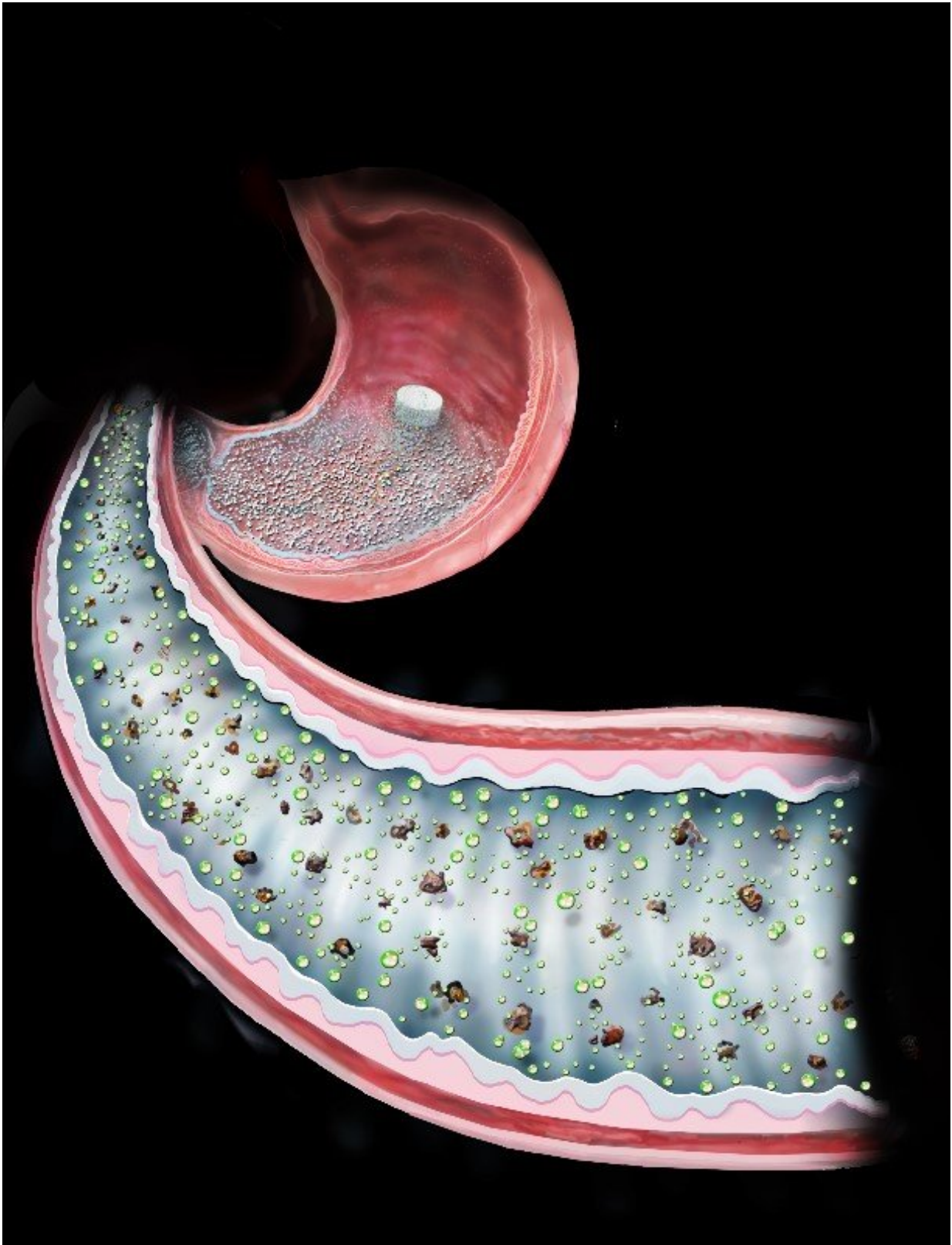


'Surgery in a pill' a potential treatment for diabetes

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'Surgery in a pill' in the intestine. Credit: Brigham and Women's Hospital and

Randal Mckenzie

Over the last decade, bariatric surgeons have made strides in performing weight loss surgery that not only reverses obesity but can also reverse type 2 diabetes in patients with both conditions. Despite dramatic improvements in quality of life and diabetes remission, the number of patients who pursue surgery remains relatively low, according to Ali Tavakkoli, MD, co-director of the Center for Weight Management and Metabolic Surgery at BWH. This prompted a collaboration between Tavakkoli and Brigham and Women's Hospital researchers to find a less invasive but equally effective treatment for reversing type 2 diabetes, one that can offer the same benefits as surgery but that may have wider appeal and application. In a paper published this week in *Nature Materials*, the team reports on results of a preclinical study in which an oral agent was administered in rats to deliver a substance that could temporarily coat the intestine to prevent nutrient contact with the lining in the proximal bowel and avoid post-meal spikes in blood sugar.

"We envision a pill that a patient can take before a meal that transiently coats the gut to replicate the effects of [surgery](#)," said co-senior author Jeff Karp, Ph.D., a bioengineer and principal investigator at BWH. "Over the last several years, we've been working with our surgical colleagues on this idea and have developed a material that meets an important clinical need."

The team members searched for a starting material that would have just the right properties to adhere to the small intestine and then dissolve within a matter of hours. They selected a substance known as sucralfate, an FDA-approved drug that is used in the treatment of gastrointestinal ulcers. The team further engineered the substance into a novel material that can coat the lining of the intestine without requiring activation by

gastric acid. The engineered compound, referred to as LuCI (Luminal Coating of the Intestine), can be made into a dry powdered form that can be encapsulated as a pill.

"What we've developed here is essentially, 'surgery in a pill,'" said co-lead author Yuhan Lee, Ph.D., a materials scientist in the BWH Division of Engineering in Medicine. "We've used a bioengineering approach to formulate a pill that has good adhesion properties and can attach nicely to the gut in a preclinical model. And after a couple of hours, its effects dissipate."

The team found that once in the intestine of rats, LuCI can coat the gut, forming a thin barrier that alters nutrient contact and lowers blood glucose response after a meal. After a meal, [blood sugar](#) levels rise and can stay elevated over time. However, one hour after LuCI was administered to the rats, the response to glucose was lowered by 47 percent. The team found that this response was temporary, and after three hours, the effect essentially disappeared.

The team is now testing the effect of short- and long-term use of LuCI in diabetic and obese rodent models. They also plan to advance some of their pilot studies showing that LuCI can be used to deliver drugs, including proteins directly to the gastrointestinal tract.

"Gastric bypass is one of the best studied surgeries in the world, and we know that it can lead to many benefits including positive effects for blood pressure, sleep apnea and certain forms of cancer, and a remarkably fast and weight-independent improvement in diabetes," said Tavakkoli, co-senior author of the study. "Having a transient coating that could mimic the effects of surgery would be a tremendous asset for patients and their care providers."

More information: Yuhan Lee et al, Therapeutic luminal coating of

the intestine, *Nature Materials* (2018). [DOI: 10.1038/s41563-018-0106-5](https://doi.org/10.1038/s41563-018-0106-5)

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