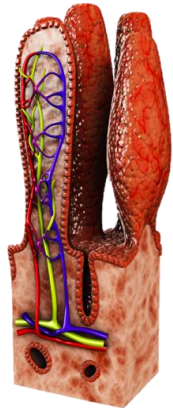


# A Quad-Culture Microfluidic Human Gut-on-a-Chip System

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## INTRODUCTION



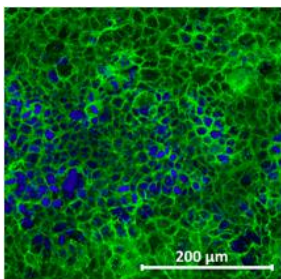
- Successful treatments in animal models rarely translate into effective drugs for humans
- Microfluidic devices are a cheap and effective way to model the gut

**Goal:** To better recapitulate the intestinal environment, we seek to mimic the anatomy of the human villi in our device.

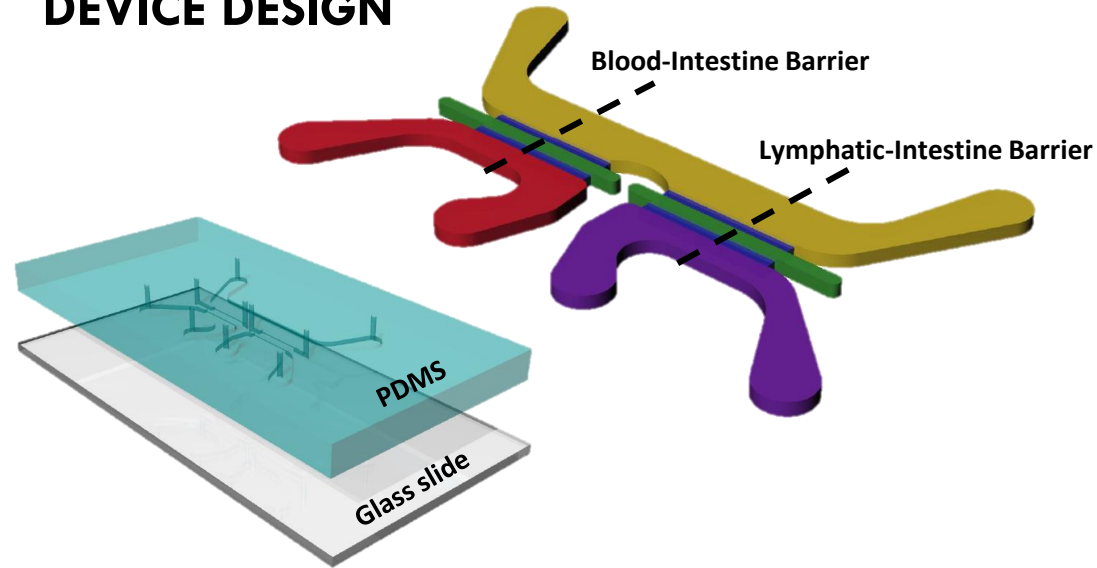
## METHODS

### Staining and Imaging of Quad-Culture Model

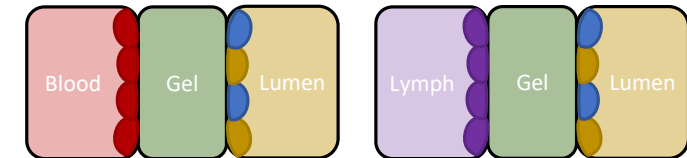
- Live-dead cell assay
- Actin and nuclei visualization
- Immunofluorescence staining of mucus and cell junctions



## DEVICE DESIGN



## CELL BARRIERS



Blood-Intestine

Lymph-Intestine

(Cross-sections of device design)

- **HT-29** and **Caco-2**: colon cancer cells and epithelial colorectal cancer cells (respectively) that form monolayer like enterocyte in the small intestine.
- **Blood endothelial cells** or **Lymphatic endothelial cells**: form interface between blood or lymph and the lumen.
- **Gel Channel**: fibrin structure provides support and acts as the extra-cellular matrix.

## CONCLUSION

**In progress:** device fabrication and cell culture.

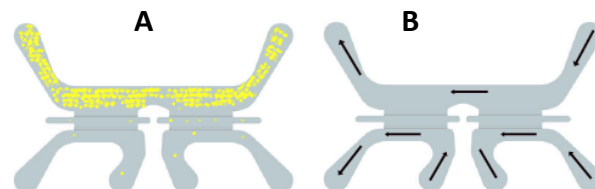
**Future applications:** statistically reliable clinical trials with novel drugs; modelling microbiome.

## WORKS CITED

1. Worp et al, 2010. PLoS Medicine.
2. Bein et al, 2018. Cellular and Molecular Gastroenterology and Hepatology.
3. Sun et al, 2009. Textbook of Gastroenterology.
4. Wang et al, 2016. Cell Metabolism.

### Evaluating Barrier Function (A) and Comparing Flow vs. Static Conditions (B)

- A.** Measure and quantify diffusion of lucifer yellow into blood and lymphatic channels.
- B.** Evaluate villi-like structure formation, MUC2 expression, and barrier formation due to flow condition.



### Measuring the Selective Uptake of Chylomicrons

Add fluorescently-labelled lipids to the lumen and observe chylomicron localization to lymphatic channel.

**Chylomicrons:** lipoproteins that transport dietary lipids in the body.

