

3D Printing for Engineering Complex Tissues

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Abstract

The generation of complex tissues has been an increasing focus in tissue engineering and regenerative medicine. With recent advances in bioprinting technology, our laboratory has focused on the development of platforms for the treatment and understanding of clinically relevant problems ranging from congenital heart disease to preeclampsia. We utilize stereolithography-based and extrusion-based additive manufacturing to generate patient-specific vascular grafts, prevascular networks for bone tissue engineering, dermal dressings, cell-laden models of preeclampsia, and bioreactors for expansion of stem cells. Furthermore, we have developed a range of UV crosslinkable materials to provide clinically relevant 3D printed biomaterials with tunable mechanical properties. Such developments demonstrate the ability to generate biocompatible materials and fabricated diverse structures from natural and synthetic biomaterials. In addition, one of the key challenges associated with the development of large tissues is providing adequate nutrient and waste exchange. By combining printing and dynamic culture strategies, we have developed new methods for generating macrovasculature that will provide adequate nutrient exchange in large engineered tissues. This presentation will cover the diverse range of materials and processes developed in our laboratory and their application to relevant, emerging problems in tissue engineering.

Biography

Dr. John P. Fisher is the Director of NIBIB / NIH Center for Engineering Complex Tissue, Fischell Family Distinguished Professor, and Department Chair in the Fischell Department of Bioengineering at the University of Maryland. As the Director of the Tissue Engineering and Biomaterials Laboratory, Dr. Fisher's group investigates biomaterials, stem cells, bioprinting, and bioreactors for the regeneration of lost tissues, particularly bone, cartilage, and cardiovascular tissues. Dr. Fisher's laboratory has published over 165 articles, book chapters, and proceedings (7500+ citations / 48 h-index) as well as delivered over 340 invited and contributed presentations, while utilizing over \$15M in financial support from NIH, NSF, FDA, NIST, DoD, and other institutions. Dr. Fisher has been elected Fellow of both the American Institute for Medical and Biological Engineering (2012) and the Biomedical Engineering Society (2016). Dr. Fisher is currently the Co-Editor-in-Chief of the journal *Tissue Engineering* and Chair of the Tissue Engineering and Regenerative Medicine International Society - Americas Chapter.

