MAR14-2013-020362
Abstract for an Invited Paper
for the MAR14 Meeting of
the American Physical Society

Modeling cell migration on filamentous tracks in 3D

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Cell motility is integral to a number of physiological processes ranging from wound healing to immune response to cancer metastasis. Many studies of cell migration, both experimental and theoretical, have addressed various aspects of it in two dimensions, including protrusion and retraction at the level of single cells. However, the *in vivo* environment for a crawling cell is typically a three-dimensional environment, consisting of the extracellular matrix (ECM) and surrounding cells. Recent experiments demonstrate that some cells crawling along fibers of the ECM mimic the geometry of the fibers to become long and thin, as opposed to fan-like in two dimensions, and can remodel the ECM. Inspired by these experiments, a model cell consisting of beads and springs that moves along a tense semiflexible filamentous track is constructed and studied, paying particular attention to the mechanical feedback between the model cell and the track, as mediated by the active myosin-driven contractility and the catch/slip bond behavior of the focal adhesions, as the model cell crawls. This simple construction can then be scaled up to a model cell moving along a three-dimensional filamentous network, with a prescribed microenvironment, in order to make predictions for proposed experiments.