Mucus might prove useful in treating IBD, ulcerative colitis and Crohn's disease

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Imagine mucus—which most people find unpleasant—actually helping your body maintain its equilibrium, prevent inflammation, and reduce food allergy problems.

Researchers from the Icahn School of Medicine at Mount Sinai's Immunology Institute foresee a day when mucus could be manufactured and given to sick people to help them fight inflammation and increase immunity. For the first time ever, they report that mucus in the large intestine provides a valuable anti-inflammatory and self-regulating immune function. In fact, they propose that mucus may one day prove valuable in treating gut diseases, such as inflammatory bowel disease (IBD), Crohn's disease, as well as cancer.

The research is published online September 26 in the peer-reviewed journal *Science*.

"We asked ourselves whether dendritic cells in the gut could capture mucus, as well as bacteria and food antigens," said Andrea Cerutti, MD, PhD, the study's senior author and Professor in the Department of Medicine at the Immunology Institute at the Icahn School of Medicine. Dendritic cells are a type of immune cell found in the mucosa that launch an immune response. "We found that whenever mucus was present, it was stimulating the production of anti-inflammatory cytokines [regulatory proteins released by the cells of the immune system that act to regulate an immune response]," he added. The mucus prevented bacteria from inducing a damaging immune response.

Put another way, intestinal mucus not only acted as a barrier against bacteria and dietary toxins, but also stopped the onset of inflammatory reactions against these agents. "This important property of mucus was unknown until now," said Meimei Shan, MD, PhD, the study's lead author, and Assistant Professor in the Department of Medicine at the Immunology Institute at Icahn School of Medicine at Mount Sinai.

In this research, mucus was isolated and analyzed from the intestine of healthy mice, from pigs, and from a human intestinal cell line. A number of techniques involving cellular immunology and molecular biology were used to demonstrate the anti-inflammatory properties of mucus. In addition, genetically engineered mice lacking intestinal mucus and mice with colitis were given mucus from healthy mice.

Under normal conditions, people release about one liter of mucus every single day. Mucus is normally secreted by mucosal tissues throughout the body, according to the researchers. The large intestine carries 80 percent of the body's immune cells. In inflammatory gastrointestinal disorders, such as Crohn's disease and inflammatory bowel disease, people may have alterations of intestinal mucus that impede the generation of a protective anti-inflammatory response.

"Future research will focus on further exploring the mechanisms to synthesize gut mucus or an equivalent drug-like compound for oral administration," said Dr. Shan. "We hope to artificially synthesize mucus or an equivalent compound for oral use."

Besides helping to treat inflammatory gut diseases, the researchers see ramifications in treating cancer. Dr. Cerutti explained: "Several aggressive tumors, such as colon, ovarian, and breast cancers produce mucous, including MUC2. Mucus produced by malignant cells may prevent protective immune responses against the malignant cells." As researchers gain a better understanding of the properties of mucus, it

could also have a positive effect in treating tumors.

More information: "Mucus Enhances Gut Homeostasis and Oral Tolerance by Delivering Immunoregulatory Signals" *Science*, 2013.

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