

# Spring 2008 SEMINAR SERIES

## F21C Bioprocessing & Biosensing Center

• DIVISION OF FOOD SYSTEMS & BIOENGINEERING •

**PRESENTER:**      **Dr. Jason A. Burdick**  
Department of Bioengineering  
University of Pennsylvania

**TITLE:**            **Biodegradable Polymers to Control Cellular Behavior for  
Musculoskeletal Tissue Engineering**

### **ABSTRACT:**

Photopolymerization is a process that is finding many applications in the fabrication of biomaterials for drug delivery, in the design of microdevices, and especially for the regeneration of tissues. Through the addition of a photoinitiator and an initiating light source, liquid solutions containing multifunctional monomers solidify into crosslinked networks. The widespread application of this process has been motivated by the spatial and temporal control that is afforded during photoinitiated polymerizations. This has allowed for the development of injectable biomaterials, the reduction of exotherms during the radical polymerization process, the entrapment of cells and growth factors, and for the construction of devices with controlled microstructures. Of particular interest to our laboratory is designing hydrogels with controlled properties that can influence the behavior of cells that interact with the material. Others have shown the importance of material chemistry and mechanics on the differentiation and behavior of encapsulated stem cells. Our work is motivated by the use of mesenchymal stem cells (MSCs) towards the regeneration of a wide range of tissues. Towards cartilage regeneration, we have been designing hydrogels based on hyaluronic acid (HA) that interact with cells via surface receptors (e.g., CD44) and degrade via hyaluronidases. When MSCs are encapsulated in HA hydrogels, enhanced chondrogenesis is noted compared to inert hydrogels (e.g., PEG) and chondrogenesis is observed even without growth factors present. Also, the mechanical loading of HA hydrogels leads to enhanced ECM and hyaluronidase expression. To enhance the control over network temporal properties, we recently synthesized a novel HA macromer with lactic acid between the backbone and reactive groups. When polymerized, this hydrogel degrades via both enzymatic and hydrolytic mechanisms and can be used for control over growth factor delivery and ECM distribution. For instance, one composition forms gels that degrade in buffer solution over a week, whereas little degradation in gels without lactic acid is observed without hyaluronidases. Our recent efforts are towards dynamic hydrogels containing photocleavable units, where crosslinking density can be controlled with light exposure, and with hydrogels containing patterned mechanical properties for controlled spatial MSC differentiation.

### **BIOGRAPHY:**

Jason A. Burdick, PhD is the Wilf Family Term Assistant Professor of Bioengineering at the University of Pennsylvania in Philadelphia, PA, USA. Jason has his PhD in Chemical Engineering from the University of Colorado working with Dr. Kristi Anseth and joined the faculty at the University of Pennsylvania in the summer of 2005 from a postdoctoral position at the Massachusetts Institute of Technology working with Dr. Bob Langer. His postdoctoral work was funded through a fellowship from the Spinal Cord Research Foundation. Dr. Burdick's research involves the development of photopolymerizable and degradable biomaterials for various biological applications and his laboratory is specifically interested in understanding and controlling polymers on a molecular level to control overall macroscopic properties. The applications of his research range from controlling stem cell differentiation through material cues to fabricating scaffolding for regenerative medicine. Jason currently has over 50 peer-reviewed publications and has been awarded a K22 Scholar Development and Career Transition Award through the National Institutes of Health and a Packard Fellowship in Science and Engineering.

### **DATE • TIME • LOCATION:**

**Tuesday, April 22, 4:00 pm**  
**Ag Eng Bldg 105 • Refreshments**