Special Seminar

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Thursday, March 3rd

1:30 p.m., Seminar Hall (1315) Chemistry

Model Substrates for Studying and Directing Stem Cell Differentiation

Substrates that are designed to mimic the extracellular matrix are useful tools for studying cell adhesion and signaling in the microenvironment. Here I present the use of self-assembled monolayers that are patterned with matrix proteins or tailored with short peptide ligands for exploring the cues in the microenvironment that direct stem cell fate. First I will show how micropatterning single mesenchymal stem cells (MSCs) can be used to investigate the role of cell shape during differentiation. Geometric features that promote a contractile cytoskeleton promote osteogenesis while geometries that promote a less organized cytoskeleton promote adipogenesis. Next I will present evidence that varying cell density through patterning can influence the differentiation outcome by modulating paracrine signaling between adjacent cells. Lastly I will show how MSC fate can be guided solely by the affinity and density of ligand-receptor interactions at the biomaterials interface. Cells adherent to monolayers that present the high affinity cyclic-RGD peptide show increased marker expression for osteogenesis. In contrast, cells on monolayers presenting the lower affinity linear-RGD peptide express early markers of myogenesis and neurogenesis. Taken together, these studies demonstrate how tailored substrates can be used to explore the interplay of physical, chemical and biological signaling during stem cell differentiation.