May 19th, 9:30 AM - 10:00 AM

Mathematical Modeling of Tumor and Cancer Stem Cells Treated with CAR-T Therapy and Inhibition of TGF-β

Elizabeth Zollinger
St. Joseph's University, Brooklyn, ezollinger@sjcny.edu

BAMM 2022 Abstract

Elizabeth Zollinger

St. Joseph's University, Brooklyn, NY

In this poster we will consider the various mathematical models describing the immune systems attack on both cancerous tumor cells and cancer stem cells. The stem cell hypothesis suggests that there is a small group of malignant cells, the cancer stem cells, that initiate the development of tumors, encourage its growth, and may even be the cause of metastases. Traditional treatments, such as chemotherapy and radiation, primarily target the tumor cells leaving the stem cells to potentially cause a recurrence. Chimeric antigen receptor (CAR) T-cell therapy is a form of immunotherapy where the immune cells are genetically modified to fight the tumor cells. Traditionally, the CAR T-cell therapy has been used to treat blood cancers and only recently has shown promising results against solid tumors. We create an ordinary differential equations model which allows for the infusion of trained CAR-T cells to specifically attack the cancer stem cells that are present in the solid tumor microenvironment. Additionally, we incorporate the influence of TGF-β which inhibits the CAR-T cells and thus promotes the growth of the tumor. We verify the model by comparing it to available data and then examine combinations of CAR-T cell treatment targeting both non-stem and stem cancer cells and a treatment that reduces the effectiveness of TGF-β to determine the scenarios that eliminate the tumor.