CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)

Tina Huang

Project Number

S1205

Project Title

Creation of 3D Printed Microstructures to Investigate Cancer Cell Migration

Abstract

Objectives/Goals

One of the most difficult questions of cancer biology is how cancer spreads.Understanding the physical behavior and nature of cancer cells helps answer that question.A cost and time efficient, biomimetic drug screening platform does not exist, therefore hampering the process of drug screening for medicine.My goal was to create a 3D biomimetic microstructure that could be an alternative to the costly, inefficient, and inaccurate models currently used in in vitro cell study, replacement of animal models in testing, and tissue engineering.

Leveraging the latest microscale 3D printing technology to mimic the structure of blood vessels in the human body, I created a novel 3D biomimetic drug-screening platform and used it to test, monitor, and analyze cancer and normal cell behavior.

Methods/Materials

I first designed a honeycomb design that imitated the structure of human blood vessels and used Matlab software to convert it into .dat files. I needed to optimize material as well as procedure, so creating the structures themselves then required extensive synthesis and testing of various PEGDA (polymer) percentages with varying percentages of photosensitive initiator and UV light absorber.

I then seeded normal (10T½) and cancerous (Hela) cells onto honeycomb-structured structures of differing widths (4, 8, 16, and 32-pixels wide) to simulate different sizes of blood vessels. For a period of five hours, images were taken every five minutes of each microstructure. Images were then processed and analyzed using Fiji, a scientific image analysis software.

Results

My research showed that the fastest cancerous (Hela) cells were the largest cells, as well as the cells grown in the narrowest channels. The slowest cancerous cells were also the smallest cells#grown from the widest channels.

Conclusions/Discussion

These results demonstrate the feasibility of the cancer-drug screening platform I created. This in vitro platform for cancer drug screening is versatile and cost-efficient: one structure can be created within seconds. In addition to being a cost and time efficient, structurally accurate drug-screening platform to test cancer drugs, this model provides great value to researchers in understanding cancer biology, migration, and metastasis. It can potentially replace animal models in early-stage drug testing, act as a

Summary Statement

I designed and created novel 3D printed biomimetic microstructures and used them to test, monitor, and analyze cancer cell migration.

Help Received

Used lab equipment at UCSD under supervision of Dr. Paul Qu