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.

Hosted by Professor Liang Guo and sponsored by the Chronic Brain Injury program. Refreshments will be provided. The room is reserved until 5:00 pm for networking and social after the talk.