

SCIENCE &amp; MEDICINE

# Silver found to increase effectiveness of antibiotics

BY MONTE MORIN, LOS ANGELES TIMES

JUNE 20, 2013 12 AM PT

Thousands of years before the discovery of microbes or the invention of antibiotics, silver was used to protect wounds from infection and to preserve food and water.

The alluring metal — which was fashioned into a multitude of curative coins, sutures, foils, cups and solutions — all but vanished from medical use once physicians began using anti-bacterial drug agents to fight sickness in the 1940s.

But now, as bacteria grow increasingly resistant to these medications and new pathogens invade hospitals, some doctors are turning once again to the lustrous element that Hippocrates prescribed for patients in ancient Greece.

In a study published Wednesday in *Science Translational Medicine*, researchers found that by adding trace amounts of silver to common antibiotics, the medications became up to 1,000 times more effective in fighting infections in mice.

Also, study authors said they were surprised and excited to find that the silver-antibiotic combo was able to “re-sensitize” bacteria that had developed a resistance to the drugs. It even extended the effectiveness of the commonly used antibiotic vancomycin to a class of bacteria that was previously immune to its effects.

“We went from basically no killing to substantial killing,” said senior author James Collins, a professor of microbiology at Boston University.

The study is one of the first comprehensive examinations of the ways that silver affects bacteria that are known as Gram-negative. These bacteria are equipped with an extra protective membrane that prevents antibiotic drug molecules from penetrating and killing them.

In a series of experiments, Collins and colleagues from Boston University and Harvard University examined the effects of a simple solution of silver nitrate salt on Gram-negative bacteria like *Escherichia coli*.

What they found was that even small amounts of silver ran roughshod over some of the toughest bacteria around.

“It did two things,” Collins said. The positively charged silver ions degraded the bacteria’s protective layer, giving the antibiotics easier access to the pathogens’ innards. It also messed with the bugs’ metabolism and their ability to manage their iron levels.

The second effect led to the creation of molecules that can kill bacteria, including oxygen molecules that are prone to chemical reactions that can damage cells, Collins said.

In one experiment, researchers induced peritonitis in mice by injecting them with *E. coli* cells. Of the mice treated with silver and vancomycin, 90% survived.

Mice treated with just silver or just vancomycin fared much worse. Half of the mice that got silver died, along with 90% of the mice treated with antibiotics.

The researchers also observed that silver was effective against biofilms — colonies of slime-protected bacteria that create stubborn infections on medical implants, heart valves and hospital equipment.

Although experiments combining silver and antibiotics have yet to be performed on humans, the study suggests that the metal may become a powerful helper in the fight against multi-drug-resistant microbes.

Researchers who were not involved in the study said it was timely, given the rising concern over the dwindling power of antibiotics. The World Health Organization warns that “many infectious diseases risk becoming untreatable and uncontrollable.”

“This is exciting data and should help pave the way for clinical trials into the use of silver,” said Wilmore Webley, an assistant professor of microbiology at the University of Massachusetts at Amherst. “The investigators covered a lot of ground.”

While the precise mechanisms by which silver kills germs remain something of a mystery, the element's medicinal and preservative qualities have been recorded throughout history.

Silver has been used variously to treat skin ulcers, compound fractures and even bad breath.

In his "History of the Medical Use of Silver," Dr. J. Wesley Alexander wrote that North American pioneers routinely dropped silver coins into vessels of drinking water during long journeys to ward off infection. In addition, privileged families benefited from using silver eating utensils that often caused "a bluish-gray discoloration of the skin, thus becoming known as 'blue bloods.'"

Argyria, an irreversible condition in which the skin turns blue or gray due to the buildup of silver particles, is the result of consuming silver solutions or flecks of the metal over long periods of time.

Though the quantity of silver solution used in the study was very small, Webley said repeated use of the metal to treat stubborn infections would be a potential concern for patients. He also noted that there had been reports of bacteria eventually developing resistance to silver.

The study authors acknowledged that much more testing needed to be done before the solution was used on humans. But they envision a day when antibiotics might be coated with silver or otherwise combined with the metal, perhaps in the form of

nanoparticles. (Some studies have found similar qualities in copper and zinc, though Collins and his colleagues did not test those metals.)

By using small doses of silver in combination with drugs, the researchers said they hoped to reduce the speed in which bacteria would develop resistance to the treatment.

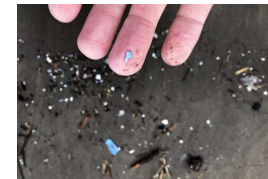
“Bugs will develop resistance to anything that’s causing damage to them,” Collins said. “Anybody who says otherwise is either not informed or yanking your chain.”

[monte.morin@latimes.com](mailto:monte.morin@latimes.com)

#### **MORE TO READ**

**Microplastics may be new risk factor for cardiovascular disease, researchers say**

March 7, 2024



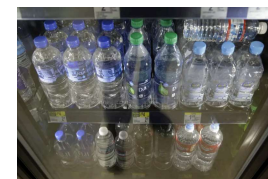
**Could a single synthetic molecule outsmart a variety of drug-resistant bacteria?**

Feb. 15, 2024



**Researchers discover thousands of nanoplastic bits in bottles of drinking water**

Jan. 8, 2024





Monte Morin

Monte Morin is the environment, health and science editor for the Los Angeles Times.