CLAIMS

What is claimed is:

1. A method of cell differentiation, comprising:

a) seeding viable airway epithelial cells on to a surface of a device under conditions such that at least a portion adheres thereon;

b) introducing a stimuli responsive polymer gel on top of the cells under conditions such that differentiation of the cells is prevented and the cells remain viable, wherein the polymer gel blocks cells from air exposure;

c) removing the gel and exposing the cells to the air and allowing the cells to differentiate; and

d) detecting cell differentiation.

2. The method of claim 1, wherein the lung epithelial cells are airway epithelial cells.

3. The method of claim 1, wherein said detecting comprising detecting ciliated epithelium.

4. A method for restricting the position of cells in a microfluidic device, the device including a first region and a second region, the method comprising:

polymerizing a biopolymer material in the first region;

seeding cells such that they attach to the second region but are prevented from attaching to the first region by the polymerized material such that the adhered cells remain viable; and

after the seeding, depolymerizing and removing the biopolymer material from the first region.

5. The method of claim 4, wherein the first region and second region are separated by a porous membrane, the porous membrane having top and bottom surfaces.

6. The method of claim 5, further comprising imaging cell migration across the porous membrane.

7. The method of claim 4, wherein the depolymerizing is in response to applying an external stimulus.

8. A method for restricting the position of cells in a microfluidic device, the device including a first compartment and a second compartment separated by a porous membrane, wherein said porous membrane permits the passage of at least a first cell type, the method comprising:

a) forming a gel in the first compartment or portion thereof so as to block the passage of cells of said first type through at least a portion of said membrane; and

b) seeding cells of the said first cell type in a region of the second compartment; and

c) removing the gel from the microfluidic device.

9. The method of claim 8, further comprising d) culturing said cells.

10. The method of claim 9, wherein the gel is removed by a method comprising depolymerizing the gel in response to applying an external stimulus.

11. The method of claim 10, wherein the external stimulus is one or more of a temperature application, a light application, a pH application, an enzyme application and a small molecule application.

12. The method of claim 8, wherein the forming of the gel in step a) includes polymerizing a biopolymer material.

13. The method of claim 8, wherein the microfluidic device is an organ-on-chip device.

14. The method of claim 8, wherein the microfluidic device further includes ports in fluid communication with the first and second compartments and the seeding comprises introducing cells into the ports in a flow of culture media.

15. A method for restricting the position of cells in a microfluidic device, the device including a porous membrane, the porous membrane including i) pores and ii) first and second sides, the method comprising:

a) forming a gel in the first or second side of the membrane, or portion thereof; and

b) seeding cells on a region of the membrane on the side opposite to the side comprising the gel under conditions such that the cells are prevented by the gel from moving through the

pores, thereby restricting the position of the cells in the microfluidic device.

16. The method of claim 15, further comprising c) removing the gel from the microfluidic device.

17. The method of claim 1, wherein said stimuli responsive gel is selected from the group consisting of poly(N-isopropylacrylamide), alginates, and a combination thereof.