Mathematics Faculty Search

Mathematical Biology

Candidate interview for assistant professor

Marissa Eisenberg

MBI/Ohio State

http://people.mbi.ohio-state.edu/meisenberg/index.html

Eisenberg is a postdoctoral fellow at the Mathematical Biosciences Institute. Her research is in mathematical and systems biology, and is centered around using and developing parameter estimation and identifiability techniques to build models of human disease at a variety of scales.

Research interests include parameter identifiability and estimation, uncertainty quantification, mathematical physiology, feedback control systems, algebraic biology, disease dynamics, epidemiology, cancer, and endocrine regulation.

Iowa State University

TEACHING DEMO

401 Carver
TBA

HOSPITALITY

404 Carver
Monday, February 27 at 3:45 p.m.

COLLOQUIUM

282 Carver
Monday, February 27 at 4:10 p.m.

Exploring cholera transmission dynamics using identifiability and parameter estimation

Waterborne diseases cause over 3.5 million deaths annually, with cholera alone responsible for 3-5 million cases/year and over 100,000 deaths/year. Many waterborne diseases exhibit multiple characteristic timescales or pathways of infection, which can be modeled as direct and indirect transmission. A major public health issue for waterborne diseases involves understanding the modes of transmission in order to improve control and prevention strategies. One question of interest is: given data for an outbreak, can we determine the role and relative importance of direct vs. environmental/waterborne routes of transmission? We examine these issues by exploring the identifiability and parameter estimation of a differential equation model of waterborne disease transmission dynamics. We use a novel differential algebra approach together with several numerical approaches to examine the theoretical and practical identifiability of a waterborne disease model and establish if it is possible to determine the transmission rates from outbreak case data (i.e. whether the transmission rates are identifiable). Our results show that both direct and environmental transmission routes are identifiable, though they become practically unidentifiable with fast water dynamics. Adding measurements of pathogen shedding or water concentration can improve identifiability and allow more accurate estimation of waterborne transmission parameters, as well as the basic reproduction number. Parameter estimation for a recent outbreak in Angola suggests that both transmission routes are needed to explain the observed cholera dynamics. I will also discuss some ongoing applications to the current cholera outbreak in Haiti.