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## Attacking bacterial pathogens using nanoparticle-based approaches: Steps and hurdles

**Alan W Decho**

University of South Carolina, USA



**T**he challenge of antibiotic-resistant infections (ARI) extends to global scales. New antibiotics having novel mechanisms of action and more-efficient delivery approaches to infections are needed to slow the climb in this emerging crisis. Engineered nanoparticles (NP) have been successfully used in eukaryotic systems, including humans for drug delivery purposes. Their applications to the microbial realm for delivery of antibiotics and other antimicrobials has remained steps behind due to methodological limitations, and the physiological properties and defenses of bacteria. The present talk will overview some recent advances toward attacking and manipulating bacterial cells to illustrate (hopefully) how engineered NPs can be used to obviate the seemingly strong defenses used by bacteria in pathogen infections. Specifically addressed topics will be: enhancing current antibiotic efficacy with molecular enhancers; attaching multiple antibiotics to NPs; and NP-antibiotic entry into bacterial cells. Major obstacles exist in nano-based approaches and negate the 'one solution fits all' approach using NPs. A first broad obstacle is how to specifically target the pathogens of interest, while not significantly impacting the 1–2 kg of 'good' bacteria that humans typically possess and require to varying

extents. A further complication is in the adaptability of bacterial surface signatures, and their capability to 'hide' within protective biofilms. A third obstacle addresses the selection of resistant variants to any antimicrobial attack. These and other issues for consideration will be addressed at the conference.

### Biography

Alan W Decho is the Professor and Director of the Microbial Interactions Laboratory at the University of South Carolina, Arnold School of Public Health. He completed his PhD from LSU, then conducted his Fulbright Post-Doctoral Fellow at CSIRO Laboratories in Australia. His research centers on attached forms of bacteria, called 'biofilms', and the use of nanotechnology for combatting biofilms. His lab is examining bacterial cell-cell communication (quorum sensing-QS) and the use of nanoparticles to control QS; searching natural environments for novel antibiotics to thwart biofilms; and determining how nanoparticles can be used as antibiotic-delivery vehicles. He has published more than 110 papers in journals such as *Nature*, *Nature Nanotechnology*, *ACS Infectious Diseases* and *Chemical Reviews*. He also serves as Associate Dean for Research in the Arnold School of Public Health at USC.

awdecho@mailbox.sc.edu