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Seminar - Strategic Faculty Hiring Initiative in Health (SFHI)

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"Biologically Inspired Tissue-Engineered Bone and Cartilage Substitutes: A Next Generation Treatment for Musculoskeletal Injuries and Diseases"

Wednesday, February 24, 3:00 in room G06 Rekhi Hall

Abstract

Various bone and articular cartilage defects, caused by trauma, disease or age-related degeneration, represent a crucial clinical problem all over the world. However, traditional implant treatments may cause many complications after surgeries, leading to intense patient pain. Thus, our research aims to create biologically inspired tissue-engineered bone, cartilage and osteochondral substitutes via state-of-the-art nanotechnology and biotechnology for replacing damaged or diseased musculoskeletal tissues and recovering their functionality.

For this purpose, we have designed a series of nanostructured scaffolds with excellent cytocompatibility and mechanical properties based on biomimetic nanoceramic particles, rosette nanotubes (a novel biologically inspired nanotube obtained through the self-assembly of DNA base pairs in water), collagen and hydrogels. Different cell types including osteoblast (bone forming cell), endothelial cell, mesenchymal stem cell and fibroblast responses towards these nanocomposites were investigated. Our results demonstrated that these biomimetic nanocomposites with controllable surface chemistry can significantly enhance bone cell functions and osteogenic differentiation of mesenchymal stem cells, thus making them promising for further study in bone tissue engineering and orthopedic applications. Furthermore, I will also introduce our work in cartilage tissue engineering. Through a novel self-assembling tissue engineering method, a cartilage construct was grown from chondrocytes and the mechanical, optical properties and extracellular matrix distribution of these constructs were measured over times. In summary, the results of our study indicate the importance of tissue-engineered bone and cartilage substitutes for improving current therapies of musculoskeletal disorders and diseases.

Biography

Dr. Lijie Grace Zhang is a postdoctoral research fellow at Harvard Medical School and Harvard-MIT Division of Health Sciences and Technology. She obtained her B.S. in Chemical Engineering and M.S. in Applied Chemistry from Tianjin University in China. During three and half year's study at Brown University, she got her second M.S. in Chemical Engineering and obtained her Ph.D. in Biomedical Engineering in Dr. Thomas Webster's Nanomedicine lab in January 2009. After graduation, she worked as a postdoc in Dr. Kyriacos Athanasiou's Musculoskeletal Bioengineering lab at Rice University. Lijie's research areas include bone and cartilage tissue engineering, regenerative medicine, nanobiomaterials, drug delivery, and biomechanics. She has published 5 invited book chapters, 12 peer-reviewed papers, 7 conference proceedings and has presented her work on over 22 conferences. Moreover, Lijie was the recipient of the Society for Biomaterials STAR Awards in 2007 and 2009. She also received the Joukowsky Family Foundation Outstanding Dissertation Award at Brown and the Sigma Xi Award for Excellent Research in 2009.

For information, contact the Department of Biomedical Engineering.