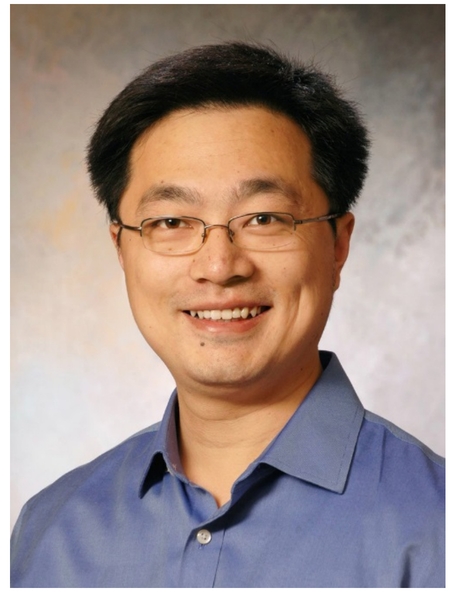
BIOMEDICAL ENGINEERING
Carnegie Mellon University

Thursday, September 27, 2018
10:30 – 11:30 a.m.
Baker Hall 136A



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Physical Biology at the Semiconductor-based Biointerfaces

Abstract: Although there are numerous studies on either semiconductors or biological components, our understanding of the fundamentals at the semiconductor-based biointerfaces has been limited. As different types of energy (such as electrostatic, mechanical, thermal, and chemical energies) display diverse scaling behaviors and can converge, an appropriate selection of the length scale is critical for promoting new scientific discoveries. My group integrates material science with biophysics to study several semiconductor-based biointerfaces. We synthesize new forms of semiconductor materials and use them to probe biological dynamics, with particular focus at the sub-micrometer and sub-cellular length scales. In particular, we have recently identified a biology-guided two-step design principle for establishing tight intra-, inter-, and extracellular silicon-based interfaces in which silicon and the biological targets have matched mechanical properties and efficient signal transduction. We proved light-controlled non-genetic modulations of intracellular calcium dynamics, cytoskeleton-based transport and structures, and cellular excitability, highlighting the utility of these new interfaces. Additionally, we demonstrated an uninformed search-based optical cellular-modulation approach that mimics naturally occurring extracellular signals, i.e., random, fast and multisite input signals.