

### **233d Combinatorial Libraries for Investigation of Cell Interactions with Polymer Surfaces**

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In this talk we present two recent innovations in combinatorial screening of osteoblasts (MC3T3-E1) to biodegradable polymer surfaces. Polymer surface-cell interactions are critical in tissue engineering, diagnostic materials, and other implantable biomaterials. The complex nature of cells and polymer surface features, along with the natural statistical variance of cell behaviors, is overwhelming to the traditional experimental design methodology of 1 sample-1 measurement. To improve the ability to optimize surface to achieve cell responses, or to generate knowledge of cell-surface interactions, an efficient experimental method combined with tools for statistical analysis of cell responses is needed. In particular, combinatorial and high-throughput methods allow a wide range of combinations of polymer surface properties to be screened against cell behavior in efficient experiments.

We have previously developed a combinatorial polymer surface library technology that has been proved a promising high-throughput experimental tool for this task. We have applied this technology to complex blends of biodegradable polymers, in which both chemistry and physical surface features are varied in two-dimensional gradient libraries. Surface morphological lateral patterns can be established through phase separation of polymer blends or through crystallization of one polymer phase. On such libraries, diverse combinations of surface properties are packed on small silicon chips. Subsequently, cell responses to combinations of polymer surface properties are examined efficiently on these libraries by through automatic scanning immunofluorescence microscopy. Afterwards, mass image data are managed by and analyzed on a database/data warehouse system and new knowledge is achieved.

First, we will present a comprehensive model describing effects of polymer surface morphological patterns on cell proliferation. In this specific case, cell-surface interaction and cell-cell interaction are found as two major factors modulating cell proliferations. By selecting appropriate cell densities, these two interactions are detangled and studied individually, and an overall model is reached. Secondly, the capability and efficiency of the novel, database/data warehouse platform based methodology for mass data analysis and data mining will also be illustrated.

The biomaterial systems of study are mixtures of polycaprolactone and poly(lactide-co-glycolide). We investigate specifically the dependence of cell proliferation on the underlying surface topography.