Department of Mathematics and Statistics Colloquium

When Leaders Don't Lead: Insights into Wound Healing and Cancer Metastasis from Mathematical Modeling

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Abstract: Multicellular organisms require groups of cells to function together as a unit. A common scenario involves the collective movement of cells. For example, when your skin gets cut, one of the first processes is re-epithelialization where epidermal cells crawl over the wounded region. Likewise, in cancer, tumor cells often move as a group to detach from the primary tumor and invade distal regions of the body. In this presentation, I will describe the work that we have been doing to develop a multiscale model for collective cell migration. This model is based in the fundamental biophysics of a single cell. We show that a combination of directed cell motility, dipole-distributed forces, and adhesion to neighboring cells and the environment is sufficient to explain in vitro wound healing dynamics and gives insight into the biophysical changes that occur when cancer cells become metastatic. This model provides testable predictions, such as that the rate of wound healing should be proportional to the contractile stress that the cells exert on their surroundings. I will conclude with some exciting new experimental results that confirm some of the model predictions.

Tuesday, April 28 at 3:45 in Roop 103

refreshments at 3:30