Laboratory of Surface Science

HEAD:

Prof. Sławomir Sęk*, PhD DSc

GROUP MEMBERS:

Joanna Juhaniewicz-Dębińska, PhD;
Jan Pawłowski, PhD
PhD students: Damian Dziubak,
Dorota Konarzewska

RESEARCH PROFILE:

adsorption at solid-liquid interfaces; biomimetic membranes; long-range electron transport.

CURRENT RESEARCH ACTIVITIES:

Scientific interests of our research group are related to adsorption phenomena and self-assembly of organic molecules at solid-liquid interfaces. Currently, our research team is involved in the design of advanced biomimetic lipid bilayers based on the concepts of „polymer cushioned membrane", „tethered membrane" and „floating membrane". The key feature of these systems is an aqueous reservoir between a lipid bilayer and solid surface. It is meant to provide sufficient hydration of lipid polar heads and it enables insertion of transmembrane proteins/ion channels. Apart from quite obvious implications for medicine, the importance of artificial membranes with embedded functional channels also stems from their potential applications in biosensors and bioelectronics devices.

Other research activities of our group are related to peptide-mediated electron transport phenomena. In particular, we strive to reveal how the efficiency of electron transport is affected by the conductance of individual amino acids and the higher-order structures adopted by peptide molecules. Another important issue is to evaluate whether it is possible to modulate peptide conductance through conformational structural changes triggered either by physical or chemical stimuli including external electric field, nanomechanical modulation or variation of pH value. This would enable construction of a molecular switch with two conductance values depending on the instantaneous secondary structure of the system.

*e-mail: slasek@chem.uw.edu.pl

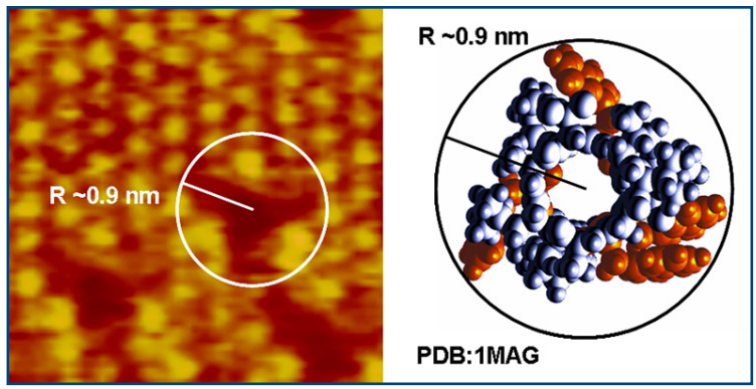

Fig. 1 High resolution image of the ion channel of gramicidin D embedded into the lipid membrane supported on gold surface. Adapted with permission from Sek et al. Journal of the American Chemical Society, 131 (2009) 6439–6444. Copyright (2009) American Chemical Society.

SELECTED PUBLICATIONS:

1. J. Juhaniewicz-Dębińska, D. Tymecka, S. Sęk, Diverse effect of cationic lipopeptide on negatively charged and neutral lipid bilayers supported on gold electrodes, Electrochimica Acta. 298 (2019) 735-744.
2. K. Pułka-Ziach, A.K. Puszko, J. Juhaniewicz-Dębińska, S. Sęk, Electron Transport and a Rectifying Effect of Oligourea Foldamer Films Entrapped within Nanoscale Junctions, Journal of Physical Chemistry C. 123 (2019) 1136–1141.
3. J. Pawłowski, J. Juhaniewicz, A. Guzeloglu, S. Sęk, Mechanism of Lipid Vesicles Spreading and Bilayer Formation on a Au(111) Surface, Langmuir. 31 (2015) 11012–11019.
4. J. Juhaniewicz, S. Sęk, Atomic Force Microscopy and Electrochemical Studies of Melittin Action on Lipid Bilayers Supported on Gold Electrodes, Electrochimica Acta. 162 (2015) 53-61.
5. J. Pawłowski, J. Juhaniewicz, D. Tymecka, S. Sęk, Electron Transfer Across α-Helical Peptide Monolayers: Importance of Interchain Coupling, Langmuir. 28 (2012) 17287–17294.