

CLAIMS

1. A method of perfusing cells, comprising:

(A) providing (a) a culture module, the culture module comprising (i) an actuation assembly configured to move (ii) a pressure manifold, the pressure manifold comprising a mating surface with pressure points; and (b) a plurality of microfluidic devices, each of the microfluidic devices comprising (i) one or more microchannels comprising living cells, (ii) one or more reservoirs comprising culture media, and (iii) a cover assembly above the one or more reservoirs, the cover assembly comprising a cover with ports that correspond to the pressure points on the pressure manifold mating surface;

(B) placing the plurality of microfluidic devices on or in the culture module; and

(C) simultaneously contacting the ports on the cover of each microfluidic device of the plurality of microfluidic devices with the mating surface of the pressure manifold, such that the ports are in contact with the pressure points, under conditions such that culture media flows from the reservoirs into the microchannels of the microfluidic devices, thereby perfusing the cells.

2. A method according to Claim 1, in which the plurality of microfluidic devices are positioned on one or more trays prior to step (B) and the placing of step (B) comprising moving at least a subset of the plurality of microfluidic devices simultaneously into the culture module.

3. A method according to Claim 1, in which the simultaneous contacting of step (C) is achieved by moving, via the actuation assembly, the mating surface of the pressure manifold down onto the cover assemblies of the plurality of microfluidic devices.

4. A method of controlling pressure while perfusing cells, comprising:

(A) providing (a) a culture module, the culture module comprising (i) an actuation assembly configured to move (ii) a pressure manifold, the pressure manifold comprising a mating surface with pressure points, and (iii) one or more pressure controllers to provide pressure to the pressure points; and (b) a plurality of microfluidic devices, each of the microfluidic devices comprising (i) one or more microchannels comprising living cells, (ii) one or more reservoirs comprising culture media, and (iii) a cover assembly

above the one or more reservoirs, the cover assembly comprising a cover with ports that correspond to the pressure points on the pressure manifold mating surface;

(B) placing the plurality of microfluidic devices on or in the culture module;

5 (C) simultaneously contacting the ports on the cover of each microfluidic device of the plurality of microfluidic devices with the mating surface of the pressure manifold, such that the ports are in contact with the pressure points, under conditions such that culture media flows from the reservoirs into the microchannels of the microfluidic devices, thereby perfusing the cells; and

10 (D) turning the one or more pressure controllers off and on, thereby controlling pressure while perfusing the cells.

5. A method according to Claim 4, in which the pressure controllers are turned off and on in a switching pattern.

15 6. A method according to Claim 5, in which the switching pattern is selected such that the average value of pressure acting liquid in the one or more reservoirs corresponds to a desired value.

7. A method according to Claim 5, in which the switching pattern is selected such that the average gas pressure is maintained below 1 kPa.