecules and then be removed. The result is a very clean biological sample that is essentially free of contaminates. There is no need for expense or specialized equipment, such as is needed for centrifugation, chemical

## THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method for removing one or more contaminants from a biological sample, the method comprising ~~the steps of~~:

providing a first well and a second well connected to each other via a ~~micro channel;~~

~~providing a fluid in the first well, the second well and the~~ microchannel;

placing the biological sample into the first well;

introducing magnetic beads into the first well ~~;~~

to attract~~drawing~~ target molecules within the biological sample ~~to the magnetic beads~~;

applying an electric field across the microchannel, the electric field adapted to interact~~interacting~~ with at least some of the one or more contaminants~~contaminates~~;

introducing a magnet generating a magnetic field into the vicinity of the first well, the magnetic~~magnet~~ field interacting with the magnetic beads; and

moving the magnetic beads into and through the microchannel and to the second well by moving the magnet;

~~moving the magnet toward the microchannel, the magnetic beads being drawn along with the movement of the magnet such that the magnetic beads and the target molecules are drawn into the microchannel;~~

wherein, while moving the magnetic beads into and through the microchannel and to the second well by moving the magnet, the electric field acts on at least some of the one or more contaminants ~~the contaminates so as~~ to maintain at least some of the one or more contaminants~~contaminates~~ in the microchannel as the magnetic beads and attracted target molecules move

through the microchannel~~; and~~

~~moving the magnet toward the second well, the magnetic beads and target molecules being drawn along with the movement of the magnet such that the magnetic beads~~ and to~~target molecules are drawn into~~ the second well.

2. The method of claim 1, further comprising: ~~comprises the steps of:~~

withdrawing the magnetic beads from the second well;

inserting the magnetic beads into a container including a fluid; releasing the target molecules from the magnetic beads; and

~~de-tuning the magnetic beads, which functions to release the target molecules into the fluid in the container;~~

removing the magnetic beads from the container.

~~3. The method of any one of claims 1-2 wherein the biological sample comprises blood.~~

~~4. The method of any one of claims 1-3 wherein the target molecules comprises nucleic acids.~~

~~5. The method of any one of claims 1-4 wherein the contaminants are negatively charged.~~

~~6. The method of any one of claims 1-5 wherein the first~~

well is approximately 2 mm in diameter.

7. The method of any one of claims 1-6 wherein the microchannel ranges from 50 to 200 pm in depth and ranges from 2 to 3 cm in length.

8. The method of any one of claims 1-7 wherein the microchannel is approximately 100 pm deep and approximately 2.5 cm in length.

9. The method of any one of claims 1-8 wherein the microchannel comprises a buffer that functions to further separate any contaminates from the target molecules drawn into the microchannel.

310. The method of any one of claims 1, and 3-9 further comprising: the steps of:

providing a third well and a second microchannel, the third well connected to the second well via the second microchannel;

moving the magnet toward the second microchannel, the magnetic beads and target molecules through the second microchannelbeing drawn along with the movement of the magnet such that the magnetic beads and totarget molecules are drawn into the second microchannel; and

moving the magnet toward the third well using the magnet, the magnetic beads and target molecules being drawn along with the movement of the magnet such that the magnetic beads and target molecules are drawn into the third well.

4. The method of any one of claims 1 to 3, further comprising:

providing a buffer within the microchannel, the buffer to separate at least some of the one or more contaminants from the target molecules in the

microchannel.

5~~11~~. ~~The~~ The method of any one of claims 1~~-10~~ to 4, further comprising:

~~the step of~~providing a fluid in the first well, the second well, and the~~:~~

microchannel; and

creating a volume differential of the fluid between the second well and the first well such that a flow of the fluid is created in the microchannel from the second well toward the first well.

~~12. The method of any one of claims 1-11 wherein the movement of the magnet is automated and controlled by motion control hardware.~~

6~~13~~. The method of any one of claims 1 to 5,~~-12~~ further comprising ~~the steps of~~: ~~providing a magnetic stirrer in the first well; and~~

stirring the biological sample in the first well.

7~~14~~. The method of any one of claims 1 to 6,~~-13~~ further comprising: ~~the steps of:~~

~~providing a heater for the first well; and~~

heating the biological sample in the first well.

~~15. The method of claim 14 further comprising a temperature sensor and a controller, wherein the controller adjusts the heater based on a temperature signal received from the temperature sensor.~~

~~16. The method of any one of claims 14-15 wherein the heater is a resistive metal coating to which a voltage can be applied.~~

~~17. The method of claim 16 wherein the resistive metal coating is Indium Tin Oxide.~~

~~18. The method of any one of claims 1-17 wherein the first well, the second well and the microchannel are provided on a chip.~~

8~~19~~. The method of any one of claims 1 to ~~18~~ 7, wherein ~~the step of~~ applying an electric field across the microchannel includes~~comprises the step of~~ disposing a first probe in the first well and a second probe in the second well, the first probe and the second probe having opposite polarities.

9~~20~~. The method of any one of claims 1 to 8, ~~18~~ further comprising ~~the steps of~~ providing a third well in communication with the microchannel and ~~providing~~ a fourth well in communication with the microchannel, ~~and~~ wherein ~~the step of~~ applying an electric field across the microchannel includes~~comprises the step of~~ disposing a first probe in the third well and a second probe in the fourth well, the first probe and the second probe having opposite polarities.

10~~21~~. A system for removing one or more contaminants from a biological sample, the system comprising:

magnetic beads that are tuned to attract target molecules from the

biological sample;

a first well adapted to contain ~~a fluid and receive~~ the biological sample and the magnetic beads;

a second well adapted to contain ~~a~~the ~~fluid~~biological sample and the magnetic beads;

a microchannel extending between ~~said~~the first well and ~~said~~the second well; ~~wherein magnetic beads are adapted to be introduced into the first well, the magnetic beads tuned to attract target molecules in the biological sample;~~

~~a source of electrical power and two probes coupled to said source of electrical power, said two probes adapted to apply an electric field across the microchannel;~~

~~wherein when electrical power is applied to the two probes, said two probes are adapted to generate and electric field therebetween such that the contaminates interact with the electric field;~~

a magnet adapted to be moved into the vicinity of the first well, ~~said~~ the magnet adapted to generate a magnetic field to interact with the magnetic beads,~~;~~ ~~wherein said~~the magnet further capable of moving the magnetic beads from the first well to the second well via the microchannel~~is adapted to be moved toward said microchannel such that the magnetic beads are drawn along with the movement of the magnet and into said microchannel~~;

a source ~~wherein the~~of electrical power~~field~~ and two probes coupled thereto, the two probes adapted to apply an electric field across the microchannel when the source provides electrical power, such that

when the magnetic beads are moved by the magnet from the first well to the second well via the microchannel, the electric field ~~is adapted to~~ interacts with at least some of the one or more contaminants ~~contaminates such that~~ to maintain at least some of the one or more ~~contaminates~~contaminants in ~~are maintained within~~ the microchannel as~~; and~~

~~wherein said magnet is adapted to move toward said second well such that~~ the magnetic beads and attracted target molecules move from the first well to the~~are drawn into said~~ second well.

~~22. The system of claim 21 wherein the biological sample comprises blood and the target molecules comprise nucleic acids.~~

~~23. The system of any one of claims 21-22 wherein the contaminants are negatively charged.~~

~~24. The system of any one of claims 21-23 wherein said first well is approximately 2 mm in diameter.~~

~~25. The system of any one of claims 21-24 wherein said microchannel ranges from 50 to 200 pm in depth and ranges from 2 to 3 cm in length.~~

~~26. The system of any one of claims 21-25 wherein said microchannel is approximately 100 pm deep and approximately 2.5 cm in length.~~

11~~27~~. The system of ~~any one of~~ claim~~s~~ 10~~21-26~~, further comprising:

a third well; and

a second microchannel, said third well connected to the~~said~~ second well via the~~said~~ second microchannel;

wherein the~~said~~ magnet is adapted to move along the~~toward said~~ second microchannel from the~~, such that, the magnetic beads and target molecules are drawn into said~~ second well to the~~microchannel; and~~

~~wherein said the magnet is adapted to move toward said~~ third well to move~~, such that,~~ the magnetic beads and target molecules from the second

well to thearе drawn into said third well.

1228. The system of claimany one of claims 10 or21-27 11 further comprising:

a fluid in the first well, the second well, and the microchannel; and

a volume differential of the fluid created between thesaid second well and thesaid first well, such that,the volume differential adapted to provide a flow of the fluid is created in saidthe microchannel from saidthe second well toward saidthe first well.

29. The system of any one of claims 21-28 further comprising a controller adapted to control said source of electrical power.

30. The system of claim 29 wherein said controller is adapted to control movement of said magnet.

13~~31~~. The system of any one of claims ~~29-30~~10 to 12, further comprising~~:~~

a magnetic stirrer adapted to stir the contents of said first well.~~;~~

~~said controller adapted to control said magnetic stirrer.~~

14~~32~~. The system of any one of claims 10 to 13~~29-31~~, further comprising~~:~~

a heater adapted to heat said first well~~:~~.

~~said controller adapted to control said heater.~~

~~33. The system of claim 32 further comprising:~~

~~a temperature sensor coupled to said controller and adapted to generate a temperature signal;~~

~~wherein said controller is adapted to control said heater based on the temperature signal received from said temperature sensor.~~

~~34. The system of any one of claims 32-33 wherein said heater comprises a resistive metal coating.~~

~~35. The system of claim 34 wherein the resistive metal coating comprises Indium Tin Oxide.~~

~~36. The system of any one of claims 21-35 wherein said first well, said second well and said microchannel are positioned on a chip.~~

15~~37~~. The system of any one of claims ~~21-36~~10 to 14, wherein

a first one of the two probes is disposed in the first well and a second one of the two probes is disposed in the second well, the first probe and the second probe having opposite polarities.

16~~38~~. The system of any one of claims ~~21-36~~10 to 15, further comprising a third well in communication with the microchannel and a fourth well in communication with the microchannel, ~~and~~ wherein a first one of the two probes is disposed in the third well and a second one of the two probes is disposed in the fourth well, the first probe and the second probe having opposite polarities.

~~39. A method for removing contaminants from a biological sample comprising the steps of:~~

~~providing a first well and a second well connected to each other via a micro channel;~~

~~providing a fluid in the first well, the second well and the microchannel;~~

~~placing the biological sample into the first well;~~

~~introducing magnetic beads into the first well;~~

~~drawing target molecules within the biological sample to the magnetic beads;~~

~~introducing a magnet generating a magnetic field into the vicinity of the first well, the magnet field interacting with the magnetic beads;~~

~~moving the magnet toward the microchannel, the magnetic beads being drawn along with the movement of the magnet such that the magnetic beads and the target molecules are drawn into the microchannel;~~

~~providing a gel in the microchannel where the gel interacts with the~~

~~contaminates; and~~

~~moving the magnet toward the second well, the magnetic beads and target molecules being drawn along with the movement of the magnet such that the contaminates are separated from the target molecules as the contaminates are maintained within the gel and the magnetic beads and target molecules are drawn into the second well.~~

~~40. The method of claim 39 wherein the gel comprises a polyether compound.~~

~~41. The method of claim 40 wherein the polyether compound comprises polyethylene glycol.~~

~~42. The method of any one of claims 39-41 wherein the biological sample comprises blood.~~

~~43. The method of any one of claims 39-42 wherein the target molecules comprises nucleic acids.~~

~~44. The method of any one of claims 39-43 wherein the contaminants are negatively charged.~~

~~45. The method of any one of claims 39-44 wherein the first well is approximately 2 mm in diameter.~~

~~46. The method of any one of claims 39-45 wherein the microchannel ranges from 50 to 200 pm in depth and ranges from 2 to 3 cm in length.~~

~~47. The method of any one of claims 39-46 wherein the microchannel is approximately 100 pm deep and approximately 2.5 cm in length.~~

48. The method of any one of claims 39-47 further comprises the steps of:

withdrawing the magnetic beads from the second well;

inserting the magnetic beads into a container including a fluid;

de-tuning the magnetic beads, which functions to release the target molecules into the fluid in the container;

removing the magnetic beads from the container.

49. The method of any one of claims 39-47 further comprising the steps of:

providing a third well and a second microchannel, the third well connected to the second well via the second microchannel;

providing a gel within the second microchannel;

moving the magnet toward the second microchannel, the magnetic beads and target molecules being drawn along with the movement of the magnet such that the magnetic beads and target molecules are drawn into the second microchannel; and

moving the magnet toward the third well, the magnetic beads and target molecules being drawn along with the movement of the magnet such that the magnetic beads and target molecules are drawn through the gel in the second microchannel and into the third well.

50. The method of any one of claims 39-49 further comprising the step of providing the gel in the second well.

51. The method of any one of claims 39-50 further comprising the step of providing the gel in the first well.

52. The method of any one of claims 39-51 further comprising the

~~step of creating a volume differential of the gel in the second well and the fluid in the first well such that a flow of the gel is created in the microchannel from the second well toward the first well.~~

~~53. The method of any one of claims 39-52 wherein the movement of the magnet is automated and controlled by motion control hardware.~~

~~54. The method of any one of claims 39-53 further comprising the steps of: providing a magnetic stirrer in the first well; and stirring the biological sample in the first well.~~

~~55. The method of any one of claims 39-54 further comprising the steps of:~~

~~providing a heater for the first well; and~~

~~heating the biological sample in the first well.~~

~~56. The method of claim 55 further comprising a temperature sensor and a controller, wherein the controller adjusts the heater based on a temperature signal received from the temperature sensor.~~

~~57. The method of any one of claims 55-56 wherein the heater is a resistive metal coating to which a voltage can be applied.~~

~~58. The method of claim 57 wherein the resistive metal coating is Indium Tin Oxide.~~

~~59. The method of any one of claims 39-58 wherein the first well, the second well and the microchannel are provided on a chip.~~

~~60. A system for removing contaminants from a biological sample~~

~~comprising:~~

~~a first well adapted to contain a fluid and receive the biological sample;~~

~~a second well adapted to contain a fluid;~~

~~a microchannel extending between said first well and said second well;~~

~~a gel located within said microchannel;~~

~~wherein magnetic beads are adapted to be introduced into the first well, the magnetic beads tuned to attract target molecules in the biological sample;~~

~~a magnet adapted to be moved into the vicinity of the first well, said magnet adapted to generate a magnetic field to interact with the magnetic beads;~~

~~wherein said magnet is provided to be moved toward said microchannel such that the magnetic beads are drawn along with the movement of the magnet and into said microchannel;~~

~~wherein said gel is adapted to interact with the contaminates such that at least some of the contaminates are captured within said gel when the magnetic beads move through said gel; and~~

~~said magnet is adapted to move toward said second well such that the magnetic beads and target molecules are drawn into said second well.~~

~~61. The system of claim 60 wherein said gel comprises a polyether compound.~~

~~62. The system of claim 61 wherein said polyether compound comprises polyethylene glycol.~~

~~63. The system of any one of claims 60-62 wherein the contaminants are negatively charged.~~

64. The system of any one of claims 60-63 wherein the biological sample comprises blood and the target molecules comprise nucleic acids.

65. The system of any one of claims 60-64 wherein said first well is approximately 2 mm in diameter.

66. The system of any one of claims 60-65 wherein said microchannel ranges from 50 to 200 pm in depth and ranges from 2 to 3 cm in length.

67. The system of any one of claims 60-66 wherein said microchannel is approximately 100 pm deep and approximately 2.5 cm in length.

68. The system of any one of claims 60-67 further comprising:

a third well; and

a second microchannel, said third well connected to said second well via said second microchannel, said second microchannel comprising said gel;

wherein said magnet is adapted to move toward said second microchannel, such that, the magnetic beads and target molecules are drawn into said second microchannel and at least some of the contaminates are captured by said gel within said second microchannel; and

wherein said the magnet is adapted to move toward said third well, such that, the magnetic beads and target molecules are drawn into said third well.

69. The system of any one of claims 60-68 wherein said second well comprises said gel and a volume differential of the fluid in the first well created between said gel in said second well, such that, a flow of said gel is created in said microchannel from said second well toward said first well.

~~70. The system of any one of claims 60-69 further comprising a controller adapted to control movement of said magnet.~~

~~71. The system of claim 70 further comprising:~~

~~a magnetic stirrer adapted to stir the contents of said first well;~~

~~said controller adapted to control said magnetic stirrer.~~

~~72. The system of any one of claims 70-71 further comprising:~~

~~a heater adapted to heat said first well:~~

~~said controller adapted to control said heater.~~

~~73. The system of claim 72 further comprising:~~

~~a temperature sensor coupled to said controller and adapted to generate a temperature signal;~~

~~wherein said controller is adapted to control said heater based on the temperature signal received from said temperature sensor.~~

~~74. The system of any one of claims 72-73 wherein said heater comprises a resistive metal coating.~~

~~75. The system of claim 74 wherein the resistive metal coating comprises Indium Tin Oxide.~~

~~76. The system of any one of claims 60-75 wherein said first well, said second well and said microchannel are positioned on a chip.~~

~~77. A system comprising:~~

~~a horizontal actuator;~~

~~a tray coupled to the horizontal actuator;~~

~~a well plate coupled to the tray;~~

~~a microfluidic chip coupled to the well plate;~~

~~a vertical actuator;~~

~~a pipette coupled to the vertical actuator;~~

~~a heater coupled to the pipette to control a temperature of a fluid within the pipette;~~

~~a pump coupled to the pipette to control movement of the fluid within the pipette; and~~

~~a controller communicatively coupled to the horizontal actuator to control horizontal movement of the tray, the well plate, and the microfluidic chip, communicatively coupled to the vertical actuator to control vertical movement of the pipette, communicatively coupled to the pump to control the pump, and communicatively coupled to the heater to control the heater.~~

~~78. The system of claim 77, further comprising:~~

~~a rotational actuator; and~~

~~a magnet coupled to the rotational actuator;~~

~~wherein the controller is communicatively coupled to the rotational actuator to control rotation of the magnet underneath the tray.~~

~~79. The system of any one of claims 77-78 wherein the well plate includes a plurality of electrically conductive leads located underneath the microfluidic chip.~~

~~80. The system of any one of claims 77-79 wherein the pipette includes a pipette tip held in a vertical orientation by a support arm and an end of the pipette opposite to the pipette tip is held within a cartridge.~~

81. The system of any one of claims 77-80 wherein the heater includes a stationary sidewall and a hinged sidewall rotatably coupled to the stationary sidewall by a hinge.

82. The system of claim 81 wherein the stationary sidewall includes a first groove and the hinged sidewall includes a second groove, the pipette extending between the stationary sidewall and the hinged sidewall through the first and second grooves.

83. The system of any one of claims 81-82 wherein the stationary sidewall includes a first bar movable outward from the stationary sidewall toward the hinged sidewall to pinch the pipette at a first location near a first side of the stationary sidewall and a second bar movable outward from the stationary sidewall toward the hinged sidewall to pinch the pipette at a second location near a second side of the stationary sidewall opposite to the first side of the stationary sidewall.

84. A method, comprising:

receiving a biological sample in a first well in a well plate;

receiving another reagent in a second well in the well plate;

operating a pump to draw the biological sample from the first well of the well plate into a pipette;

operating an actuator to move the pipette from the first well of the well plate to a first well of a microfluidic chip;

operating the pump to expel the biological sample from the pipette into the first well of the microfluidic chip;

operating the actuator to move the pipette from the first well of the microfluidic chip to a second well of the microfluidic chip;

operating the pump to draw the biological sample from the second

well of the microfluidic chip into the pipette;

operating the actuator to move the pipette from the second well of the microfluidic chip to the second well of the well plate;

operating the pump to draw the other reagent from the second well of the well plate into the pipette;

operating a heater to heat the biological sample and the other reagent within the pipette;

operating the pump to expel the biological sample from the pipette into a third well in the well plate.

85. The method of claim 84 wherein the biological sample includes DNA.

86. The method of claim 84 wherein the biological sample includes RNA.

87. The method of claim 84 wherein the biological sample includes mRNA.

88. The method of claim 84 wherein the biological sample includes proteins.

89. The method of any one of claims 84-88 wherein contaminants are removed from the biological sample in the microfluidic chip.

90. The method of any one of claims 84-89 wherein a polymerase chain reaction occurs within the pipette.

91. A microwell plate, comprising:

a plurality of microwells formed in an upper surface of the microwell

~~plate; and~~

~~a cavity formed in the upper surface of the microwell plate, wherein the cavity is sized to receive a microfluidic chip.~~

~~92. The microwell plate of claim 91 wherein the cavity has a shape comprising a right rectangular prism.~~

~~93. The microwell plate of any one of claims 91-92 wherein the cavity extends all the way to, and is coincident with, an edge of the microwell plate.~~

~~94. The microwell plate of any one of claims 91-93, further comprising the microfluidic chip positioned within the cavity.~~

~~95. The microwell plate of claim 94 wherein the cavity has a first set of dimensions, and the microfluidic chip has a second set of dimensions that match the first set of dimensions.~~

~~96. The microwell plate of any one of claims 94-95 wherein a surface of the microwell plate that forms a bottom boundary of the cavity faces microfluidic channels in a bottom surface of the microfluidic chip and forms a lower boundary of pathways formed by the microfluidic channels.~~

~~97. The microwell plate of any one of claims 91-95, further comprising a plurality of channels formed in a surface of the microwell plate that forms a bottom boundary of the cavity.~~

~~98. The microwell plate of claim 97 wherein each of the channels includes a relatively wide bottom end portion and a relatively narrow top end portion that extends from the surface that forms the bottom boundary of the cavity to the relatively wide bottom end portion.~~

99. The microfluidic plate of any one of claims 97-98, further comprising a respective electrically conductive lead positioned in and extending through each of the channels.

100. The microwell plate of any one of claims 91-99, further comprising a plurality of protrusions that extend horizontally outward from opposing ends of the microwell plate.

101. A micropipette system, comprising:

a first micropipette including a first micropipette tip and a first end of the first micropipette opposite to the first micropipette tip along a first length of the first micropipette;

a second micropipette including a second micropipette tip and a second end of the second micropipette opposite to the second micropipette tip along a second length of the second micropipette; and

a horizontal support arm that holds the first and second micropipettes with the first and second micropipette tips in a vertical orientation;

wherein the horizontal support arm is hollow, has an end, and has an opening at the end.

102. The micropipette system of claim 101 wherein the horizontal support arm has an upper surface and includes a groove that extends downward into the upper surface.

103. The micropipette system of any one of claims 101-102, further comprising a cartridge including an outer frame, the outer frame having a portion of a fluid connector, the portion of the fluid connector including a first fluid port and a second fluid port.

104. The micropipette system of claim 103 wherein the first

~~end of the first micropipette is coupled to the first fluid port and the second end of the second micropipette is coupled to the second fluid port.~~

~~105. The micropipette system of any one of claims 103-104 wherein the outer frame of the cartridge includes a plurality of openings.~~