

## UC SAN DIEGO NANOENGINEERING SEMINAR

Wednesday, May 8, 2019

Seminar Presentation: 11:00am - 12:00pm

SME 248

### “Fiber Optics for *In Situ* Nanomechanical Sensing and Biological Interfacing”

**Dr. Donald J. Sirbuly**

*Associate Professor*

*Department of NanoEngineering*

*University of California, San Diego*

**Abstract:** The ability to stimulate, track, and record biological processes with as many data channels as possible is central to decoding complex phenomena in the body. For example, underlying many biological processes are unique nanomechanical events that help drive chemical reactions and guide chemical pathways. These small mechanical cues can be subtle and difficult to track, but are an intricate part of a living organism’s response to the environment and sustaining life. Unfortunately, measuring these mechanical signals requires unique tools that cannot only detect small sub-piconewton forces, but can record from multiple sites and be minimally invasive (i.e., maintain a small footprint). This is nearly impossible with state-of-the-art instruments such as atomic force microscopes and optical traps due to difficulty in multiplexing and size requirements to obtain force feedback. In the first part of the talk I will discuss our efforts in designing a novel nanofiber-optic platform that leverages near-field plasmon-dielectric coupling effects to detect forces with femtonewton resolution. In the second part of the talk, I will discuss how these fiber optics can be engineered to provide minimally invasive, multi-modal interfaces with intrinsic neural circuits. By utilizing a coaxial metal-dielectric architecture around a central fiber optic core, this electro-optical neural probe technology has the ability to address many of the shortcomings of state-of-the-art neural interfaces including a small cross-sectional dimensions, mechanical flexibility, electrical and optical communication with neurons, single neuron resolution, and deep neural interfacing.

**Biosketch:** Donald J. Sirbuly is an Associate Professor in the Department of NanoEngineering and an Affiliate Professor in the Materials Science and Engineering Program at University of California, San Diego. He received his Ph.D. in chemistry from University of California, Santa Barbara in 2003. Prior to joining UC San Diego in 2009, he was a staff scientist at Livermore National Laboratory (LLNL) and a postdoctoral researcher at University of California, Berkeley. His research at UC San Diego is focused on utilizing low-dimensional nanostructures for applications in nanophotonics, sensors, energy conversion, and biological interfacing. He has won several awards and science recognitions including the Hal Graboske Award, Hellman Fellowship, and NSF CAREER Award.