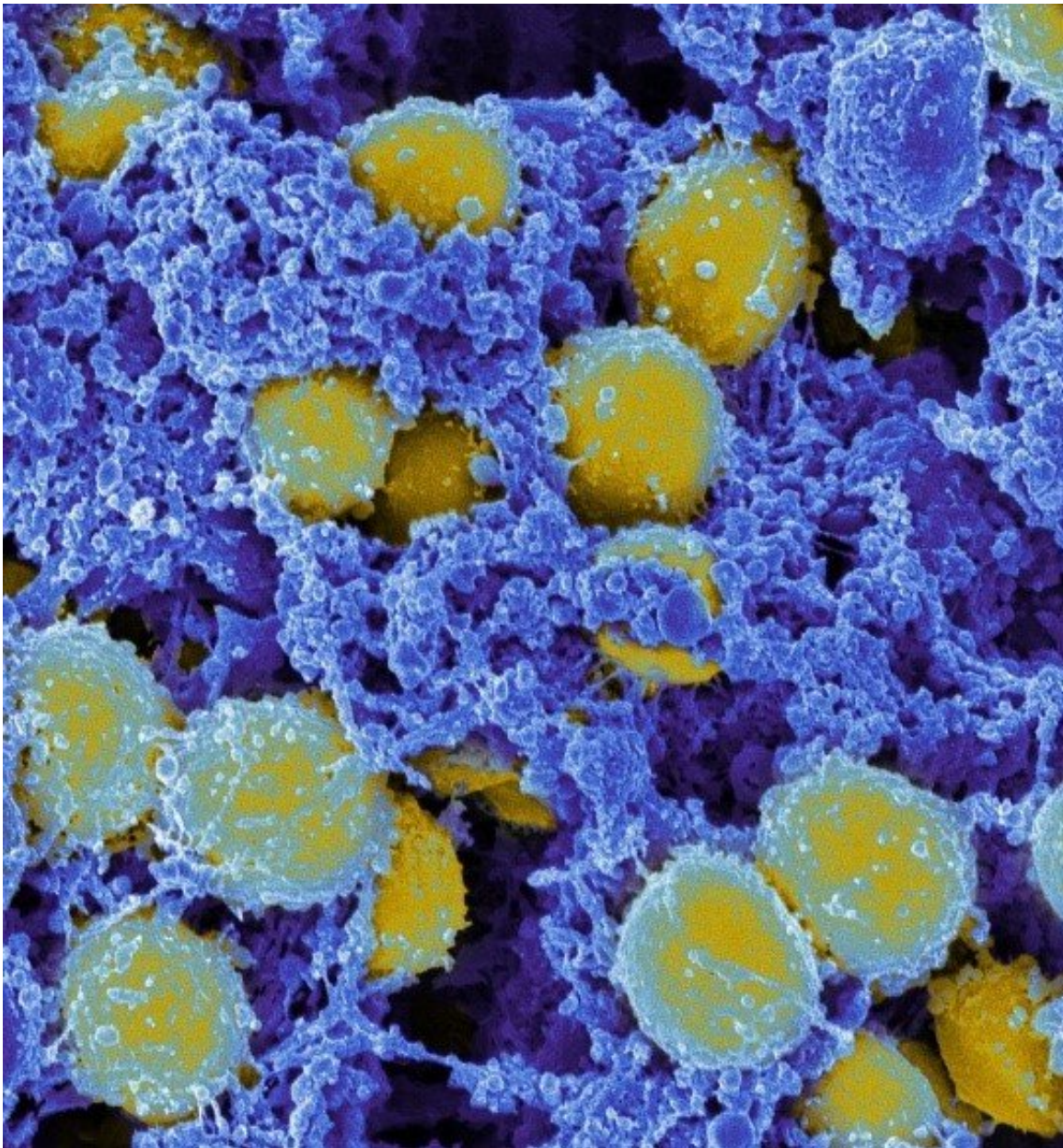


Probiotic combo found to stop bacteria that cause toxic shock syndrome

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Scanning electromicrograph of Staphylococcus aureus bacteria. Credit: NIAID

The widespread, pathogenic microbe *Staphylococcus aureus* can colonize the skin and mucous membranes throughout the body, particularly the vagina and gastrointestinal tract. A virulent strain of the bacterium produces proteins that trigger toxic shock syndrome (TSS), a disease characterized by the quick onset of fever, a telltale rash, and, without treatment, multi-organ failure. In the vagina, TSS is associated with a life-threatening reaction from the immune system.

Probiotics may help prevent the disease before the cytokine cascade ever begins. A study published in the journal *Microbiology Spectrum* reports that strains of two bacteria, *Lactobacillus acidophilus* and *Lacticaseibacillus rhamnosus*, successfully inhibited the production of the superantigens that cause TSS, in lab experiments. *L. Acidophilus*, in addition, inhibited the growth of the *S. aureus* strains that produce the problematic proteins.

A combination of the two could both prevent growth and inhibit the immune response. "It's kind of a double whammy against *S. aureus*," said microbiologist Patrick Schlievert, Ph.D., at the University of Iowa Carver College of Medicine, in Iowa City. "If any toxin is made, the probiotics still prevent inflammation."

He noted that adding these probiotics to tampons or other menstrual products could reduce the risk—and global incidence—of TSS associated with menstruation. Such a [preventive measure](#) has the potential to benefit millions of [vulnerable people](#), Schlievert said. "We know that 20% of people over age 12 cannot make antibodies and never will make antibodies against [toxic shock syndrome](#)," he said.

Schlievert has been studying TSS—and its prevention—for decades. In the [early 1980s](#), he was the first researcher to identify the toxin that triggers an overreaction of the [immune system](#), and to show how high-absorbency tampons facilitated production of that toxin if *S. aureus* was present.

The new work, he said, was motivated by observations made during an earlier study. A few years ago, he and his colleagues recruited 205 women to test whether a novel molecular mixture, when added to tampons, would inhibit [pathogenic bacteria](#). That molecule proved effective against *E. coli* and other pathogens, but the researchers noticed an unexpected consequence.

"Some of the women in the treatment group had this tremendous growth of *Lactobacilli*," Schlievert said.

Further studies revealed that nine of those women were colonized with only *L. crispatus* and no other bacteria. In microbiology research, Schlievert said, colonization by a single bacterium is often regarded as unhealthy. In this case, however, it offered an effective action against pathogenic *S. aureus*.

Lactobacillus bacteria have already been shown to be safe, Schlievert said, and the new work suggests that treatment with *L. crispatus* alone, or *L. acidophilus* and *L. rhamnosus* in combination, could dramatically reduce the risk of TSS in vulnerable populations. Strains of *S. aureus* can also cause enterocolitis, a life-threatening immune response in the gut. Probiotics may also help reduce the production of dangerous proteins for that disease, said Schlievert.

In ongoing and future work, Schlievert and his team are investigating how to use probiotics to prevent skin staph infections. The skin of people with [atopic dermatitis](#), or with type 2 diabetes, is often colonized

with the strains of *S. aureus* that produce superantigens, which are often resistant to treatment with standard antibiotics. In patients with type 2 diabetes, those superantigens could lead to foot ulcers that, if not treated successfully, could lead to amputation.

Schlievert sees probiotics as a promising way to prevent those complications. "If we can improve their lives by using this approach, that would be wonderful."

More information: Patrick M. Schlievert et al, Inhibition of Toxic Shock Syndrome-Associated *Staphylococcus aureus* by Probiotic Lactobacilli, *Microbiology Spectrum* (2023). [DOI: 10.1128/spectrum.01735-23](https://doi.org/10.1128/spectrum.01735-23)

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