Indian Institute of Science
Centre for BioSystems Science and Engineering

BSSE Seminar

29th May 2019, 04:00PM, MRDG Seminar Hall, 1st floor, Biological Sciences Building

Stochastic Modeling of the Cancer-Immune Interaction

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ABSTRACT

Immunotherapy has revolutionized cancer treatment by delivering durable remission outcomes to many cancer patients in recent years. T-cell immunotherapy relies on enhancing or replacing immune cells, which can recognize and eliminate a growing malignancy in much the same way as infected cells are cleared during an infection. While promising, this strategy does not eliminate cancer in all patients. The fundamental dynamics of the cancer-immune interaction are quite complex owing in part to a large number of unique T-cell clones and significant intra-tumor heterogeneity. Here, I describe several foundational mathematical models of the interplay between a continuously adaptive immune system and an evolving cancer population that may evade immune recognition. By applying stochastic process theory to this problem, I generate a framework for assessing the relative frequencies cancer detection, recognition, and evasion. I first studied the effects of thymic negative selection on T-cell recognition of tumor-associated antigens, which are detectable peptide fragments that closely resemble self-peptide. I will also discuss the temporal dynamics of a population of cancer cells which may evolve mechanisms of immune evasion. My foundational model predicts variations in immunotherapeutic efficacy as a function of immune-relevant parameters and tracks the population-level behavior of an evolving threat under adaptive immune recognition.

ABOUT THE SPEAKER:

About the speaker: Dr. Jason George's research interest is in the development of mathematical models of cancer populations. His work focuses on developing novel stochastic processes by the application of stochastic and probabilistic analysis in order to describe cancer dynamics and evolution with the goal of making improved predictions for optimized treatment. He works at the Center for Theoretical Biological Physics and Department of Bioengineering at Rice University in Houston, Texas.