

PHYSICAL MATHEMATICS SEMINAR

Mathematics and Epidemics: Challenges and Opportunities in the Study of the Dynamics and Control of Influenza

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ABSTRACT:

Although we can trace back the study of epidemics to the work of Daniel Bernoulli nearly two and a half centuries ago, the fact remains that key modeling advances followed the work of three individuals (two physicians) involved in the amelioration of the impact of disease at the population level a century or so ago: Sir Ronald Ross (1911) and Kermack and McKendrick (1927). Ross' interests were in the transmission dynamics and control of malaria while Kermack and McKendrick's work was directly tied in to the study of the dynamics of communicable diseases. In this presentation, I will deal primarily with the study of the dynamics of influenza type A, a communicable disease that does not present a fixed target. The study of the short-term dynamics of influenza, single epidemic outbreaks, makes use of extensions/modifications of the models first introduced by Kermack and McKendrick while the study of its long-term dynamics requires the introduction of modeling modifications that account for the continuous emergence of novel influenza variants: strains or subtypes. Here, I will briefly review recent work on the dynamics of influenza A/H1N1, making use of single outbreak models that account for the movement of people in the transmission process over various regions within Mexico. Next, I will discuss models that are tied in to the study of the long-term dynamics of influenza, models that account for outbreak-generated year-to-year shifts on the immunological profile of large populations, a process often referred to as cross-immunity. In particular, the role of cross immunity, population structure and interventions as drivers of sustained oscillations will be assessed. This research has been carried in collaboration with a large number of researchers over a couple of decades.

SHORT BIO:

Carlos Castillo-Chavez is a Regents Professor, a Joaquin Bustoz Jr. Professor of Mathematical Biology, a Distinguished Sustainability Scientist and the Executive Director of the Mathematical and Theoretical Biology Institute and The Institute for Strengthening the Understanding of Mathematics and Science, both institutes recognized by the White House, at Arizona State University. He co-established the David Blackwell and Richard Tapia Award (2000). While a professor at Cornell, where he spent 18 years, he was recognized with two White House Awards (1992 and 1997), the SACNAS Distinguished Scientist Award; and the Richard Tapia Award. Recent recognitions include the American Mathematical Society Distinguished Public Service Award and the 2007 AAAS Mentor award. He has mentored 27 PhD students (14 US Latinos and 10 women); 22 postdoctoral researchers; and hundreds of undergraduates. He held a Stanislaw M. Ulam Distinguished Scholar at Los Alamos National Laboratory; holds an honorary professorship at Xi'an Jiaotong University in China and a Martin Luther King Jr. Professorship at MIT. He is a fellow of the AAAS, SIAM, AMS and a member of President's Committee on the National Medal of Science.

TUESDAY, October 16, 2012
2:30 PM
Building 4, Room 145

*Reception at 3:30 PM in Building 2, Room 290
(Math Dept. Common Room)*

<http://math.mit.edu/pms>