

# Development of multi-organ-on-chip model to unravel gut-blood-cerebrospinal fluid-brain communication

Created on: 17-11-2025 - Last modified on: 18-11-2025

# **Contact person**

**Debby Laukens** 

# **Organisation**

Name of the organisation Ghent University (UGent)

**Department** Internal Medicine and Pediatrics

Specific Research Group or Service IBD Research Unit

**Country** Belgium

Geographical Area Flemish Region

Name of the organisation VIB - UGent

**Department** Inflammation Research Center

**Country** Belgium

Geographical Area Flemish Region

#### SCOPE OF THE METHOD

The Method relates to	Human health
The Method is situated in	Basic Research, Translational - Applied Research

Type of method	In vitro - Ex vivo
Species from which cells/tissues/organs are derived	human
Type of cells/tissues/organs	intestinal epithelial cells, choroid plexus epithelial cells, cortical brain cells

#### **DESCRIPTION**

# **Method keywords**

gut-brain

microfluidics

# Scientific area keywords

fatigue

inflammatory bowel disease

### **Method description**

We established a human multi-organ-on-chip model to recapitulate key physiological elements of gut-brain communication via the systemic circulation and the blood-cerebrospinal fluid barrier (BCSFB). In our model, a gut-blood barrier, comprised of Caco-2 (enterocytes) and HT29-MTX cells (goblet cells), is connected to a BCSFB, composed of HIBCPP and iHCPEnC cells (choroid plexus (ChP) epithelial and endothelial cells respectively), and to a brain compartment (SH-SY5Y, neurons) via recirculation of cell culture medium.

### Lab equipment

- QuasiVivo® 1200 (QV1200) platform (Kirkstall Ltd (York, UK)), compatible with Millicell® standing cell culture inserts (Ø 12 mm)

- Ismatec® Reglo ICC Digital 4 channel peristaltic pump, silicone tubing (Ø 0.8-2.26 mm) and Luer-lock connectors.

#### Method status

Still in development

# PROS, CONS & FUTURE POTENTIAL

### **Advantages**

Millifluidics allows to sample the cells for flexibility in downstream analysis. In addition, it reduces the air bubble clogging, mass transport issues with nutrients, oxygen and waste metabolites.

#### Challenges

- Leaks, contamination.
- No immune cells are included for now.
- No real-time monitoring of TEER.

#### **Modifications**

- Primary cells can easily be implemented (eg human gut organoids, and brain cells).
- 3D structures in the gut compartment will allow more physiological conformation.
- Immune cells could be included in the blood flow compartment.

### **Future & Other applications**

The method is optimized for gut, cerebrospinal fluid, brain studies, that could be of interest in other diseases in which the gut-brain axis is implicated, such as Parkinson's disease, multiple sclerosis, depression)

# REFERENCES, ASSOCIATED DOCUMENTS AND OTHER INFORMATION

Coordinated by





Financed by



