Dr. Christopher Chen, Boston University

Talk Title: Engineering Tissue Structure and Function

Abstract: Multicellular ecosystems such as biofilms, tissues, and whole organisms operate as highly integrated systems that link physical structure and biological function. In mammalian tissues, structure determines the effectiveness by which muscles generate force, lungs oxygenate blood, or glandular organs produce bile, milk, or saliva. Even at the level of single cells, tissue structure constrains how cells interact with surrounding extracellular matrix, neighboring cells, and physical forces, and these "microenvironmental" cues in turn regulate cell function at a fundamental level. Here, I will describe our efforts to design and generate functional tissue architectures most relevant to the cardiovascular system, using a variety of fabrication and cell-driven assembly approaches. We will present ongoing efforts to build in vitro organotypic models that mimic native tissue functions, studies to examine integration of engineered structures in vivo, and discuss opportunities and challenges for how to connect these insights to the ultimate translational objectives set by regenerative medicine.

Bio: Christopher S. Chen, M.D., Ph.D., is Founding Director of the Biological Design Center, Director of the Tissue Microfabrication Laboratory, and Professor of Biomedical Engineering at Boston University and the Wyss Institute for Biologically Inspired Engineering at Harvard University. Dr. Chen has been an instrumental figure in the development of engineered cellular microenvironments to understand how cells build tissues. His group pioneered the use of micro- and nanofabrication technologies to identify the underlying mechanisms by which cells interact with materials and each other to build organized tissues, and to apply this knowledge in the biology of stem cells and tissue vascularization. Most recently, he has used these insights to engineer biomimetic cultures that recapitulate the architecture and function of a variety of human tissues, as a new platform for studying human physiology and disease. He has served or is serving as a member of the American Institute for Medical and Biological Engineering, Faculty of 1000, the Board of Trustees for the Society for BioMEMS and Biomedical Nanotechnology, and Defense Sciences Study Group. He has been awarded the Presidential Early Career Award for Scientists and Engineers, the Angiogenesis Foundation Fellowship, the Office of Naval Research Young Investigator Award, the Mary Hulman George Award for Biomedical Research, and the Herbert W. Dickerman Award for Outstanding Contribution to Science. He received his A.B. in Biochemistry from Harvard, M.S. in Mechanical Engineering from M.I.T., and Ph.D. in Medical Engineering and Medical Physics from the Harvard-M.I.T. Health Sciences and Technology Program. He earned his M.D. from the Harvard Medical School. He began his academic career as an Assistant Professor in Biomedical Engineering and in Oncology at Johns Hopkins University, and then was recruited to the University of Pennsylvania as the Skirkanich Professor of Innovation and founding director of the Center for Engineering Cells and Regeneration prior to his current appointment.