CALIFORNIA STATE SCIENCE FAIR
2017 PROJECT SUMMARY

Name(s)

Stanley C. Liu

Project Number

J0114

Project Title

Development of Advanced Microfluidic Devices for Circulating Tumor Cells Captured from Blood Samples

Abstract

Objectives/Goals

In my project, I focused on developing a microfluidic device, which manipulates microfluidic generated vortexes in order to separate and isolate CTC from a blood sample based on their cell mass difference and compared it to an existing CTC detection technology.

Methods/Materials

I fabricated my microfluidic devices using the soft lithography method. A syringe pump and function generator were used to achieve separation of cells. A microscope was used too in the test. The blood sample tested in this project is a control cell line that is commercially available made by Beckman Coulter. It contains mixture of human blood cells. Breast cancer cells (MCF-7) were obtained from a cell line at UC-Irvine.

Results

Both inertial and acoustic vortex microchannel devices displayed successful capture and separation of CTCs from blood cells. However, for the inertial vortex devices, clogging of the 40 μm wide channels by large particles was a large concern. In the acoustic vortex device, clogging is not an issue, and it can process significantly greater volumes of fluid, but could be a longer process due to low flowrate. Both devices are similar in CTC capture efficiency, but the acoustic vortex device provides greater practicality in cancer diagnostics due to the absence of clogging.

Conclusions/Discussion

The microfluidic vortex devices developed in this project successfully captured and separated CTCs from blood cells. By developing an automated, easy-to-use, inexpensive device which can perform early detection for all types of cancers, this CTC microfluidic device can replace conventional CTC detection methods and has the potential to save millions of lives.

Summary Statement

I developed a microfluidic device to separate and isolate circulating tumor cells from a blood sample and compared it with an existing CTC capture technology.

Help Received

Robin Liu (mentor), RD Biosciences Inc; Professor Abe Lee, UCI; Neha Garg, UCI.