Harvey Mudd College
Mathematics

Senior Thesis
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Research Proposal: An ODE Model of Tumor Growth and Effect of Immuno- and Chemotherapy Treatment in Metastatic Colorectal Cancer

Hannah Savage

Faculty Advisor: Professor L. G. de Pillis

1 Introduction

As our cells age and are exposed to sources of damage both from within the cell and the cell's environment, cells accumulate mutations. Sometimes these mutations can affect the mechanisms within the cell that control cell proliferation, resulting in uncontrolled growth of the cell and the formation of a tumor. There are many different treatment options for tumors, depending on how big it has grown and whether the proliferating cells have spread to other parts of the body (metastasized).

In advanced colorectal cancer, chemo- and immunotherapy are often used in addition to surgery to reduce the size of tumors, ensure that the tumor has not metastasized, and to prolong the life of those with metastatic tumors [1]. Immunotherapy is a new treatment for colorectal cancer, and many treatment options involving immunotherapy are still in experimental stages [2].

2 Proposed Research

I plan to adapt a previous model for tumor growth [3] to be specific to late stage/metastatic colorectal cancer, particularly by finding or approximating values for the coefficients. I also plan to adapt the model for the treatment option of using monoclonal antibodies with 5-fluorouracil, a chemotherapy drug. For the monoclonal antibody medications, I plan to look at cetuximab and panitumumab, but may only look at one, as time permits. I will compare how well the combination therapy (monoclonal antibody with chemotherapy) works compared to just chemotherapy, as well as looking at how the effectiveness of the two monoclonal antibodies differs.

3 Prior Research

The original model was constructed and revised by de Pillis *et al*, and presented in *Mathematical model creation for cancer chemo-immunotherapy*, Comp. and Math. Methods in Med. (2009), pp. 1-19 [3]. Research has been done on colorectal cancer [4] [5], and many clinical trials have been done with these medications [6] [7] [8] [9].

References

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