BIOMATH SEMINAR
Friday, March 27
1-2 pm
Harris 4119

A Mathematical Model of Hematopoietic Stem Cell Transplantation and Analysis of the Effect of Filgrastim and Plerixafor Drug Treatment on Transplantation in Lymphoma Patients

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Abstract: Hematopoietic stem cells present in the bone marrow are primarily responsible for replenishing blood cell lines that do not undertake mitosis. We present an ordinary differential equations model to account for the underlying dynamics of stem cells in the bone marrow and blood as well as precursors to erythrocytes, white blood cells, and platelets in the bone marrow and their relation to subsequent populations in the blood. We develop a compartmental model that accounts for the movement between bone marrow and blood compartments of the important populations listed, where stem cells in the bone marrow differentiate into each precursor population and also diffuse directly into the blood. Each precursor population also diffuses into the blood.

In addition to modeling the dynamics of the underlying biology of the system, we also use the model to explore the effect of Filgrastim on the system in order to model drug treatments of patients during stem cell collection for treatment of lymphoma. We also analyze how effective Plerixafor, an expensive yet effective treatment, is for poor mobilizers who were treated with Filgrastim. This allows for a mathematical analysis of the dynamics governing collection in poor mobilization cases and prediction of a more effective treatment and collection process for these patients.