Got starch? There's bacteria in your gut for that

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Credit: University of Michigan

Soft foods like white bread and rice might seem like an easy thing for your body to digest, but a tiny organism in your gut is actually

responsible for chowing down some types of starch and turning it into nutrients your body can use.

Now, a team of University of Michigan researchers has unpacked an element of this process, which will ultimately help both in the development of probiotics and to inform doctors who are prescribing antibiotics.

One type of gut bacteria that breaks down dietary carbohydrates like starch is called Bacteroides thetaiotaomicron, or Bt. Bt is a member of a dominant group of bacteria that live in the gut and are essential parts of your microbiome—the community of microorganisms that live in your body.

"For example, after you take antibiotics for an ear infection, you might have an upset stomach. That's because the antibiotic is not selective. It's just wiping out all the bacteria—the good and the bad—in your gut," said Julie Biteen, U-M associate professor of chemistry and biophysics. "So what we're studying are the good bacteria, and focusing on the proteins on the surface of the Bt cell that recognize starch, break it down into simpler sugar units, and then internalize these nutrients into the cell."

There are five starch-metabolizing proteins on the surface of the Bt cell. Together, this protein complex is called the starch utilization system, or Sus. Previous work by Biteen's lab found that one of the proteins in this system, SusG, is mobile—it roams the surface of Bt, slows down when it encounters the other complex proteins, and stops when it binds starch.

Biteen and her colleagues assumed the same would be true of two other Bt surface proteins, SusE and SusF. Instead, in this new study, they found that these two proteins are stationary, even though they are held to the cell by just a wisp of a lipid chain. Their results are published in

Biophysical Journal.

"We didn't definitively solve the question of why these proteins are immobile, but we did prove that this immobility is a really key characteristic of these proteins," Biteen said. "Due to competition, bacteria are highly evolved. They can't expend energy to do something they don't have to, and vice versa."

SusE and SusF may be immobile because it's more efficient for them to form a complex with the mobile SusG in order to start metabolizing starch the moment they contact it, Biteen says.

This expanded description of how the Sus system works brings us one step further toward developing more effective probiotic therapies, or more targeted antibiotics.

"Those applications may seem pretty far removed from the basic chemistry we're doing here, but the tools we've developed to study the prototypical Sus system will also let us probe other protein complexes in gut bacteria," Biteen said. "These experiments are not easy, but we've now developed tools that can extend our investigations from Sus to other systems in the microbiome."

More information: Hannah H. Tuson et al. The Starch Utilization System Assembles around Stationary Starch-Binding Proteins, *Biophysical Journal* (2018). DOI: 10.1016/j.bpj.2017.12.015

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