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Imaging Characterization of Current Generating Lipid-protein Membranes

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Citation

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UNIVERSITY OF ARKANSAS

Graduate School & International Education
Microelectronics-Photonics

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
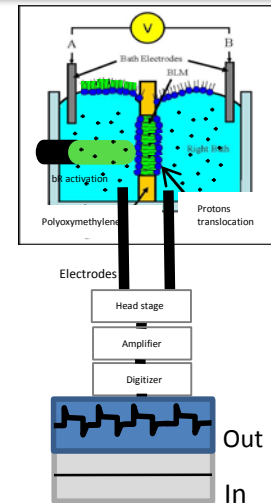
Key Results

The Protein-lipid membrane system was investigated through:

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)

Resistance vs concentration   Capacitance vs concentration   Photocurrent vs concentration
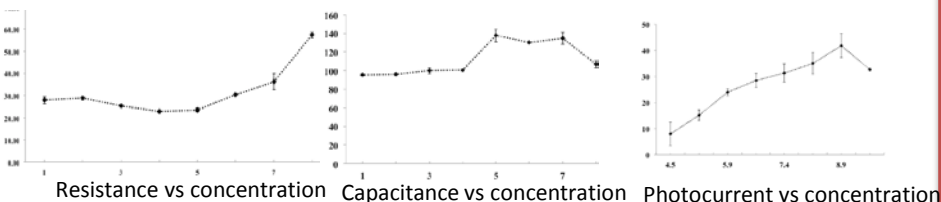
Conclusions

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