# Electrochemical Communication between Thylakoid Membranes and Osmium Redox Polymers Modified Electrodes

Lo Gorton[1], Kamrul Hasan[1], Hassan Hamidi[1], Sinan Cem Emek[1], Yusuf Dilgin[2], Dónal Leech[3], Hans-Erik Åkerlund[1], Per-Åke Albertsson[1]

[1]Department of Analytical Chemistry/Biochemistry and Structural Biology, Lund University, P.O. Box 124, SE-221 00 Lund, Sweden Address

[2]Çanakkale Onsekiz Mart University, Science &Art Faculty, Department of Chemistry, 17100 Canakkale, Turkey

[3]School of Chemistry, National University of Ireland Galway,
University Road, Galway, Ireland

Photosynthetic reaction centers (RCs) are very efficient in light energy conversion with a quantum yield near 100% making them potentially useful for photovoltaic devices and power sources. Electrochemical studies of the interaction of RCs with electrodes may reveal the mechanisms of interprotein electron transfer (ET) pathways [1]. The light dependent photosynthetic reaction sites are contained in thylakoid membranes and electrons produced during incidence of light can be trapped by effective “wiring” of the RCs within the membranes and transferred to the electrode. Recently, *Rhodobacter capsulatus* was electrochemically “wired” to electrodes with flexible $Os^{2+/3+}$ functionalised polymers [2]. Badura et al. reviewed recent concepts for the integration of PS I and PS II into bioelectrochemical devices with special focus on strategies for the design of ET pathways between redox enzymes and conductive supports [3].

In this work we have studied the electrochemical communication of thylakoid membranes from spinach with electrode surfaces by functionalizing the electrode with various Os-polymers of different potentials. Cyclic voltammetric and chronoamperometric measurements were performed under anoxic conditions for characterization and optimization of electrochemical communication of illuminated thylakoid membranes and Os-polymers modified electrodes to achieve very high photocurrents. The effects of temperature and inhibitors as well as oxygen evolution were also investigated and will be shown in detail.

References

[1] S.A. Trammell, L.Y. Wang, J.M. Zullo, R. Shashidhar, N. Lebedev, Biosensors & Bioelectronics, 19 (2004) 1649-1655.

[2] K. Hasan, S. A. Patil, K. Górecki, D. Leech, C. Hägerhäll, L. Gorton, Bioelectrochemistry, (2013) in press.

[3] A. Badura, T. Kothe, W. Schuhmann, M. Rogner, Energy & Environmental Science, 4 (2011) 3263-3274.