Plant Membrane Bioelectronic Devices for the Study of a Membrane Transporter

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Principal Investigator(s): Susan Daniel
User(s): Barituziga Banuna, Miriam Huerta

Affiliation(s): Smith School of Chemical and Biomolecular Engineering, Cornell University

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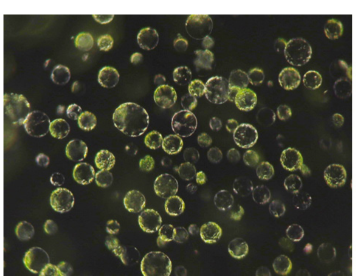
Contact: sd386@cornell.edu, bb675@cornell.edu, gh437@cornell.edu
Primary CNF Tools Used: Malvern NS300 NanoSight

Abstract:

As a "label-free" alternative to optical sensing, electrical sensing represents a more feasible, reproducible, and scalable detection method [1,2]. Among various electrical sensing techniques, the non-invasive electrochemical impedance spectroscopy (EIS) technique is especially suitable for accurately quantifying the bio-recognition events occurring at a variety of biointerfaces, such as bacterial, viral, cellular and synthetic lipid membranes [3,4]. Our group aims to design a microelectrode system that will support the self-assemble of supported lipid bilayers (SLBs) on the electrode surfaces, and their electrical properties (resistance, capacitance) can be extracted by applying an alternating voltage and recording the current response [4-7]. Since the electrode dimensions and the local environment are readily controlled via photolithography, this system gives us a edge to easily mimic and manipulate the local environment to support the assembly of various SLBs of interest. Future work will focus on the incorporation of the microfluidic system into the microelectrode system.

Summary of Research:

Lipid vesicle nanoparticles were induced to form via chemical induction of cell-wall free Arabidopsis Thaliana plant protoplast. These vesicles or blebs composed of the native membrane materials were collected and then the size, distribution and concentration were characterized via NTA with Malvern NS300 NanoSight. Following characterization, blebs were used to form SLBs on microelectrodes and the resulting device was used with electrical sensing techniques such as EIS.



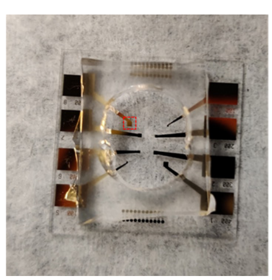


Figure 1: Arabidopsis Thaliana *derived protoplast (left); PDMS well stamped on a single device to enable self-assembling of SLB and EIS measurement (right).*

References:

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