

Level: bachelor				
Course title: Biodegradation and biotransformation				
Status: elective				
ECTS: 6				
Requirements: none				
Learning objectives: Introduce students to biology, role and significance of microorganisms in environmental degradative processes and in biotechnological use, as well as in environmental protection.				
Learning outcomes: Enabling students to understand the role of microorganisms in processes of matter cycle in nature, and their significance in biotechnological processes and in environmental protection. Enabling students for independent and individual research work: experiment design, results recording, analysis, interpretation of results, elaboration and presentation, and eventually use of new experience in conducting simple experiments related to the role of microorganisms in biotechnological processes and in natural environments.				
Syllabus: <i>Theoretical instruction:</i> Students get acquainted with general characteristics of microorganisms, especially as producers of degradative enzymes, with their significance in biodegradation of natural and anthropogenic waste materials and their bioconversion into high-value products (bioconversion of straw into sugars and alcohol; fermentation carbohydrates into alcohol or organic acids and antibiotics; anaerobic bioconversion of waste materials into biogas; production of single-cell proteins; bioconversion of precursors into active hormones; provitamins into vitamins; bioconversion of high-toxic xenobiotics into low-toxic or nontoxic, etc. Biotechnological processes as the basis of non-green revolution expected in this century. Production of food, pharmaceuticals and energy, based on heterotrophic activity of bacteria, fungi and other heterotrophs. Saprotrophism as the basis of function of wastewater purification plants, production of biosynthetic ecologically friendly plastic materials, and bioremediation processes and methods. Understanding microbial processes of biodegradation of easy-to-degrade as well as resistant, difficult to degrade organic substances, biosynthetic and chemosynthetic: xenobiotics (pesticides, polycyclic aromatic and halogenated compounds). Emphasis will be placed on microbial metabolic processes as the basis for self-purification of surface freshwaters as the main recipients of anthropogenic pollution, and in biotechnological processes in wastewater purification. Biodegradation as the basis for bioremediation processes and methods. <i>Practical instruction:</i> Developing competence in cultivation of microorganisms. Principles of experimental work: the best sampling practice, inoculation on solid media and cultivation procedure. Developing skills in results recording procedure. Getting knowledge in methods of purification of bacterial isolates. Conservation for culture collection and learning rules and procedures for culture maintenance. Through the practicals, students get acquainted with physiological characteristics of isolated cultures of microorganisms. Cultivation with the aim of optimization of microbial growth in different experimental conditions in order to understand microbial (eco)physiology (enzyme activity: hydrolase, esterase, protease, lypase, saccharase, cellulase, etc. as the basis of biodegradations and biotransformations. Microbial degradation of phenolic compounds, naphtha and oil derivatives, polycyclic aromatic hydrocarbons, pesticides, what is in the basis of biodegradative processes used in environmental protection technology. Biomass and biogas biosynthesis.				
Weekly teaching load				Other:
Lectures: 2	Exercises: 2	Other forms of teaching:	Student research:	
Teaching methodology: lectures, practicals, consultations, seminars, colloquia, visiting water purification plant.				