Study on how bacteria move could help researchers develop anti-bacterial surfaces

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Jacinta Conrad, an assistant professor of chemical and biomolecular engineering at the University of Houston, likens her research into how bacteria move to "tracking bright spots on a dark background."

Using a digital camera affixed to a microscope, Conrad and her collaborators videotape hours of moving bacteria. They then analyze these tens of thousands of images to determine exactly how they cross surfaces before forming biofilms, colonies of potentially dangerous bacteria that can be found in industrial, natural and hospital environments.

Conrad has co-authored an article on the subject that is featured in the new issue of the Proceedings of the National Academy of Sciences (*PNAS*), one of the nation's most prestigious scientific journals.

"This marks another step in our effort to fully understand how bacteria move along a surface," said Conrad, who co-authored a related paper that appeared last fall in Science.

Understanding how bacteria move on their way to forming biofilms could lead to discovering ways to hinder or prevent this process.

Biofilms can form on food processing equipment, potentially leading to food-borne illnesses, and on medical implants, leading to high rates of infection in hospitals. They also can disrupt the flow of sewage and oil pipelines and increase drag on marine vessels, slowing ships and wasting fuel, among other things.

In the Science paper, Conrad and her collaborators detailed how bacteria use hair-like appendages called pili to pull themselves upright and "walk" across a surface.

The research in the PNAS paper builds on that finding, with researchers discovering that the bacteria employ a "slingshot" motion to move using multiple pili, which act as grappling hooks. Conrad said that bacteria rapidly "snap" to a new orientation when they release one pilus, while others remain attached. This is because the bacteria re-orients in the direction of the net force from the remaining attached pili.

"We think the bacteria use this rapid-snap motion to move forward," she said. "We believe that this method allows the bacteria to move faster and more efficiently across a surface through this sticky, viscous pre-matrix substance that surrounds it. The bacteria may use less energy this way."

Bacteria often move along a surface to form biofilms, which develop on surfaces and are shielded by an extracellular matrix of polymers. The bacteria excrete polymers as they move, which forms the basis for this shield.

This substance can be very thick and difficult to move through. The researchers hypothesize that the "slingshot" motion thins the sticky goo and makes it easier for the bacteria to travel through it. The next step is for Conrad and her collaborators to thoroughly test this hypothesis.

Provided by University of Houston

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