**CLAIMS**

1. A microfluidic device comprising a membrane, the membrane comprising a first surface and a second surface, a first extracellular matrix comprising Collagen I and a second extracellular matrix, in which the first surface comprises hepatocytes and the second surface comprises endothelial cells, in which the first extracellular matrix is between the hepatocytes and the first surface of the membrane and in which the hepatocytes are overlaid by the second extracellular matrix.

2. A microfluidic device according to Claim 1, in which the hepatocytes are primary hepatocytes.

3. A microfluidic device according to Claim 1, further comprising additional cell types over, under or within the gel, the additional cell types selected from the group consisting of Stellate cells and Kupffer cells.

4. A method of culturing cells, comprising:

(a) providing a microfluidic device comprising a membrane, the membrane comprising a first surface and a second surface, and a first extracellular matrix comprising Collagen I on the first side;

(b) seeding viable hepatocytes on the first surface and viable endothelial cells on the second surface;

(c) overlaying the hepatocytes with a second extracellular matrix; and

(d) culturing the seeded cells under flow conditions such that the cells remain viable for at least 28 days.

5. A method according to Claim 4, in which the hepatocytes are primary hepatocytes.

6. A method of culturing cells, comprising:

(a) providing

(i) a microfluidic device comprising a first chamber, a second chamber, a removable top, and a membrane, the membrane comprising a first surface and a second surface,

(ii) hepatocytes and endothelial cells;

(iii) material capable of forming a gel; and

(iv) an extracellular matrix composition;

(b) removing the removable top and introducing the material into the microfluidic device such that a gel forms in the first chamber, in the second chamber, or in both chambers; and

(c) introducing the gel, and in any order,

(i) the hepatocytes into the first chamber such that the hepatocytes either affix to the first surface of the membrane or the gel is between the hepatocytes and the first surface of the membrane, and

(ii) the endothelial cells such that the endothelial cells either affix to the second surface of the membrane or the gel is between the endothelial cells and the second surface of the membrane;

(d) overlaying the hepatocytes with the extracellular matrix composition; and

(e) culturing the cells under flow conditions with media.

7. A method according to Claim 6, further comprising (f) adding additional cell types over, under or within the gel, the additional cell types selected from the group consisting of Kupffer cells and stellate cells.

8. A method according to Claim 6, in which the hepatocytes are selected from the group consisting of viable rat hepatocytes, viable dog hepatocytes and viable human hepatocytes.

9. A method of culturing cells, comprising

(a) providing

(i) a microfluidic device comprising a first chamber, a second chamber, a gel comprising Collagen I, a membrane, the membrane comprising a first surface and a second surface,

(ii) hepatocytes, endothelial cells and Stellate cells;

(b) introducing the gel, and in any order,

(i) the hepatocytes into the first chamber such that the hepatocytes either affix to the first surface of the membrane or the gel is between the hepatocytes and the first surface of the membrane,

(ii) the endothelial cells such that the endothelial cells either affix to the second surface of the membrane or the gel is between the endothelial cells and the second surface of the membrane, and

(iii) Stellate cells within the gel, in which the gel inhibits activation and/or migration of the Stellate cells; and

(c) culturing the cells under flow conditions with media.

10. A method according to Claim 9, further comprising the step of modifying the porosity and/or stiffness of the gel.

11. A method for culturing cells, comprising:

(a) providing a fluidic device comprising a first structure defining a first chamber, a second structure defining a second chamber, and a membrane located at an interface region between the first chamber and the second chamber, the membrane including a first side facing toward the first chamber and a second side facing toward the second chamber;

(b) introducing a first extracellular comprising Collagen I into the first and/or second chamber;

(c) seeding hepatocytes in the first chamber and endothelial cells in the second chamber;

(d) overlaying the hepatocytes with a second extracellular matrix;

(e) perfusing at least one of the first chamber and second chamber with at least one fluid;

(f) disposing a test compound into the fluid, or introducing a second fluid comprising the test compound, such that hepatocytes, endothelial cells or both come in contact with the test compound; and

(g) stopping the perfusing in the first chamber, the second chamber, or both, so as to increase the residence time of the test compound within the fluidic device.

12. A method according to Claim 11, further comprising (h) assessing the clearance of the test compound.

13. A method according to Claim 12, in which the assessing the clearance comprises measuring the disappearance of the test compound.

14. A method for culturing cells, comprising:

(a) providing a fluidic device comprising a first structure defining a first chamber, a second structure defining a second chamber, and a membrane located at an interface region between the first chamber and the second chamber, the membrane including a first side facing toward the first chamber and a second side facing toward the second chamber;

(b) introducing a first extracellular matrix comprising Collagen I into the first chamber;

(c) seeding hepatocytes in the first chamber and endothelial cells in the second chamber;

(d) overlaying the hepatocytes with a second extracellular matrix;

(e) perfusing at least one of the first chamber or second chamber with at least one fluid;

(f) disposing a test compound into the fluid such that the hepatocytes, endothelial cells or both come in contact with the test compound; and

(g) recirculating the fluid so as to increase the interaction time of the test compound with the cells.

15. A method according to Claim 14, further comprising (h) assessing the clearance of the test compound.