Novel microfluidic device models gut neuro-epithelial connections

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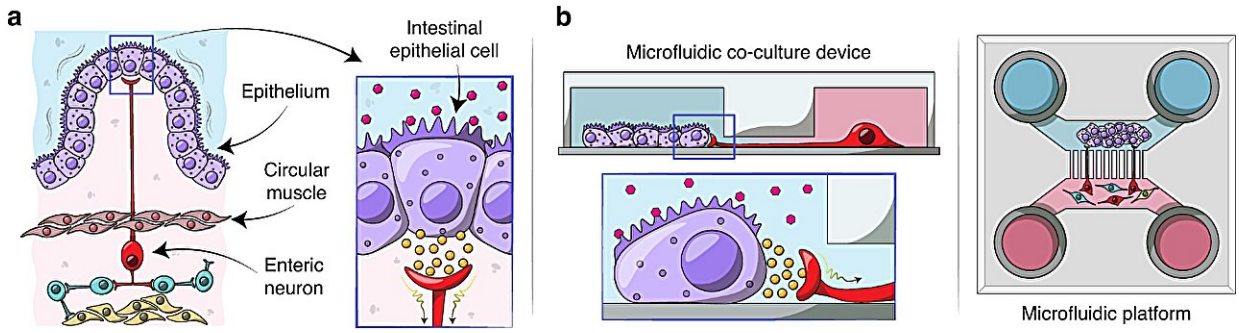

Creating enteric neuro-epithelial co-cultures in a microfluidic device. Credit: *Microsystems & Nanoengineering* (2023). DOI: 10.1038/s41378-023-00615-y

Epithelial cells and sensory neurons communicate through neuro-epithelial connections in the GI tract, essential for major senses and digestion. Studying these interactions has been complicated due to the differing needs of epithelial cells and neurons.

A new study introduces a novel microfluidic device for co-culturing intestinal epithelial cells and enteric neurons, overcoming previous challenges. The device's innovative design enables detailed observation and study of neuro-epithelial interactions, marking a significant advancement in understanding gastrointestinal functions and potentially contributing to improved health care solutions for related disorders.

For the study published on 14 November 2023 in the journal *Microsystems & Nanoengineering*, a team from the Department of Physiology and Biomedical Engineering, Mayo Clinic, Rochester, MN, U.S. developed a novel microfluidic device that mimics the intricate neuro-epithelial connections in the human gut.

The research introduces an advanced microfluidic device designed to simulate the complex neuro-epithelial connections in the human gut. This device features two compartments that enable the co-culture of enteric neurons and intestinal epithelial cells from human organoids.

The neuronal compartment contains intestinal myenteric neurons, including intrinsic primary afferent neurons (IPANs) from transgenic mice. These neurons extend projections into microgrooves, often contacting adjacent epithelial cells and enhancing the density and directionality of neuronal projections.

This design allows for detailed study of gut neuron and epithelial cell interactions in a natural-like environment. It provides a unique opportunity to understand gut neuro-epithelial dynamics, contributing to our knowledge of gut physiology and paving the way for further studies in other organs.

The researchers on the project stated, "This microfluidic device is a leap forward in our ability to understand and potentially treat a range of gastrointestinal disorders. It allows us to closely study the interactions between gut neurons and epithelial cells in a controlled environment."

The device's capacity to model gut neuro-epithelial connections has significant implications for medical research and treatment. It provides a platform for studying the gut's response to various stimuli and diseases, potentially leading to better understanding and treatment of conditions such as irritable bowel syndrome and other functional gastrointestinal

disorders. This technology could also be adapted to study other organs and systems, broadening its impact.

More information: Jose M. de Hoyos-Vega et al, Modeling gut neuro-epithelial connections in a novel microfluidic device, *Microsystems & Nanoengineering* (2023). DOI: 10.1038/s41378-023-00615-y