TEXAS TECH UNIVERSITY
Edward E. Whitacre Jr.
College *of* Engineering™

Mechanical Engineering Department: Faculty Candidates Seminar Series

Monday, February 17th 3:00-4:00 ME Conference Room – ME 106

Developing Tools for Musculoskeletal Regeneration

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Abstract: My current research focuses on bone, skeletal muscle and cartilage regeneration with the intention of developing a program which can look at strategies for simultaneous regeneration of multiple tissues to engineer orthopedic tissue interfaces required for complete joint reconstruction. The overall approach is based on (1) the use of *biomimetic materials* such as ceramic scaffolds and natural polymeric matrices in (2) *bioreactors* that simulate the unique physiological conditions of *mechanical loading and fluid transport* and (3) recapitulate the physiological biochemical milieu by *controlled growth factor delivery.* This approach promotes the stimulation of multi-lineage stem cell differentiation as well as preconditions the bio-artificial grafts to match *the native tissue properties.* Driven by the translational need of patients suffering from massive trauma in either the civilian or military setting, tissue biomechanics plays a crucial role in the development of regenerative therapies for orthopedics. Biomimetic cues are used to develop different architectures of ceramics and composites which optimize both local fluid perfusion as well as global mechanical strength to serve as synthetic bone graft substitutes for large bone defects. The evaluation of mechanical properties is not always directly possible in a physiological setting in vivo and necessitates the development of appropriate predictive models which can link functional recovery to non-destructive imaging modalities. In this regard, micro computed tomography is useful in the evaluation of spatial distribution and quality determination of mineralized tissues such as bone.

Background/Vita: I am currently appointed as an Assistant Professor of Research in the Biomedical Engineering Department at the University of Texas at San Antonio, where I also received my doctoral degree in Biomedical Engineering. Prior to this, I was an Armed Forces Institute of Regenerative Medicine fellow at Wake Forest University focusing on injectable materials and drug delivery for regenerative medicine. My undergraduate training was as a mechanical engineer from the Indian Institute of Technology, Bombay. Given this background, my primary research focus has been on the mechanics of tissue regeneration and my teaching experience has mirrored my interests in biomechanics, biomaterials and product design. My current areas of research are on developing bioreactor technologies for tissue engineering, vascularization in bone and skeletal muscle, development of appropriate preclinical models and the effects of competitive biochemical and biophysical stimuli on tissue differentiation. These efforts have been supported by awards from the Department of Defense, at the university level and sponsored projects from industry. I have published over 25 peer reviewed journal publications in the field and am actively mentoring a lab of 8 students at the undergraduate, MS and doctoral levels.