Electrical & Computer ENGINEERING

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DSN-I Seminar Series

Dr. Adam Feinberg

Bottom-Up Engineering of the ECM: From Nanofabricated Basement Membranes to 3D Printed Protein Scaffolds

WHEN: December 5, 2014
WHERE: Scaife Hall 125
TIME: 3:30 – 4:30 p.m.

Abstract

The extracellular matrix (ECM) is a nanofibrillar network of proteins such as collagen and other molecules that physically integrates cells into tissues and acts as an insoluble, mechanosensitive signaling network. Recent work has demonstrated that decellularized organs can serve as scaffolds to regrow tissues by providing instructive ECM cues for cells. But this top-down approach requires an existing organ to be decellularized first. We asked, why not build the ECM from the bottom-up just like cells do during embryogenesis or wound healing? To do this, we have developed a biomimetic, surface-initiated assembly process that recapitulates how cells naturally build the ECM in tissues. We are using these ECM nanofibers to engineer scaffolds for cardiac tissue engineering that mimic the ECM structure and composition in the embryonic heart, using developmental biology as a design template. Further, we are also developing new 3D bioprinting techniques to create larger structures that incorporate more intricate anatomy. Together, these approaches provide a reductionist system where complexity can be engineered back into the matrix system, which we are exploiting as a tissue engineering platform and basic science tool.

Speaker Bio

Dr. Feinberg is the principal investigator of the Regenerative Biomaterials and Therapeutics Group at Carnegie Mellon University. He earned his BS in Materials Science and Engineering from Cornell University in 1999 with Co-op experience at Abiomed, Inc., working on total artificial hearts. He then earned MS and PhD degrees in Biomedical Engineering from the University of Florida, focused on engineering cell-material interactions to prevent and enhance adhesion. This was followed by postdoctoral training at Harvard University, developing new biomaterials and stem cell-based cardiac tissue engineering strategies. He joined Carnegie Mellon in the fall of 2010 as an Assistant Professor with joint appointments in Biomedical Engineering and Materials Science and Engineering. Dr. Feinberg has co-authored over 20 peer-reviewed publications and holds 10 US patents and patent applications. He has also been awarded the NIH Director's New Innovator Award and the American Heart Association Scientist Development Grant. Current research is focused on biomimetic strategies to fabricate ECM protein-based materials from fibronectin, laminin, and collagens type I and IV to build 2D and 3D scaffolds for corneal and cardiac tissue engineering. Further, he is working to understand the biomechanics and mechanobiology of these engineered ECM protein materials, specifically how strain modulates biological activity.

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