Biosolar cells: natural and artificial assemblies of light energy transducing protein complexes.

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ABSTRACT. The harvesting of solar energy in photosynthesis is dependent upon an interconnected macromolecular network of membrane associated chlorophyll-protein complexes. In the past decade my workgroup and others have elucidated the structure and functioning of these networks to great detail. Here I will briefly discuss our efforts in high resolution AFM imaging of native membranes and the models derived from light spectroscopy (1, 2). In the second part I will discuss our recent efforts in applying and mimicking the natural assemblies in hybrid biosolar cells, photosynthesis based electrodes as components for sensors (3), photovoltaics (4) and, possibly, photofuels. If time allows, I end with our recently designed algae powered robot which showcases the possibilities (http://www.raoulfrese.nl/the-symbiotic-machine/).

1. *The native architecture of a photosynthetic membrane*; Bahatyrova et al. *Nature* **430**, (2004); p. 1058-1062.

2. *Jumping Mode Atomic Force Microscopy on Grana Membranes from Spinach*; K Sznee et al. Journal of Biological Chemistry 286 (45), 2011; p. 39164-39171.

3. *Evaluation of a biohybrid photoelectrochemical cell employing the purple bacterial reaction centre as a biosensor for herbicides*; DJK Swainsbury et al. Biosensors and Bioelectronics 58, (2014), p.172-178

4. *Enhanced Photocurrent Generation by Photosynthetic Bacterial Reaction Centers through Molecular Relays, Light-Harvesting Complexes, and Direct Protein Gold Interactions*; M-J den Hollander et al. Langmuir 27, (2011) 10282–10294.