CLAIMS

1. A method of culturing cells, comprising:

(a) providing a microfluidic device comprising a membrane, the membrane comprising a first surface and a second surface;

(b) seeding induced motor neuron cells on the first surface and skeletal muscle cells on the second surface so as to create seeded cells;

(c) exposing the seeded cells to a flow of culture media for a period of time; and

(d) culturing the seeded cells under conditions such that a neuromuscular junction forms.

2. A method according to Claim 1, in which the culturing induces the skeletal muscle cells to differentiate into the myofibers.

3. A method according to Claim 1, in which the culturing of seeded cells is for more than ten days.

4. A method according to Claim 1, in which the induced motor neuron cells are derived from induced pluripotent stem cells from a human.

5. A method according to Claim 4, in which the human is diagnosed with a CNS disorder.

6. A method according to Claim 1, further comprising the step of (e) assessing the health and/or integrity of the neuromuscular junction.

7. A method according to Claim 1, further comprising the step of (e) electrically stimulating the motor neurons and/or the skeletal muscle cells.

8. A microfluidic device comprising

(a) a membrane, the membrane comprising a top surface and a bottom surface; and

(b) induced motor neuron cells on the top surface and skeletal muscle cells on the bottom surface.

9. A device according to Claim 8, in which the induced motor neuron cells are derived from induced pluripotent stem cells from a human.

10. A device according to Claim 9, in which the human is diagnosed with a CNS disorder.

11. A device according to Claim 10, in which the CNS disorder is ALS.

12. A method of culturing cells, comprising:

(a) providing a microfluidic device comprising a membrane, the membrane comprising a top side and a bottom side;

(b) seeding neurons on the top side and non-neuronal cells on the bottom side so as to create seeded cells;

(c) exposing at least some of the seeded cells to a flow of culture fluid for a period of time; and

(d) culturing the seeded cells under conditions such that at least a portion of the neuron has transmigrated the membrane in which contact is made with some of the non-neuronal cells.

13. A method according to Claim 12, in which the seeded cells further comprise endothelial cells.

14. A method according to Claim 12 , in which the culture fluid comprises blood or blood components.

15. A method according to Claim 12 , in which the neurons comprise neuronal terminal bulbs and the contact is made between the bulbs and the non-neuronal cells.

16. A method according to Claim 12 , in which the non-neuronal cells are muscle cells.

17. A method according to Claim 16, in which the muscle cells are skeletal muscle cells.

18. A method according to Claim 16, in which the muscle cells are smooth muscle cells.

19. A method according to Claim 16, in which the muscle cells are cardiac muscle cells.

20. A method according to Claim 12 , in which the non-neuronal cells are selected from the group consisting of intestinal epithelial cells, lung epithelial cells and skin epithelial cells.

21. A method according to Claim 12 , in which the neurons are motor neurons.

22 A method of culturing cells, comprising:

(a) providing a microfluidic device comprising a membrane, the membrane separating a top channel and a bottom channel;

(b) seeding induced motor neuron cells in the top channel and skeletal muscle cells in the bottom channel so as to create seeded cells;

(c) exposing the seeded cells to a flow of culture media for a period of time; and

(d) culturing the seeded cells such that a neuromuscular junction forms, exhibiting spontaneous bursts of neuronal activity, within the microfluidic device.

23. A method of culturing cells, comprising:

(a) providing a microfluidic device comprising a membrane, the membrane separating a top channel and a bottom channel;

(b) seeding induced motor neuron cells in the top channel and skeletal muscle cells in the bottom channel so as to create seeded cells;

(c) exposing the seeded cells to a flow of culture media for a period of time; and

(d) culturing the seeded cells such that a neuromuscular junction forms, comprising action potential spikes having an amplitude, duration and frequency, within the microfluidic device.

24. A method according to Claim 1, the neuromuscular junction comprising a terminal bulb of a motor neuron transmigrating the membrane and contacting the skeletal muscle cells.

25. A method according to Claim 22, the neuromuscular junction comprising a terminal bulb transmigrating the membrane and contacting the skeletal muscle cells.

26. A method according to Claim 23, the neuromuscular junction comprising a terminal bulb transmigrating the membrane and contacting the skeletal muscle cells.