## CLAIMS

What is claimed is:

1. A method of culturing cells, comprising: a) providing a microfluidic device comprising a membrane, said membrane comprising a first surface and a second surface; b) seeding viable human hepatocytes on said first surface and viable human liver sinusoidal endothelial cells on said second surface; and c) culturing said seeded cells under flow conditions such that said cells remain viable for at least 14 days.

2. The method of Claim 1, wherein said human hepatocytes are primary human hepatocytes that were previously cryopreserved.

3. The method of Claim 1, further comprising d) assessing the level of activity of one or more cellular enzymes.

4. The method of Claim 1, further comprising d) assessing the level of one or more cellular proteins.

5. The method of Claims 3 or 4, wherein, prior to step d), said seeded viable human hepatocytes are exposed to an agent.

6. The method of Claim 5, wherein said agent is a drug candidate.

7. The method of Claim 1, wherein, prior to step b), said top surface of said membrane is treated with at least one extracellular matrix protein.

8. The method of Claim 7, where the at least one extracellular matrix protein comprises collagen.

9. A method of culturing cells, comprising: a) providing a microfluidic device comprising a membrane, said membrane comprising a first surface and a second surface; b) seeding viable rat hepatocytes on said first surface and rat liver sinusoidal endothelial cells on

said second surface; c) culturing said seeded cells under flow conditions such that said cells remain viable for at least 14 days.

10. The method of Claim 9, wherein said flow conditions comprise perfusing said cells with media.

11. The method of Claim 9, wherein said rat hepatocytes are primary rat cryopreserved hepatocytes.

12. The method of Claim 9, wherein, prior to step b), said top surface of said membrane is treated with a mixture of fibronectin, collagen I and collagen IV.

13. The method of Claim 9, wherein said viable rat hepatocytes are covered with an overlay comprising a mixture of Matrigel and fibronectin.

14. The method of Claim 9, wherein, prior to step d), said seeded viable rat hepatocytes are exposed to an agent.

15. The method of Claims 1 or 9, wherein the microfluidic device further comprises cholangiocytes.

16. The method of Claims 1 or 9, wherein the hepatocytes display at least one of the following characteristics:

cuboidal morphology;

formation of a bile canaliculus network;

albumin secretion over a period of time; and

at least a 2-fold increase in activity of CYP450 drug metabolizing enzyme in the presence of an agent that induces CYP450 drug metabolizing enzyme.

17. The method of Claim 9, wherein, prior to step b), said top surface of said membrane is treated with fibronectin.

18. The method of Claim 9, wherein, prior to step b), said top surface of said membrane is treated with fibronectin and collagen.

19. A method of culturing cells, comprising: a) providing a microfluidic device comprising a membrane, said membrane comprising a first surface and a second surface; b) seeding viable hepatocytes on said first surface and viable cholangiocytes on said second surface; and c) culturing said seeded cells under flow conditions such that said cells remain viable for at least 14 days.