CLAIMS

1. A method of providing an *in vitro* intestinal model system, the method comprising:

(a) providing (i) an intestinal enteroid or colonoid comprising primary intestinal epithelial cells, (ii) a microfluidic culture device, the device comprising a porous membrane having first and second surfaces, the membrane in fluidic communication with a microchannel, the microchannel in fluidic communication with a source of fluid;

(b) disrupting the intestinal enteroid or colonoid comprising primary intestinal epithelial cells into enteroid or colonoid fragments;

(c) seeding the second surface of the porous membrane with the enteroid or colonoid fragments so as to create seeded primary intestinal epithelial cells;

(d) expanding the seeded primary intestinal epithelial cells so as to create a monolayer of cells; and

(e) differentiating the monolayer of cells so as to create two or more different differentiated intestinal cell types.

2. A method according to Claim 1, in which the method further comprises:

providing, in step (a), intestinal endothelial cells; and

seeding, in step (c), a culture of the intestinal endothelial cells on the first surface of the porous membrane.

3. A method according to Claim 1 or 2, in which the epithelial monolayer is exposed to the fluid from the source of fluid at a flow rate whereupon intestinal villi; folds; and/or an intact intestinal barrier form.

4. A method according to any preceding claim, in which the different differentiated intestinal cell types comprise absorptive enterocytes, Paneth cells, goblet cells and enteroendocrine cells.

5. A method according to Claim 4, in which at least one of the differentiated intestinal cell types exhibits mucus secretion.

6. A method according to any preceding claim, in which step (b) comprises disrupting in the presence of a ROCK inhibitor.

7. A method according to Claim 6, in which the ROCK inhibitor is Y27632.

8. A method according to any preceding claim, in which the method further comprises step (f) maintaining the culture of the intestinal epithelial cells.

9. A method according to Claim 8, in which the maintaining step comprises providing the epithelial cells with expansion medium comprising one or more of the following:

Wnt-3A; EGF; Rspo1; Noggin; gastrin; TGF-β receptor inhibitor; p38 MAPK inhibitor.

10. A method according to Claim 8 or 9, in which the maintaining step comprises providing the epithelial cells with expansion medium comprising Wnt-3A; EGF; Rspo1; Noggin; gastrin; TGF-β receptor inhibitor; and p38 MAPK inhibitor.

11. A method according to any preceding claim, the method further comprising:

providing, in step (a), fibroblasts; and

seeding, in step (c), a culture of the fibroblasts on the first surface of the porous membrane.

12. A method according to Claim 11, in which the fibroblasts are cultured with the epithelial cells.

13. A method according to Claim 11, in which the fibroblasts are cultured on a hydrogel on the membrane.

14. A method according to Claim 3, further comprising measuring the permeability of the intestinal barrier.

15. A method according to Claim 1, in which the fragments comprise groups of from 2 to 100 intestinal epithelial cells.