



**L.H. BAKER CENTER FOR BIOINFORMATICS AND  
BIOLOGICAL STATISTICS AND IGERT  
SEMINAR SERIES**

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**Prediction and control of disease spread in populations**

One of the fundamental goals in epidemiology is determining the necessary conditions for the persistence of a disease. As we increase our resources to fight diseases, pathogens become more resilient in their means to survive. In addition to the well-known single strain diseases, such as measles, mumps and rubella, other multi-strain diseases are becoming more prominent, such as dengue hemorrhagic fever. In its endemic state, dengue consists of four serotypes, and is governed by a mechanism called antibody-dependent enhancement (ADE), a phenomenon in which viral replication is increased rather than decreased by immune sera. The introduction of ADE into a four-serotype dengue model results in a wide array of complex dynamics ranging from periodic to chaotic outbreaks. In the first part of the talk, I will present how dengue dynamics depends on the ADE parameter.

As important as modeling how the disease spreads is properly representing its environment. As we attempt to model real disease dynamics in finite populations, the modeling assumption of a well-mixed, homogeneous population becomes less realistic. Some populations are better described as a network of subgroups that follow divisions caused by geography or social groupings or networks. Immigration probabilities play an important factor in the dynamics. In the second part of my talk, I will present both qualitative and quantitative results on the effects of immigration on outbreak synchronization and disease persistence. The analysis suggests novel vaccination policies that underscore the importance of optimal placement of finite resources.

This work is in collaboration with Dr. Ira Schwartz and Dr. Luis Mier-y-Teran of the Naval Research Laboratory, and Dr. Derek Cummings of the Johns Hopkins Bloomberg School of Public Health. The research is supported by the National Institutes of Health and the Office of Naval Research.

**Date: Wednesday, February 8**

**Time: 4:00-5:00 PM**

**Room: 1414 Molecular Biology**