Northeastern University
College *of* Engineering

Please join us for a
Special Chemical Engineering Seminar

Wednesday, November 7, 2012
108 West Village H
11:45 a.m. – 1:00 p.m.

"An Immunoengineering Approach to Vaccination: Tuning the Immune Response with Redox-Sensitive Nanoparticles"

EVAN SCOTT, Ph.D.

ABSTRACT

Antigen presenting cells (APCs) are central components of the adaptive immune system that are responsible for initiating antigen-specific cellular responses essential to both humoral and cell-mediated immunity. As a result, most cancer immunotherapies and vaccine strategies focus on the delivery of antigen and adjuvant to APCs. Dendritic cells (DCs) are considered to be the most potent APC and possess highly efficient mechanisms of endocytosis and unique redox-dependent endocytic pathways for antigen processing and presentation that are not fully understood. I will present two nanoparticle platforms responsive to either oxidative or reductive chemistries that we have designed for either passive (induced by inherent cellular mechanisms) *in vivo* delivery or precise spatio-temporal active (induced by external direct manipulation) delivery at the single-cell level *in vitro* to the DC cytosol. The first platform utilizes solid-core pluronic-stabilized poly(propylene sulfide) (PPS) particles that allow surface conjugation of antigen via reduction-sensitive disulfide bonds. The second platform consists of oxidation-sensitive polymeric vesicles, or polymersomes, that were self-assembled from block copolymers composed of hydrophilic poly(ethylene glycol) and hydrophobic PPS blocks. Using these platforms either alone or in combination, we have demonstrated an ability to tailor the type and breadth of immune response elicited. Furthermore, the incorporation of a photo-oxidizer within the polymersome membrane permitted triggered optofluidic vesicle rupture at specified wavelengths of light to control payload delivery within submicron and millisecond spatio-temporal resolution. The implications of our results for enhanced control over elicited immune responses via synergistic combined nanoparticle strategies as well as for optofluidics-based measurements of intracellular kinetics will be discussed.

BIOGRAPHY: Evan Scott respectively received a B.S. and Ph.D. in Biomedical Engineering from Brown University in 2002 and Washington University in St. Louis in 2009. His dissertation developed methods based in proteomics and polymer chemistry to both analyze and control the interactions between cells and material surfaces. His awards include the Whitaker International Scholar Grant and an American Heart Association Predoctoral Fellowship. He has co-authored 15 peer-reviewed journal articles, 15 conferences proceedings, and 2 US patents. He is currently a Postdoctoral Research Fellow in the laboratories of Prof. Jeffrey Hubbell and Prof. Melody Swartz at the École Polytechnique Fédérale de Lausanne. Focusing on the development of immunomodulatory nanoparticle formulations for both HIV vaccination and cancer therapy, his research directly contributes to inter-institutional projects funded by the Gates Foundation.

Refreshments will be served