

CEITEC MENDELU – overview of the topics

1	CEIPEX RESEARCH TOPIC LEVEL2
2	NAME OF THE RESEARCH GROUP
3	TOPIC/TOPICS
4	SHORT SUMMARY
5	WEBPAGE OF THE GROUP/CONTACT

TOPIC 1

1	CEIPEX RESEARCH TOPIC LEVEL2 advanced biomaterials
2	NÁZEV VÝZKUMNÉ SKUPINY Research group for Molecular Biology and Nanomedicine
3	TÉMA/TÉMATA Hybrid nanozymes as smart therapeutic modalities
4	ANOTACE K TÉMATU/TÉMATŮM The proposed topic is aimed on development of smart enzymomimetic biomaterials with intrinsic ability to trigger bioorthogonal reactions leading to prodrugs activation for targeted anticancer therapy. Alternatively, the topic plans to explore biomaterials acting as stable nanozymes able to control intracellular redox conditions. Projects dealing with metal- or zeolitic-organic frameworks as platforms for nanozymes design are of utmost interest.
5	WEBPAGE VÝZKUMNÉ SKUPINY/KONTAKT https://ucb.af.mendelu.cz Assoc. prof. Zbynek Heger, Ph.D.

TOPIC 2

1	CEIPEX RESEARCH TOPIC LEVEL2 protein structure and dynamics; protein-DNA interactions
2	NÁZEV VÝZKUMNÉ SKUPINY Research group for Molecular Biology and Nanomedicine
3	TÉMA/TÉMATA Novel approaches to biocompatible proteins modeling
4	ANOTACE K TÉMATU/TÉMATŮM Within the proposed topic, we seek for projects aimed on various aspects of <i>in silico</i> protein folding prediction. The applied projects must involve any relevant aspect of protein prediction problem or relevant technical approaches (molecular dynamics, machine learning, <i>etc.</i>). The main essence of the topic is to develop biocompatible approaches to protein prediction that mimic biological processes responsible for folding with the aim to overcome the drawbacks of AI-based prediction approaches, thus opening new avenues to predict structures of difficult-to-predict proteins.
5	WEBPAGE VÝZKUMNÉ SKUPINY/KONTAKT https://ucb.af.mendelu.cz Assoc. prof. Zbynek Heger, Ph.D.

TOPIC 3

1	CEIPEX RESEARCH TOPIC LEVEL2 nanostructures at surfaces
2	NÁZEV VÝZKUMNÉ SKUPINY Research group of synthesis and chemical analysis
3	TÉMA/TÉMATA Hybrid lipid–nanomaterial interfaces for studying interactions of nanoplastics with biological membranes
4	ANOTACE K TÉMATU/TÉMATŮM This theme focuses on the development of hybrid lipid–nanomaterial interfaces as biomimetic platforms to investigate the interactions of nanoplastics with biological membranes. By combining bilayer lipid models with functional nanomaterials, the system will enable controlled studies of nanoplastic binding, penetration, and disruption mechanisms. The results will provide fundamental insights into the biological impact of nanoplastics and contribute to the design of advanced sensing tools for environmental and health risk assessment.
5	WEBPAGE VÝZKUMNÉ SKUPINY/KONTAKT https://ucb.af.mendelu.cz/vyzkumna-skupina-syntezy-a-chemicke-analyzy/ Assoc. prof. RNDr. Lukáš Richtera, Ph.D.

TOPIC 4

1	CEIPEX RESEARCH TOPIC LEVEL2 advanced instrumentation and methods for analysis
2	NÁZEV VÝZKUMNÉ SKUPINY Advanced Biotechnology and Environmental Analysis
3	TÉMA/TÉMATA Advanced Data-Driven Vis-NIR Spectroscopy for Biomass Monitoring
4	ANOTACE K TÉMATU/TÉMATŮM The research develops novel methods and modelling approaches using Vis-NIR spectroscopy for monitoring plants and other biomass materials. Advanced machine learning techniques are applied to extract meaningful information from complex spectral data, enabling accurate, non-invasive characterization and predictive analysis.
5	WEBPAGE VÝZKUMNÉ SKUPINY/KONTAKT https://ucb.af.mendelu.cz/veda-a-vyzkum/laborator-prvkove-a-speciální-analyzy/ Ing. Andrea Ridošková, Ph.D.

TOPIC 5

1	CEIPEX RESEARCH TOPIC LEVEL2 production biology
2	NÁZEV VÝZKUMNÉ SKUPINY Research Group of Advanced Biotechnologies and Environmental Analysis. (aBETA)
3	TÉMA/TÉMATA Sustainable High-Value Bioproducts from Cyanobacteria
4	ANOTACE K TÉMATU/TÉMATŮM Cyanobacteria represent an untapped resource of antioxidant and medicinally active metabolites. The proposed project will identify and cultivate safe strains (e.g., Arthrospira, Nostoc, Scytonema) rich in phycocyanin, carotenoids (β-carotene, zeaxanthin), phenolic compounds, and sulfated polysaccharides with antioxidant, anti-inflammatory, antiviral, and anticancer activities. We will integrate advanced cultivation strategies in photobioreactors

	with strain selection and aim at elucidation of the high-value product biosynthesis upregulation aided by -omics approaches. Molecular profiling and bioassays will guide the strain selection and validate health-relevant properties. The research will also focus on biorefinery and separation methods to maximize the recovery of target molecules from cyanobacterial biomass. Life-cycle and techno-economic assessments will ensure environmental and economic sustainability. The project will deliver scalable technologies and a basis for next-generation nutraceuticals, cosmeceuticals, and pharmaceutical leads derived from cyanobacteria.
5	WEBPAGE VÝZKUMNÉ SKUPINY/KONTAKT https://ucb.af.mendelu.cz/veda-a-vyzkum/vyzkumna-skupina-nanobiotech-rostlin-a-mikroras/ Ing. Pavel Chaloupský, Ph.D.

TOPIC 6

1	CEIPEX RESEARCH TOPIC LEVEL2 production biology
2	NÁZEV VÝZKUMNÉ SKUPINY Research Group of Advanced Biotechnologies and Environmental Analysis. (aBETA)
3	TÉMA/TÉMATA Nutrient Recovery and Soil Enrichment via Algal Turf Systems
4	ANOTACE K TÉMATU/TÉMATŮM We aim to demonstrate Algal Turf Scrubber (ATS) technology for integrated water treatment and nutrient circularity. ATS units will remove nitrogen, phosphorus, and trace elements from agricultural wastewaters and aquaculture, producing nutrient-rich algal biomass. This harvested biomass will be processed into soil conditioners and biofertilizers that enhance soil organic matter, nutrient retention, and microbial activity. Research will optimize ATS design, hydrodynamics, and seasonal operation, while biochemical and agronomic tests will verify fertilizer quality and environmental safety. This aim provides a scalable, nature-based solution linking clean water production with sustainable soil management and circular nutrient flows.
5	WEBPAGE VÝZKUMNÉ SKUPINY/KONTAKT https://ucb.af.mendelu.cz/veda-a-vyzkum/vyzkumna-skupina-nanobiotech-rostlin-a-mikroras/ Ing. Pavel Chaloupský, Ph.D.