CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

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Project Number

34710

Project Title

Optimized Electroformation Settings for the Formation of Giant Unilamellar Vesicles

Abstract

Objectives/Goals

Giant unilamellar vesicles (GUVs) are biomimetic cells used by researchers to study the qualities of lipid membranes, specifically the permeability. These vesicles are formed through a process known as electroformation. The objective of this experiment is to find the optimal electroformation settings to form these vesicles. The purpose was also to find the relationship between the frequency setting of electroformation and the diameter and yield of unilamellar vesicles formed.

Methods/Materials

Using DPPC (Dipalmitoylphosphatidylcholine) lipid, I applied it as a film on a electrically conductive (ITO coated) glass by dissolving the lipid in alcohol at a concentration of 2mg/ml, applying it to the glass, and then evaporating the alcohol. When electroforming them, I kept the voltage and time as constants: 1V, 2 hours. I varied the frequency by increments of 5Hz in order to observe the effects of frequency on vesicle formation, diameter, and yield. I tested three samples of vesicles for each frequency. I then imaged the samples using a diascopic microscope and analyzed them by recording vesicle count and diameters.

Results

GUV diameter is the largest at 35hz, but has reasonable range at 10hz and 35hz. About 60% of vesicles formed at 10Hz are unilamellar, with very little variation. The results conclude that 10Hz is the optimal frequency for the largest diameters and yield of vesicles.

Conclusions/Discussion

While there is no trend that explains the relationship between frequency and vesicle diameter or yield, I found that 10Hz is the optimal frequency for the electroformation of unilamellar vesicles. In the future, I would like to use the vesicles to study the permeability of the lipid bilayer or find a method of electroformation that takes less time.

Summary Statement

The purpose of my project is to find the optimal settings for the electroformation of unilamellar vesicles in order to produce a large yield of artificial cells, and to understand how the frequency setting affects production of vesicles.

Help Received

Used lab equipment at University of Southern California under the supervision of Dr. Noah Malmstadt and Kristina Runas.