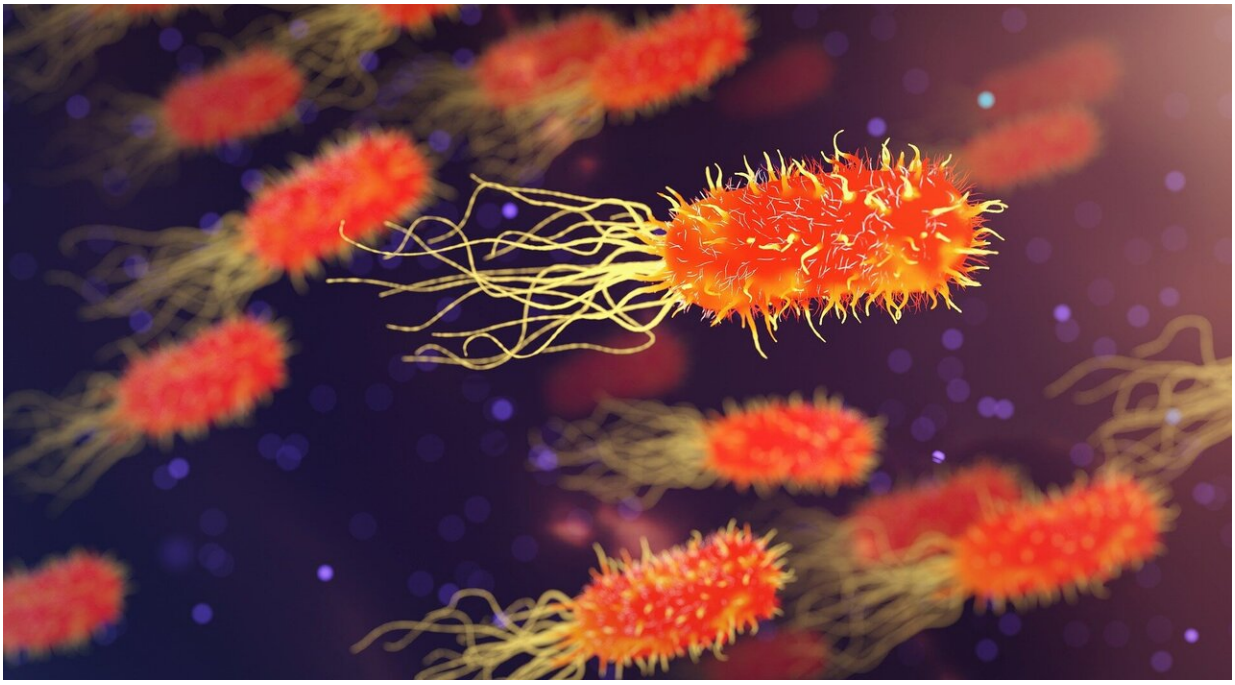
Scientists invent new drug candidates to treat antibiotic-resistant bacteria

February 24 2025



Credit: CC0 Public Domain

There's an arms race in medicine—scientists design drugs to treat lethal bacterial infections, but bacteria can evolve defenses to those drugs, sending the researchers back to square one. In an article published in the *Journal of the American Chemical Society*, a University of California, Irvine-led team describes the development of a drug candidate that can stop bacteria before they have a chance to cause harm.

"The issue with antibiotics is this crisis of antibiotic resistance," said Sophia Padilla, a Ph.D. candidate in chemistry and lead author of the new study. "When it comes to antibiotics, bacteria can evolve defenses against them—they're becoming stronger and always getting better at protecting themselves."

About 35,000 people in the U.S. die each year from antibiotic-resistant bacterial infections from pathogens like Staphylococcus, while about 2.8 million people suffer from bacteria-related illnesses.

"It's a big problem," said James Nowick, a Distinguished Professor of chemistry at UC Irvine who co-led the study.

The team designed a new family of antibiotics that's a variation of an existing drug called vancomycin, which is used as a last resort for extremely ill patients. The new version of vancomycin targets, bonds to and renders inactive two different parts of a molecule on the surfaces of pathogenic bacteria.

Nowick likens the process to grabbing the bacteria with both hands and subduing it. "What's happening at the molecular level is there are two pieces that can be targeted and that can be grabbed on to," he said.

This new version of vancomycin could be a giant leap forward. By binding molecules that bacteria need to build a protective cell wall, the drug may help end the antibiotic-bacteria arms race and eliminate the need for researchers to continuously design new drugs to treat newly evolved strains of antibiotic-resistant bacteria.

Padilla explained that the arms race is an ongoing and expensive endeavor. "It doesn't really solve the problem," Padilla said. "In terms of antibiotic development, I believe we shouldn't focus solely on modifying what we already know works, but rather take a step back and adopt a

new approach."

Padilla and Nowick hope their new family of antibiotics inspires other researchers to explore similar approaches for treating antibiotic-resistant pathogens in non-traditional ways.

"What's a new way that we can develop an antibiotic that doesn't require us to keep doing the same thing over and over again?" said Padilla. "I think with our approach, and the approach of several others, we're starting to target something that bacteria will most likely not evolve resistance to."

More information: Maria Sophia Teresa Lee Padilla et al, Vancomycin–Teixobactin Conjugates, *Journal of the American Chemical Society* (2025). DOI: 10.1021/jacs.4c17175

Provided by University of California, Irvine