Topics in Biology

- **Title**: Optimal Genetic Augmentation Strategies for an Endangered Population
Speaker: *Erin N. Bodine* (bodinee@rhodes.edu), Rhodes College

Abstract: One conservation method of reducing species loss is to augment a declining/threatened wild population with individuals from a captive-bred or stable, wild population. This method is known as species augmentation. I have used optimal control theory to determine augmentation strategies which minimize the presence of a detrimental allele in an endangered population in minimum time while minimizing the cost of augmenting the endangered population. I will present the construction of the optimal control formulation, the necessary conditions for an optimal control, the characterization of an optimal control, and some numerical simulations. Additionally, I will discuss some of the challenges of systematically exploring the effects of uncertain parameters in optimal control problems, and demonstrate a new method for quantifying the sensitivity of the optimal control strategy with respect to uncertain parameter values.

- **Title**: Sensitivity Analysis of a Three-Species Non-Linear Response Omnivory Model
Speaker: *James Vance* (jav6e@uvawise.edu), University of Virginia's College at Wise
Coauthors: *Kevin Wilson*, University of Virginia's College at Wise

Abstract: We investigate how sensitive population densities are to changes in the parameters of a three-species non-linear response omnivory model. By deriving sensitivity equations and solving for the sensitivities, we determined that the predator mortality rate is the most sensitive and biologist should take extra care in collecting predator mortality data.

- **Title**: A Multilayer Grow-or-Go Model for GBM: Understanding the Effects of Anti-Angiogenic Drugs
Speaker: *Fathallah-Shaykh, Hassan* (hfathall@uab.edu), Univ. of Alabama at Birmingham
Coauthors: *Saut, Olivier* (Olivier.Saut@math.u-bordeaux1.fr), Univ. of Bordeaux; *Lagaert, Jean-Baptiste* (Jean-Baptiste.Lagaert@legi.grenoble-inp.fr), Grenoble, INP; *Colin, Thierry* (Thierry.Colin@math.u-bordeaux1.fr), Univ. of Bordeaux

Abstract: The recent use of anti-angiogenesis (AA) drugs for the treatment of glioblastoma multiforme (GBM) has uncovered unusual tumor responses. We derive a mathematical model that takes into account the ability of proliferative cells to become invasive under hypoxic conditions. We show that simulations generate the multilayer structure proliferation, invasion, and necrosis. The model is validated and inter- rogated to derive fundamental insights in cancer biology and on the clinical and biological effects of AA drugs.