NIMBioS Interdisciplinary Seminar
3:30 p.m.*, Tuesday, January 27, 2015

Dr. Suzanne O'Regan
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"Detecting critical transitions in infectious disease dynamics"

Predicting abrupt shifts in state ("critical transitions") of complex systems is a key research topic in a variety of scientific domains. Small smooth changes in underlying drivers leading to a sudden change in system behavior, mathematically described as a bifurcation, is a mechanism for critical transitions of considerable interest. Bifurcations may be detectable because prior to reaching the dynamical threshold, the system may exhibit "critical slowing down." Statistical signatures of critical slowing down have been detected from temporal and spatial data in biological systems ranging from the global climate system, ecosystems, experimental microcosms and physiological systems. Anticipating infectious disease emergence and documenting progress in disease elimination are important applications for the theory of critical transitions. A key problem is the development of theory relating the dynamical processes of transmission to observable phenomena. In this talk, I consider compartmental epidemiological SIS and SIR models that are slowly forced through a critical transition. I develop expressions for the behavior of several candidate indicators during the approach to emergence or elimination. I show that moving-window estimates of the candidate indicators may be used for anticipating critical transitions in infectious disease systems. Although leading indicators of elimination were highly predictive, I found the approach to emergence to be much more difficult to detect. It is hoped that these results, which show the anticipation of critical transitions in infectious disease systems to be theoretically possible, may be used to guide the construction of online algorithms for processing surveillance data.

Location: Room 205 at NIMBioS, Claxton Education Bldg, 1122 Volunteer Blvd.
Join us for refreshments in the Visitor Break Room at 3 p.m.

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