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AN HONORS UNIVERSITY IN MARYLAND

Department of Mechanical Engineering

Fall 2006 Seminar Series, Friday- Sept. 29th, ITE 229 at 2:30pm

Calcium Phosphate Nano-Materials for Hard Tissue Repair

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Abstract

Approximately one million bone grafts are performed each year to treat osseous defects in the United States alone. This need is increasing dramatically as the world population ages. Autograft, the gold standard in bone repair, is restricted by bone availability, donor site morbidity, and contouring difficulty. Allografts and xenografts raise concerns of immunorejection and disease transmission. Calcium phosphate biomaterials have gained clinical acceptance for bone substitution and augmentation. One focus of our current research is developing injectable calcium phosphate nano-materials for bone repair. These materials can be easily manipulated and shaped, provide intimate adaptation to the contours of defect surfaces, and set *in situ* in the bone cavity to form a nano-crystalline hydroxyapatite solid. They are expected to be useful in procedures involving defects with limited accessibility or narrow cavities, when there is a need for precise placement of the paste to conform to a defect area, and when using minimally invasive surgical techniques. Another focus is incorporating cell-encapsulating alginate hydrogel beads into calcium phosphate and improving the mechanical properties of the tissue engineering scaffold. Osteoblast cell-encapsulated, alginate-calcium phosphate constructs show favorable cell attachment, proliferation and viability. The use of a biopolymer chitosan and a fiber mesh progressively improves the mechanical properties of the cell-seeded implant to match the mechanical properties of cancellous bone. With relatively high flexural strength, elastic modulus, work-of-fracture and fracture toughness, these novel cell-seeded hydroxyapatite composites are promising candidates for bone tissue engineering.

Biographical Sketch

Dr. Hockin Xu is a senior project leader at ADAF Paffenbarger Research Center, National Institute of Standards and Technology (NIST). He received his B.S. degree in Physics from Hangzhou University, China, M.S. degree in Material Science and Engineering from Kansas State University, and Ph.D. from University of Maryland, College Park. He worked as a postdoc fellow during 1993-1995 and research associate during 1995-1999 at NIST prior to joining the ADAF Paffenbarger Research Center. His research interests span dental composites, microstructure-property relationships, and bioactive materials. He is the recipient of multi-million dollar research awards from NIH, NIDCR, and etc.

Refreshments will be served

Host: Dr. D. Arola