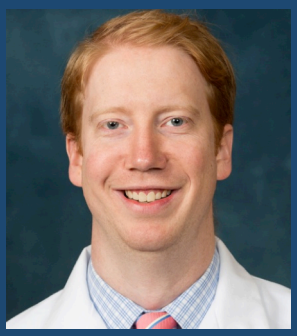
Department of Applied and Computational Mathematics and Statistics Colloquium



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Using Single-Cell Observations and Mathematical Modeling to Predict Tumor Growth and Cancer Stem Cell Population Changes

Cancer stem-like cells (CSCs) play a critical role in cancer growth, chemotherapy resistance, and disease recurrence. These properties make CSCs an appealing target for new anti-cancer therapies. Unfortunately, CSCs rarity and ability to rapidly differentiate makes them difficult to study in the laboratory setting. Costly and time consuming in-vivo studies are required to evaluate treatment approaches or translational concepts. These challenges offer an opportunity to implement mathematical modeling to speed translational discovery in cancer. Novel microfluidics capture devices now allow us to grow and evaluate single cancer cells in isolated culture for short time frames (< 72 hours). We deployed microfluidics devices to evaluate the self-renewal and asymmetric division potential of ovarian CSCs. Based on this rich data, we developed an easy to use empirical data-sampling computer algorithm on the freely available software R to predict cancer growth in-vitro and in-vivo. We compared the predictions from our hybrid microfluidics chip and computational algorithm with validation in-vivo and in-vitro experiments for both cell line and primary ovarian cancer. We found a strong correlation between observed and predicted in-vitro total and CSC counts for both cell line and primary ovarian cancer cells. Furthermore, this approach appropriately predicted changes in cell growth in the presence of the CSC-promoting growth factors both in vitro and in vivo over time frames up to 28 days. We believe this platform offers an easy-to-use alternative early translational discovery tool. Direct applications include evaluation of new treatment strategies prior to more involved experiments. Future applications include the investigation of rare events, such as estimating the likelihood of de-differentiation of tumor cells to cancer stem cells

Monday, November 16, 2015
4:00 PM – 5:00 PM
127 Hayes-Healy Center

Colloquium Tea 3:30 PM to 4:00 PM 154 Hurley Hall