

CLAIMS

1. A method of culturing cells, comprising: (a) providing a fluidic device comprising a membrane, the membrane comprising a top surface and a bottom surface; (b) seeding endothelial cells on the bottom surface so as to create seeded endothelial cells; (c) seeding
5 neurons on the top surface to create seeded neurons and (d) exposing the seeded endothelial cells and the seeded neurons to a flow of culture media for a period of time, in which the neurons exhibit a more mature electrophysiology after exposure to the flow as compared to the same neurons cultured in a static culture.
2. A method according to Claim 1, in which the endothelial cells are selected from the
10 group consisting of stem cell-derived cells, cells differentiated from stem cells and primary cells.
3. A method according to Claim 1, further comprising (e) seeding astrocytes to create seeded astrocyte cells.
4. A method according to Claim 3, further comprising culturing the astrocytes under
15 conditions such that an astrocyte or portion thereof transmigrates the membrane and contacts one or more brain microvascular endothelial cells on the bottom surface.
5. A method according to Claim 3, in which the neurons are derived or extracted from EZ spheres, iNPCs or iMNP.
6. A method of culturing cells, comprising: (a) providing a microfluidic device comprising
20 a membrane, the membrane comprising a top surface and a bottom surface; (b) coating the top surface of the membrane with laminin and the bottom surface with a mixture of collagen and fibronectin, the mixture free of laminin; (c) seeding induced motor neuron progenitor cells on the top surface and brain microvascular endothelial cells on the bottom surface so as to create seeded cells; (d) exposing the seeded cells to a flow of culture media for a period of time; and
25 (e) culturing the seeded cells under conditions such that the brain microvascular endothelial cells on the bottom surface form tight junctions.
7. A method according to Claim 6, in which the induced motor neuron progenitor cells are derived from induced pluripotent stem cells from a human patient diagnosed with a CNS disorder.

8. A method according to Claim 6, in which the flow promotes the differentiation of the induced motor neuron progenitor cells.
9. A method according to Claim 8, in which the induced motor neuron progenitor cells differentiate into neurons.
- 5 10. A method according to Claim 9, in which the neurons exhibit a more mature electrophysiology as compared to the same neurons cultured in a static culture
11. A method according to Claim 6, in which the induced motor neuron progenitor cells are derived from induced pluripotent stem cells from a patient diagnosed with Amyotrophic lateral sclerosis (ALS).
- 10 12. A method according to Claim 6, in which the brain microvascular endothelial cells are derived from induced pluripotent stem cells from a patient diagnosed with MCT8-specific thyroid hormone cell-membrane transporter deficiency.
13. A method according to Claim 6, in which the induced motor neuron progenitor cells were stored frozen and then thawed prior to step (c).
- 15 14. A microfluidic culture of neurons in contact with flowing media in which the neurons are cultured in a microchannel or on a membrane of a microfluidic chip, in which the neurons exhibit a more mature electrophysiology as compared to the same neurons cultured in a static culture.
- 20 15. A microfluidic co-culture of neurons with vascular cells, in which the neurons and vascular cells are in contact with flowing culture media, in which the neurons exhibit a more mature electrophysiology as compared to the same neurons cultured in a static culture.