Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Elasticity of adherent active cells on a compliant substrate[1] SHILADITYA BANERJEE, Department of Physics, Syracuse University, AARON F. MERTZ, ERIC R. DUFRESNE[2], Department of Physics, Yale University, M. CRISTINA MARCHETTI, Department of Physics and Syracuse Biomaterials Institute, Syracuse University — We present a continuum mechanical model of rigidity sensing by livings cells adhering to a compliant substrate. The cell or cell colony is modeled as an elastic active gel, adapting recently developed continuum theories of active viscoelastic fluids. The coupling to the substrate enters as a boundary condition that relates the cell's deformation field to local stress gradients. In the presence of activity, the substrate induces spatially inhomogeneous contractile stresses and deformations, with a power law dependence of the total traction forces on cell or colony size. This is in agreement with recent experiments on keratinocyte colonies adhered to fibronectin coated surfaces. In the presence of acto-myosin activity, the substrate also enhances the cell polarization, breaking the cell's front-rear symmetry. Maximal polarization is observed when the substrate stiffness matches that of the cell, in agreement with experiments on stem cells.

[1]This work was supported by NSF grants to MCM (DMR-0806511 and DMR-1004789) and ERD (DBI-0619674) and NSF graduate fellowship to AFM.
[2]Additional Affiliations: Department of Mechanical Engineering and Materials Science, Department of Chemical and Environmental Engineering, Department of Cell Biology, Yale University.

Abstract APS

Date submitted: 08 Dec 2011 Electronic form version 1.4