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Bacterial 'bling': Adding silver to antibiotics boosts their effectiveness

By Loren Grush
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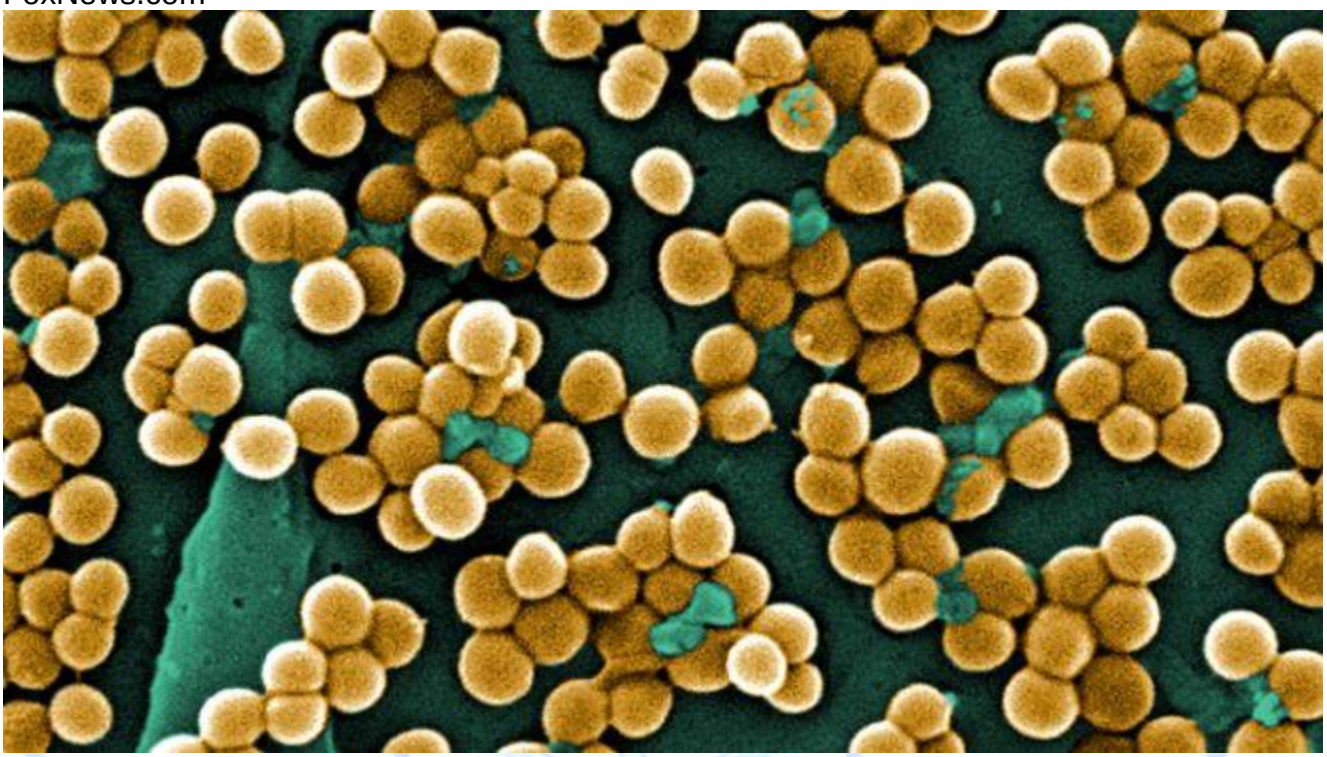

- This colorized scanning electron micrograph (SEM) depicts numerous clumps of methicillin-resistant Staphylococcus aureus (MRSA) bacteria. It is especially dangerous because it is resistant to many antibiotics. (CDC.gov)

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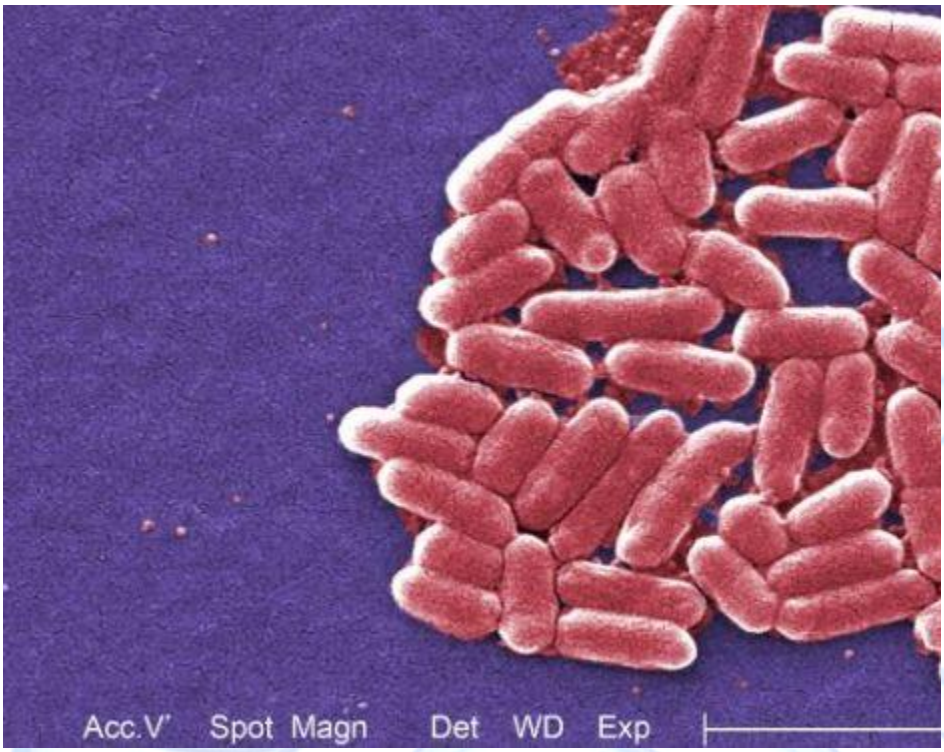
- 

This colorized scanning electron micrograph (SEM) depicts a number of Escherichia coli (E. coli) bacteria. (Janice Haney Carr/CDC)
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With the recent rise of deadly drug-resistant bacteria in the United States, once potent antibiotics are losing their luster as they increasingly becoming powerless in the fight against these dangerous infections. But new research suggests that an extra ingredient could help boost antibiotics' overall effectiveness.

All they need is a bit of "bling."
A new study from Boston University revealed that adding silver to antibiotics enhanced the drugs' abilities to fight off lethal infections in mice. Even more encouragingly, the added silver component also helped make an antibiotic-resistant strain of bacteria more sensitive to antibiotics once again.

Silver has been used for thousands of years as an antimicrobial agent and has been included in wound dressings and bandages to inhibit the growth of infectious microorganisms. In this study, researchers wanted to gain a more comprehensive understanding of why silver acts this way against bacteria.
"We found that (silver) was affecting the membrane of gram-negative bacteria, such as E. coli, making their membranes more permeable," study author Jim Collins, the William F. Warren Distinguished Professor at Boston University and a faculty member at the Wyss Institute for Biologically Inspired Engineering, told FoxNews.com.

Collins explained that the silver also interacts with central metabolism, leading to the disruption of iron homeostasis. In turn, this causes the production of molecules known as reactive oxygen species (ROS), which ultimately damage the bacterial cell's DNA and enzymes.

"We recognized that one or both of these mechanisms could be exploited to enhance the killing efficacy of antibiotics," Collins said.
Along with his colleague J. Ruben Morones-Ramirez, a former post-doctoral fellow in Collins' laboratory who is currently a professor at Universidad Autónoma de Nuevo Leon in Mexico, Collins and his team conducted a series of tests on the antibiotic-silver combination in vitro (in petri dishes) and in vivo (in mouse models).
Through their tests, the team showed that just a small amount of silver made E. coli bacteria between 10 and 1,000 times more sensitive to commonly prescribed antibiotics, such as penicillin. In the mice models, Collins and his team demonstrated that silver was able to change the membrane permeability of gram-negative bacteria. This enabled a large antibiotic called vancomycin, which has normally been used to fight gram-positive bacteria, to be effective against gram-negative as well.
Most importantly, the researchers showed that silver helped the antibiotic tetracycline fight a previously resilient strain of E. coli. This signified that the combination of silver and antibiotics could be used to resensitize antibiotic-resistant strains of bacteria.
"Overall, what we show is that small amounts of silver, non-toxic levels, can be used in conjunction with commonly used antibiotics to treat persistent infection and to treat bio-film based infections, which are problematic for medical implants," Collins said.
The rise of antibiotic-resistant bacteria, such as deadly MRSA or Clostridium difficile, has been considered a major health threat by the Food and Drug Administration. To fight this growing problem, the FDA has called for the reduction of drug-resistant bacteria in foods and animals used in food production, as well as the creation of new antibiotics to combat these deadly infections.

But the study's findings indicate that the development of new drugs may not be necessary, Collins said. The team suggested silver could be used as coating on existing antibiotics or incorporated into medical implants, to help prevent or eradicate infections that often occur during such medical procedures.
"Can we make our antibiotic arsenal stronger using these engineering methods?" Collins said. "The number of antibiotic-resistant strains has been growing, and the number of new antibiotics being made and approved are dramatically dropping. So instead of discovering and developing novel antibiotics, could we figure out ways to make the ones we have better?"
The research was published June 19 in *Science Translational Medicine*.

Read more: http://www.foxnews.com/health/2013/06/19/bacterial-bling-adding-silver-to-antibiotics-boosts-effectiveness/#ixzz2WnBvEDpR