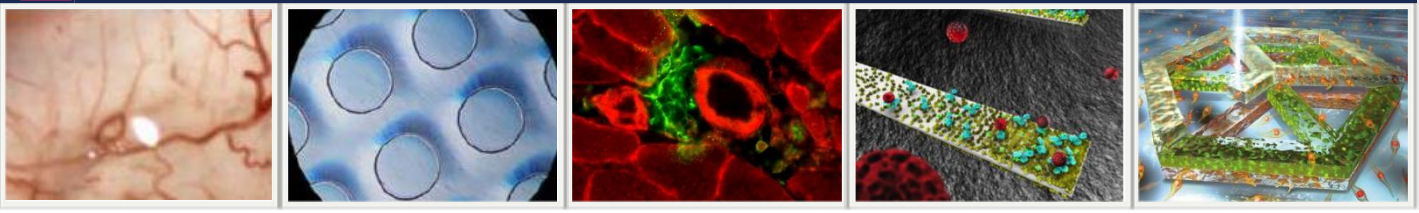
BioNanotechnology Seminar Series

Spring 2012



Human Colon Carcinoma Cells on Gels: Spatial Confinement and Mechanosensing

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Date: **Tuesday, April 17, 2012**
Time: **12:00 – 12:30 p.m. CST (10:00 – 10:30 a.m. PST)**
Location: **1000 MNTL at Illinois (SSM 150 at UC Merced)**

Abstract:

New Mounting experimental evidences suggest that cells can sense and respond to mechanical cues (i.e. substrate stiffness) and geometric cues in 2D and 3D culture models. Hence, engineered mechanical microenvironment can enable new in vitro mechano-biology studies, which are otherwise complicated to realize. In the first part of my presentation, I will talk about a novel approach to micropattern extracellular matrix (ECM) proteins on 2D polyacrylamide (PA) hydrogels and consequently obtain spatially defined cell culture with precision [1]. This method provides an excellent and robust tool to study the coupled effect of mechanical cues and geometric cues on 2D polyacrylamide hydrogels.

In the second part, I will discuss on the in-vitro metastasis of human colon carcinoma cells driven solely by the elasticity of the substrate [2]. In the work, our group has shown that human colon carcinoma (HCT-8) cells can exhibit a dissociative, metastasis-like phenotype (MLP) in vitro when cultured on ECM coated substrates with appropriate mechanical stiffness (physiologically relevant 21–47 kPa), but not on very soft (1 kPa) and very stiff (3.6 GPa) substrates [2]. However, the role of cell-ECM adhesions (integrins) or cell-cell adhesions (E-cadherin) in the mechanosensing process remain elusive. Hence, we cultured the HCT-8 cells on E-cadherin coated soft substrates of appropriate mechanical stiffness (21 kPa) to mimic cell-cell interactions. Interestingly, HCT-8 cells show the distinct dissociative phenotype on E-cadherin coated substrates as well. These results suggest that the E-cadherin, but not the integrins, is the dominant mechanosensor for the MLP on soft substrates. The inhibition of the MLP on E-cadherin coated substrates by blebbistatin, a potent inhibitor of non-muscle myosin II ATPase, indicates that the intracellular forces are involved in the initiation of the MLP. In addition, the actin cytoskeletal structure and nuclei deformation on both fibronectin (ECM) and E-cadherin coated substrates are also investigated before and after the MLP using laser scanning confocal microscopy [3].

References:

[1] Tang, X.; Ali, M. Y.; Saif, T. A Novel Technique for Micro-patterning Proteins and Cells on Polyacrylamide Gels. Soft Matter 2012 (under review).
[2] Tang, X., Kuhlenschmidt, T.B., Zhou, J., Bell, P., Wang, F., Kuhlenschmidt, M. S., Saif, T. A. Mechanical Force Affects Expression of an In Vitro Metastasis-Like Phenotype in HCT- 8 Cells. Biophysical Journal 2010; 99:2460-9. [3] Ali, M. Y.; Saif, T. On the Mechanosensing of Human Colon Carcinonoma Cells on E-Cadherin Coated Soft Substrates (in preparation).
[3] Ali, M. Y.; Saif, T. On the Mechanosensing of Human Colon Carcinonoma Cells on E-Cadherin Coated Soft Substrates (in preparation).

Seminar Presented by:

Center for Cellular Mechanics
University of Illinois at Urbana-Champaign

IGERT Integrative Graduate Education and Research Traineeship
Cellular and Molecular Mechanics and BioNanotechnology

M-CNTC NCI Alliance for Nanotechnology in Cancer
Midwest Cancer Nanotechnology Training Center

CNST University of Illinois Center for Nanoscale Science and Technology