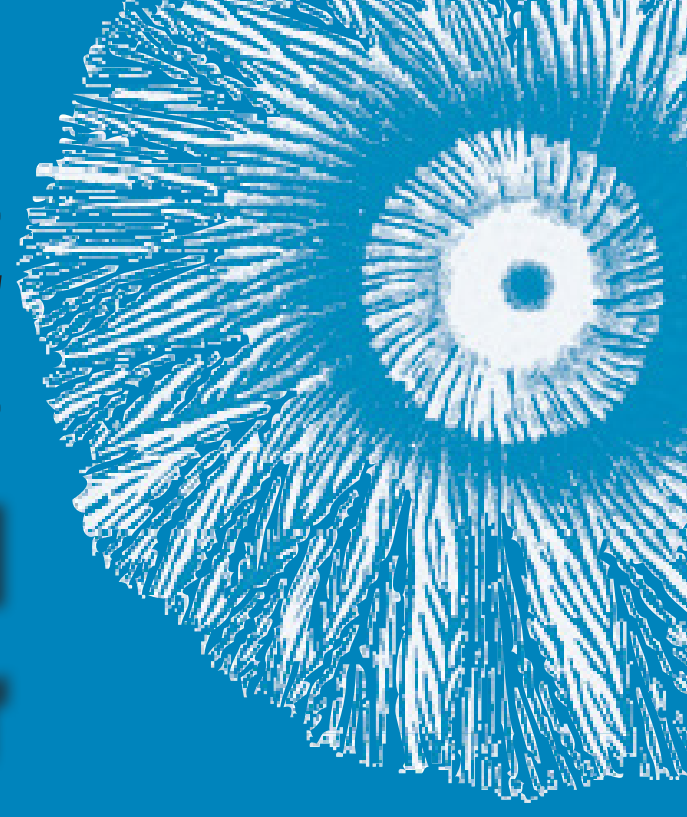
The Center for Theoretical Biological Physics at Rice University presents its

Inaugural Research Seminar



Tuesday, January 22, 2013

Inbal Hecht, Tel Aviv University, Israel

Cellular Navigation: from Amoeba to Cancer

Cellular migration is a central part in diverse biological processes, from development and immune response to cancer metastasis. In many cases, cellular motility is guided by directional cues, such as a gradient of a nutrient or a growth factor. The motion of a cell is also restricted by the structure of its surrounding environment, which typically includes other cells as well as the extracellular matrix (ECM). The migrating cell therefore needs to perform a complicated task of navigation under physical constraints.

Motivated by amoeboid cancer cell motility, we study the fundamental characteristics of amoeboid motion in complex environments, from motion in an obstacle-free environment to navigation in a maze. We show that cells employing simple chemotactic strategies will often be unable to navigate through maze-like geometries, but a simple chemical marker mechanism serves as a "memory" and significantly improves success rates.

Cancer cell invasion typically involves degradation of the surrounding ECM by secretion of matrix metalloproteases (MMPs). Using the maze platform together with energy considerations and including maze wall degradation by the cell, we investigate how the different tasks of the cell, i.e. proliferation, invasion and migration, need to be balanced in order to optimize the overall dissemination. Interestingly, a different priority set is needed for different resource levels. This implies that different cellular phenotypes, such as highly invasive or highly proliferative, are optimal for different conditions. We conclude that tumor plasticity, namely the coexistence of different phenotypes (also termed "proliferation-invasion dichotomy"), can be explained as optimization in a constantly-changing environment, as tumors typically go through cycles of hypoxia (low resources) and angiogenesis (high resources). Our simulation platform can be used to study additional diverse phenomena, such as collective vs. independent motility, cellular motility mode selection and cell decision making.

go to **ctbp.rice.edu** for additional information

12:30 -1:30 PM, Refreshments Served at 12:15

BioSciences Research Collaborative Building, Room 1060A/B

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