CALIFORNIA STATE SCIENCE FAIR
2012 PROJECT SUMMARY

Name(s)
Emily To

Project Number
S0533

Project Title
Intracellular Ion Channel Drug Potency Assay: Ensemble Mitochondrial Measurements Demonstrate Bilayer Platform Potential

Abstract

Objectives/Goals
Ion channels and transmembrane proteins are crucial in regulating many physiological processes. Scientific and sensing measurements of ion channel conductance depicting activity often utilize lipid bilayers and Patch Clamp, which have great shortcomings in application. This experiment uses a bilayer formation system that integrates the measurement electronics within the fluidic controls. The system enables commercial operation of the platform, a step toward applications of ion channel measurements for remote sensing and pharmacological studies requiring minimal operator involvement.

Methods/Materials
Novel lipid bilayer platforms were created from several acrylic plates following a modified stencil of a previously developed platform being studied at the time. A gravity-propelled pin-tool mechanism was used to form the bilayers and to read ionic flux. Results of flux obtained reflect the efficacy of the platform as a suitable alternative to Patch Clamp in its ability to read, characterize, and isolate multiple ion channels with ease. The experiment was conducted with mitochondrial ion channels as a model channel with identifiable characteristics.

Results
After a series of homogenizing and centrifuging, the cells were obtained. The resulting membrane fragments containing the ion channels were incorporated into the lipid bilayer and currents were run through the electrode to receive conductance levels. The levels accumulated were then used to study characteristics of ion channels found in the mitochondria. Blockers were added, ionic flux was successfully acquired, and the platform was proven highly effective.

Conclusions/Discussion
Information accumulated could provide additional insight into the functions and potentials of ion channels, as well as a new mechanism to study ion channels, drug-screening, and cell characterization.

Summary Statement
Novel lipid bilayer platforms are designed to replace Patch Clamp technology in order to efficiently study intracellular ion channels commonly found in mitochondria.

Help Received
Used lab equipment under supervision of Dr. Jacob J Schmidt; Graduate student/mentor Ahmad El-Arabi at UCLA