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Microscopic fingers trigger flow in small intestine FREE

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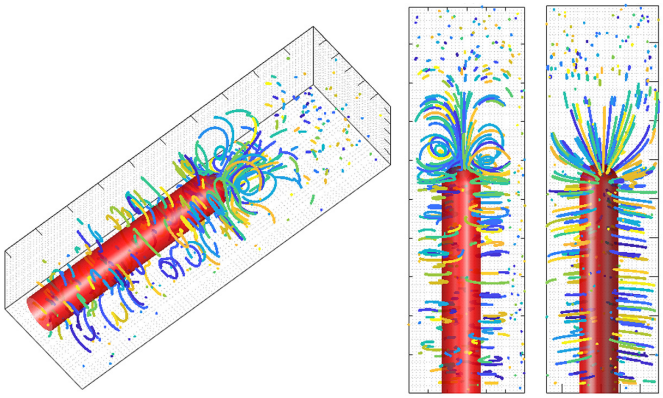
The movement of villi in the small intestine generates a steady streaming flow to transport particles, such as those used to deliver drugs.



Small intestines are carpeted in villi, microscopic finger-like protrusions that passively enhance nutrient absorption by increasing the amount of surface area available for exchange. However, work has shown that villi also actively enhance absorption, which may be explained by their spontaneous movement.

Melepattu and Loubens used numerical simulations to study how the spontaneous movement of villi affects the flow and transport of microparticles in the small intestine.

The authors simulated oscillating microstructures resembling villi. They found the villi generated a steady streaming flow over a time scale of a few minutes. While this flow did not accelerate nutrient absorption, it did contribute to the transport of micro- and nanoparticles, such as protein aggregates, bacteria, and particles used to deliver drugs.

“This work should improve understanding of how physical conditions in the gastrointestinal tract impact the organization of microbiota and their interaction with the immune system,” author Clément de Loubens said.

These simulations highlight the importance of a steady streaming flow in transporting particles and nutrients around the villi in the small intestine. Understanding how conditions of the small intestine affect nanosized drug delivery systems could also help with the design of these particles. Additionally, this work could be used to learn more about other active biological structures similar to villi, such as cilia in the lungs.

Next, the researchers will build an experimental setup to study the flow conditions at the microscopic scale of the villi.

Source: “Steady streaming flow induced by active biological microstructures; application to small intestine villi,” by Midhun Puthumana Melepattu and Clément de Loubens, *Physics of Fluids* (2022). The article can be accessed at https://doi.org/10.1063/5.0094994.