

Strategies in Antimicrobial Therapy, Protein Engineering and Application in Biotechnology

Keywords: *microbial biocontrol, pulsed electric field, antimicrobial therapy, protein engineering, enzyme modifications*



Research group activities

Our team intensively works on two strong research areas.

Our first task is biocontrol of human pathogenic microorganisms. Skin infections caused by microorganisms represent a clinical challenge, due to them being widespread and their ability to cause mortality of the patients. The increasing resistance of the microorganisms to antibiotics and antifungal agents is promoting the search for new compounds and methods for the treatment of skin diseases as well as understanding the physiology and metabolic plasticity of the infectious microorganisms. A combination of novel chemical compounds along with pulse electric field (PEF) technology allows us to perform a wide scale biocontrol of skin pathogens.

Another research area of ours is development and improvement of new different biocatalysts by protein engineering methods. Our main target is recombinant lipolytic enzymes of *Geobacillus* bacteria that can be applied in the production of biofuel, fragrance and flavor esters, detergents, etc. Our study scope also encompasses microbial ureases, involved in biocementation processes and nitrate reductases which can be applied for biological production of silver nanoparticles.



Proposal

We are interested and can collaborate by helping you in further areas:

• Medical and Pharmaceutical Industry

- » Screening and application of new antibacterial and antifungal compounds against pathogenic bacteria and fungus
- » Development of production and application of silver nanoparticles
- » Development of electroporation techniques for biocontrol of pathogenic microorganisms
- » Research of microgravity on microorganism physiology
- » Research of yeasts prions as models for human disease

• Molecular Microbiology

- » Cell count in environmental samples
- » Optimization of growth conditions for microorganisms
- » Identification of microorganisms using 16S rDNA analysis
- » Screening of microorganisms with desired characteristics from environmental samples

• Enzymes for Industrial Application

- » Microbial recombinant lipolytic enzymes for biofuel, laundering, synthesis of fatty acids esters as flavor and fragrance compounds, degradation of lipid pollutants in environmental waste
- » Native microbial ureases for biocementation and microbially induced calcium carbonate precipitation
- » Native microbial nitrate reductases for production of silver nanoparticles
- » Native and recombinant keratinases for production of peptides and keratin waste degradation
- » Development of immobilized biocatalysts for more effective industrial application
- » Creation and purification of new recombinant enzymes

• Protein Engineering

- » Design of new lipolytic enzymes for different industrial areas
- » Improvement of target biocatalysts using DNA shuffling, epPCR, site specific mutagenesis and other strategies
- » Design of chimeric biocatalysts
- » All necessary gene engineering methods for the creation of recombinant biocatalysts



Meet our team

Head

Assoc. Prof. Dr. Eglė Lastauskienė

Scientists

Assist. Prof. Dr. Renata Gudiukaitė

Assist. Prof. Dr. Audrius Gegeckas

PhD students: Justina Jurgelevičiūtė

Research fellows: Vilius Malūnavičius, Kotryna Čekuolytė, Gytis Druteika, Neda Jonutytė



Research outcomes

Most important publications

- Lastauskiene E., Cepulyte J., Girkontaite I., Zinkeviciene A. Phenotypic switching of *Candida quilliermondii* is associated with pseudohyphae formation and antifungal resistance. *Mycopathologia*. 2015. 179:205–211.
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- Novickij V., Lastauskiene E., Svediene J., Grainys A., Staigvila G., Paskevicius A., Girkontaite I., Zinkeviciene A., Markovskaja S., Novickij J. Membrane Permeabilization of Pathogenic Yeast in Alternating Sub-microsecond Electromagnetic Fields in Combination with Conventional Electroporation. 2017. *Jour Membr Biol*. DOI: 10.1007/s00232-017-9951-4.
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- Gegeckas A., Simkute A., Gudiukaite R., Citavicius D. Characterization and application of keratinolytic paptidases from *Bacillus* spp. *International Journal of Biological Macromolecules*, 2018, 113, 1206-1213.
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