CENTER FOR FLUID MECHANICS
AND
THE FLUIDS, THERMAL AND CHEMICAL PROCESSES GROUP
OF
THE DIVISION OF ENGINEERING
SEMINAR SERIES

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Mechanics of the Cytoskeleton and Cell Migration

Cell motility is essential for a variety of processes such as vertebrate embryonic development, tissue repair, and the metastatic spreading of some cancer cells. Cell crawling requires the integration and coordination of complex biochemical and biomechanical signals which regulate the traction forces exerted through the cytoskeleton at the local adhesion points on the substratum. Although it is generally accepted that actin and myosin are the common elements in most cell crawling movements, these proteins undergo many different transformation as the cell migrates. A complete understanding of the mechanisms of cell crawling must provide a molecular explanation for these transformations, explain how they are coordinated in time and space, and relate them to changes in the mechanical parameters such as the rheological properties of the cell and the adhesion forces to the substrate. This lecture will discuss new measurements of the spatial and temporal distribution of traction forces as well as the associated changes in the mechanical properties of the cell which take place during the crawling of the cell over deformable elastic substrates. In addition, the kinematics of the migration under the effects of the varying degree of chemo-attractant concentration gradients will also be discussed. The trajectory of the cell´s center of mass, as well as cells´ polarization along gradient lines, will be shown to follow a quasi-periodic evolution with characteristic frequencies related to the biochemical processes regulating the internal remodeling of the cytoskeleton.

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