

# Department of Bioanalysis



Vilnius  
University

**Keywords:** biosensors, bioreactors, biofuel cells, bioelectrochemistry, enzymes, direct electron transport, mathematical modelling



## Research group activities

More than twenty years our research team is focused on the investigation of biomolecules in electrochemical systems with the aim to create new biosensors and bioreactors.

Biosensors open new possibilities for the development of novel types of analytical systems possessing higher selectivity and sensitivity and the new applications in medicine diagnostics, food quality control, industry process safety, and environment monitoring.

New electrochemical bioreactors allow the stereoselective synthesis of new drugs, hormones, other bioactive molecules as well as creation of innovative technologies of the conversion waste compounds into new, more useful compounds or even polymers.

Wiring of the active centres of enzymes contributes to creation of new sources of energy that is especially important for the feeding of the electronic devices inside the body.

We investigate mechanisms of action of such bioelectrocatalytic systems and develop mathematical models for the further monitoring of these systems. Moreover, we build robust biosensor-based analytical systems for different applications in medicine and industry.



## Proposal

- We offer our experience in bioelectrochemistry, selection of new biomolecules and experience in the modelling of the heterogeneous biocatalytic systems.
- We are looking for the new fields of the application of our biosensors and bioreactors creating more safe industrial technologies and new medical diagnostic system.
- We are looking for partners for developing research projects targeting HORIZON 2020, other international programs and industry demand.



## Meet our team

Our department includes a mix of both young and highly experienced researchers having different scientific background including biochemistry, molecular biology, biophysics, electrochemistry and organic chemistry. We have close contacts with microbiologists. They offer us new (if necessary, genetically modified) enzymes and polyenzymatic complexes. We also have close contacts with mathematicians. They assist us in the cre-

ation of mathematical models and algorithms of the regulation of the biocatalytic systems. This enables us to use complementary approaches in solving complex research problems. We have good contacts with a number of foreign universities, it allows us to share ideas and equipment, enhance the rate and width of the research.



## Research outcomes

**Nanostructured carbonaceous matrixes in bioelectrocatalysis.** Modified carbon materials have been applied as electrode material for the reagentless glucose and urea biosensors and implemented for the monitoring of urea in blood and dialysis fluids in haemodialysis systems.

**Enzymatic mechanisms at nanostructured surfaces in bioelectrocatalytic systems.** The enzymes with potential application in bioelectronics were made to work at heterogeneous conditions; some enzymes exhibited improvement of catalytic efficiency on nanosurfaces.

### Most important publications

- **Energy & Environmental Science.** 2017, v.10, 498-502.
- **Electrochimica Acta.** 2016, v.199, 254-260.
- **Electrochemistry Communications.** 2010, v. 12, 933-935.
- **Nonlinear Analysis: Modelling and Control.** 2016, v.21, 702-715.
- **Journal of Mathematical Chemistry.** 2016, v.54, 1221-1232.
- **Luminescence.** 2016, v.31, 127-134.
- **Czech Journal of Food Sciences.** 2016, v.34, 133-142.
- **Bioscience, Biotechnology, and Biochemistry.** 2016, v.80, 2100-2108.
- **Biosensors and Bioelectronics.** 2004, v.20, 1217-1222.



## Resources

Renovated laboratories equipped with modern potentiostats for all types of electrochemical experiments, magnetron and AFM based equipment for preparation and control of electrode surfaces.



## Contacts

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