Video: Nanosponge decoy fights superbug infections

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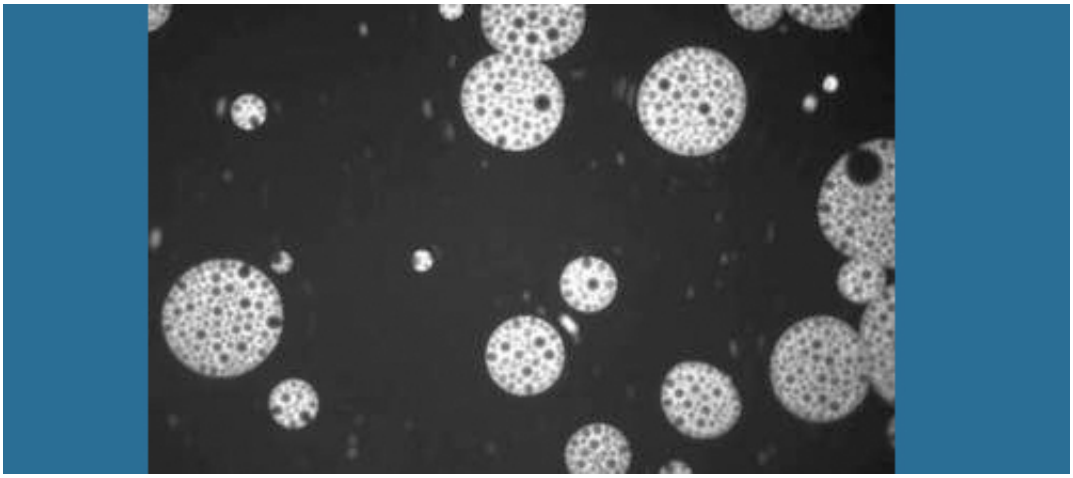

Medicated adhesive patches have become a preferred method of delivery for everything from nicotine to hormones to motion sickness medication. Researchers at Drexel University are trying to expand the possibilities of this system--called transdermal delivery--with the help of a cleverly designed delivery vehicle and an ultrasonic "push," or pressure from sound waves. The advantage of transdermal drug delivery is the ability to regulate the release of medication into the bloodstream and promote a more direct interaction of the treatment with the affected area. But the challenge of this method is that the skin is very good at protecting the body from invaders--even the helpful kind. Steven P. Wrenn, of Drexel's College of Engineering, and Peter A. Lewin, from Drexel's School of Biomedical Engineering, Science and Health Systems, lead a team that is investigating the molecular architecture of human skin and certain promising drugs and compounds, as well as the mechanics of an ultrasound interface necessary to broaden the capabilities of transdermal drug delivery. Their work is part of a larger trend: More and more, researchers are exploring advanced materials and manufacturing techniques for biomedical applications.

New, high-precision technologies and more rapid, personalized fabrication methods allow engineers to design on smaller scales, such as those required to traverse the human body. Credit: Drexel University

Our first instinct with infection in the body is often to find it and get rid of it! But, engineer Liangfang Zhang had another idea. With support from the National Science Foundation (NSF), Zhang and his team at the University of California, San Diego (UCSD), have created a nanosponge to combat drug-resistant infections, such as those caused by Methicillin-resistant Staphylococcus aureus (MRSA).

The nanosponge, made from biocompatible, biodegradable polymer nanoparticles, is camouflaged with a red blood cell membrane. It circulates in the bloodstream, absorbing the toxins produced by infection. One red blood cell membrane can be used as a cloak for more than 3,000 of these stealthy nanosponges. Once the nanosponges are fully loaded with toxins, they are safely disposed of by the liver. They are designed to work with any type of infection or poison that attacks the cellular membrane.

Zhang is working closely with doctors and students at the UCSD Moores Cancer Center on this "nano" approach to tackling infections. He has been testing his approach on mice, with nearly a 100 percent success rate against staph infections. Human clinical trials are the next step!

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