New research into a microrobot powered by urea for E. coli biofilm eradication

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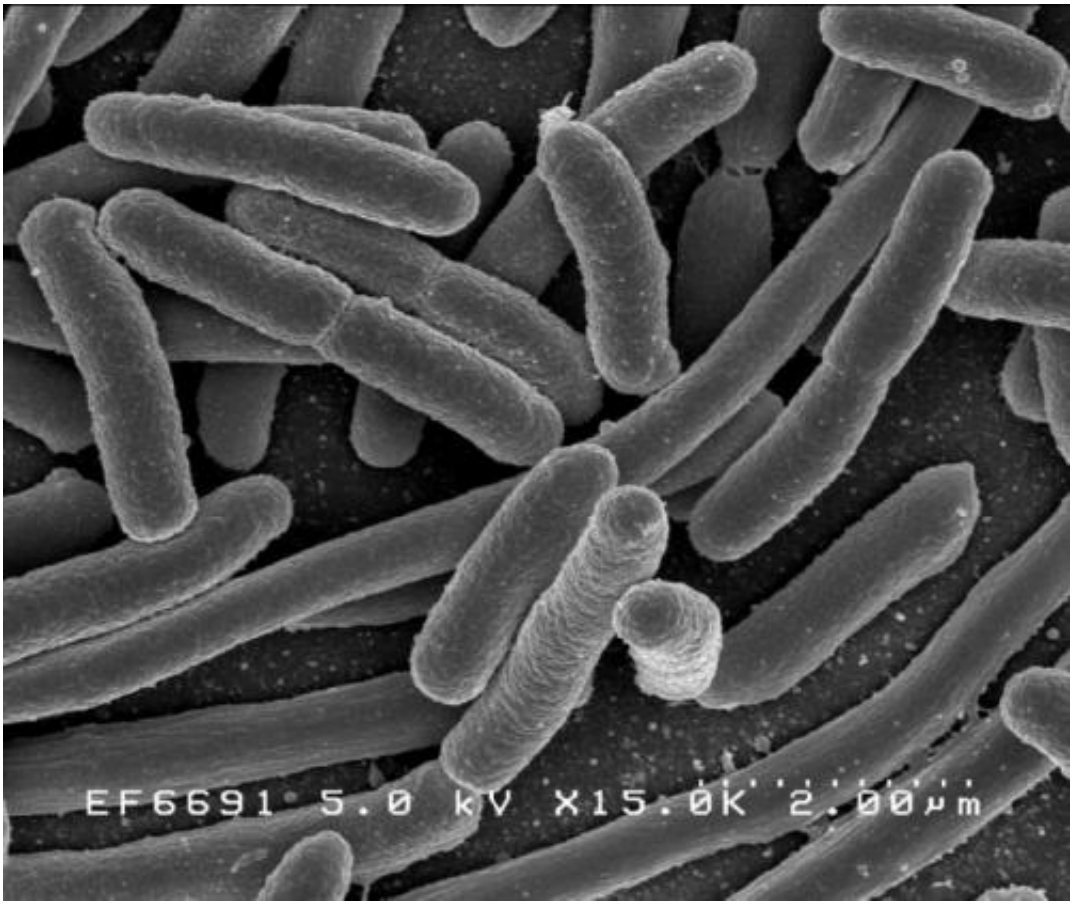

Escherichia coli. Credit: Rocky Mountain Laboratories, NIAID, NIH

Urinary tract infections are one of the most common afflictions caused by bacteria. It affects about 150 million people per year worldwide. Such types of infection are mainly associated with the presence of Escherichia

coli, which initiates the infection from the periurethral area to the urethra and finally colonizes the bladder. Once there, bacteria can adhere to the walls, leading to biofilm formation. This can only occur not only in the bladder but also in indwelling urinary catheters.

Different approaches dealing with bacterial biofilm inactivation have been developed over the last years, including liposomes and polymer-based drug delivery vehicles and application of external fields such as ultrasound, electrical, and light. Recently, these strategies have been combined with self-propelled micro/nanorobots that convert energy from the environment into mechanical energy. Because of their active motion, these devices can increase penetrability into the biofilm, leading to a higher dispersibility of antimicrobial agents in comparison with passive particles.

Researchers from the University of Chemistry and Technology have fabricated nanostructured microrobots consisting of nanotube bundles. These microrobots exhibit a crystalline structure and visible light absorption. The immobilization of urease on their structure provided them with an additional catalytic ability for triggering their autonomous motion in the presence of urea. These hybrid microrobots were able to efficiently disrupt E. coli biofilm after 2 hours of visible light irradiation.

"Overall, our work demonstrates the potential of combining enzyme/photocatalytic components within the same microrobot structure for the efficient removal of a bacterial biofilm," says principal researcher professor Pumera.

The research was published in *Small*.

More information: Katherine Villa et al, Enzyme-Photocatalyst Tandem Microrobot Powered by Urea for Escherichia coli Biofilm

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