CLAIMS

1. A method of producing a co-culture of intestinal epithelial cells and microbial cells, comprising:

providing a cell culture system comprising a fluidic device having a fluid channel connected to a fluid source, the fluid source supplying fluid to the fluid channel, and a membrane positioned within the channel;

providing a fluid suitable for maintaining intestinal epithelial cells to the cell culture system such that the fluid contacts the intestinal epithelial cells;

culturing the intestinal epithelial cells *in vitro*, in which the intestinal epithelial cells adhere to at least one surface of the membrane;

maintaining microbial cells in the system for at least 1 day, in which the microbial cells adhere to the surface of the viable intestinal epithelial cells; and

flowing fluid continuously through the channel such that microbial cells not adhering to the intestinal epithelial cells are washed out.

2. A method according to Claim 1, in which the fluid flows through the microchannel at a flow rate less than 500 μL/hr.

3. A method according to Claim 1, in which the intestinal epithelial cells are selected from the group consisting of: Caco2 cells; HT-29 cells; primary small intestine epithelial cells; primary large intestine epithelial cells; paneth cells; crypt cells; and mucus-secreting cells.

4. A method according to Claim 1, in which the intestinal epithelial cells are from stem cells.

5. A method according to Claim 4, in which the stem cells are iPS cells or ESC cells.

6. A method according to Claim 1, in which the device further comprises at least one layer of endothelial cells on at least the second surface of the membrane.

7. A method according to Claim 1, in which the membrane is at least partially porous.

8. A method according to Claim 1, in which the shear stress on the fluid flowing through the microchannel is less than 1.0 dyne/cm^2.

9. A method according to Claim 1, in which the bacterial cells are selected from the group consisting of:

Lactobacillus; Bacterioides; Ruminococcus; Peptococcus; Peptostreptococcus; Bifidobacterium; Escherichia; Achromobacter; Acidaminococcus fermentans; Acinetobacter cacoaceticus; Aeromonas; *Alcaligenes faecalis*; Bacillus; *Butyriviberio fibrosolvens*; Camplyobacter; *Enterobacter cloacae*; *Enterococcus faecalis*; *Enterococcus faecium*; Flavobacterium; Mycobacterium; Mycoplasma; *Plesiomonas shigelloides*; *Propionibacterium acnes*; *Pseudomonas aeruginosa*; *Ruminococcus bromii*; Sarcina; *Staphylococcus aureus*; *Streptococcus anginosus*; Veillonella; Vibrio; *Yersinia enterocolitica*; and *Streptococcus thermophilus*.

10. A method according to Claim 9, in which the Lactobacillus is *Lactobacillus acidophilus*; *Lactobacillus plantarum*; *Lactobacillus paracasei*; *Lactobacillus bulgaricus*; *Lactobacillus rhamnosus*; or *Lactobacillus rhamnosus* GG.

11. A method according to Claim 9, in which the Bifidobacterium is *Bifidobacterium breve*; *Bifidobacterium longum*; or *Bifidobacterium infantis*.

12. A method according to Claim 9, in which:

the Escherichia is *Escherichia coli*;

the Campylobacter is *Campylobacter coli*;

the Bacillus is *Clostridium difficile*; or

the Bacillus is *Clostridium sordelli*.

13. A method according to Claim 1, in which the bacterial cells are aerobic; or in which the bacterial cells comprise aerobic and anaerobic bacterial cells.

14. A method according to Claim 1, in which the bacterial cells comprise aerobic and anaerobic bacterial cells.

15. A method according to Claim 1, in which the channel comprises walls that forma chamber and the membrane is mounted to the chamber wall.