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**"Biomimetic Polymers to Control Stem Cell Behavior"**

Tuesday, March 6, 2007  
Classroom 299 - Love Building

3:00-4:00PM

**ABSTRACT**

The fields of biomaterials and tissue engineering have grown over the past decade at a breathtaking pace. Dramatic advances in biomaterials synthesis and development, biological performance evaluation, and engineering analysis have combined to cause a paradigm shift in how we use the term "biomaterials". Our concepts of how we design "parts" for the body now focus on integrating biological specificity, i.e. bioactivity, into materials rather than trying to minimize the inevitable complications associated with their biological performance. Images in technical and lay publications that commonly showed a schematic of the human heart with an assortment of artificial devices made from metal and plastic to emphasize progress in biomaterials science, now show the same functions being the targets of tissue engineering assisted by biomaterials designed to instruct cell fate.

In spite of these efforts, materials that precisely control the survival, proliferation, and fate of stem cell populations in vitro and in vivo are not well developed. To address these issues, we have created artificial extracellular matrices (ECMs) that are environmentally responsive and tunable with respect to mechanical properties (e.g.  $G^*$ ), biological ligands, and protease degradation. Ultimately, we intend to use these tunable hydrogels to establish design rules for engineering tissue regeneration in vivo. As a first step in this program, we have synthesized modular hydrogel ECMs where different properties of the matrix can be manipulated independently, thus creating a system where parametric analysis of the effect of hydrogel properties on cell proliferation and differentiation is possible. This system allows for easy synthesis of admixtures of biological signals while independently maintaining the mechanical properties of the matrix. Therefore, studies addressing the effect of biological ligand type and density, in the context of matrices with various mechanical properties, can be easily performed. We propose a general strategy based upon our novel artificial ECMs that will provide: 1) a foundation for local cell development from undifferentiated satellite stem cells; 2) enhance angiogenesis and host cell infiltration; and, 3) promote tissue regeneration in a defect model. Examples relevant to regeneration of bone and ischemic myocardium will be discussed.

**BIOGRAPHY**

Kevin E. Healy, Ph.D. is a Professor at the University of California at Berkeley in the Departments of Bioengineering and Materials Science and Engineering. He received a Bachelor of Science degree from the University of Rochester in Chemical Engineering in 1983. In 1985 he received a Masters of Science degree in Bioengineering from the University of Pennsylvania, and in 1990 he received a Ph.D. in Bioengineering also from the University of Pennsylvania. He was elected a Fellow of the American Institute of Medical and Biological Engineering in 2001. He has authored or co-authored more than 200 published articles, abstracts, or book chapters which emphasize the relationship between materials and the tissues they contact. His research interests include the design and synthesis of biomimetic materials that actively direct the fate of mammalian cells and facilitate regeneration of damaged tissues and organs. Major discoveries from his laboratory have centered on the control of cell fate and tissue formation in contact with materials that are tunable in both their biological content and mechanical properties. These materials find applications in medicine, dentistry, and biotechnology. He is currently an Assistant Editor of the Journal of Biomedical Materials Research.

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