



Bacterial colonies grown from kombucha (flavor unspecified)

Gut Check

Researchers test the probiotics in food and supplements / BY KATE BECKER

It's a great time to be a bacterium. For more than a century, bacteria have been typecast as villainous bodily invaders in the stomach-churning, fever-inducing drama of infectious disease. But researchers know that bacteria can play the good guys, too.

BENEFICIAL GUT BACTERIA—AND THERE are trillions of them in the typical human digestive system—help digest and extract nutrients from everything we eat, and they can crowd out the bad-guy bacteria that make us sick.

That's the big idea behind the shelf full of “probiotic” supplements at your local pharmacy or grocery store. Manufacturers claim that these

products contain billions of live bacteria. Some doctors recommend that patients take them when they are prescribed broad-spectrum antibiotics, which wipe out good and bad bacteria alike, and millions of consumers buy them hoping for relief from gastrointestinal problems or to support general good health. But do the supplements

actually contain what the labels promise, and how do they compare to fermented foods, like kombucha or miso soup, which are also teeming with microbes?

Sandra Buerger, a College of General Studies lecturer in natural science and mathematics, and Alexander Smith (CGS'19), supported by a grant from the Center for Interdisciplinary Teaching & Learning, wanted to find out. (Yemi Osayame, CAS'19, joined the project last fall.) They headed to the drugstore and brought their probiotic haul back to Buerger's lab, where they cracked open the pills, diluted the bacterial powder stuffed inside, and dabbed the mix onto petri dishes. Because the probiotic pill bottles specify what bacterial strains are inside, Buerger and Smith prepared the dishes according to those species' preferences. Then they waited to see what would grow.

So far, their preliminary results line up fairly well with what's advertised on the pill bottles. “The numbers from our methods have been a little lower than what's claimed on the box,” says Buerger, “but there are definitely living bacteria in there.”



JACKIE RICCIARDI (2)

Still, says Buerger, from a bacterium's perspective, the conditions inside the pill are less than ideal. "They are being shoved into a little pill capsule, and they might be happier in some of the other liquids, where they have more room to grow."

To find out whether bacteria were "happier" elsewhere, Buerger decided to test the pills against popular fermented drinks that naturally contain good bacteria. She started with miso soup and apple cider vinegar, then added kombucha, a fermented tea. Next, Smith repeated the process of plating the samples and growing the bacteria.

The results looked very different from the over-the-counter probiotics. While the bacteria from the pills colonized in tidy white circles, the dishes plated with fermented foods bloomed in colorful, disorderly splotches. Buerger and Smith will use gene sequencing to identify the specific strains of bacteria inside the fermented foods, but they say it's already clear that the foods have greater bacterial diversity than the over-the-counter probiotics.

That diversity makes it tough for consumers to know exactly what they are getting when they tuck into their miso soup, and also introduces the danger of contamination. But, Buerger says, it might give fermented foods an edge over the more homogeneous drugstore probiotics. "A healthy collection of gut bacteria is not one type of bacteria. It's many types of bacteria, so there could be potential health benefits of having more variety," she says. It's also possible that the diversity could help the bacteria thrive. "Bacteria interact with each other all the time. Some of those relationships are antagonistic, but other times they talk to each other and cooperate."

The next step is finding out whether all those bacteria actually make it through the digestive system to the small intestine. "What we're really concerned about is how they survive the trip through the stomach," says Buerger. "The stomach doesn't have a lot of bacteria in it because it has this high acidity level. But once the food travels through your intestines, that's where the bacteria are going to be able to have the most action." There, bacteria help the body produce vitamins,

break down foods, and keep "bad" bacteria, like those that cause food poisoning, from moving in.

Buerger and Smith are building an artificial stomach that will "digest" the probiotic pills by churning them

up with hydrochloric acid, potassium chloride, and sodium chloride, the main components of the gastric juice that helps break down food in the stomach.

Buerger hopes the research will help doctors and consumers make more informed choices about over-the-counter and food-based probiotics.

◀ Sandra Buerger and her student Alexander Smith (CGS'19) study the bacterial makeup of probiotics.

IN PROGRESS

Mapping the Masterpieces; the Weight Soldiers Carry; How to Reduce Medical Overtreatment; What Wind Can Tell Us about Global Warming

THE STORIES BEHIND ART MASTERPIECES

Did Pablo Picasso really steal the *Mona Lisa*? Jodi Cranston, a College of Arts & Sciences professor of history of art and architecture, can tell you. She also can tell you the owners (including thieves) of hundreds of great paintings spanning centuries. The virtual museum created by Cranston and her team of CAS students, Mapping Paintings (www.mappingpaintings.org), displays 750 works of art by 200 masters, with maps and timelines detailing what's known about their ownership lineage.



A TREATMENT FOR OVERTREATMENT

Overtreatment in American healthcare is a \$200-billion-a-year problem. A big part of that cost comes from unnecessary tests and services. Research by Questrom School of Business faculty members Jillian Jaeker and Anita Tucker suggests that requiring doctors to spend a few moments justifying their decisions to order extra tests could reduce testing, with no measurable impact on the quality of care.



LOADED QUESTION

Helmet, uniform, boots, armor, weapon, ammo, food, canteens—everything a soldier carries can add up to more than 68 pounds, and can climb to as much as 120 pounds in a combat mission. For female soldiers, the risk of stress fractures to their lower extremities is 2 to 10 times greater than for their male counterparts. Doctoral candidate Kari Loverro (Sargent'19) is investigating how men and women change the way they walk when carrying heavy loads—research that may lead to interventions that can prevent injuries.

WINDS OF CHANGE

A BU team wants to better understand the relationship between wind patterns in the tropical Pacific and climate change. They are measuring the manganese in corals to determine the strength of trade winds and El Niño winds over the past 100 years. Strong winds from the west release manganese and other trace metals trapped in lagoon sediments, which are then incorporated into coral skeletons growing on nearby reefs. As a result, manganese spikes in the corals record the fingerprint of trade winds and El Niño conditions.

