Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Designing Smart Surfaces to Segregate Cells GERMAN KOLMAKOV, SAMDEN LAMA, FERNANDO HERNANDEZ, ERVIN IBRAGIMOV, New York City College of Technology CUNY, COLLIN EDINGTON, RICHARD KOEPSEL, JILL ANDERSEN, DANIEL MCKEEL, McGowan Institute for Regenerative Medicine, University of Pittsburgh, SUNGEUN EOM, TAKEO KANADE, CARSEN KLINE, Carnegie Mellon University, ZVI LIRON, Israel Institute for Biological Research, HIRONOBU MURATA, ALAN RUSSELL, McGowan Institute for Regenerative Medicine, University of Pittsburgh, ANNA BALAZS, Chemical Engineering Department, University of Pittsburgh — Our aim is to utilize smart surfaces to separate specific populations of cells from a heterogeneous sample. There are a number of diseases (e.g., malaria and various cancers) that alter the elasticity of biological cells. In this work, we use the mechanical stiffness of the cells as a key parameter since it can reveal the presence of disease. By integrating mesoscale models for hydrodynamics of surrounding fluids and for micromechanics of cells, and the Hierarchical Bell Model for specific cell-substrate interactions, we examine the fluid-driven motion of cells in a microchannel over a hard, weakly adhesive surface that contains "sticky" diagonal stripes. We show that as cells roll along the surface, they obtain a net displacement perpendicular to the direction of the fluid flow. This displacement is a function of the cell's stiffness, meaning that two cells with different compliances or adhesive properties exhibit different amounts of displacement, and in this manner are effectively sorted. We compare the results of the simulations with the data obtained in the experiments with HL-60 cells.

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Date submitted: 08 Dec 2011 Electronic form version 1.4