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**PRESS RELEASE**

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# Controlling bacteria with light: from tackling antibiotic resistance to “bacterial robots”

## Results from Politecnico di Milano’s EOS research project published in *The European Physical Journal Plus*

Milan, June 03, 2025 - A groundbreaking technique developed by Politecnico di Milano researchers is enabling scientists to control specific bacterial functions using light-sensitive materials. The **Engineering Of bacteria to See light (EOS)** project, funded by the European Research Council (ERC), has pioneered a system that allows bacteria to sense light and convert light energy into electrical signals across their membranes **without the need for any genetic modification.** This method is being explored as a promising solution to the growing global challenge of antibiotic resistance.

Its potential applications include developing next-generation **antimicrobial platforms**, where light is used to target resistant pathogens, and **biocompatible, light-guided “bacterial robots”** capable of **delivering drugs to specific areas of the body, even those that are typically difficult to reach**, such as the gastrointestinal tract.

Politecnico di Milano’s research team uses special photo-transducing molecules that irreversibly attach to the bacterial surface. When exposed to light, these molecules alter the electrical potential of the bacterial membrane. Department of Physics professor and EOS project scientific coordinator **Giuseppe Maria Paternò** said: “**This interplay between light and electrical signalling allows us to control key biological processes** such as movement, biofilm formation, and antibiotic sensitivity. **By manipulating the membrane potential on demand, we can influence antibiotic uptake** and restore or even enhance the effectiveness of treatments against resistant strains.”

**The team’s initial findings, published in *The European Physical Journal Plus (Springer Nature)*,** demonstrate that optomodulation, which is the light-induced modulation of electrical signals, directly affects the absorption of antibiotics. **“Using a photosensitive molecule called Ziapin2, the researchers altered the membrane potential of *Bacillus subtilis*, modulating the action of antibiotics** such as Kanamycin (which acts within the cell) and Ampicillin (which targets the cell wall). **Under blue light (470 nm), the effectiveness of Kanamycin was significantly reduced**, suggesting that membrane potential plays a crucial role in the drug’s uptake. Ampicillin, on the other hand, retained much of its efficacy under illumination” Paternò said.

The EOS project unites expertise across physics, chemistry, materials science, and microbiology, involving researchers from the Departments of Physics, Chemistry, Materials and Chemical Engineering at Politecnico di Milano.

**Launched in 2023, the project secured a prestigious ERC Starting Grant,** receiving **€1.5 million** in funding under the Horizon Europe programme. **Dr Paternò was also named an**

**“Ambassador for the ERC Network”** on 28 April, joining 31 other grant recipients from 26 countries in advocating for the importance of scientific research across governments, media, and local communities.

**LINK TO HIGH-DEFINITION PHOTOS**

**LINK TO THE FULL PUBLICATION**

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