Bioprinting: Implementation, Process Dynamics and Process-Induced Cell Injury

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Abstract: Maskless (including extrusion-, laser-, and inkjet-based) three-dimensional (3D) cell bioprinting is a revolutionary advance for printing arbitrary cell patterns as well as creating heterogeneous living constructs. More importantly, bioprinting provides a promising solution to the problem of organ donor shortage by providing printed tissue/organ constructs for transplantation, resulting in what is known as organ printing. Using representative jet-based model printing systems (laser-induced forward transfer and inkjetting), we have been investigating their process dynamics as well as studying the printing-induced cell injury. In this talk, the perspective of ongoing bioprinting research is first introduced. Then the investigation of bioink printability and the modeling of cellular droplet formation and landing processes during printing are discussed. The relationship between the mechanical loading information and the post-transfer cell injury/viability is further established through an apoptosis signaling pathway-based modeling approach. Finally, this talk shares some thoughts regarding basic scientific challenges during bioprinting.

Bio: Dr. Yong Huang is a professor of Mechanical and Aerospace Engineering, Biomedical Engineering, and Materials Science and Engineering at the University of Florida, Gainesville, Florida. His research interests are two-fold: 1) processing of biological and engineering materials for healthcare/energy applications, and 2) understanding of material dynamic behavior during manufacturing and process-induced damage or defect structures. His current research topics include three-dimensional (3D) printing of biological and engineering structures, precision engineering of medical implants and performance evaluation of machined implants, and fabrication of polymeric microspheres / microcapsules / hollow fiber membranes. He served as the Technical Program Chair for the 2010 American Society of Mechanical Engineers International Manufacturing Science and Engineering Conference (ASME MSEC 2010) and the 2012 International Symposium on Flexible Automation (ISFA 2012). He received various awards for his manufacturing research contributions including the ASME Blackall Machine Tool and Gage Award (2005), the Society of Manufacturing Engineers Outstanding Young Manufacturing Engineer Award (2006), the NSF CAREER Award (2008), and the ASME International Symposium on Flexible Automation Young Investigator Award (2008). He received his Ph.D. in Mechanical Engineering from the Georgia Institute of Technology in 2002 and is a Fellow of ASME.