Materials Science & Engineering Seminar Series

Carnegie Mellon University
Materials Science & Engineering

presents

3D Printed Bionic Materials

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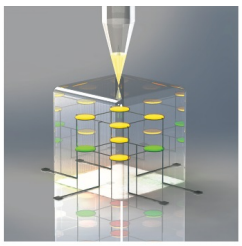
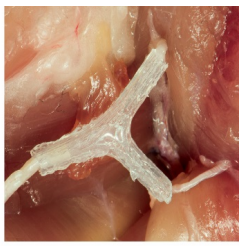
ABSTRACT: The development of methods for interfacing high performance functional devices with biology could impact regenerative medicine, smart prosthetics, medical robotics, and human-machine interfaces. Indeed, the ability to three-dimensionally interweave biological and functional materials could enable the creation of bionic devices possessing unique geometries, properties, and functionalities. Yet, most high quality functional materials are two dimensional, hard and brittle, and require high crystallization temperatures for maximally efficient performance. These properties render the corresponding devices incompatible with biology, which is three-dimensional, soft, stretchable, and temperature sensitive. Via custom-designed 3D printing approaches, we solve these dichotomies by: 1) using 3D printing and scanning for customized, hierarchical, and interwoven device architectures; 2) employing nanotechnology as an enabling route for overcoming mechanical discrepancies while retaining high performance; and 3) 3D printing a range of soft and nanoscale materials to enable the integration of a diverse palette of high quality functional nanomaterials with biology. 3D printing is a multi-scale platform, allowing for the incorporation of functional nanoscale inks, the printing of microscale features, and ultimately the creation of macroscale devices. This blending of 3D printing, novel nanomaterial properties, and 'living' platforms may enable next-generation 3D printed bionic nanodevices.


Cells & Tissue


3D Electronics


Chemical Control


Biomedical Devices

BIOGRAPHY: Michael C. McAlpine is the Benjamin Mayhugh Associate Professor of Mechanical Engineering at the University of Minnesota (2015-Present). Previously, he was an Assistant Professor of Mechanical and Aerospace Engineering at Princeton University (2008-2015). He received a B.S. in Chemistry with honors from Brown University (2000) and a Ph.D. in Chemistry from Harvard University (2006). His research is focused on 3D printed bionic nanomaterials, which is the three-dimensional interweaving of biological and electronic nanomaterials using 3D printing. He has received a number of awards, most prominently an NIH Director's New Innovator Award, a TR35 Young Innovator Award, an Air Force Young Investigator Award, an Intelligence Community Young Investigator Award, a DuPont Young Investigator Award, a DARPA Young Faculty Award, an American Asthma Foundation Early Excellence Award, a Graduate Student Mentoring Award, and an invitation to the National Academy of Engineering Frontiers in Engineering.

Doherty Hall 2315, 11:30AM
Friday, February 19, 2016