

Double duty: Gut's immune system helps regulate food processing, too

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The small intestine is ground zero for survival of animals. It is responsible for absorbing the nutrients crucial to life and it wards off toxic chemicals and life-threatening bacteria.

In a new study published March 18 in the journal *Science*, Yale researchers report the critical role played by the gut's [immune system](#) in these key processes. The immune system, they found, not only defends against pathogens but regulates which nutrients are taken in.

The findings may provide insights into origins of metabolic disease and malnutrition that is common in some undeveloped regions of the world.

"We were surprised that the immune system was so involved in nutrition," said first author Zuri Sullivan, a former graduate student in the immunology department at Yale and now a Howard Hughes Medical Institute Hanna H. Gray postdoctoral fellow at Harvard. "And the study lays the groundwork for understanding how this reciprocal interaction works."

Working in the lab of senior author Ruslan Medzhitov, Yale's Sterling Professor of Immunobiology and an investigator at the Howard Hughes Medical Institute, Sullivan became interested in how the diets of humans and other animals can dramatically change the organization of their digestive tracts. For instance, the digestive systems of carnivores and herbivores are organized differently to accommodate their specialized diets. Omnivores have the most complex system, which must adapt to a diverse diet of proteins, fats, and carbohydrates depending upon what's available in the environment.

Sullivan, Medzhitov, and a group of colleagues decided to study how the large numbers of immune cells present inside intestinal tracts might influence nutrition. For instance, a specific immune system signaling molecule, known as interleukin-22 (IL-22), plays a key role in combatting bacterial pathogens such as those that cause food poisoning. The presence of IL-22 also seems to prevent the uptake of certain nutrients in the digestive system when pathogens are present.

In a series of experiments, the researchers discovered that a specific group of immune system cells—gamma delta T cells—can suppress expression of interleukin-22 in mice and allow the cells on the intestinal wall to activate digestive enzymes and nutrient transporters.

In addition to providing insights into malnutrition in some parts of the world—where bacterial infections lead to chronic expression of IL-22 and suppress the uptake of nutrients. The findings might also eventually help researchers develop ways to combat high rates of metabolic diseases, such as Type 2 diabetes and obesity in the developed world, Sullivan said.

More information: $\gamma\delta$ T cells regulate the intestinal response to nutrient sensing, *Science* (2021). [science.sciencemag.org/cgi/doi/...1126/science.aba8310](https://science.sciencemag.org/cgi/doi/10.1126/science.aba8310)

Provided by Yale University

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