CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)

Shu Hee Kim

Project Number

S1714

Project Title

Mathematical Modeling of Cancer Cell Proliferation after Radiotherapy

Abstract

Objectives/Goals

The main purpose of this research is to obtain a better understanding of optimal radiotherapy that can be used to treat cancer patients. Dedifferentiation is a relatively recent discovery which shows that cancer cells may revert back to their previous cell stages, instead of, as always presumed, progressing forward in cancer lineage. The influence of dedifferentiation is a pivotal aspect of cancer proliferation which my research studies.

Methods/Materials

By using the parameter values of renewal (p), differentiation (v), and dedifferentiation (q), the data collected from breast cancer strains exposed to radiation was fit to the computer software model. By comparing the changes in the steady state values from the model as a result of changes in the dedifferentiation rates, the impact of differing dedifferentiation rates on steady state populations was quantified.

Results

Thus, when dedifferentiation rate increased, the steady state populations of stem cells increased. The equilibrium population with a higher dedifferentiation rate was greater than the equilibrium population with a smaller dedifferentiation rate.

Conclusions/Discussion

This successful model quantifies the behavior of the stem cell and differentiated cell populations as a result of radiotherapy; furthermore, this computer model allows doctors to understand the best treatment for different types of cancers and for different cancer patients. Ultimately, this model can allow doctors to improve the efficacy of individualized cancer treatment methods for many different types of cancer.

Summary Statement

The main point of my project is to find the optimal radiotherapy treatment method for patients of all cancer types and cancer stages.

Help Received

Dr. John Lowengrub (UCI Professor) oversaw accuracy of mathematical equations and derivations