CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
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Project Number
S0535

Project Title
Fluorescent Imaging for Nano-Detection (FIND) of Cancer Cells for Future Surgery

Abstract

Objectives/Goals
Currently, surgeons operate blindly on tumor patients: many tumor cells escape surgery and spread. The purpose of this project is to introduce a biodegradable fluorescent nanoparticle for imaging tumors to aid cancer surgery. The three main goals of this year's study are: 1) to optimize the procedure for making fluorescent nanoparticles to achieve a particle under 200 nm, 2) to study the uptake of the nanoparticles with a variety of tumor cell lines, and 3) to determine the mechanism of nanoparticle uptake by tumor cell lines.

Methods/Materials
The fluorescent nanoparticles were made with albumin protein and FITC fluorescent dye using a method called desolvation. In order to optimize the protocol to achieve the smallest sized particle, certain conditions were varied while all other variable were controlled, and the average size of each sample was measured. In order to study the uptake of the nanoparticles by different types of cancer cells and demonstrate the general utility of this imaging method, the nanoparticles were incubated with eight cancer cell lines. A study of competition was designed to determine the mechanism of nanoparticle uptake. Increasing concentrations of unlabeled albumin were added to the cells along with the nanoparticles and the numbers of fluorescent cells were counted.

Results
The optimized protocol yielded nanoparticles under 200 nm, right inside the target range. The study of the nanoparticle uptake by cancer cell lines showed a positive uptake of the nanoparticles by all eight tumor cell lines. The uptake mechanism study revealed a decrease in the number of fluorescent cells with an increasing concentration of additional albumin.

Conclusions/Discussion
The optimization of the protocol achieved a particle size that has the highest chance of escaping the blood vessel to the tumor tissues. The study of the nanoparticle uptake by cancer cell lines shows that the fluorescent nanoparticles can be uptaken by a variety of tumor cell lines, demonstrating that this imaging system can be used for a variety of different cancers. Finally, the results from the mechanism of particle uptake indicates that the mechanism is receptor mediated and not by general endocytosis. In future surgery, the nanoparticles can be injected to a patient#s circulatory system, escape to the tumor, attach, and glow. This would allow surgeons to completely remove the tumors, extending the lifetime of many patients.

Summary Statement
The purpose of this project is to introduce a biodegradable fluorescent nanoparticle for imaging tumors to aid cancer surgery.

Help Received
Used lab equipment at the University of the Pacific under the supervision of a graduate student, Poonam Saraf.