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New Slippery Surface Prevents Deadly Bacterial Roll Call

By Alex Berezow — July 23, 2016

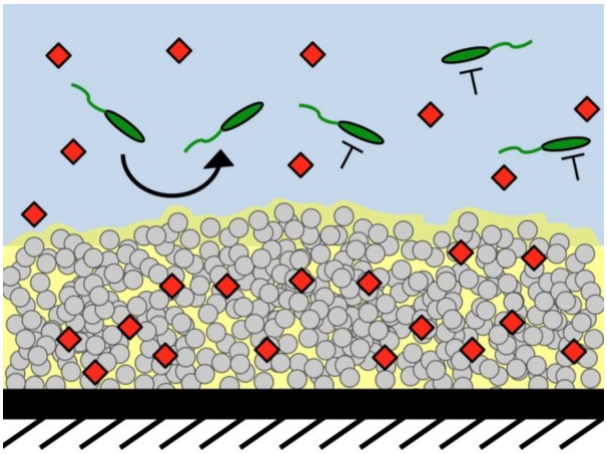
Unwanted microorganisms are a fact of life. Bugs grow everywhere we don't want them [1], from our showers and sinks to our toilets and toothbrushes. The scummy layers they form, called biofilms, are ugly and disgusting but mostly harmless in these settings. However, when they form on medical devices, such as catheters and implants, they can be life-threatening.

Biofilms are complex miniature ecosystems that bacteria can build after settling down on a surface. Because assembling such a structure requires the presence of a sufficient number of bacteria, many microbes have a way of detecting how many of its friends are nearby. This ability is called *quorum sensing*, and it is based upon bacteria secreting and detecting a particular signal molecule. Essentially, microbes are taking roll call.

If a quorum is present, bacteria will begin a coordinated assault. The bacteria will build a biofilm, which protects them from stressors in the environment (including antibiotics), and they will activate virulence (i.e., disease-associated) genes that can inflict damage on humans. For these reasons, preventing the growth of biofilms on medical devices is an enormous concern.

A slippery material aptly named SLIPS (slippery liquid-infused porous surface) has been used to prevent biofilm formation. These surfaces are either textured or porous, and a slippery liquid such as oil can be infused into them. The greasy surface allows other liquids to flow by but blocks the growth of biofilms.

The problem, however, is that biofilms can and do grow on nearby surfaces that are not protected by the slick coating. So, researchers from the University of Wisconsin set about finding a way to improve SLIPS technology. They published their findings in *ACS Infectious Diseases*.



[2] *SLIPS containing anti-quorum sensing molecules can block bacterial growth and activation of virulence genes. (Credit: Kratochvil et al., ACS Infect Dis, 2016.)*

The team infused quorum sensing inhibitors (QSIs) into SLIPS. (See diagram.) These molecules (colored red) prevent bacteria (colored green and, in this experiment, represent the ubiquitous and highly antibiotic-resistant *Pseudomonas aeruginosa*) from forming a biofilm on the greasy surface, which consisted of polymers (gray circles) and oil (yellow goo). The QSIs were slowly released over time, blocking the ability of the bacteria to activate virulence genes or form biofilms, even on nearby non-SLIPS surfaces.

In previous research, the authors infused the microbicide triclosan, commonly found in hand soap, into their surface. The controlled release of triclosan successfully killed yeast as they swam by. However, the authors believe their new technique, which uses QSIs, is superior because it is less likely to trigger resistance. (Quorum sensing is not vital to bacterial survival, so there is less selective pressure to become resistant.)

The team's work is clever and should improve the safety of medical devices. Bringing their innovation to market should certainly help save lives.

Source [2]: Michael J. Kratochvil et al. "Slippery Liquid-Infused Porous Surfaces that Prevent Bacterial Surface Fouling and Inhibit Virulence Phenotypes in Surrounding Planktonic Cells." *ACS Infect. Dis.* 2 (7): 509–517. Published: May 24, 2016. DOI: 10.1021/acsinfecdis.6b00065
