Indian Institute of Science

Centre for BioSystems Science and Engineering

Joint IMI-CES-BSSE Seminar

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CES seminar hall, 3rd Floor Biological Sciences Building

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.

About the Speaker

Carlos Castillo-Chavez is a Regents' Professor, a Joaquin Bustoz Jr. Professor of Mathematical Biology, and a Distinguished Sustainability Scientist at Arizona State University. He is also the rector of Yachay University of Experimental Technical Research in Ecuador. His research program is at the interface of the mathematical and natural and social sciences with emphasis on (i) the role of dynamic social landscapes on disease dispersal; (ii) the role of environmental and social structures on the dynamics of addiction and disease evolution, and (iii) Dynamics of complex systems at the interphase of ecology, epidemiology and the social sciences.