



JOHNS HOPKINS

BIOMEDICAL ENGINEERING



Monday, February 2, 2009, 1:00 PM, Clark 110

Light lunch will be provided at 12:00



Engineered Matrices for Regenerative Medicine

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Host: Dr. Jennifer Elisseeff

Abstract: An important need for expansion of primary cells and progenitor cells in three dimensions (3-D) is a synthetic mimic of the extracellular matrix (ECM) with user-controllable composition that would permit rapid recovery of viable cells under mild, non-enzymatic conditions. Ideally, this synthetic ECM (sECM) would be an injectable vehicle for delivery, retention, growth, and differentiation of stem cells for regenerative medicine. To meet this need, we developed a synthetic extracellular matrix (sECM) that is an *in situ* crosslinkable hyaluronan-based hydrogel. These reproducible, approvable, and affordable biomaterials can be used for cell therapy and for developing cell-device combination products. The crucial design criterion met by these materials is the seamless translational utility from 3-D culture of cells *in vitro*, to preclinical *in vivo* models, to use in the clinic. Several of these materials are now in clinical development as human medical devices, and have reached the market for veterinary wound care and as research tools for 3-D cell culture and tissue engineering. Specific *in vivo* examples to be described include repair of cutaneous and ophthalmic wounds, vasculogenesis by controlled growth factor delivery, repair of bone and cartilage defects, regeneration of liver tissue, and development of a “tumor engineering” strategy for creation and treatment of orthotopic cancers. Additional sECMs are being developed used as research tools for 3-D culture of stem and primary human cells, tumor xenografts, growth factor delivery, wound healing, and tissue regeneration. First, we have customizable sECMs for use with progenitor cell populations obtained from skin, fat, liver, heart, muscle, bone, cartilage, nerves, as well as embryonic tissues. Second, we developed reductively-cleavable crosslinkers that allow cell growth and expansion in 3-D; the hydrogel network can be dissolved within 1 h with 25 mM *N*-acetyl-cysteine, allowing cell recovery in high yield under non-enzymatic conditions. Third, progress with printable hydrogels for organ printing will be described. Finally, the development of “animal-free” sECMs, in which animal-derived protein and GAG components are replaced with non-animal-derived substitutes, will be highlighted.

Upcoming Seminar:

February 9: Dr. Robert Linhardt

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