BIOENGINEERING
UNIVERSITY *of* WASHINGTON
A Department of the College of Engineering & School of Medicine

BIOEN 509 – DEPARTMENTAL SEMINAR SERIES

Thursday, May 20th, 12:00pm – 1:30pm

William H. Foege Building, Seminar Room, N130

Regulation of Cellular and Multicellular Form and Function with Nanoscale Cues: Implications for Wound Healing, Cancer Metastasis, and Tissue Engineering

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Living tissues are intricate ensembles of cells of different types embedded in complex and well defined structures of extracellular matrix (ECM). Functioning of many cell types in health and disease states can be significantly affected by naturally occurring nanotopographic structures within the ECM. Compared with the effects of other biochemical matrix-bound and soluble cues, however, the extent and the importance of nanotopography of the ECM in defining cell behavior is poorly understood, in part due to almost complete neglect of this factor in most in vitro experimentation.

In this talk, I will present interdisciplinary efforts directed towards better understanding of the role of physical interactions of living cells with the ECM in regulation of cellular and multi-cellular form and function. Inspired by ultrastructural analysis of the native tissue, I will focus on three different settings in normal and disease contexts, in which controlling cell-ECM interactions on the nanoscale can have dramatic consequences: cell migration during wound healing, cancer cell invasion, and cardiac tissue engineering. As novel approaches to address these problems, I will introduce scalable, nanotopographically controlled models of physiologically relevant and therapeutic tissue constructs including microfabricated epithelial wound healing model, structurally defined metastatic tumor invasion model, myocardium mimicking the in vivo ventricular organization, and tissue engineered cardiac stem cell patch. Using these tools in combination with traditional molecular and cell biology approaches, I will highlight how these nanotopographically-defined cell culture models enabled by micro and nanotechnologies help to gain better understanding of the fundamental aspects of establishment of cell polarity and guidance in the contexts of wound healing and cancer metastasis, and allow us to establish general principles for development of more precise and defined scaffolds for tissue engineering. We propose that controlling cell-material interactions on the nanoscale can stipulate structure and function on the tissue level, and yield novel insights into in vivo tissue physiology, while providing scaffolding materials for tissue repair.

Deok-Ho Kim received the BS degree from POSTECH (1998), the MS degree from Seoul National University (2000), in Mechanical Engineering, and the PhD degree in Biomedical Engineering from the Johns Hopkins University School of Medicine (2010). From March 2000 to June 2005, he worked as a research scientist at Korea Institute of Science and Technology (KIST), Korea, including his 7 months academic visit at the Swiss Federal Institute of Technology at Zurich (ETH-Zurich). He is currently an assistant research professor in the Department of Biomedical Engineering at the Johns Hopkins University, investigating how the engineered cellular microenvironments can direct cell function and tissue regeneration. His research interests include micro- and nanoengineering of the cell microenvironment, development and applications of lab-on-a-chip technologies and advanced biomaterials in stem cells and tissue engineering, and micro- and nanotechnologies for cell mechanobiology. He has published more than 90 peer-reviewed journal and conference publications, 4 book chapters, and 11 patents issued or pending in the areas of micro/nanotechnology, biomaterials, biomechanics, and cell/tissue engineering. Among the award he has received are American Heart Association Predoctoral Fellowship (2008), Samsung Humantech Thesis Award (2009), and the Harold M. Weintraub Graduate Student Award in Biological Sciences (2010).