CLAIMS

[Claim 1]

A method for controlling liquid transport in a flow path of a biomolecule analyzer by a computer, wherein

the biomolecule analyzer includes a first chamber storing a first liquid, a second chamber storing a second liquid, a membrane chamber having a purification membrane, and a waste liquid chamber,

the method comprises:

controlling, by the computer, transport of the second liquid until the second liquid exceeds at least a junction between a first flow path leading from the first chamber to the waste liquid chamber and a second flow path extending from the second chamber, and discharging a fluid different from the first and second liquids from the second flow path;

controlling, by the computer, transport of the first liquid from the first chamber to the waste liquid chamber via the membrane chamber; and

controlling, by the computer, transport of the second liquid in the second chamber from the second chamber to the membrane chamber.

[Claim 2]

The method according to claim 1, wherein

the membrane chamber is disposed between the first chamber and the second chamber, and the waste liquid chamber,

and

the method further comprises:

controlling, by the computer, further transport of the second liquid transported to the membrane chamber to the waste liquid chamber.

[Claim 3]

The method according to claim 1, wherein

the membrane chamber is disposed between the first chamber and the second chamber, and

the method further comprises:

controlling, by the computer, further transport of the second liquid transported to the membrane chamber to the first chamber.

[Claim 4]

The method according to claim 1, wherein

the computer is configured to control applied pressure and opening and closing of a valve in response to input information on flow rates of the first liquid and the second liquid, and execute each transport of the first liquid and the second liquid.

[Claim 5]

The method according to claim 4, wherein

the membrane chamber is disposed between the first chamber and the second chamber, and the waste liquid chamber, and

the computer is configured to (i) transport the second liquid to exceed at least the junction by closing a first valve provided closer to the first chamber than the junction in the first flow path, opening a second valve provided in the second flow path, and applying a pressure to liquid, (ii) then, transport the first liquid from the first chamber to the waste liquid chamber via the membrane chamber by closing the second valve, opening the first valve, and applying a pressure to liquid, and (iii) further, transport the second liquid from the second chamber to the waste liquid chamber via the membrane chamber by closing the first valve, opening the second valve again, and applying a pressure to liquid.

[Claim 6]

The method according to claim 4, wherein

the membrane chamber is disposed between the first chamber and the second chamber, and

the computer is configured to (i) transport the second liquid to exceed at least the junction by closing a first valve provided between the first chamber and the membrane chamber, opening a second valve provided in the second flow path and a third valve provided between the junction and the waste liquid chamber, and applying a pressure to liquid, (ii) then transport the first liquid from the first chamber to the waste liquid chamber via the membrane chamber by closing the second valve, opening the first and third valves, and

applying a pressure to liquid, and (iii) further transport the second liquid from the second chamber to the first chamber via the membrane chamber by closing the third valve, opening the first and second valves, and applying a pressure to liquid.

[Claim 7]

The method according to claim 4, wherein

the membrane chamber is disposed between the first chamber and the second chamber, and the waste liquid chamber, and

the computer is configured to (i) transport the first liquid from the first chamber to the waste liquid chamber via the membrane chamber to fill a flow path from the third valve to an inlet port of the waste liquid chamber with the first liquid by opening a first valve provided between the junction and the first chamber and a second valve provided between the junction and the membrane chamber, closing a third valve provided in the second flow path, and applying a pressure to liquid, (ii) then transport the second liquid to exceed at least the junction by closing the second valve, opening the first and third valves, and applying a pressure to liquid, and (iii) further transport the second liquid from the second chamber to the waste liquid chamber via the membrane chamber by closing the first valve, opening the second and the third valves, and applying a pressure to

liquid.

[Claim 8]

The method according to claim 4, wherein

the membrane chamber is disposed between the first chamber and the second chamber, and

the computer is configured to (i) transport the first liquid from the first chamber to the waste liquid chamber via the membrane chamber by opening a first valve provided between the first chamber and the membrane chamber, a second valve provided between the membrane chamber and the junction, and a third valve provided between the junction and the waste liquid chamber, closing a fourth valve provided in the second flow path, and applying a pressure to liquid, (ii) then transport the first liquid to at least exceed the junction, (iii) then transport the second liquid from the second chamber toward the waste liquid chamber to discharge a fluid different from the first liquid and the second liquid contained in the second flow path to the waste liquid chamber by closing the second valve while maintaining a state in which a space between the purification membrane and a first liquid outlet port of the membrane chamber and a flow path between the first liquid outlet port and the second valve are filled with the first liquid, opening the third valve and the fourth valve, and applying a pressure to liquid, and (iv) further transports the second liquid from the second

chamber to the first chamber via the membrane chamber by closing the third valve, opening the first valve, the second valve, and the fourth valve, and applying a pressure to liquid.

[Claim 9]

The method according to claim 1, wherein

the first flow path connected to the membrane chamber has a cross-sectional area of 314 mm^2 or less.

[Claim 10]

The method according to claim 1, wherein

the purification membrane is capable of holding particles of 0.1 μm or more.

[Claim 11]

The method according to claim 1, wherein

a composition of the purification membrane is silica.

[Claim 12]

The method according to claim 1, wherein

the first liquid contains one or more molecules selected from the group consisting; a biopolymer containing a nucleic acid, a protein, a lipid, or a polysaccharide, a biomonomer containing an amino acid, a lipid, a sugar, or a nucleobase, and a substance having a molecule that contains a derivative of the biopolymer or the biomonomer in a structure.

[Claim 13]

The method according to claim 1, wherein

the second liquid has a higher evaporation rate, a lower surface tension, or a larger contact angle with respect to a membrane than the first liquid.

[Claim 14]

The method according to claim 1, wherein

the first liquid is a lysate, the second liquid is a wash buffer, and the fluid is air.

[Claim 15]

The method according to claim 1, wherein

after the first liquid passes through the purification membrane, the computer is configured to transport the first and second liquids at a pressure lower than a pressure required for the fluid to pass through the purification membrane.

[Claim 16]

The method according to claim 4, wherein

the computer is configured to define switching timing of transport of the first liquid and the second liquid by a liquid level detection sensor, time, pressure, or a combination thereof.

[Claim 17]

The method according to claim 1, wherein

a volume of the second flow path is equal to or larger than a volume of a first space between the purification

membrane and an inlet port of the membrane chamber.

[Claim 18]

A method for controlling liquid transport in a flow path of a biomolecule analyzer by a computer, wherein

the biomolecule analyzer includes a first chamber storing a first liquid, a second chamber storing a second liquid, a membrane chamber having a purification membrane, and a waste liquid chamber, the membrane chamber has a first inlet port, a second inlet port, and an outlet port, a first flow path extending from the first chamber is led to the first inlet port of the membrane chamber, a second flow path extending from the second chamber is led to the second inlet port of the membrane chamber, and a third flow path extending from the outlet port of the membrane chamber is led to the waste liquid chamber, and

the method comprises:

transporting, by the computer, the first liquid from the first chamber to the waste liquid chamber via the membrane chamber;

transporting, by the computer, the second liquid from the second chamber to a first space between the first and second inlet ports of the membrane chamber and the purification membrane via the second inlet port of the membrane chamber, and discharging the second liquid from the first inlet port of the membrane chamber to the first flow

path side in a state where the first space is filled with the second liquid; and

transporting, by the computer, the second liquid from the second chamber to the waste liquid chamber via the membrane chamber in a state where the second liquid is present on the first flow path side.

[Claim 19]

The method according to claim 18, wherein

the computer is configured to control applied pressure and opening and closing of a valve in response to input information on flow rates of the first liquid and the second liquid, and execute each transport of the first liquid and the second liquid.

[Claim 20]

The method according to claim 19, wherein

the computer is configured to (i) transport the first liquid from the first chamber to the waste liquid chamber via the membrane chamber by opening a first valve provided in the first flow path, closing a second valve provided in the second flow path, and applying a pressure to liquid, (ii) discharge the second liquid from the first inlet port to the first flow path side while filling the first space of the membrane chamber with the second liquid by opening the first and second valves and applying a pressure to liquid in a state where a second space between the purification membrane

of the membrane chamber and the outlet port is filled with the first liquid, and (iii) further transport the second liquid from the second chamber to the waste liquid chamber via the membrane chamber by closing the first valve and applying a pressure to liquid in a state where the second liquid is present on the first flow path side.

[Claim 21]

A method for controlling liquid transport in a flow path of a biomolecule analyzer by a computer, wherein

the biomolecule analyzer includes a first chamber storing a first liquid, a second chamber storing a second liquid, a membrane chamber having a purification membrane, and a waste liquid chamber, a first flow path extending from the first chamber is led to an inlet port of the membrane chamber, a second flow path extending from the second chamber is joined to the first flow path at a junction, and a communication flow path leading a first space between the inlet port of the membrane chamber and the purification membrane and the waste liquid chamber is further provided, and

the method comprises:

transporting, by the computer, the first liquid from the first chamber to the waste liquid chamber via the membrane chamber;

transporting, by the computer, the second liquid from

the second chamber to the first space and the communication flow path from the inlet port of the membrane chamber; and

transporting, by the computer, the second liquid from the second chamber to the waste liquid chamber via the membrane chamber in a state where the first space and the communication flow path are filled with the second liquid.

[Claim 22]

The method according to claim 21, wherein

the computer is configured to control applied pressure and opening and closing of a valve in response to input information on flow rates of the first liquid and the second liquid, and execute each transport of the first liquid and the second liquid.

[Claim 23]

The method according to claim 22, wherein

the computer is configured to (i) transport the first liquid from the first chamber to the waste liquid chamber via the membrane chamber by opening a first valve provided in the first flow path, closing a second valve provided in the second flow path, and applying a liquid feeding pressure, (ii) fill the first space of the membrane chamber and the communication flow path with the second liquid by closing the first valve in a state where a second space between the purification membrane and an outlet port of the membrane chamber is filled with the first liquid, and opening a second

valve provided in the second flow path and a third valve provided in the communication flow path, and applying a liquid feeding pressure, and (iii) further transport the second liquid from the second chamber to the waste liquid chamber via the membrane chamber while maintaining a state in which the second liquid is present in the communication flow path by closing the third valve and applying a liquid feeding pressure.

[Claim 24]

A biomolecule purification system comprising:

a biomolecule analyzer having a flow path; and

a computer configured to control liquid transport in the flow path, wherein

the biomolecule analyzer includes:

a first chamber that stores a first liquid;

a second chamber that stores a second liquid;

a waste liquid chamber; and

a membrane chamber having a purification membrane and disposed between the first chamber and the second chamber and the waste liquid chamber, and

the computer is configured to execute:

controlling transport of the second liquid until the second liquid exceeds at least a junction between a first flow path leading from the first chamber to the waste liquid chamber and a second flow path extending from the second

chamber, and discharging a fluid different from the first and second liquids from the second flow path;

controlling transport of the first liquid from the first chamber to the waste liquid chamber via the membrane chamber; and

controlling transport of the second liquid in the second chamber from the second chamber to the waste liquid chamber via the membrane chamber.

[Claim 25]

A biomolecule purification system comprising:

a biomolecule analyzer having a flow path; and

a computer configured to control liquid transport in the flow path, wherein

the biomolecule analyzer includes:

a first chamber that stores a first liquid;

a second chamber that stores a second liquid;

a membrane chamber having a purification membrane and disposed between the first chamber and the second chamber; and

a waste liquid chamber, and

the computer is configured to execute:

controlling transport of the second liquid until the second liquid exceeds at least a junction between a first flow path leading from the first chamber to the waste liquid chamber and a second flow path extending from the second

chamber, and discharging a fluid different from the first and second liquids from the second flow path;

controlling transport of the first liquid from the first chamber to the waste liquid chamber via the membrane chamber; and

controlling transport of the second liquid in the second chamber from the second chamber to the first chamber via the membrane chamber.

[Claim 26]

A biomolecule purification system comprising:

a biomolecule analyzer having a flow path; and

a computer configured to control liquid transport in the flow path, wherein

the biomolecule analyzer includes:

a first chamber that stores a first liquid;

a second chamber that stores a second liquid;

a membrane chamber having a purification membrane, a first inlet port, a second inlet port, and an outlet port;

a waste liquid chamber;

a first flow path extending from the first chamber and led to the first inlet port of the membrane chamber;

a second flow path extending from the second chamber and led to the second inlet port of the membrane chamber; and

a third flow path extending from the outlet port of

the membrane chamber and led to the waste liquid chamber, and

the computer is configured to execute:

transporting the first liquid from the first chamber to the waste liquid chamber via the membrane chamber;

transporting the second liquid from the second chamber to a first space between the first and second inlet ports of the membrane chamber and the purification membrane via the second inlet port of the membrane chamber, and discharging the second liquid from the first inlet port of the membrane chamber to the first flow path side in a state where the first space is filled with the second liquid; and

transporting the second liquid from the second chamber to the waste liquid chamber via the membrane chamber in a state where the second liquid is present on the first flow path side.

[Claim 27]

A biomolecule purification system comprising:

a biomolecule analyzer having a flow path; and

a computer configured to control liquid transport in the flow path, wherein

the biomolecule analyzer includes:

a first chamber that stores a first liquid;

a second chamber that stores a second liquid;

a waste liquid chamber;

a membrane chamber having a purification membrane, an inlet port, a communication port with the waste liquid chamber, and an outlet port;

a first flow path extending from the first chamber and led to the inlet port of the membrane chamber;

a second flow path extending from the second chamber to a junction with the first flow path;

a communication flow path leading the communication port and the waste liquid chamber, the communication flow path being provided in a first space between the inlet port of the membrane chamber and the purification membrane; and

a third flow path extending from the outlet port of the membrane chamber and led to the waste liquid chamber, wherein

the computer is configured to execute:

transporting the first liquid from the first chamber to the waste liquid chamber via the membrane chamber;

transporting the second liquid from the second chamber to the first space and the communication flow path via the inlet port of the membrane chamber; and

transporting the second liquid from the second chamber to the waste liquid chamber via the membrane chamber in a state where the first space and the communication flow path are filled with the second liquid.