YEDITEPE UNIVERSITY

Department of Biomedical Engineering

SEMINAR

February 17, 2012 (Friday)

16:00

Engineering Building B-308

Nanofiber-based biomaterials as grafts and controlled delivery systems for the engineering of connective tissue to bone transitions

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Integration of connective tissues such as cartilage, ligament or tendon to bone is facilitated by an intricate multi-tissue interface, which exhibits gradients in terms of structural and functional properties. This interface is known to enable minimization of stress concentrations for mediating load transfer between soft and hard tissues. Injuries associated with these connective tissues are common, with more than 4 million knee arthroscopies and over a million rotator cuff tendon surgical procedures performed worldwide each year. However, mechanical fixation of current reconstruction grafts often fails to reestablish the hierarchical soft tissue-to-bone transition post-surgery, mainly due to poor biocompatibility and insufficient mechanical strength, rendering it as a challenge.

One possible way of approaching this problem relies on the utilization of technologies that can allow for the generation of relevant structures that are inherently embedded into grafts/scaffolds, which can also serve as delivery systems for controlled release of bioactive molecules for improved healing. In this regard, nanofiber-based grafts/scaffolds offer superior biomimetic potential and physiological relevance as their properties such as fiber diameter and alignment can be modulated during fabrication. In addition, hormones/growth factors are useful bioactive molecules for mediating the healing process, and these molecules can be incorporated into nanofiber-based grafts/scaffolds, remain active during processing and storage, and be made available to more effectively regulate cell behavior so as to form a structure that can meet the functional demands of multi-tissue interfaces. This talk is intended to introduce a novel technology, namely extrusion-electrospinning technology, for the fabrication of functionally graded composite grafts and demonstrate their potential for the engineering of soft tissue to bone transitions. Additionally, theoretical models describing the process of electrospinning as well as mechanism of controlled release phenomena of biological molecules from electrospun nanofibers are also presented.

Cevat Erişken / Biography

Dr. Cevat Erişken received his B.Sc. and M.Sc. degrees in Chemical Engineering from Middle East Technical University, Ankara, Turkey, and Ph.D. degree in Chemical and Biomedical Engineering from Stevens Institute of Technology, New Jersey, US. Currently, Dr. Erişken is a post-doctoral research fellow in Biomaterials and Interface Tissue Engineering Laboratory at Columbia University in the City of New York, and performs research on the design and fabrication of clinically relevant biomaterials to be utilized in soft tissue-to-bone interfaces for integrative ligament and tendon repair. His research also focuses on controlled release of bioactive molecules from nanofibrous biomaterials to modulate the differentiation of stem cells into desired lineages. Part of his research involves mathematical modeling of release behavior of bioactive molecules from delivery systems to be able to better control their dosage to the cells. He has authored and co-authored in numerous scientific articles and books, and lectured at conferences and universities.