The **Department of Mathematics** presents

A COLLOQUIUM

A simple stochastic model for cell population dynamics in colonic crypts

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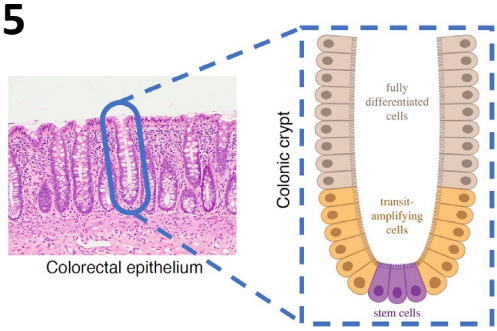
Thursday, February 15
Bond Hall 225
4:00 pm



The questions of how healthy colonic crypts maintain their size under the rapid cell turnover in intestinal epithelium, and how homeostasis is disrupted by driver mutations, are central to understanding colorectal tumorigenesis. We propose a three-type stochastic branching process, which accounts for stem, transit-amplifying (TA) and fully differentiated (FD) cells, to model the dynamics of cell populations residing in colonic crypts. Our model is simple in its formulation, allowing us to estimate all but one of the model parameters from the literature. Fitting the single remaining parameter, we find that model results agree well with data from healthy human colonic crypts, capturing the considerable variance in population sizes observed experimentally. Importantly, our model predicts a steady-state population in healthy colonic crypts for relevant parameter values. We show that APC and KRAS mutations, the most significant early alterations leading to colorectal cancer, result in increased steady-state populations in mutated crypts, in agreement with experimental results. Finally, our model predicts a simple condition for unbounded growth of cells in a crypt, corresponding to colorectal malignancy. This is predicted to occur when the division rate of TA cells exceeds their differentiation rate, with implications for therapeutic cancer prevention strategies.

Everyone is welcome!

Refreshments will be served at 3:30pm in Bond Hall 300.