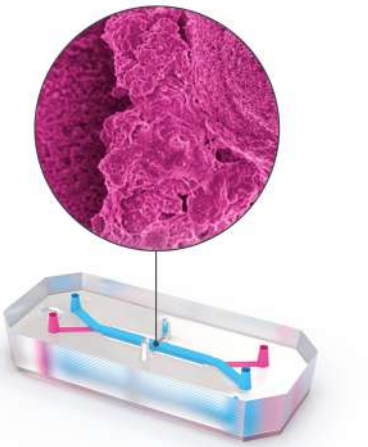
Emulate Human Colon Intestine Bio-Kit



Investigate mechanisms of colon inflammation and immune cell recruitment to discover novel and targeted anti-inflammatory drug candidates in a human-relevant Organ-on-a-Chip model.

Overview

The human colon plays a critical role in health and gastrointestinal disease, but it remains challenging to study due to the complex cell-cell interactions and dynamic conditions that are critical drivers of colon functionality. Conventional *in vitro* models cannot recreate this level of complexity, while animal models suffer from species differences that lead to clinical translation issues. The Emulate Colon Intestine-Chip addresses these challenges, as it is the only model that recreates *in vivo* physiology by incorporating pre-qualified, biopsy-derived primary human organoids and colonic endothelial cells in a dynamic, tissue-specific microenvironment. This model can be applied to study inflammatory response and immune cell recruitment, allowing researchers to better understand disease mechanisms and evaluate drug efficacy.

Model Configuration

The Colon Intestine-Chip combines organoids with Organ-Chips to overcome many of the limitations of organoid suspension culture, including its lack of vasculature and mechanical forces. Organ-on-a-Chip technology enables researchers to recreate the intestinal microenvironment with improved cell morphology, functionality, and gene expression. The model features two parallel channels separated by an extracellular-matrix-coated porous membrane, enabling cell-cell interactions between epithelium and vasculature (see **Figure 1**). Vacuum channels alongside the culture channels allow users to apply cyclic stretch to recreate intestinal peristalsis.

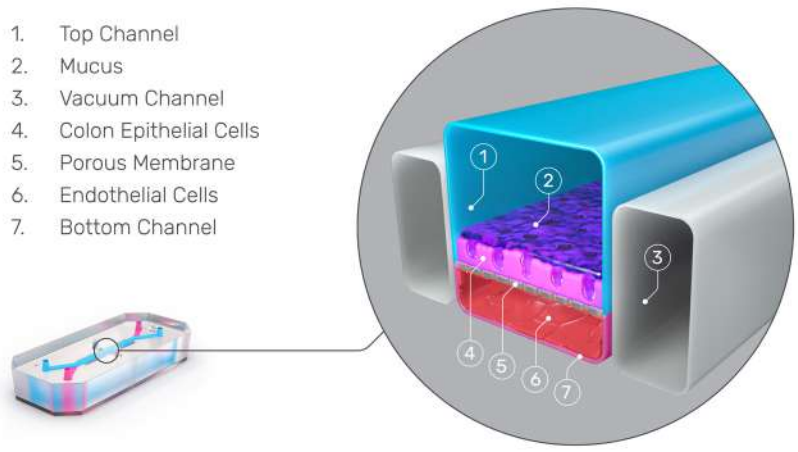


Figure 1: *Colon Intestine-Chip Diagram.*

Model Characterization

Under the dynamic conditions of the Colon Intestine-Chip, cells differentiate into characteristic populations and structures, creating the intestinal barrier and forming microvilli. This contrasts with conventional cell cultures, which have limited and largely undifferentiated cell populations as well as a lack of physical stimuli.

- **Primary human model:** Avoids translational issues caused by species differences.
- **Cellular diversity:** Develops the expected epithelial subtypes at the expected ratios seen *in vivo*, with improved differentiation over organoids.
- ***In vivo*-like gene expression:** Produces transcriptome profile more closely resembling human tissue compared to organoids.
- **Physiologically relevant morphology:** Drives increased epithelial polarization and differentiation using mechanical forces.
- **Enhanced barrier function:** Creates well-defined tight junctions and low permeability due to co-culture with colonic endothelial cells (see **Figure 2**).

Learn more in the Colon Intestine-Chip Inflammation Application Note.

SUPPORTED APPLICATION

Cytokine-Mediated Inflammation

The Colon Intestine-Chip has been characterized as a model of inflammation—a mechanism seen in "leaky gut" diseases such as inflammatory bowel disease—enabling researchers to identify novel drug targets and validate those targets' effects. By administering proinflammatory cytokines, such as IFNγ or IL22, colonic barrier inflammation can be modeled in a concentration-, time-, and donor-dependent manner, and anti-inflammatory drug efficacy can be evaluated. Measurable endpoints include:

- Barrier disruption (see **Figures 3-4**)
- Inflammatory gene pathway enrichment
- Pro-inflammatory cytokine secretion
- Apoptotic activation

Learn more in the Colon Intestine-Chip Characterization Note.

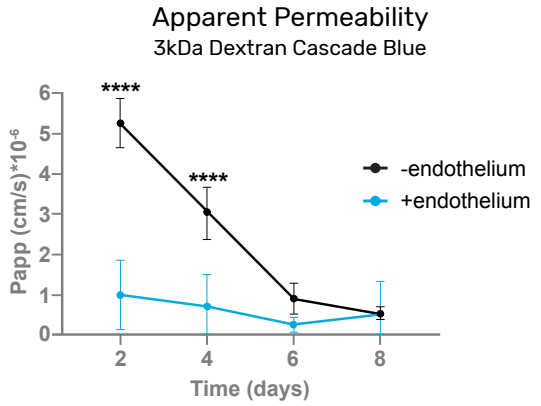


Figure 2: *Apparent permeability (P_{app}) of 3 kDa dextran cascade blue in the presence or absence of endothelial co-culture. n= 3-11 chips/group, mean±95% CI. Two-way ANOVA, Tukey's post hoc test, ****: p<0.0001.*

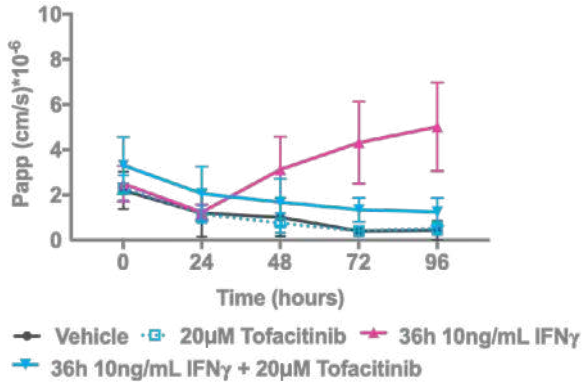


Figure 3: *Co-treatment with tofacitinib prevents cytokine-mediated (IFNγ) barrier disruption. N=3-11 chips/group, mean±95% CI.*

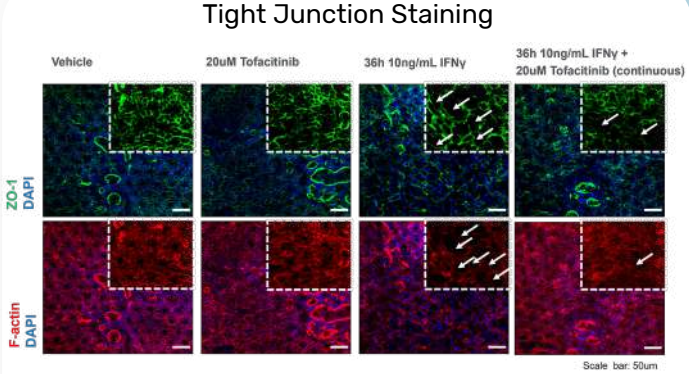


Figure 4: *Tofacitinib prevents the re-localization of ZO-1 and F-actin, indicating that treatment prevented the degeneration of the tight junctions. White arrows indicate degeneration of tight junctions.*

SUPPORTED APPLICATION

Inflammatory Immune Cell Recruitment

The Colon Intestine-Chip offers an unparalleled window into the complex mechanisms of human immune response in inflammatory bowel disease (IBD). By administering peripheral blood mononuclear cells (PBMCs) into the vascular channel in the presence of a pro-inflammatory priming stimulus, researchers can create a highly holistic human- and colon-specific recapitulation of immune cell recruitment and downstream response. This model can be applied to investigate mechanisms of inflammation and evaluate the efficacy of IBD drug candidates. Emulate has demonstrated:

- Gut-tropic immune cell attachment to vasculature
- Immune cell migration through vasculature to epithelial tissue
- Immune cell activation and downstream effector function
- Damage to epithelial tight junctions and barrier permeability
- Co-administration of clinically relevant drugs to prevent inflammatory response (see **Figure 5**)

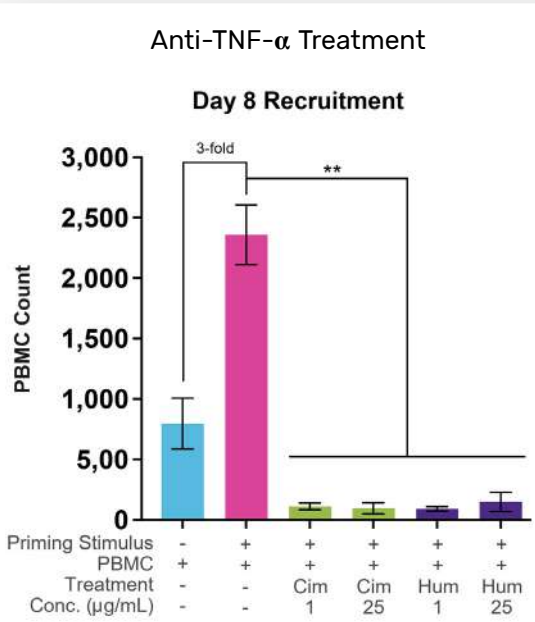


Figure 5: *Inhibition of immune cell recruitment by Anti-TNF-α therapies. 1-way ANOVA, Tukey's multiple comparison test (n=4). *p<0.01. Error bars = mean ± SEM.*

Part of the Human Emulation System®

The Colon Intestine-Chip is designed to be cultured using the Human Emulation System, a complete Organ-on-a-Chip solution that includes instruments, consumables, and software, providing the dynamic conditions needed to culture up to 12 Organ-Chips.

Colon Intestine-Chip Specifications:

Specification	Details
Supported applications	Cytokine-mediated inflammation and inflammatory immune cell recruitment
Storage conditions	• Cells: Store in liquid nitrogen • ER-1® and ER-2® Reagents: 2–8°C • Other kit components: Ambient temperature (15–25°C)
Shelf life	1 year from date of manufacture
Cell types	Biopsy-derived human colonic organoids and primary colonic microvascular endothelial cells
Characterization endpoints	• Transcriptomic profiling, qPCR, and immunofluorescent analysis confirming key cell types and transporters • Barrier integrity (P_{app}, tight junction staining) • Cell death (Caspase-3, STAT3) • Pro-inflammatory cytokine release

Ordering Information

Every Colon Intestine Bio-Kit includes the essential components needed to create the Colon Intestine-Chip—including Emulate-qualified cells—and is available in multiple sizes to meet various study needs.

To learn more, visit emulatebio.com/colon-intestine-chip

Product Name	Cells	Chips per Kit	Catalog Number
Colon Intestine Bio-Kit	Chip-S1® Stretchable Chips, Pod® Portable Modules, ER-1® / ER-2® Chip Activation Reagents, Steriflip® Filter, Emulate-qualified human cells: Biopsy-derived human colonic organoids and primary colonic micro-vascular endothelial cells.	12	BIO-CH1-12
		24	BIO-CH1-24