CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)

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Project Number

31578

Project Title

Treatment of Simulated Cancer Cells with Compton Scattering-Produced Secondary Radiation

Abstract

Objectives/Goals

The purpose of the experiment, as defined in the hypothesis, is quite simple. Using moderate energies and intensities of x-rays in combination with tin particles in close proximity to cells, the simulated cancer (yeast, Saccharomyces cerevisiae) will be more effectively killed, demonstrating a technique for inexpensive cancer treatment.

Methods/Materials

The procedure is designed to measure the amount of cells that die after treatment. The cultures are divided into four sets: one with radiation and tin (A), one with tin (B), one with neither radiation nor tin (C), and one with radiation (D). The masses of the cells left living will be determined before and after incubation and appropriate treatment of each culture, with the intent of having the greatest change in culture set A, demonstrating that cell death was more effectively introduced. The key to effective measurement before and after treatment is centrifuging the cultures. The initial cell mass can be accurately calculated once all water is removed from the live culture, and the final LIVING cell mass can be determined because all dead cell bodies become the same density as the 2.5% agar solution, and are poured off with the supernatant; thus, only the non-blebbed cells remain.

Results

Our data and calculations have revealed that in four distinct trials (each with the four sets of tubes), treatment of "cancer" cells with tin and radiation is 17.9% more effective than irradiation alone and is 18.7% more effective than no treatment. The tin metal had no negative impact on the growth of the cells over the 72 hour period, affirming that the tin itself was not causing any damage to the cells.

Conclusions/Discussion

From this data, it is possible to conclude that the technique involving production of secondary radiation (produced as the initial x-rays interact with tin to produce stochastically scattered secondary x-rays) is a more effective, less expensive way to localize damage to eukaryotic cells all without raising the total amount of absorbed radiation. In addition to the more effective treatment and less radiation needed for the patient's treatment, the entire experimental design costs less than $100, and can theoretically be implemented in current treatment setups to augment the efficacy of existing radiation treatment therapies. The experiment was conducted in a highly controlled environment with minimized contamination and sources of error.

Summary Statement

Our project tests a new, effective, and inexpensive way to treat cancer by increasing the efficacy and safety of radiation therapy using tin to produce secondary radiation in a specific area.

Help Received

All research, design, experimentation, and analysis for the project was conducted by our team alone.