

# Swallowable sensors reveal mysteries of human gut health

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Close up of the ingestible gas-sensing capsule developed by researchers at RMIT University. Credit: RMIT University/Peter Clarke

Findings from the first human trials of a breakthrough gas-sensing swallowable capsule could revolutionise the way that gut disorders and

diseases are prevented and diagnosed.

The [trials](#) by researchers at RMIT University in Melbourne, Australia have uncovered mechanisms in the human body that have never been seen before, including a potentially new immune system.

The new technology and discoveries offer a game-changer for the one-in-five people worldwide who will suffer from a gastrointestinal disorder in their lifetime. They could also lead to fewer invasive procedures like colonoscopies.

The ingestible capsule (the size of a vitamin pill) detects and measures gut gases - hydrogen, carbon dioxides and oxygen - in real time. This data can be sent to a mobile phone.

Professor Kourosch Kalantar-zadeh, study lead and capsule co-inventor, said the trials showed that the human stomach uses an oxidiser to fight foreign bodies in the gut.

"We found that the stomach releases oxidising chemicals to break down and beat foreign compounds that are staying in the stomach for longer than usual," Kalantar-zadeh said.

"This could represent a gastric protection system against [foreign bodies](#). Such an immune mechanism has never been reported before."

Another never before seen observation from the trial was that the colon may contain oxygen.

"Trials showed the presence of high concentrations of oxygen in the colon under an extremely high-fibre diet," Kalantar-zadeh said. "This contradicts the old belief that the colon is always oxygen free."

"This new information could help us better understand how debilitating diseases like [colon cancer](#) occur."

The trials were conducted on seven healthy individuals on low- and high-fibre diets. Results showed that the capsule accurately shows the onset of food fermentation, highlighting their potential to clinically monitor digestion and normal gut health.

The trials also demonstrated that the capsule could offer a much more effective way of measuring microbiome activities in the stomach, a critical way of determining gut health.

"Previously, we have had to rely on faecal samples or surgery to sample and analyse microbes in the gut," Kalantar-zadeh said.



Human trials for an ingestible gas-sensing capsule have revealed a potentially new immune system. Credit: RMIT University/Peter Clarke

"But this meant measuring them when they are not a true reflection of the [gut microbiota](#) at that time. Our capsule will offer a non-invasive method to measure microbiome activity."

Now that the [capsule](#) has successfully passed human trials, the research team is seeking to commercialise the technology.

Co-inventor Dr Kyle Berean said: "The trials show that the capsules are perfectly safe, with no retention.

"Our ingestible sensors offer a potential diagnostic tool for many disorders of the gut from food nutrient malabsorption to colon cancer. It is good news that a less invasive procedure will now be an option for so many people in the future.

"We have partnered with Planet Innovation to establish a company called Atmo Biosciences and bring the product to market.

"This will lead to Phase II human trials, and help raise the funds needed place this safe and revolutionary gut monitoring and diagnostic device into the hands of patients and medical professionals."

**More information:** Kourosch Kalantar-Zadeh et al, A human pilot trial of ingestible electronic capsules capable of sensing different gases in the gut, *Nature Electronics* (2017). [DOI: 10.1038/s41928-017-0004-x](https://doi.org/10.1038/s41928-017-0004-x)

Provided by RMIT University

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