Department of Applied and Computational Mathematics and Statistics Colloquium

J. Scott Gens

The Biocomplexity Institute
Indiana University

will give a lecture entitled:

Biologically-based Mathematical Modeling of Contact Inhibition of Cell Growth

Abstract

In vivo, contact-inhibition (CI) of cell growth serves to limit the size of the tissues and organs in mature organisms according to their body plan. Under certain circumstances, contact inhibition must be turned off in a regulated fashion. Normal examples of CI function in tissue development or maintenance include the growth of tissues during embryonic development, regeneration of tissues, wound healing responses. However, inappropriate regulation of CI function carries implications for disease. Loss of appropriate regulation of contact inhibition is now considered to be one of the now classic "Hallmarks of Cancer" [Hanahan and Weinberg, 2000; 2011]. Here, we propose a constitutive model for contact inhibition in cells and simulate it using a multi-cellular modeling environment, Compucell3D. Cell-cell contact is represented in terms of cell surface area. Using a mathematical formula, we allow individual simulated cells to make informed decisions about growth based on their local environment. Our model predicts that presence of free edges is sufficient to initiate cell growth until the total cell-cell contact is reached. Our initial model includes only a few key biological factors, but provides useful insights about tissue culture and tissue morphogenesis. We demonstrate the effectiveness of our mathematical approach is effective in three test scenarios: (a) confluent monolayer formation in cell culture (b) re-growth of a tissue in response to wounding, and (c) tissue growth during development. In addition, we have extended our approach to simulate recently published experimental investigations of the interplay between contact inhibition and local concentrations of the growth factor EGF.

Monday, March 19, 2012
4:00 p.m. to 5:00 p.m.
127 Hayes-Healy Center