CLAIMS

1. A method of culturing cells, comprising:

(a) providing

(i) a microfluidic device comprising first and second microfluidic channels separated by a membrane, the membrane comprising top and bottom surfaces,

(ii) viable lamina propria-derived cells

(iii) viable gastrointestinal epithelial cells; and

(iv) viable endothelial cells;

(b) introducing the lamina propria-derived cells and gastrointestinal epithelial cells into the microfluidic device so as to create a co-culture on the top surface of the membrane;

(c) introducing the viable endothelial cells onto the bottom surface of the membrane; and

(d) perfusing the co-culture with fluid under flow conditions to create a contiguous epithelial cell layer that covers the viable lamina propria-derived cells, the endothelial cells and the epithelial cell layer having barrier function.

2. A method according to Claim 1, in which the lamina propria-derived cells are human lamina propria-derived cells.

3. A method according to Claim 1, in which the fluid in step (c) comprises tissue-culture medium.

4. A method according to Claim 1, in which the lamina propria-derived cells and viable gastrointestinal epithelial cells are introduced in step (b) sequentially.

5. A method according to Claim 1, in which the lamina propria-derived cells were derived from inflamed gastrointestinal tissue.

6. A method according to Claim 1, in which the lamina propria-derived cells comprises cells derived from a site of an ulcer or injury.

7. A method according to Claim 1, in which the lamina propria-derived cells were obtained from a human with inflammatory colitis.

8. A method according to Claim 7, in which the lamina propria-derived cells obtained from a human with inflammatory colitis cause weakened barrier function of the epithelial cell layer as compared to healthy lamina propria-derived cells.

9. A method according to Claim 1, further comprising measuring the barrier function.

10. A method of culturing cells, comprising:

(a) providing a microfluidic device comprising first and second microfluidic channels separated by a membrane, the membrane comprising a top surface and a bottom surface;

(b) seeding viable lamina propria-derived cells and viable gastrointestinal epithelial cells on the top surface and viable endothelial cells on the bottom surface so as to create seeded cells; and

(c) culturing the seeded cells in fluid under flow conditions to create a contiguous epithelial cell layer, the epithelial cell layer having barrier function.

11. A method according to Claim 10, in which the gastrointestinal endothelial cells comprise human gastrointestinal endothelial cells.

12. A method according to Claim 10, in which the gastrointestinal epithelial cells are selected from the group consisting of Caco-2 epithelial cells, primary small intestinal epithelial cells and primary large intestinal epithelial cells.

13. A method according to Claim 10, in which the lamina propria-derived cells comprise immune cells from healthy tissue.

14. A method according to Claim 10, in which the lamina propria-derived cells comprise immune cells from disease tissue.

15. A method according to Claim 10, further comprising a step after step (c) of sampling cytokines present in the fluid.

16. A method according to Claim 15, in which the cytokines are selected from the group consisting of interleukin-6 and interleukin-9.

17. A method according to Claim 10, further comprising adding an agent to the cells, the agent comprising a drug.

18. A method according to Claim 10, further comprising contacting the epithelial cell layer with a bacterial antigen.

19. A method according to Claim 18, in which the bacterial antigen is PAM2CSK4.

20. A method according to Claim 18, further comprising after contacting with the bacterial antigen, measuring barrier function of the epithelial cell layer.

21. A method according to Claim 17, further comprising detecting a response to the agent comprising a drug.