LIFE SCIENCES

Nature-Inspired Self-Assembled Systems and Applications Group

Vilnius University

Keywords: *self-assembly, toxin detection, biosensor, phospholipid, membrane, electrochemical impedance spectroscopy, vibrational spectroscopy, atomic force microscopy, surface plasmon resonance, neutron reflectometry.*

Research group activities

We focus on development of nature inspired models, in particular, surface tethered phospholipid membranes (tBLM) and membrane-protein complexes exhibiting catalytic activities. The group addresses problems related to basic life-science as well as applications in biomedicine. In particular, including sensor development for various endogenous and exogenous pathogens. Ultrasensitive detection of microbial toxins.

Proposal

We can offer a broad spectrum of technological solutions to reconstitute proteins into the tethered bilayer for structural and functional studies. Bioelectrochemical and Biospectroscopy techniques and relevant expertise can be accessed by the external users through the standard open access procedures implemented at Vilnius University.

We seek both academic and industrial partnerships to further develop molecular devices based on tethered bilayer technologies and advance basic knowledge in the field of the protein function in biological membranes. In particular, we seek to establish partnerships with theoretical groups having expertise in modelling structures of biomolecules in membranes as well as predicting the dynamic properties of ion carriers in confined nano-compartments. Also, we aim to spread our technological knowledge into the areas of biochemistry and molecular biology where the phospholipid milieu is required for functional reconstitution of membrane proteins for structural and functional studies. Joint initiatives for EU and other international funding for research and technology development are also sought-after.

Meet our team

Research Group

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Research outcomes

Most important publications

- Technological viable solutions for fabrication of tethered bilayers on metal and/or metal-oxides semiconductor surfaces (Rakovska et al., Langmuir. 2015, 31 846-857 (2015).
- Analytical and numerical solutions for the electrochemical impedance spectroscopy of tethered bilayers (Valincius et al., Langmuir. 28, (1) 977-990, (2012).
- Expertise in applications of the neutron-based instrumentation for the structural studies of self-assembled systems (Budvytytė et al., Langmuir. 29, 4320–4327, 2013).
- Platform for bacterial toxin detection (Preta et al., Biochim. Biophys. Acta-Biomembranes. 2016 1858, 2070-2080).
- Surface enhanced Raman analysis of self-assembled structures and water state at interfaces (Talaikis et al. Journal of Physical Chemistry C, 2016, vol. 120, 22489-22499).
- Long-term projects with research groups at the Institute for Biotechnology and Bioscience Research at the University of Maryland (College Park), Carnegie Mellon University and NIST Center for Neutron Research, Niels Bohr Institute at University of Copenhagen.

Resources

- Proprietary technology and compounds for the production of the self-assembled molecular anchors and tethered phospholipid bilayers (patent application).
- Wide spectrum of electrochemical and spectroscopy instrumentation for molecular level characterization of the structure and function of phospholipid bilayers, membrane-protein interaction, detection of membrane-damaging toxins and surface visualization by the fluorescence and atomic force microscopies.
- Proprietary algorithms and software for the analysis of the electrochemical impedance spectral data of tethered bilayers.

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