Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Optical Force Probe Microscopy of the Pericellular Matrix LOUIS T. MCLANE, PATRICK CHANG, School of Physics, Georgia Institute of Technology, ANNA GRANQVIST, The Renal Center, The Wallenberg Laboratory for Cardiovascular Research, Sahlgrenska University Hospital, HEIKE BOEHM, New Materials and Biosystems, Max Planck Institute for Metals Reserach, Stuttgart, Germany, ANTHONY KRAMER, JENNIFER E. CURTIS, School of Physics, Georgia Institute of Technology — The pericellular matrix is a microns-thick grafted polymer film on the surface of cells. Its structure and mechanics influence processes as diverse as filtration, cell adhesion, proliferation, migration, cancer metastasis and possibly mechanotransduction. Optical force probe microscopy enables dynamic and equilibrium measurements of this polymer film on living cells. We show that equilibrium force measurements can be related to the osmotic pressure in the pericellular matrix, leading to a prediction of a spatially varying correlation length (mesh size) profile ranging from ∼100 nm at the cell surface to 1000 nm near the edge of the cell coat. Assuming the film is brush-like, comparison to polymer brush theory provides estimates of the equilibrium brush length and the grafting density at the surface. The equilibrium length is consistent with that observed during dynamic force measurements, and the grafting density is close to that of maximal packing for the large, space filling molecules in the system - i.e. tethered polymers populated by semi-flexible side chains with cross sections ∼80 x 400 nm^2.

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Date submitted: 29 Nov 2011 Electronic form version 1.4