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## Nano-biotechnology strategies and engineering design approaches towards the development of smart therapeutics biomaterials against infectious diseases

There is a growing need to enhance our antibacterial arsenal given the rising incidence of antibiotic resistance, the emergence of novel virulent pathogens, and the almost 40-year innovation gap between introductions of new molecular classes of antibiotics. In the face of newly infectious organisms and the global crisis in antibiotic resistance, there is a need to invigorate the basic science and technology of antimicrobial development. This work, describes different engineering approaches to resolve some of the challenges in antibiotic development. The first approach involves exploring potentiation of current antibiotics using novel and naturally existing therapeutic adjuvants (such as silver and supplementary metallic micronutrients) based on a better understanding of the mechanisms of infectious disease, a comprehension of microbe-therapeutic biochemical interactions as well as the microbial genetic responses to therapeutics. The second approach includes some of the work in progress to develop novel drug delivery systems, using the interface of Nanotechnology and Synthetic Biology, to design intelligent and endogenous antimicrobial therapeutics. The final approach addresses the commitment to discover novel antimicrobial molecules and therapies. This work, in the third approach, describes an innovative mechanism to discover antimicrobial molecules through the identification of fruitful competitive biochemical interactions between a set of microorganisms in synthetic and natural ecologies.

### Recent Publications


- JR Morones-Ramirez, JA Winkler, CS Spina, and JJ Collins (2013) Silver enhances the activity and broadens the spectrum of antibiotics against Gram-negative bacteria. Science Translational Medicine. 5: 190ra81. (2013)
- S Kalghatgi, CS Spina, JC Costello, M Liesa, JR Morones-Ramirez, S Slomovic, A Molina, OS Shirihai, and JJ Collins (2013) Clinically relevant doses of bactericidal antibiotics induce oxidative damage in mammalian cells via a common mechanism. Science Translational Medicine. 5: 192ra85.
- JR Morones-Ramirez (2014) Coupling metallic nanostructures to thermally responsive polymers allow the development of intelligent responsive membranes. International Journal of Polymer Science. 2014: 1-7.
- Garza Gonzalez MT, Barboza Perez D, Vazquez Rodriguez A, Garcia-Gutierrez DI, Zarate X, Cantú Cardenas ME, Urraca-Botello LI, Lopez-Chuken UJ, Trevino-Torres AL, Cerino-Córdoba FJ, Medina-Ruiz P, Villarreal-Chiu JF, JR Morones-Ramírez (2016) Metal-induced production of a novel bioadsorbent exopolysaccharide in a native Rhodotorula mucilaginosa from the Mexican Northeastern region. PLoS One. 11(2): e0148430.

- Garza-Cervantes J A, Chávez-Reyes A, Castillo E C, García-Rivas G, Ortega-Rivera O A, Salinas E, JR Morones-Ramirez (2017) Synergistic antimicrobial effects of silver/transition-metal combinatorial treatments. Scientific Reports. doi:10.1038/s41598-017-01017-7.

## Biography

J Ruben Morones-Ramirez is a Full Time Professor in Chemical Engineering Department of the Universidad Autonoma de Nuevo Leon (UANL). He is the Principal Investigator of the NanoBiotechnology Research Group (www.rubenmorones.com) and is the Director of the Biotechnology and Nanotoxicology Research Center (www.cibyn.uanl.mx) of the UANL. His research focuses on projects at the intersection of the fields of Nanotechnology and Systems and Synthetic Biology to advance in the development and design of therapeutics, materials and alterative and clean energy. He has written more than 20 research articles, has more than 5,000 citations and his work has been highlighted in diverse prestigious press sources. He has won numerous awards, including the MIT Technology Review Innovator of the Year and the Innovator of the Year award by the Mexican Institute of Chemical Engineering.

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