

APPLIED MATHEMATICS COLLOQUIUM

Date: Wednesday, April 15, 2015

Time: 2:30 – 3:30 p.m.

Location: Middlesex College Room 204

Compartmental modeling of lysogenic and lytic cycles during phage-bacteria interaction

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Abstract:

Bacteriophage, viruses that infect bacteria, sometimes incorporate their genetic material into the host cell DNA but do not harm the host (lysogeny), rather than using cellular resources to produce new phage, ultimately killing the host (lysis). A mechanistic understanding of the conversion of lambda-phage from lysogeny to lysis has been well developed empirically as well as theoretically at a molecular level. From an evolutionary perspective, however, the decision-making strategy of bacteriophage to pursue either lysogeny or lysis is not well understood. In this contribution, a deterministic population model is developed to study the interaction of wild type bacteria with both lytic and lysogenic viruses. The interesting phenomenon of conversion, from a lysogenic life cycle to a lytic cycle, is also considered in the model. Quantitative parameter estimates have been obtained from the primary experimental literature. Although the basic reproductive ratio is always higher for lytic phage, we explore scenarios in which lysogeny has an evolutionary advantage. A sensitivity analysis by parametric variations is performed to study the impact of parameter values on phage fitness.