You are invited to the Biophysics Seminar by

Dr. Amnon Buxboim

Physics and Astronomy, University of Pennsylvania, USA

Monday, April 22th at 14:00

Resnick building, Seminar Room (2nd floor)

How deeply cells feel: Matrix mechanics directs (stem cell) nuclear physics

Cells lack eyes to see and ears to hear but can physically feel into the depths their microenvironment by actively deforming their surroundings. To study how deeply cells feel, adult stem cells, as prototypical yet particularly sensitive adhesive cells, were cultured on collagen-coated gel-based microfilms of controlled elasticity and thickness. Cells spread and nuclei stretched significantly less on soft, marrow-like gels, as compared with soft but thin or bone-like stiff films. As indicated by the transition from small to large spreading, the tactile length scale for mechanosensitivty was ~10 microns. Novel physicochemical transcriptional analysis of titrated DNA microarray binding curves combined with protein profiling revealed a set of four most malleable nuclear envelope genes across tissues and in a dish. Overexpression and siRNA knockdown of nucleostructural lamina components induced 'stiff' versus 'soft' phenotypes while maintaining proportionality with myosin-facilitated cellular contractility. Rates of fluorescence recovery after photobleaching of phospho-mimetic laminA mutants were indicative of stiffness-dependent nuclear remodeling during early stages of matrix engagement. Nuclear tension was shown to suppress lamin phosphorylation while nucleus rounding induced degradation. Matrix-directed nuclear remodeling is important for maintaining normal functions within physically-diverse cellular compartments by nuclear mechanotranduction.