NANOACTUATORS FOR NEURAL MODULATION

Gabriela Romero Uribe
Klesse Associate Professor
University of Texas at San Antonio

Abstract: The ability to modulate neural activity on-demand is essential for understanding the basic biology of neural circuit dynamics and developing novel therapies for neurological disorders and psychiatric conditions. Existing technologies for the control of neural circuits offer only limited possibilities. Manipulation of neural signaling via chemical agents is restricted by the blood-brain barrier, the rapid cerebrospinal fluid clearance, and the lack of cell-type specificity, resulting in poor cell response and adverse drug reactions. Microelectronic and optogenetic technologies have opened the possibility for stimulation through direct control of brain circuit dynamics and for simultaneous cell activity recording. However, they require implantable devices that are damaging to biological tissues. Transduction of external stimuli by nanomaterials, particularly magnetic nanoparticles (MNPs) has been studied for the wireless control of cellular signaling. The weak magnetic properties and low electrical conductivity of tissues allow alternating magnetic fields (AMFs) to reach deep into the body, making MNPs particularly promising to actuate on deep tissues. MNPs with tailored properties may act as transducers for AMFs remote stimulation by dissipating heat, exerting mechanical forces, or delivering chemical stimulus. These transduction mechanisms have been studied due to their potential applications in cancer research and therapies. In this talk, an overview of our recent results in the development of magnetic and soft nanotechnologies for the modulation of biological signaling will be presented.

Bio: Dr. Gabriela Romero is a Klesse Associate Professor in the Department of Biomedical Engineering and Chemical Engineering at the University of Texas at San Antonio since 2017. Dr. Romero received her B.S. in Chemical Engineering from the Universidad Autonoma de San Luis Potosi, Mexico in 2007, a M.S. in Advanced Materials Engineering in 2009 and Ph.D. in Applied Chemistry and Polymer Science in 2012 from the Universidad del Pais Vasco, Spain. After completing her graduate studies, she held postdoctoral positions at the University of Kentucky (2012-2013) and at the Massachusetts Institute of Technology (2013-2015). Prior to joining UTSA, she worked for two years as a Senior Scientist at Poseida Therapeutics (La Jolla, CA). Dr. Romero's primary research interests involve the investigation of biomedical soft materials and hybrid platforms as therapeutic tools for the treatment of brain diseases.