Plastic 'ninjas' take on deadly bacteria (w/ Video)

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For decades, bacteria like the stubborn methicillin-resistant Staphylococcus aureus (MRSA) have concerned gym goers, hospital patients and staff, and parents of school children. MRSA is particularly worrisome because it is not contained and killed by commonly available antibiotics. So, the bacteria can produce painful and sometimes deadly results for those who come in contact with it.

In 2004, MRSA accounted for 94 percent of all healthcare-associated infections per 1,000 patient bed days in the Pittsburgh Veterans Administration Health System. Precautions and education about the disease have lowered incidents significantly, but reports of new outbreaks of this health hazard still appear in the news regularly.

But the answer to a healthcare issue that has long baffled doctors and medical scientists alike might come from an unlikely place. At IBM Research in Almaden, California, chemists have drawn upon years of expertise in semiconductor technology and material discovery to crack the code for safely destroying the bacteria.

Ninja polymers

In earlier chip development research, IBM researchers identified specific materials that, when chained together, produced an electrostatic charge that allows microscopic etching on a wafer to be done at a much smaller scale.

This newfound knowledge that characterization of materials could be manipulated at the atomic level to control their movement inspired the team to see what else they could do with these new kinds of polymer structures. They started with MRSA.

The outcome of that experiment was the creation of what are now playfully known as "ninja polymers" – sticky nanostructures that move quickly to target infected cells in the body, destroy the harmful content inside, and then disappear by biodegrading without causing damaging side effects or accumulating in the organs.

As a bonus, all of this occurs without damaging healthy cells in the area.

"The mechanism through which [these polymers] fight bacteria is very different from the way an antibiotic works," explains Jim Hedrick, a polymer chemist in IBM Research. "They try to mimic what the immune system does: the polymer attaches to the bacteria's membrane and then facilitates destabilization of the membrane. It falls apart, everything falls out and there's little opportunity for it to develop resistance to these polymers."

Making products safer

In addition to the potential use for systemic delivery of drugs, scientists suggest that additional applications for these polymers could include adding them to every day personal and cleaning solutions. Imagine being able to wipe away MRSA-strength bacteria in a surgical theater, hospital room, or even your own kitchen without using dangerous chemicals or damaging surrounding surfaces.

The ideas for future applications include replacing toxins in things like deodorants and nail polishes with similar but eminently safer materials.

Through a variety of delivery mechanisms – gel, antibacterial wipes, injection or special coatings on hospital equipment – the research has the potential to stop the widespread distribution of antimicrobial agents that are found in everything from toothpaste to socks.

"Think about toothpaste and mouthwash–we spit it into sink, it goes into the water supply, that in turn is used on agricultural crops, or it's in the streams and oceans, and it still has these antimicrobials," Hedrick says. "Our polymers do their job and safely disappear."

Looking forward, the IBM Research team, along with its collaborators from the Institute of Bioengineering and Nanotechnology in Singapore, is exploring partnership opportunities with consumer goods companies and the food industry. In addition to creating beneficial replacements for personal and industrial hygiene items, tainted food processing equipment that may provoke food-borne illness could be similarly protected with polymer coatings.

Source: IBM

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