Modeling the Immune Response to Immunotherapy and Triple Negative Breast Cancer in Mice

Dayton Syme*[1], Yun Lu[2], Anna G. Sorace[2], and Nicholas G. Cogan[1]
[1] Dept. of Mathematics, Florida State University, Tallahassee FL, USA
[2] Dept. of Biomedical Engineering, University of Alabama at Birmingham, Birmingham AL, USA

Abstract

Triple negative breast cancer is particularly lethal and difficult to treat due to its aggressive and resistant behavior. Recent tumor treatment options incorporate immune checkpoint inhibitors (ICI) in aiding a patient's immune response and have shown varied levels of success. Our work details an immune response model of CD4+ and CD8+ cells to breast cancer in mice while being treated by two ICI drugs (either in combination or separately). Our model consists of a system of ordinary differential equations reflecting quantification of the immune and tumor response.

The immune response activity is defined directly from state-of-the-art positron emission tomography (PET) image data that provide the distribution of CD4+ or CD8+ cells in the organism. Our model is parameterized from this novel longitudinal data alongside tumor volume measurements from the same experiments. With our optimized parameter set, we will discuss the effects of the ICI treatments on tumor-initiated inflammation and compare our results between combination and single ICI therapy.