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Imaging Characterization of Current Generating Lipid-protein Membranes

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Imaging Characterization of Current Generating Lipid-protein Membranes

Student: Joel D. Kamwa Ph.D., August 2018
Major Professor: Dr. Jiali Li

Microelectronics

Photonics

Background/Relevance

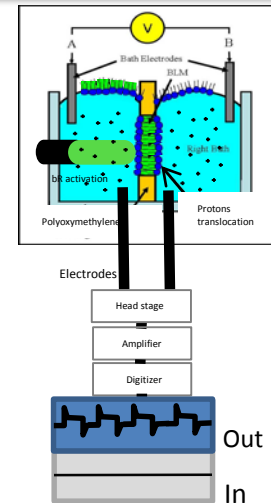
- Existing solar energy conversion methods are:
 - not biodegradable and,
 - require expensive maintenance

Innovation

- Build a system that can be used to:
 - Characterize lipid-protein membranes
 - Generate photocurrent with bacteriorhodopsin (bR) or halorhodopsin (hR), as fundamental biological species
 - Asses the impact of voltage and protein concentration on generated current

Approach

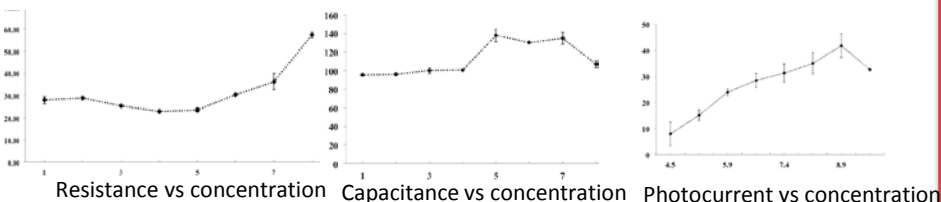
- Proteins are reconstituted in a solid supported nanolipid bilayers membrane on Teflon
- A laser is used to activate ion-pumping and a photocurrent is measured across the membrane
- The experiment is repeated while applying and increasing a voltage
- The experiment is repeated with different proteins concentration
- TEM is used to image the protein and the lipid-protein membrane solutions



Key Results

The Protein-lipid membrane system was investigated through:

- The confection of an experimental setup which can be used to form and test bilayer membranes
- The characterization of membrane resistance and capacitance
- The successful generation of photocurrent and the imaging of the solution structure with TEM (not shown)



Conclusions

This work promotes the understanding of the following topics:

- Characterization of lipid-protein membranes using electrical parameters; change of protein concentration to study generated photocurrent
- Bio-photocurrent generation using lipid-protein system, with bacterio- or halo-rhodopsin as protein examples

Future Work

- The next steps in this work would be:
 - To stabilize current generating membranes on a portable substrate for imaging, and
 - To stabilize hR current generation