CLAIMS

1. A method of culturing cells, comprising:

(a) providing human ventral spinal neuron progenitor cells, brain microvascular endothelial cells and a dual channel microfluidic device comprising a first channel and a second channel separated by a membrane;

(b) seeding the ventral spinal neuron progenitor cells within the first channel and seeding brain microvascular endothelial cells within said second channel so as to create seeded cells such that at least a portion of said neuron progenitor cells and brain microvascular endothelial cells are in contact with each other; and

(c) culturing the seeded cells such that the cultured cells express a marker of spinal motor neurons.

2. A method according to Claim 1, in which the marker is selected from a list consisting of SMI32, nuclear marker islet1 (ISL1), Beta 3 tubulin (TUBB3), NKX6.1, neurofilament marker microtubule-associated protein 2 (MAP2), and synaptic marker synaptophysin (SYNP).

3. A method according to Claim 1, in which the first channel is fluidically coupled to a top chamber comprising an open region.

4. A method according to Claim 1, in which the dual channel microfluidic device further comprises a second chamber, the second chamber fluidically coupled to the second channel.

5. A method according to Claim 1, in which the ventral spinal neuron progenitor cells seeded within the first channel are disposed within a gel or gel-precursor.

6. A method according to Claim 1, in which the ventral spinal neuron progenitor cells are seeded on top of a gel present within a portion of the first channel.

7. A method according to Claim 1, in which the ventral spinal neuron progenitor cells are derived from induced pluripotent stem-cells.

8. A method according to Claim 1, in which the ventral spinal neuron progenitor cells are derived from embryonic stem-cells.

9. A method according to Claim 1, further comprising seeding glial cells within the first channel.

10. A method according to Claim 9, in which the glial cells comprise one or more cell types selected from the list comprising astrocytes, oligodendrocytes, ependymal cells, Schwann cells, microglia, and satellite cells.

11. A method according to Claim 1, in which the culturing comprises culture media.

12. A method according to Claim 1, in which the culturing comprises blood or at least one blood component.

13. A method according to Claim 7, in which the induced pluripotent stem cells, prior to step (a), are differentiated using a WNT agonist and SMAD inhibitors to neural ectoderm.

14. A method according to Claim 13, in which the neural ectoderm cells, prior to step (a), are exposed to retinoic acid and sonic hedgehog agonist to pattern said ventral spinal neural progenitor cells.

15. A method according to Claim 1, in which the ventral spinal neural progenitor cells were frozen, banked, and thawed before step (b).

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1. A method of culturing cells, comprising:

(a) providing human ventral spinal neuron progenitor cells, brain microvascular endothelial cells and a dual channel microfluidic device comprising a first channel and a second channel separated by a membrane;

(b) seeding the ventral spinal neuron progenitor cells within the first channel and seeding brain microvascular endothelial cells within the second channel so as to create seeded cells such that at least a portion of the neuron progenitor cells and brain microvascular endothelial cells are in contact with each other;

(c) differentiating at least a portion of the ventral spinal neuron progenitor cells with a flowing culture media in the first microchannel; and

(d) culturing the seeded cells such that the ventral spinal neuron progenitor cells express a marker of spinal motor neurons.

2. A method according to Claim 1, in which the marker is selected from a list consisting of SMI32, nuclear marker islet1 (ISL1), Beta 3 tubulin (TUBB3), NKX6.1, neurofilament marker microtubule-associated protein 2 (MAP2), and synaptic marker synaptophysin (SYNP).

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9. A method according to Claim 1, further comprising seeding glial cells within the first channel.

10. A method according to Claim 9, in which the glial cells comprise one or more cell types selected from the list comprising astrocytes, oligodendrocytes, ependymal cells, Schwann cells, microglia, and satellite cells.

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12. A method according to Claim 1, in which the culturing comprises blood or at least one blood component.

13. A method according to Claim 7, in which the induced pluripotent stem cells, prior to step (a), are differentiated using a WNT agonist and SMAD inhibitors to neural ectoderm.

14. A method according to Claim 13, in which the neural ectoderm cells, prior to step (a), are exposed to retinoic acid and sonic hedgehog agonist to pattern the ventral spinal neural progenitor cells.

15. A method according to Claim 1, in which the ventral spinal neural progenitor cells were frozen, banked, and thawed before step (b).