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Bacteria communicate like we do, and we can use this to help address antibiotic resistance

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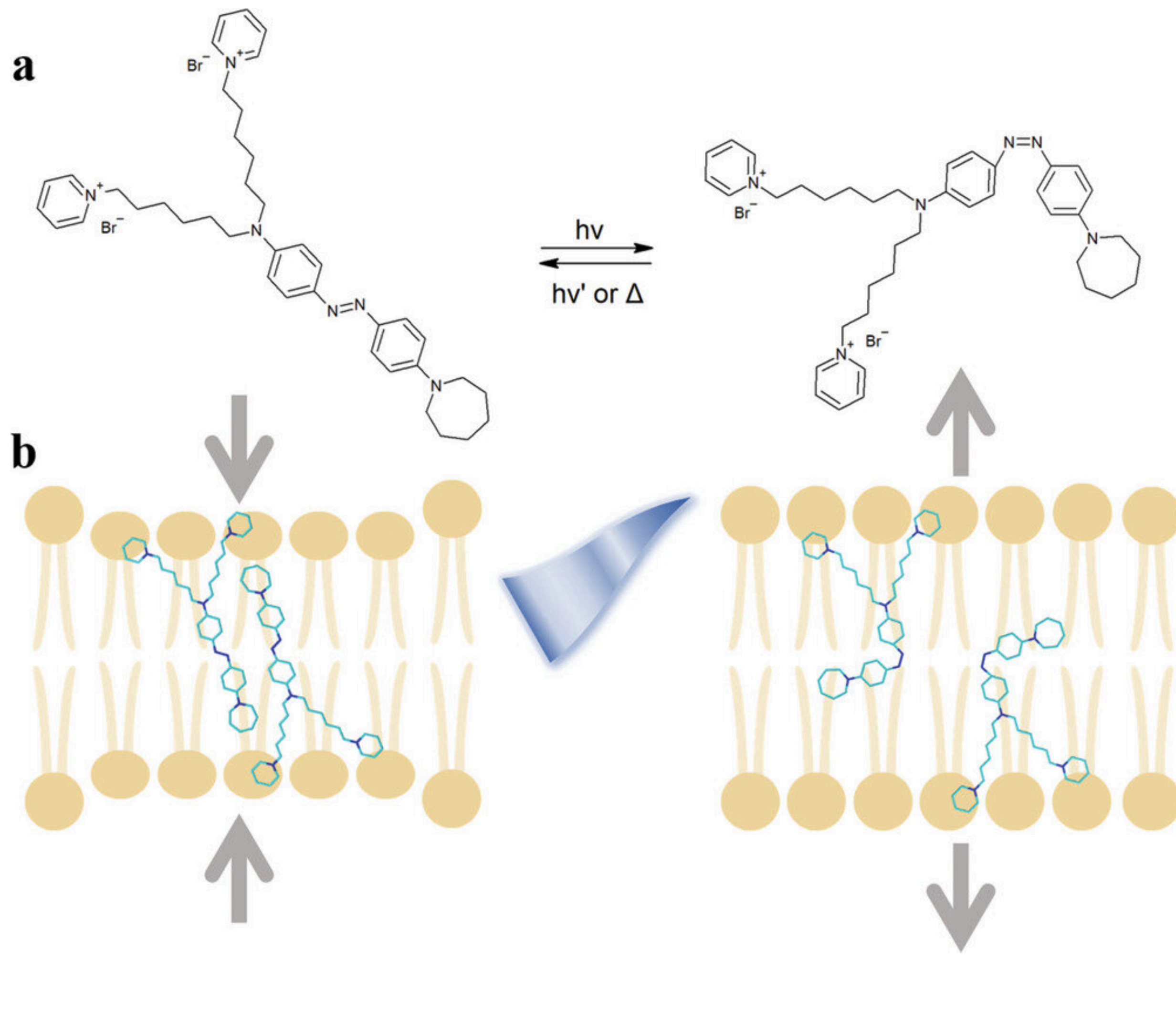

Illustrative diagram of photo-induced Ziapin2 isomerization. a) Molecular structure of Ziapin2 and representation of its isomerization reaction. b) The optomechanical action of Ziapin2 when sitting in the lipid membrane. In the trans elongated form, Ziapin2 is able to dimerize within the lipid membrane, leading to a decrease in the thickness and an increase in the membrane capacitance. On the other side, illumination with cyan light (470 nm) triggers Ziapin2 isomerization into its cis bent form, an effect that disrupts the dimers and leads to an increase in the thickness and a decrease of the membrane capacitance. Credit: *Advanced Science* (2023). DOI: 10.1002/advs.202205007

Like the neurons firing in human brains, bacteria use electricity to communicate and respond to environmental cues. Now, researchers have discovered a way to control this electrical signaling in bacteria, to better understand resistance to antibiotics.

This powerful tool will help advance understanding of bacterial infections—including the global threat of antimicrobial resistance. This is because such electric signaling is involved in antibiotic uptake and leads to some bacteria surviving antibiotic exposure.

In the study published in *Advanced Science*, researchers at the Universities of Warwick and Politecnico di Milano, report a major step forward in regulating bacterial electric signals with light. The team used a molecule, Ziapin2, which binds to bacteria membranes and changes its structure when exposed to light (a so-called "photoswitch").

Dr. Munehiro Asally, Associate Professor of the University of Warwick's Life Sciences department, said, "We found that upon exposure to blue-green light, bacteria showed an electrical pattern known as hyperpolarization. We showed that Ziapin2 causes special channels to open, causing electrical changes in bacterial cells."

"Though in its early stages, this technique may help us in the future to better understand microbial phenomena, such as cell-to-cell signaling, efficacy of antibiotics, and antimicrobial resistance," added Dr. Tailise de Souza, postdoctoral researcher at the University of Warwick.

Giuseppe Paternò, assistant professor of Physics at Politecnico di Milano University, says, "The introduction of light-methods in bacteria can potentially open up new exciting research routes. Apart from bringing a new tool for antimicrobial resistance studies, this approach can be exploited to build up bacterial hybrids that can perceive light and perform useful tasks, such as drug delivery in hard-to-reach body locations."

More information: Tailise Carolina de Souza-Guerreiro et al, Membrane Targeted Azobenzene Drives Optical Modulation of Bacterial Membrane Potential, *Advanced Science* (2023). DOI: 10.1002/advs.202205007

Provided by University of Warwick