CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

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Project Number

S0508

Project Title

Modeling the Effects of Angiostatins and Mitotic Inhibitors on Vascularized Tumor Growth

Abstract

Objectives/Goals

This model attempts to examine the effects of both angiostatic inhibitors, also known as angiostatins, and mitotic inhibitors on the growth of various attributes of a tumor as it proceeds through vascularization, namely volume, number of live cells, and radius.

Methods/Materials

Scilab, a mathematical programming language similar to Matlab, was used to create a representation of the growth of a tumor. Generalized equations were created for the growth, and public-domain data was used to calibrate the equations to the growth of observed tumors. The avascular and necrotic stages of growth were modeled to create a more comprehensive picture of the progress of the tumor. However, these two stages had fixed growth patterns as no significant parameters were in place. The vascular stage was modeled with parameters created to represent the presence and strength of angiostatins and mitotic inhibitors in the tumor. The model was run with various values in place for the strength of the two medications and the results observed.

Results

Angiostatic inhibitors were shown to have a larger impact on the tumor growth than mitotic inhibitors. Angiostatic inhibitors had a particularly pronounced effect on vascularly-supplied cells, preventing their formation. Mitotic inhibitors limited the division of all cells without regard to the nutrient supply of the cell.

Conclusions/Discussion

Angiostatins were more effective than mitotic inhibitors because they prevented the creation of the faster-growing vascularly-supplied cells. The mitotic inhibitor reduces the rate of growth for all the cells, but still allowed the creation of the relatively aggressive cells. There are many practical applications of these results. The model can demonstrate the effects of various cancer medications on the growth of a tumor. During cancer treatment, the impact of a drug on a patient can be reliably predicted before the drug is ever administered. The fact that angiostatins are more effective than mitotic inhibitors is also of considerable interest. It means that during cancer treatment, angiostatic drugs will be of more use to prevent metastasis.

Summary Statement

Scilab was used to model a tumor and determine the comparative efficacies of mitotic inhibitors and angiostatins on the growth of a tumor; the angiostatin was found to be more effective.

Help Received