Neurosurgery

Faculty Research Interests

Dr. Jae-Won Choi
Dr. Choi’s research interests include Development of Advanced Multi-Scale, Multi-Material Manufacturing Systems, 3D Structural Electronics, 3D Molded Interconnect Devices, Functional Additive Manufacturing, Direct Writing, Tissue Engineering, Biomedical Devices, Transdermal Drug Delivery System, and CAD/CAM. He has published 29 archival journal papers/proceedings.

Dr. Nic Leipzig
Dr. Leipzig group’s research interests are geared at discovering innovative approaches for tissue engineering of the central nervous system (CNS) with the goal of generating new treatments for neurodegenerative diseases, stroke, and traumatic brain/spinal cord injuries. A serious need exists for treatments that can restore function in the CNS, since currently available clinical treatments for diseased or damaged CNS tissue are limited to the prevention of further damage and minor pharmacological relief. Functional repair in the CNS can only be achieved by providing both endogenous and implanted cells with the proper physical and biochemical cues while combating the noxious environment that often accompanies CNS injuries and diseases. The group aims to stimulate functional regeneration of the central nervous system utilizing a combinational approach of engineered biomaterials, mechanical stimulation and stem cell sources. Our research specifically focuses on:
(1) Spinal cord functional tissue engineering incorporating mechanical stimulation
(2) Single cell mechanics and mechanotransduction
(3) 3D engineered microenvironments for regeneration of CNS tissues.
Dr. Rebecca Kuntz Willits
The overarching goal in the Willits lab is to design materials and devices that control cell behavior. In order to achieve this goal, significant effort has been put forth to understand the behavior of cells in biologically relevant three-dimensional scaffolds. The lab has studied how neural growth is affected by chemical changes, such as extracellular matrix factors, as well as mechanical changes in a collagen scaffold (Willits, 2004; Blewitt, 2007) and determined that scaffolds with lower stiffness generally have improved nerve extension over gels with higher stiffness. These results have translated to synthetic scaffolds, where the gels with lower stiffness support growth rates that are almost double that of scaffolds with higher stiffness (Scott, 2010). To further encourage nerve regeneration, the Willits lab, in collaboration with Dr. Matthew Becker from the Department of Polymer Science, has begun investigating aligned, peptide-tethered, nanofibers to mimic the extracellular matrix. These fibers provide both biochemical and topographical cues to direct migration and differentiation.