BIOENGINEERING SEMINAR

at 2:30 PM on January 10th, 2014 (Friday)
MRDG Seminar Hall, 1st floor, Biological Sciences Building

Gradients and 'Raw Materials' in Tissue Engineering

Michael Detamore

Professor, Department of Chemical & Petroleum Engineering
University of Kansas

Our group is interested in new technologies and strategies for osteochondral tissue regeneration. Some of the core tenets of our philosophy for tissue regeneration include the use of "raw materials" as building blocks, the engineering of continuous gradients, and leveraging osteochondral tissue engineering to enhance cartilage regeneration. The use of scaffolds built exclusively from microspheres provides a means for both raw materials and gradients to be employed in osteochondral tissue engineering. With the use of microspheres, we have shown that a single osteochondral biomaterial implant can be created with a continuous gradient in both material composition and growth factor release, with a seamless transition from one side to the other. We have further demonstrated the ability to create shape-specific scaffolds, and even fabricate the scaffolds in the presence of cells in a single step, by using dense phase CO_2 to sinter the microspheres. A series of *in vivo* tests in both the knee and in the temporomandibular joint (TMJ, or jaw joint) have yielded promising results for the use of microsphere-based scaffolds. As an alternate strategy, we are pioneering the use of interpenetrating network (IPN) hydrogels to encapsulate cells for cartilage tissue engineering. We have shown that two different hydrogel networks can be combined in such a way to create an IPN hydrogel with mechanical integrity far superior to either of the original gels, with viable cells encapsulated. This IPN approach has been further enhanced with the incorporation of "raw materials" for cartilage. In addition, we have developed a gradient-based design for a biomaterial to treat tracheal stenosis (narrowed airway). Finally, we have introduced human umbilical cord Wharton's jelly cells (WJCs) to musculoskeletal tissue engineering, which has permeated a number of different applications in our group.

About the speaker:

Michael Detamore is a Professor of Chemical & Petroleum Engineering and Director of the Biomaterials and Tissue Engineering Laboratory at the University of Kansas. He came to KU in 2004 after earning his B.S. in chemical engineering from the University of Colorado and his Ph.D. in bioengineering from Rice University. He is the recipient of the NSF CAREER Award and the Coulter Foundation Translational Research Award, and was a Fulbright Scholar and Visiting Professor at NUI Galway in Ireland in 2011. His research interests are biomaterials, biomechanics, stem cells and tissue engineering. Tissue engineering efforts focus primarily on bone and cartilage regeneration, including the temporomandibular joint (TMJ), knee, cranium, and trachea. Central research themes include umbilical cord stem cells and gradients in tissue engineering. He has published ~70 papers, and has been awarded two patents. He has also given invited lectures around the world, including in the United States, Italy, Switzerland, Scotland, Ireland, the Netherlands, Poland, India and Japan. In addition to his research, he enjoys teaching and has won numerous teaching awards.