GOLDENLIGHT : Advancing Strategies to Fight Bacteria Using Nanorods and Light

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Infections stemming from bacterial resistance to antimicrobials (AMR) are considered one of the greatest threats to global health. According to the 2019 WHO report, deaths attributable to drug-resistant microbes are projected to escalate from 0.7 to 10 million annually by 2050 if no action is taken. Bacteria develop AMR through various processes, such as the formation of biofilms. Biofilms are intricate organizations of bacterial species embedded in a protective extracellular matrix, with limited antibiotic access. Bacteria within biofilms can be up to 1000 times more resistant to antibiotics than planktonic bacteria, and 65 to 80% of human infections are caused by biofilms. Hence, urgent clinical needs call for alternative and effective antimicrobial modalities that do not rely on antibiotics, reducing economic and health burdens.

Within the GOLDENLIGHT project, our goal is to functionalize gold nanorods (GNRs) to enable specific interaction with *E. coli* bacteria (attachment to their membranes or even internalization of GNRs). We aim to utilize the photothermal and ROS-generating properties of GNRs to destroy *E. coli*. This study will be extended to biofilms to assess the destruction of bacteria in this specific protective environment. Fluorescence correlation spectroscopy will determine whether GNRs are located externally or internally to the bacteria. The use of genetically modified *E. coli* expressing green fluorescent protein (GFP) will help distinguish whether the cells are alive or dead through fluorescence imaging.

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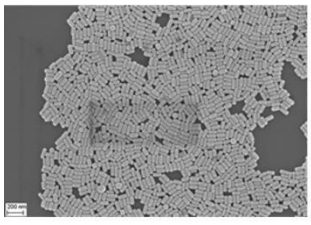
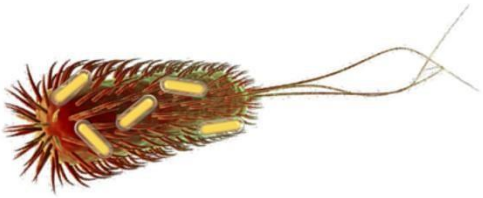
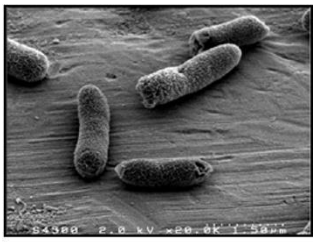


Gold nanorods



Killing E. Coli by plasmonic ROS and photothermal effect



Escherichia coli