Imaging Characterization of Current Generating Lipid-protein Membranes

Joel D. Kamwa

University of Arkansas, Fayetteville

Follow this and additional works at: https://scholarworks.uark.edu/gradstuwo

Part of the Electromagnetics and Photonics Commons, and the Membrane Science Commons

Recommended Citation
https://scholarworks.uark.edu/gradstuwo/1
Imaging Characterization of Current Generating Lipid-protein Membranes

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

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
  - Assess the impact of voltage and protein concentration on generated current

Key Results
The Protein-lipid membrane system was investigated through:
1. The confection of an experimental setup which can be used to form and test bilayer membranes
2. The characterization of membrane resistance and capacitance
3. The successful generation of photocurrent and the imaging of the solution structure with TEM (not shown)

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

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:
  1) To stabilize current generating membranes on a portable substrate for imaging, and
  2) To stabilize hR current generation