Ingestible devices sense movement and ingestion in the stomach, harness power from GI tract movement

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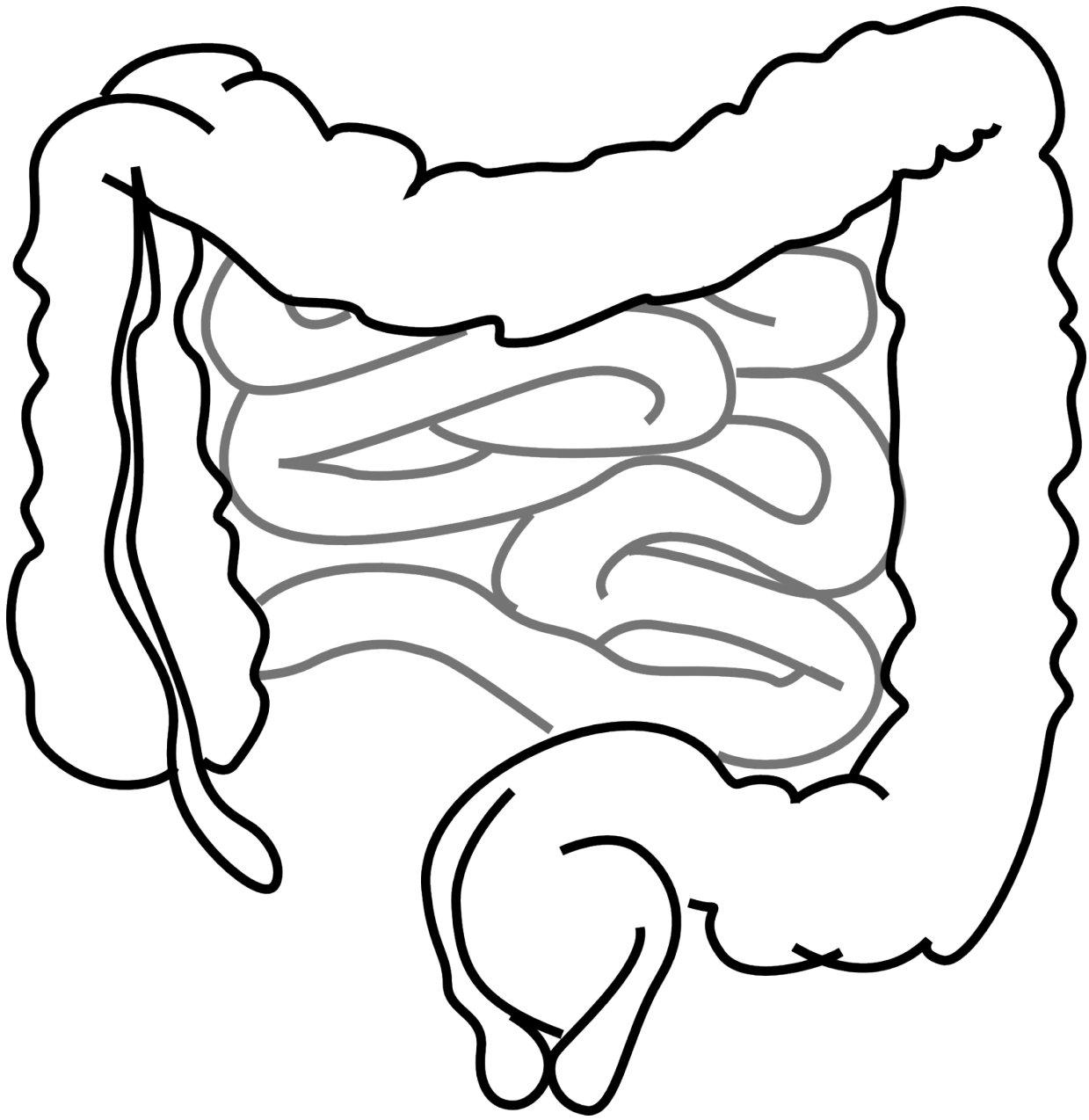

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A multi-disciplinary team co-led by researchers from Brigham and Women's Hospital and MIT has developed flexible sensors with the capacity to sense movement and ingestion in the stomach.

In collaboration with colleagues at the Media Lab and the Koch Institute at MIT, BWH investigators have created and tested flexible "piezoelectric devices," which can reside in the stomach for at least two days and sense the ingestion of a meal. Moreover, these devices can harvest energy from the movement encountered in the gastrointestinal tract and potentially apply this to meet the energy demands of novel ingestible electronic systems. The team's findings are published in the latest issue of *Nature Biomedical Engineering*.

"Just as a wearable device like a Fitbit can help track and quantify how many steps a person takes, we envision a device that could reside in the stomach and quantify how frequently a person is eating," said Carlo "Gio" Traverso, MD, PhD, a gastroenterologist and biomedical engineer at BWH.

In their study, Traverso and his colleagues evaluated the safety of the ingestible devices as well as how well they worked at sensing movement and harnessing energy from that movement. Through simulated cellular and animal gastric models, the team evaluated the devices' cellular toxicity and electrical performance, including energy harvesting for a self-powered system. The team found that the device could measure the motility states of the stomach in an awake and mobile pig model that was eating. The device remained fully functional following exposure in the gastric environment for 48 hours.

"This is the first reported system that evaluates ingestion status up to two days without any mechanical and electrical degradation," said lead author Canan Dagdeviren, PhD, who directs the research group Conformable Decoders at the MIT Media Lab.

One of the key challenges that Traverso and his colleagues face when creating ingestible devices is how to power them. In parallel projects, Traverso is pursuing remote power sources and other ways of providing

energy, but this project offers alternatives toward self-powered system.

"All of the data reported here were generated without an external power source," said Traverso. "This offers us an intriguing way to power ingestible devices."

In addition to measuring food ingestion, long-term ingestible devices could help monitor if a patient is adhering to taking the proper dosage of a medication and monitor vital signs, pH and other important read outs. The team plans to continue studying the long-term effects of such devices residing in the stomach as well as how the devices perform after different meals and activities.

Provided by Brigham and Women's Hospital

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