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Model Gut the Size of a Coaster

By Lila Abassi — May 13, 2016

Researchers have developed a coaster-size model of the human gut, which provides valuable insight into the molecular processes taking place between the intestinal microbiome and the host.

HuMiX courtesy of EurekaAlert [1]

The human gut has become the center of much focus in recent times – we often hear words like probiotics and microbiome. Your intestines are a hotbed of activity and for some people that activity can go haywire and cause considerable trouble. Disruption of the delicate balance in the gastrointestinal environment has been linked to diseases such as diabetes, obesity, inflammatory bowel disease, cancer and neurodegenerative diseases.

Scientists, in an attempt to understand intestinal intricacies on a more intimate level, have developed and patented a model of the human gut. The research [2], which was published in *Nature Communications,* demonstrates how this apparatus, which is called HuMiX (human microbial crosstalk), is a remarkably accurate reflection of human intestinal activity.

The device, which is the size of a coaster, is a three-chambered stack with the top chamber providing a nutrient supply for the intestinal epithelial cells, which are grown on a thin membrane in the middle chamber. The lowest chamber is where the bacteria grow. They engineered HuMiX in such a way that vital oxygen delivery would be made possible to the intestinal cells, while maintaining an anaerobic (without oxygen) environment required by gut bacteria. This model allows the researchers to gather crucial insight into key questions regarding how the gut microbiome affects human health and disease through real-time monitoring.

This project was a collaboration of scientists from the Luxembourg Centre for Systems Biomedicine (LCSB) of the University of Luxembourg in conjunction with the Luxembourg Institute of Health and the University of Arizona here in the U.S.

“With HuMiX, we can observe interaction of bacteria in real-time as they communicate with human

intestinal cells," stated Professor Paul Wilmes, head of the LCSB Ecosystems Biology Group and inventor of HuMiX.

It has remained a relative mystery, thus far, how molecular processes taking place between the microbiome (the sum total of all the microorganisms in residence within the confines of the gut) and the host. And how this all impacts immunity, drug metabolism, nutrition and infection. For the most part, research has relied on data obtained from animal models, though valuable, are not a true representation of what takes place in humans.

The results attained from using the HuMiX device seem to mirror previously existing research on the human gastrointestinal tract (GIT) and its microbial population which adds to the validity (ability to truly measure what it is supposed to) of this device.

"Using cutting-edge analytical methods established at the LCSB, we then studied how the gene activity and metabolism of intestinal epithelial cells change depending on the bacterial strain used in HuMiX," according to Prof. Wilmes. "A comparison of our data with results from other research groups who obtained theirs from humans or animals showed strong agreement … we can also study processes so far inaccessible by existing experimental methods."

Additionally, the neurotransmitter gamma-amino butyric acid (GABA) was stimulated in intestinal cells which supports the effect of the gut on the brain. This will allow future research efforts into investigating the governing mechanisms of the gut-brain axis.

As the authors of this study conclude, scientists will be able to apply HuMiX in the study of drug screening, drug discovery, drug delivery, drug metabolism and nutrition.
