Topics in Epidemiology

- **Title**: Control of HIV Infection of $CD4^+T$ Cells. Preliminary Results
  Speaker: *Ana-Maria Croicu* (acroicu@kennesaw.edu), Kennesaw State University

  Abstract: We will present some preliminary results of the control of HIV Infection of $CD4^+T$ cells by applying the classical control theory. The mathematical model under consideration is characterized by a system of nonlinear differential equations with unknown functions: the concentration of susceptible $CD4^+T$ cells, $CD4^+T$ cells infected by the HIV viruses and free HIV virus particles in the blood. Our goal is to minimize the $CD4^+T$ cells infected by the HIV viruses.

- **Title**: Dynamics of Triatomine Infestation in a Population of Houses
  Speaker: *Crystal L. Bennett* (clbenn88@gmail.com), North Carolina Agricultural & Technical State University
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  Abstract: Trypanosoma cruzi, is the causal agent and parasite of Chagas disease, a neglected tropical disease transmitted mainly by blood-sucking triatomine insects in Latin America. Because of the unavailability of a cure for Chagas disease, disease control relies on the control of the vector population. In this work, we developed deterministic and stochastic mathematical models for the dynamics of bug infestation in a community of houses. We used a Levins metapopulation approach in which houses are considered to be patches that can be in one of three states: empty, infested, or treated. First, we considered spatially implicit models for homogeneous and heterogenous populations. We studied the effect of differences in housing quality in infestation dynamics and the effect of heterogeneity in the distribution of the houses. Then, we developed more realistic spatially explicit, agent-based, metapopulation models. The models were used to assess the effect of different control strategies on house infestation. The results show that spraying only bad houses is more beneficial than spraying the whole community while using the same treatment rate.

- **Title**: Modeling Culling in Avian Influenza
  Speaker: *Hayriye Gulbudak* (hgulbudak@ufl.edu), University of Florida
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  Abstract: The emerging threat of a human pandemic caused by the H5N1 avian influenza virus strain magnifies the need for controlling the incidence of H5N1 infection in domestic bird populations. Culling is one of the most widely used control measures and has proved effective for isolated outbreaks. However, the socio-economic impacts of mass culling, in the face of a disease which has become endemic in many regions of the world, can affect the implementation and success of culling as a control measure. Mathematical modeling may help to understand the dynamics of Avian Influenza under different culling approaches. We incorporate culling into an SI model by considering the per-capita culling rates to be general functions of the number of infected birds. Complex dynamics of the system, such as backward bifurcation and forward hysteresis, along with bi-stability, are detected and analyzed for two distinct culling scenarios in the model. In these cases, employing other control measures temporarily can drastically change the dynamics of the solutions to a more favorable outcome for disease control.