10f Multi-Scale Characterization of Biomaterial-Hepatocyte Interactions Using Kinetic Fluorimetry and Microscopy Image Analysis

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There is increasing interest in the development of new biomaterials and surface coatings for various medical applications. However quantification of cell-surface interactions has proven challenging. Typically these interactions are quantified by random microscopic views, which are prone to sampling bias. More accurate characterization of these interactions are better understood by a multi-scale approach. This approach features analysis of microscopic hepatocyte morphology, macroscopic surface coverage and organization, and determination of total cell population. Microscopic morphology analysis is achieved through cytoplasmic fluorescence staining and imaging. Macroscopic analysis is conducted by Coomassie Blue staining and visualization under low magnification to yield surface specific organization and quantifiable surface coverage. Total cell population is determined by kinetic analysis of Hoechst fluorescence intensity. Inherent uptake, binding, and de-fluorescence rates cause static intensity measurements to be highly time sensitive and difficult to replicate. For example, static intensity measurement differences of HepG2 cells between t = 3 mins and t = 4 mins after staining yields a 62.5% increase in cell population and between t = 20 and t = 23 mins yields a decrease of 16.4% in cell population. Kinetic analysis and modeling allows improved accuracy and repeatability through determining kinetic parameters and back calculating cell populations.