**Building an Imaging Toolbox: Nanosensors for Biological Discovery**

Research focuses on the development of fluorescent nanosensors for \emph{in vitro} and \emph{in vivo} analyte detection.

Website: http://www.northeastern.edu/nanosensors/

**Abstract**

New tools have the potential to unlock unexpected insights into biology. We are extending the toolbox for cellular imaging by developing an array of optical nanosensors for the measurement of ion and small molecule concentrations \emph{in vitro} and \emph{in vivo}. Each sensor is based on a polymeric platform and works by extracting the analyte of interest into the particle, creating a change in optical signal. Our sensors are easily tunable for dynamic range and extendable to new analytes, such as sodium, chloride, glucose, and neurotransmitters. In addition to creating novel probes, we are focused on the application of these nanosensors to solving biological problems. First, we are creating “tattoo” for monitoring pharmacokinetic profiles of drugs \emph{in vivo}. Our lithium-sensitive sensors can be injected into the dermal layer of the skin and monitored semi-continuously to obtain real-time drug concentrations. Second, we are using nanosensors for monitoring neurotransmitter release and ion signaling in neural tissue slices. Our advantage is the ability to image multiple analytes with both temporal and spatial resolution. In particular, we have demonstrated that a new type of sensor, which contains quantum dots in a polymer-free sensor is selective for potassium and photostable for cellular imaging. Ultimately, by combining advanced imaging techniques with our array of nanosensors, we plan to merge our two application areas in order to image chemical dynamics at a greater depth \emph{in vivo}. 