Meet Bilophila wadsworthia—a gut microbe that's both friend and foe

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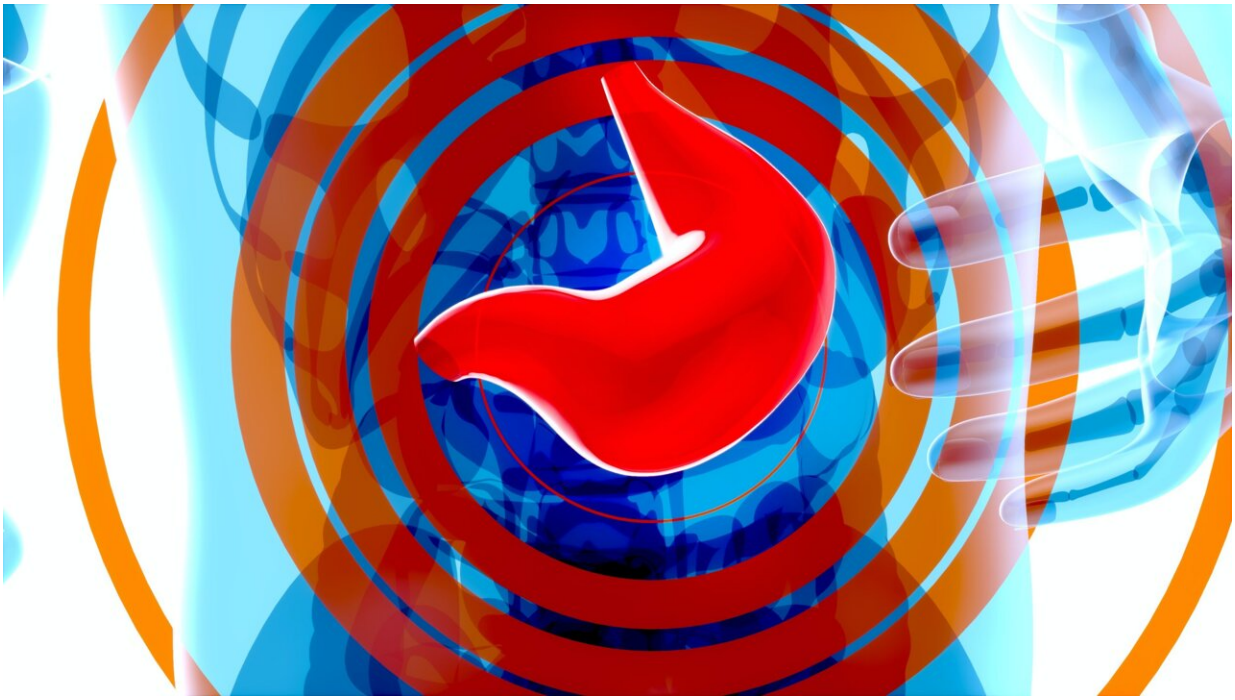

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You may not have heard of hydrogen sulfide, but I bet you'd recognize the smell. Hydrogen sulfide is the gas responsible for the rotten-egg odor that you come across near stagnant water and in drains. This gas is also highly toxic when inhaled.

You may be surprised to learn that the same kind of bacteria that

produce this highly toxic gas also reside in your gut. Bilophila wadsworthia is one such species of these bacteria. Though these bacteria only make up a small proportion of the gut's microbiome, we shouldn't underestimate their importance.

The bacteria that break down sulfur-containing organic matter and produce hydrogen sulfide are fittingly called sulfate-reducing bacteria. Sulfate-reducing bacteria are anaerobic—meaning they die when they're exposed to oxygen. This is why stagnant waters, which are not churned up and oxygenated, can allow these micro-organisms to bloom and make hydrogen sulfide.

Small amounts of hydrogen sulfide are naturally produced within the human body. In the intestine, this compound is produced by human cells as a signaling molecule to regulate bowel movements. Hydrogen sulfide also helps the cells in the colon to absorb the energy they need to function.

Sulfate-reducing bacteria live in our guts and make hydrogen sulfide. This is an important process, because these bacteria use up hydrogen as part of this reaction.

If the bacteria weren't there to use up the hydrogen, the metabolic process in our guts that breaks down food molecules so they can be used for energy would come to a stop. This is because hydrogen is a natural product of microbial fermentation. If these hydrogen-using bacteria weren't there, the partial pressure of hydrogen would increase and eventually prevent fermentation.

This would be bad news because we need the good bacteria in our guts to ferment the fiber we provide them. This is so they can make all sorts of important, health-promoting compounds, such as short chain fatty acids, which are molecules that keep our gut healthy.

Sulfate-reducing bacteria are an important part of the normal human gut microbiome, and small amounts of hydrogen sulfide are required in the human gut environment. But increased amounts of either could harm us.

Bilophila wadsworthia is unusual, in that it's the only known species of sulfate-reducing bacteria unable to use sulfate. This bacterium instead breaks down taurine, a molecule found in meat and dairy products.

Bilophila wadsworthia was discovered in the 1980s, when it was found in people who had severe appendicitis. The researchers found that it grew really well in bile, which is why the genus name is Bilophila (meaning bile loving). And, because the bacterium was first identified at the Wadsworth Veterans Administration Medical Center in the US, it was given the species name "wadsworthia".

Since then, research has associated Bilophila wadsworthia with negative effects in the gut. It has been linked to inflammatory diseases, such as inflammatory bowel disease, irritable bowel syndrome and colorectal cancer.

But is Bilophila wadsworthia a real baddie, or just misunderstood? Despite being associated with inflammation, it's part of the normal, healthy microbiome of between 50% and 60% of people. We think the differences between Bilophila wadsworthia in health and disease could be down to how much it grows and how much hydrogen sulfide it makes.

So in small amounts, it seems Bilophila wadsworthia is helpful, making a little hydrogen sulfide that helps prevent harmful disease-causing bacteria from getting settled in. But if Bilophila grows too much or makes too much hydrogen sulfide, it could trigger inflammation in the gut.

It's not clear how or why expansion of Bilophila wadsworthia can occur

in the gut. My research is working to understand how Bilophila wadsworthia's growth and hydrogen sulfide production are affected by different factors—such as diet and the composition of the gut microbiota.

If we know what factors are important for triggering Bilophila wadsworthia to grow more or make more hydrogen sulfide, we can use targeted prevention that could help us control and prevent inflammatory diseases in the gut.

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