Combinatorial Screening of Biocompatible Polymer Surfaces - Meredith

Perhaps the most vital need for developing polymeric biomaterials is surfaces that actively control cellular and physiological responses. Such "bioactive" polymers could be used in tissue engineering scaffolds that support and regulate the adhesion, growth, and function of target cells.

We have developed a novel combinatorial methodology for characterizing the effects of polymer surface features on cell function. Libraries containing hundreds to thousands of distinct microstructures and roughnesses are prepared using composition spread and temperature gradient techniques (Figure 1).

The technique overcomes complex variable spaces that limit development of biomaterial surfaces for control of cell function by enabling:

- orders of magnitude increases in discovery rate
- decreased variance
- high-throughput assays of cell response to physical surface features.

Figure 1

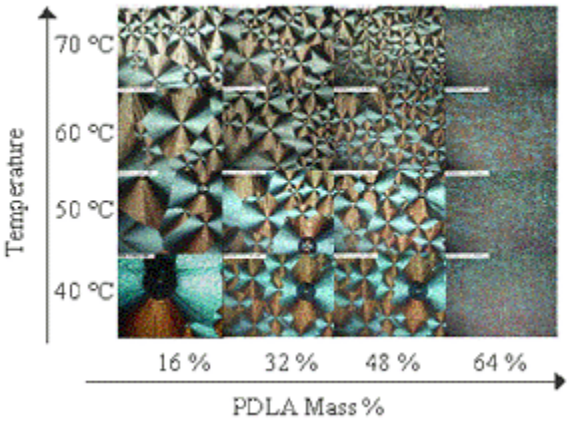
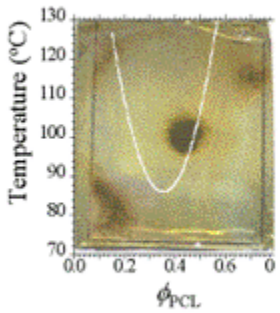


Figure 2



In particular, we use the phenomenon of heat-induced phase separation in these polymer mixtures to generate libraries with diverse microstructure and roughness, followed by culture of cells such as osteoblasts (Figure 2), capillary endothelial, human hematopeoitic stem cells, and aortic smooth muscle cells on the libraries. With these high-throughput cell cultures, we discover novel regions of surface chemistry and roughness where cells adhere and function optimally (Figure 2).

Financial Support:
NIH - National Center for Research Resources
NIH - National Heart, Lung, and Blood Institute
Rockefeller Brothers Fund
Ga Tech - Emory Biomedical Engineering Seed Grant