Nylon reveals its antibiotic powers

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Nylon, we know, is incredibly versatile, strong and resilient. Now, it may be possible to add antibiotic powers to the list of qualities for the wonder synthetic material.

Writing in the most recent edition (Dec. 19, 2007) of the *Journal of the American Chemical Society*, a team of University of Wisconsin-Madison chemists reports that variants of the material have a capacity to mimic the antibacterial molecules produced by cells in response to infection.

The discovery may have broad applications ranging from clothing that kills bacteria to antibiotic coatings for stents, catheters and other biomedical devices implanted in human patients.

"This allows for cheap, large-scale synthesis of selective antibacterial materials that should work against even those bacteria resistant to conventional antibiotics," according to Samuel H. Gellman, a UW-Madison professor of chemistry and one of the senior authors of the new study.

The work of Gellman and his colleagues builds on the native ability of organisms to produce peptides — essentially small proteins, which are themselves a kind of nylon — capable of killing invading bacteria by disrupting the germ's cellular membrane. Host defense peptides, which are part of the body's innate immune system, apparently work by carpeting and disrupting the membrane surface of an invading pathogen.

By mimicking the chemical structure of the host defense peptide using

different forms of nylon, the Wisconsin team has come up with an easy-to-produce antibacterial material that could be deployed in many different ways to help thwart infection.

The ability of the peptide mimics to selectively kill bacteria by puncturing the cell membrane is important because bacteria cannot easily evolve resistance to that form of attack.

"This is an established biological mechanism," Gellman explains. "In an evolutionary sense, it's very old. It's been around for a long time. The mechanisms by which host-defense peptides work are hard for bacteria to evolve resistance to because they target the membrane, and the membrane can't be changed by a single mutation."

Another advantage of the host defense peptides and the peptide mimics made by the Wisconsin group is that they are selective in choosing their victims: They home in only on bacteria and do not attack other kinds of cells.

"A lot of things will kill cells, but not many things can do so selectively for bacteria," says Shannon Stahl, a UW-Madison professor of chemistry and another senior author of the new study. "The natural host defense peptides and our materials exhibit such selectivity."

The peptide mimics made by the Wisconsin group are a specialized form of nylon, notes Stahl, and can be easily and inexpensively manufactured in quantity and in different forms for a variety of products.

In contrast, while it is possible for scientists to make host-defense peptides themselves, it is expensive and difficult to do so, the scientists say.

Source: University of Wisconsin