



Bio-inspired Microenvironments Regulate Cell Fate

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Location: 1000 MNTL at Illinois (KL 232 at UC Merced)

Abstract:

Epigenetic regulation of stem cell fate by intrinsic properties of the surrounding extracellular matrix (ECM), e.g. stiffness, organization, composition, etc., appears to be an important yet underappreciated contributor in development, disease, and aging. I will describe our efforts to develop biomimetic environments that mimic key intrinsic ECM properties to assess their contribution to regulating cell fate. For example, pre-cardiac mesodermal cells mature in to adult cardiomyocytes when their matrix mimics the 10-fold increase in stiffness that occurs naturally during development. Adult mesenchymal stem cells (MSCs) are particularly sensitive to small spatial stiffness gradients which can be found naturally in vivo; these gradients induce cell migration prior to differentiation and may in part explain MSC accumulation in stiffer regions of tissue interfaces. However, disease often inhibits these natural processes by creating an ischemic, fibrotic, and/or rigid environment. When matrix stiffness resembles the rigid fibrotic scar, micropatterning cells into specific morphologies can reset the cell to the appropriate contractility level required for myogenesis. Using these findings as design principles, we are engineering nano-patterned diblock copolymer foams to better guide cell differentiation in diseased microenvironments in vivo, but taken together these data at least imply that matrix properties, when displayed at the right time and place, are important regulators of cell fate.

Adam J. Engler is an assistant professor of Bioengineering at UC San Diego. His research is focused on how cell behavior is directed by the extracellular matrix (ECM), a 3-dimensional fibrillar scaffold to which cells adhere, during development, disease, and aging. Engler earned his B.S.E. degree in bioengineering at the University of Pennsylvania, and a Ph.D. in mechanical engineering and applied mechanics also at UPenn. Engler then moved to Princeton University's Department of Molecular Biology as a Postdoctoral Research Fellow, funded by the National Cancer Institute. Dr. Engler is the 2008 recipient of the Rupert Timpl and Rita Schaffer Young Investigator Awards from the International Society for Matrix Biology and the Biomedical Engineering Society, respectively, for his lab's work on the mechanical regulation of stem cell differentiation by the extracellular matrix. He is also a recipient of a 2009 NIH New Innovator Award. Engler Lab Web site: <http://ecm.ucsd.edu/Adam.html>

Seminar Presented by:

