The Department of Mechanical Engineering/College of Engineering and Applied Sciences

Stony Brook University

Mechanical Engineering Seminar

Faculty Candidate

Dr. Pranav Soman, Ph.D.
University of California, San Diego

Lecture Title: Biofabrication: Unique manufacturing challenge for the 21st century

Friday, February 22, 2013 at 2PM, Room 173 Light Engineering Building

Abstract

Biological structures possess an unparalleled level of structural complexity that drives their specific functionality. Tissue engineering aims to regenerate functional living tissue, however, it is a challenge to recreate the bio-structural complexity. Computer-aided design and manufacturing techniques are uniquely suited to develop biomimetic constructs. The processing steps have to take into account the type and mechanical properties of the biomaterials, micro-architecture of the target tissue, and most importantly cellular response typically in the form of alignment, proliferation, migration, and differentiation. In this talk, I will present two manufacturing platforms, uniquely suited for exploring individual as well as the cumulative aspects of the biological environment: (1) Digital Projection Printing utilizes digital masks to fabricate 3D biostructures from 100μm to centimeter resolution and (2) Femtosecond stereolithography utilizes two-photon polymerization to manufacture 3D biostructures from sub-micron to 100μm resolution. I will present two case studies to demonstrate the unique capabilities of these advanced manufacturing systems. Case 1 will describe the development of a vascular co-culture system using complex biomimetic geometries. Case 2 will demonstrate the fabrication of photocurable biomaterials with Negative Poisson's Ratio (NPR) or "Auxetics". These next-generation biofabrication technologies will drive innovation by addressing critical challenges in the areas of tissue sciences, regenerative medicine, drug testing, cell and organ printing.

Biography

Dr. Pranav Soman received his B.S. degree in Mechanical Engineering from Pune University, India and his Ph.D. degree in Bioengineering from Penn State University. His doctoral work in the inter-disciplinary Artificial Organs division at Penn State University involved the design and development of a pulsatile ventricular assist device to provide mechanical circulatory support in infants. Dr. Soman focused on biological interactions occurring at the blood/biomaterial interface, primarily involving adsorbed and circulating proteins, platelets, and the implanted biomaterial itself. He developed novel atomic force microscopy (AFM) techniques to characterize blood components with nanoscale precision on clinically relevant polymer-implants. As a post-doctoral researcher at University of Texas, Austin in the Department of Mechanical Engineering, Dr. Soman developed a Lab-on-a-Chip for selective manipulation of living cells. Since moving to University of California, San Diego, Dr. Soman designed, developed and optimized two manufacturing platforms suited for printing living cells in three-dimensions. These high-throughput platforms use a combination of optics, digital printing technology, and stereolithography to build cell-laden constructs using both synthetic as well as naturally-derived biomaterials. Using these two platforms, Dr. Soman investigated a variety of biological problems in the areas of tissue engineering, cancer cell migration, as well as single cell manipulation and published 9 first author papers in the past 2 years.

Directions: Please refer to website: http://www.sunysb.edu or call 631-632-8310 for more information.
Check http://me.eng.sunysb.edu for any changes to location or time.

Stony Brook University