Multifunctional polymer neutralizes both biological and chemical weapons

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In an ongoing effort to mirror the ability of biological tissues to respond rapidly and appropriately to changing environments, scientists from the McGowan Institute for Regenerative Medicine have synthesized a single, multifunctional polymer material that can decontaminate both biological and chemical toxins. They described the findings recently in *Biomaterials*.

"Our lab applies biological principles to create materials that can do many things, just like our skin protects us from both rain and sun," said senior investigator Alan Russell, Ph.D., University Professor of Surgery, University of Pittsburgh School of Medicine, and director, McGowan Institute, a joint effort of the university and UPMC. "Typically, labs engineer products that are designed to serve only one narrow function."

Those conventional approaches might not provide the best responses for weapons of mass destruction, which could be biological, such as smallpox virus, or chemical, such as the nerve agent sarin, he noted. Terrorists aren't going to announce what kind of threat they unleash in an attack.

"That uncertainty calls for a single broad-spectrum decontamination material that can rapidly neutralize both kinds of threats and is easily delivered or administered, and it must not damage the environment where it is applied," Dr. Russell said. "Much work has gone into developing ways to thwart either germ or chemical weapons, and now we're combining some of them into one countermeasure."

He and his team have devised a polyurethane fiber mesh containing enzymes that lead to the production of bromine or iodine, which kill bacteria, as well as chemicals that generate compounds that detoxify organophosphate nerve agents.

"This mesh could be developed into sponges, coatings or liquid sprays, and it could be used internally or as a wound dressing that is capable of killing bacteria, viruses and spores," said lead investigator Gabi Amitai, Ph.D., of the McGowan Institute and the Israel Institute for Biological Research. "The antibacterial and antitoxin activities do not interfere with each other, and actually can work synergistically."

In their experiments, the material fended off Staph aureus and E. coli, which represent different classes of bacteria. After 24 hours, it restored 70 percent of the activity of acetylcholinesterase, an enzyme that is inhibited by nerve agents leading to fatal dysfunction of an essential neurotransmitter.

The researchers continue to develop alternate decontamination strategies to address chemical and biologic weapons.

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