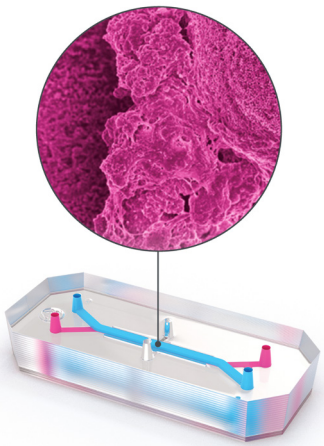
Colon Intestine-Chip S1 BioKit

Investigate mechanisms of colon inflammation and immune cell recruitment in a human-relevant 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 Colon Intestine-Chip S1 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 Con iguration

The Colon Intestine-Chip S1 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 the epithelium and vasculature (see **Figure 1**). Vacuum channels alongside the culture channels allow users to apply cyclic stretch to recreate intestinal peristalsis.

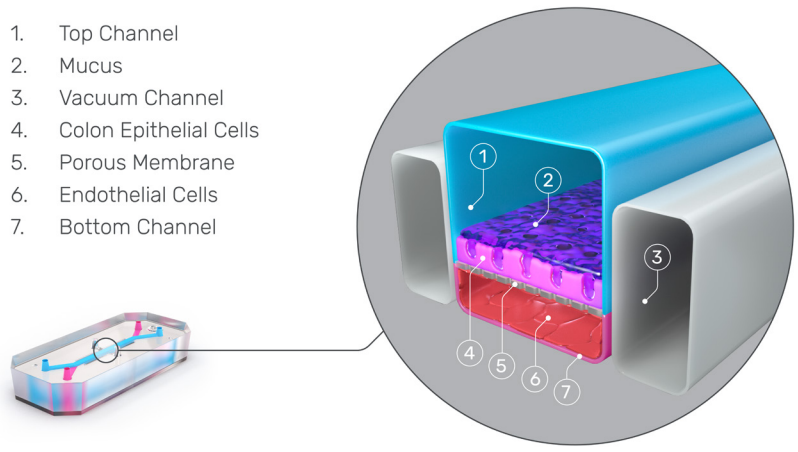


Figure 1: *Colon Intestine-Chip S1 Diagram.*

Model Characterization

Under the dynamic conditions of the Colon Intestine-Chip S1, 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 a 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 Characterization Note.

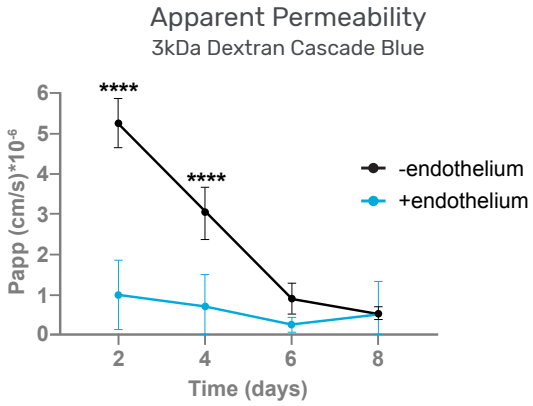


Figure 2: *Apparent permeability (P_{app}) of 3 kDa dextran cascade blue in the presence or absence of endothelial co-culture. n= 3-11 chips/group, mean±95% CI. Two-way ANOVA, Tukey's post hoc test, ****: p<0.0001.*

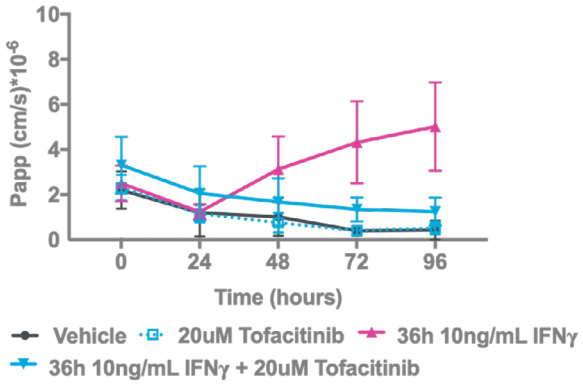


Figure 3: *Co-treatment with tofacitinib prevents cytokine-mediated (IFNγ) barrier disruption. N=3-11 chips/group, mean±95% CI.*

SUPPORTED APPLICATION

Cytokine-Mediated Inflammation

The Colon Intestine-Chip S1 can be used 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 Inflammation Application Note.

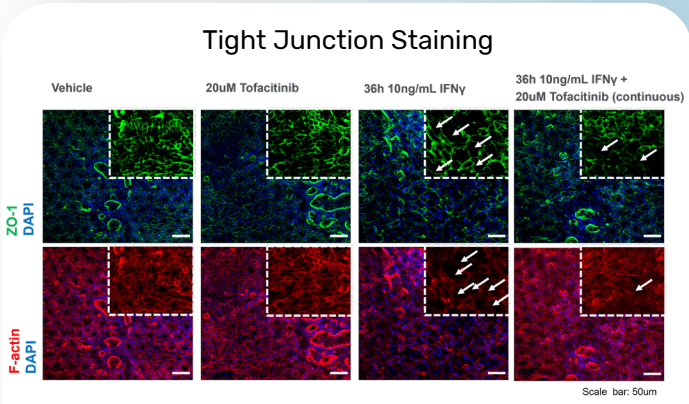


Figure 4: *Tofacitinib prevents the re-localization of ZO-1 and F-actin, indicating that treatment prevented the degeneration of the tight junctions. White arrows indicate degeneration of tight junctions.*

SUPPORTED APPLICATION

In lammatory Immune Cell Recruitment

The Colon Intestine-Chip S1 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 comprehensive 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
- Co-administration of clinically relevant drugs to prevent inflammatory response (see **Figure 5**)

Learn more in the Application Note: Modeling Inflammation-Specific Immune Cell Recruitment in the Colon Intestine-Chip.

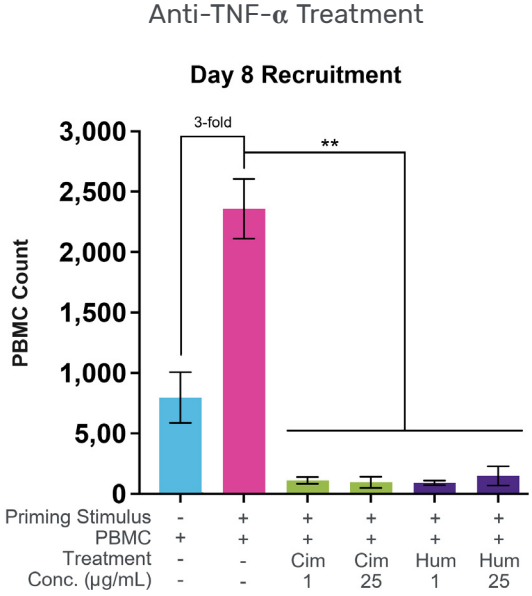
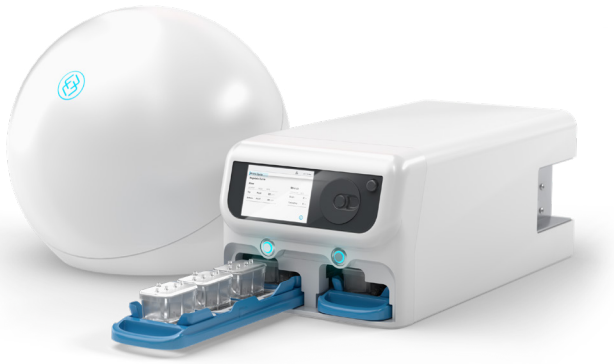


Figure 5: *Inhibition of immune cell recruitment by Anti-TNF-α therapies. 1-way ANOVA, Tukey's multiple comparison test (n=4). *p<0.01. Error bars = mean ± SEM.*

Compatible with Zoë Culture Module®

The Colon Intestine-Chip S1 is designed to be cultured using a Zoë Culture Module, a complete Organ-on-a-Chip platform that provides the dynamic conditions needed to culture up to 12 Organ-Chips per Zoë.



Colon Intestine-Chip S1 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	• Cells: Guaranteed for 6 months from date of shipment • Organ-Chip consumables: 2 years from date of manufacture • ER-1 & ER-2: 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-Chip S1 BioKit includes the essential components needed to create the Colon Intestine-Chip S1—including pre-qualified cells.

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

Product Name	Cells	Chips per Kit	Catalog Number
Colon Intestine-Chip S1 BioKit	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-CH2-12

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