Investigating the Mechanism of Eradication of Multi Drug Resistant Bacteria by Inorganic (mixed metal oxides), Organic (antibiotic), and PROJECT is RELATED TO Protein-based Nanoparticles

The increase in nosocomial infections is adding a substantial burden to the medical system as they result in extended periods of hospitalization. This increase is strongly associated with the emergence of antimicrobial-resistant bacterial strains over the last two decades.The widespread use of antibiotics has resulted in the evolution and spread of these resistant genetic determinants: multidrug resistant (MDR) and extremely drug resistant (XDR) bacteria. There is an urgent need to develope novel antimicrobial agents. The current proposal uses organic, inorganic, and protein-based nanoparticles (NPs) to kill antibiotic-resistant bacteria. Preliminary results show that inorganic mixed metal oxide (MMO) and organic antibiotic (ANB) NPs are very effective against MDR bacteria and that quorum sensing inhibiting enzyme (QSIE) NPs are effective in biofilm inhibition in pathogenic bacteria. We will investigate why these NPs are effective by studying clinical isolates of MDR bacteria in both planktonic and biofilm forms.
The proposed project brings together experts from Israel, Canada, and Spain. Gedanken will sonochemically synthesize and characterize MMO and ANB NPs. Tzanov will synthesize the QSIE NPs, study NP interactions with bacterial membrane models, and together with Banin will evaluate the efficacy of the of NPs against both planktonic and biofilm cultures. Bach will investigate the cytotoxicity and immunological response of the NPs in human cell lines and murine models infected with MDR bacteria, and develop a model of NP antibacterial mechanism using proteomics. Hafeli will perform pharmacokinetic analysis and NP distribution using bioimaging in murine models.
The significance of this project is to provide alternative antibacterial agents to tackle an emergent issue in our society.

Keywords: Nanoparticles; Quarum sensing; biofilm; metal oxides; Sonochemistry

Coordinator: Aharon Gedanken, Bar-llan University, Israel
Partners:
Horacio Bach, University of British Columbia, Canada

TzankoTzanov, Universitat Politecnica de Catalunya, Spain

EhudBarin, Bar-llan University, Israel

Urs Hafelli, University of British Columbia, Canada