Professor James Nowick’s Research Group is Fighting Antibiotic Resistance

The Nowick Research Group in the UCI Department of Chemistry is working on new antibiotics that will help combat the growing antibiotic resistance crisis.
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James Nowick's work focuses on things called supramolecular assemblies, which are large, 3D quilts of molecules.

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Laurel Hungerford Photography

Professor James Nowick's lab in the University of California, Irvine Department of Chemistry is one of the leading groups working to discover the main causes of cognitive decline in Alzheimer's Disease. But in the past few years the lab has been working on a new challenge: combating antibiotic resistance in bacteria.

In the United States alone, antibiotic-resistant bacteria are responsible for almost 3 million infections and over 35,000 deaths annually.

"There's an urgent need for new antibiotics because essentially all bacteria have developed resistance to most current antibiotics, and the development of new antibiotics in the pharmaceutical industry has not kept up with the demand," said Nowick.

In 2015, Northwestern University researcher Professor Kim Lewis reported the discovery of teixobactin — a new type of antibiotic discovered in soil bacteria. Teixobactin works by binding to a part of bacteria in such a way that, if the bacteria evolved a resistance to the antibiotic, it dies.

Professor Nowick wanted to study teixobactin and its antibiotic activity. In order to do this Nowick and his lab developed a synthetic route to teixobactin analogues that allowed them to access these molecules in sufficient quantities for testing.

Nowick's lab discovered that teixobactin assembles into larger molecular assemblies called oligomers. Oligomers play a detrimental role in diseases like Alzheimer's disease, but in the case of teixobactin, they work as antibiotics. But there's a catch: such oligomer assemblies also prevent teixobactin from adequately dissolving in the bloodstream.

NovoBiotic Pharmaceuticals, a pharmaceutical company founded by the researchers who discovered teixobactin, recently found another antibiotic related to teixobactin, one that does not have the same issues with solubility. Unfortunately, though, NovoBiotic didn't know exactly how some of the atoms of the new drug — called Novo29 — were connected, and understanding a molecule's structure is crucial to understanding whether it will work or not.

To solve this problem, NovoBiotic Pharmaceuticals reached out to Professor Nowick and his team, who devised a strategy to incorporate a chemical into a synthetic version of Novo29 that allowed them to determine how the atoms in Novo29 are

connected.

“Determining the connections of the atoms of the amino acids allows chemists to make versions of the antibiotic with improved drug properties,” said Nowick. “Our collaboration with NovoBiotic Pharmaceuticals has provided us with new insights into urgent issues in drug development and new challenges for chemists in solving these problems.”

Professor Nowick and his group are continuing to build their research on developing new antibiotics, one of the growing challenges in medicine and human health development. “We hope that this research will lead to an antibiotic that will treat the worst types of infections in people for which there are no other antibiotics that work,” he said.

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