ABSTRACT | Simone Bianco

Title

Diseases with multistrain interactions: Cross-immunity and antibody-dependent enhancement

College of William and Mary, USA
sbianco@wm.edu

Abstract

The study of multistrain diseases, diseases with several coexisting strains, is a major challenge for today's science. Example of such diseases are influenza, AIDS, dengue and ebola. The inclusion of mechanisms of interactions between the strains represents a further step in the implementation of a realistic model for this type of disease, which is paramount towards the assessment of disease control, as well as the study of vaccination strategies. In this talk I will present a mathematical model for multistrain disease with nonlinear interactions among the strains. I will focus my attention on dengue fever, a 4-strains subtropical disease which is responsible for the infection of over 50 million people worldwide every year. A prominent characteristic of dengue fever is the way dengue strains interact with each other. Once an individual is infected with one strain, after a period of temporary cross immunity, his antibodies will increase his infectiousness in the case of secondary infection with a different strain. This mechanism is called antibody dependent enhancement (ADE). While the presence of ADE alone is known to trigger chaotic outbreaks and desynchronization among the strains, the inclusion of weak cross immunity in the model is proved to have a stabilizing effect on the dynamics. Strong cross immunity leads instead to instability and chaos. Finally, I will present new results about the emergence of chaos and traveling waves in coupled communities with migration terms. These results may help to give important insight for new mechanisms of disease control.