CALIFORNIA STATE SCIENCE FAIR
2016 PROJECT SUMMARY

Name(s)

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Project Number

S0525

Project Title

Early Detection of Epithelial Ovarian Cancer via B7-H4 Quantification in a Microfluidic System

Abstract

Objectives/Goals

It has recently been discovered that B7-H4 is a protein in only low amounts in normal tissues but highly concentrated in over 90% of cases. Utilizing the monoclonal antibody, MIH43, which recognizes B7-H4, a method is presented to ascertain the presence of B7-H4 through nanoparticle luminescence, through the use of a biotinylated antibody in sandwich ELISA. Our goal is to compact the system into a microfluidic chip.

Methods/Materials

First, EDC and Sulfo NHS crosslinkers achieve the direct MIH43 conjugation to an 50nm iron oxide nanoparticle via carbohydrate moiety. A subsequent sandwich ELISA test employs avidin-horseradish peroxidase (HRP) enzyme to stimulate the luminescence of a biotinylated detection antibody, allowing the determination of the concentration of B7-H4 that bound to the particle complex. Lastly, a model of the microfluidic chip, which includes magnets to separate the particle complex, is presented.

Results

Nonspecific binding was removed with BSA, and results from five separate trials of a BCA protein assay confirm a significant concentration of bound antigen, with little influence from confounding variables. The luminescence signals were high for the particle complex in comparison to a low value for a negative control.

Conclusions/Discussion

Repetitions of the experiments proved that the method is successful in separating B7-H4 from a noisy sample and quantifying its presence. Additionally, simulations of the designed chip show that the use of multiple chambers gives unbound protein more opportunities to bind, and the incorporation of pores ensures that already bound proteins remain attached to the particle. Further analysis has shown that quantum dots are a viable alternative to the biotinylated antibody and HRP, so these will be later tested.

Summary Statement

Our project aims to create a blood test for early detection of epithelial ovarian cancer through the novel use of a new biomarker, B7-H4.

Help Received

Used lab equipment at University of California San Diego under the supervision of Dr. Lal. Experiments were performed by the students with the mentorship of Dr. Landon.