Department of Chemical Engineering
Special Guest Seminar

Abigail Koppes
Post-Doctoral Fellow
Northeastern University
Stephen's/Harvard Medical
Visiting Scientist
MIT

Host: Tom Webster
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"Manipulating the Neurological Microenvironment for Regenerative Medicine Applications"

Monday, March 31
333 Curry Student Center
11:45 – 1:00p.m.

Refreshments will be served

ABSTRACT In the U.S. there are 360,000 injuries to the peripheral nervous system (PNS) annually, and with conventional treatments only 10-40% of all patients recover normal function. This lack of functional success indicates the necessity for new clinical interventions to be developed. This seminar will focus on establishing a better understanding of nerve regeneration mechanisms through refining the "ideal microenvironment" via the presentation of synergistic combinations of biophysical (electrical stimulation), cellular (Schwann cells), and scaffold (3D vs. 2D) guidance cues towards the development of a rational therapy to support axonal re-growth. Results indicate that primary neurons and Schwann cells are responsive to electrical stimulation in both 2D and 3D microenvironments. Following stimulation, Schwann cells take on an enhanced neuro-supportive phenotype that contributes to a robust increase in neurite outgrowth through soluble factor release mediated in part by T-type voltage-gated calcium channels. Further, non-neuronal support cell migration is greater within 3D hydrogels following electrical stimulation, which could aid re-vascularization and re-myelination following PNS injury. Translatable knowledge from this work will broadly impact the field of tissue engineering; however the implications will have a profound influence on the design and application of relevant treatment strategies for PNS injury repair. I will also touch on my research initiative in regenerative medicine as a postdoctoral fellow at Northeastern University towards 1) the development of a natural matrix-based delivery vehicle for retinal progenitor cells to treat neuroretinal diseases such as age related macular degeneration, and 2) the development of a biomimetic growth substrate for engineered small intestinal tissue from primary enteroids for drug discovery and tissue replacement therapies. Finally, I will discuss my future perspectives for utilizing engineering techniques to fabricate novel 2D/3D systems to manipulate neural cell behavior and stem cell fate.

BIOGRAPHY Dr. Abigail Koppes received her Ph.D. in Biomedical Engineering from Rensselaer Polytechnic Institute (RPI) in Troy, New York in 2013. Her doctoral research with Dr. Deanna Thompson focused on using electrical stimulation to manipulate neural and supportive glial cell behavior for improved repair following peripheral nervous system injuries. In 2007, Dr. Koppes spent a year at the Cleveland Clinic with Dr. Shuvo Roy's BioMEMs group creating self-assembled monolayers to reduce blood protein adsorption for use in a miniaturized bioartificial kidney. In 2013, Dr. Koppes joined the Advanced Drug Delivery Research Laboratory with Dr. Rebecca Carrier as the Northeastern University STEM Future Faculty Fellow, and is co-advised by Dr. Thomas Webster in Chemical Engineering. Dr. Koppes holds a joint appointment at Schepen's Eye Research Institute and Harvard Medical School where Dr. Michael Young advises her. Dr. Koppes is also a visiting scientist in Dr. Douglas Lauffenburger's Molecular Cell Bioengineering group at MIT.

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