

Subject card

Subject name and code	Biotechnology - Introduction Methodology (M01_B1), PG_00196888						
Field of study	Biotechnology						
Date of commencement of studies	October 2026	Academic year of realisation of subject			2026/2027		
Education level	Bachelor's studies	Subject group			Obligatory subject group in the field of study Humanistic-social subject group Subject group related to scientific research in the field of study		
Mode of study	full-time studies	Mode of delivery			at the university		
Year of study	1	Language of instruction			Polish		
Semester of study	1	ECTS credits			2.0		
Learning profile	academic	Assessment form			credit		
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. Stanisław Ołdziej				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	0.0	9.0	0.0	14.0	23
	E-learning hours included: 0.0						
Learning activity and number of study hours	Learning activity	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	Number of study hours	23		5.0		22.0	50
Subject objectives	The aim of the course is to familiarize students with the theoretical aspects of the philosophy of science and the art of critical (scientific) thinking, the idea and application of model organisms in scientific research, with particular emphasis on the use of model organisms in biotechnology, the organization of a research laboratory, safety rules, and the ethics of scientific research.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[BIOTECHL3_K03] The graduate is willing to understand risks and dilemmas, including ethical dilemmas related to conducting scientific research and introducing advanced technologies using the achievements of biotechnology; understand and appreciate the importance of intellectual property; behave ethically.	The student identifies the principles of professional responsibility of a scientist and the importance of scientific integrity in research work, and recognizes the principles of intellectual property protection in scientific and research and development activities.	
	[BIOTECHL3_U08] The graduate is able to learn independently and in a targeted manner, develop his or her competences and plan their improvement.	The student applies selected aspects of the philosophy of science and the art of critical (scientific) thinking in the process of independent learning.	[SU4] test/exam - oral or written
	[BIOTECHL3_U04] The graduate is able to search for, analyse and use scientific information, also in English, in the field of biotechnology in the fields of exact and natural sciences and medical and health sciences; uses electronic sources; has advanced skills in using appropriate databases.	The student searches for scientific information on biotechnological issues in national and international databases and electronic library resources, assesses the credibility and validity of scientific sources, selects literature appropriate to the analyzed research problem, and applies correct principles of citation and creation of bibliographies using electronic tools.	[SU4] test/exam - oral or written
	[BIOTECHL3_K04] The graduate is aware of the importance of occupational safety rules, is able to apply them and react in hazardous situations, ensuring their own safety and the safety of others.	The student is able to work in a research laboratory, applying the principles of laboratory safety.	[SK2] presentation/project/paper/report
	[BIOTECHL3_K01] The graduate is aware of the scope of their own knowledge and skills; demonstrates a willingness to continuously update them and pursue professional development.	The student applies selected aspects of the philosophy of science and the art of critical (scientific) thinking to improve his/her own knowledge and raise qualifications in biotechnology.	[SK2] presentation/project/paper/report
	[BIOTECHL3_W10] The graduate possesses knowledge of the social sciences and humanities that fosters entrepreneurship, professional responsibility and proper functioning in society; understands ethical principles and responsibility in conducting scientific research.	The student identifies and discusses selected issues from the philosophy of science as part of the philosophy of humanities discipline related to scientific and professional activities in biotechnology, discusses the importance of entrepreneurship, cooperation and social responsibility in scientific and professional activities.	

Subject contents

M1. Art of critical thinking (6h) Finding arguments, distinguishing arguments from explanations, descriptions, instructions or assertions, formal correctness of an argument, substantive correctness of an argument, selected argumentative fallacies, premises, conclusions, propositional arguments, categorical arguments, arguments from analogy, statistical arguments, causal arguments.

This content represents social and humanities (6h + 8h of student's own work = 14h = 1 ECTS)

M2. Model organisms and their applications in science (17h)

Work organization and safety rules in the laboratory (2h).

Bacterial model organisms (*Escherichia coli* and *Bacillus subtilis*)

Preparation and principles of work in microbiology laboratory (sterile work, sterilization, health and safety rules), - basics of work with *E. coli* and *B. subtilis*, growth of bacteria on solid medium (demonstration), - microbiological media and media used for work with *E. coli* and *B. subtilis*, - division into Gram(+) and Gram(-) bacteria and staining of cells of *E. coli* and *B. subtilis*, staining of *B. subtilis* spores, - morphology of *E. coli* and *B. subtilis* on different microbiological media and including spores, - survival of bacteria and sensitivity of *E. coli* and *B. subtilis* to chemotherapeutics (demonstration)

Mammalian cells

HEK293 lines, cancer lines (e.g., HeLa, MOLT-4 suspension), recombinant lines with fluorescent proteins (GFP, mCherry): - Getting acquainted with materials, reagents and apparatus used during cell culture (laminar chamber, culture plastics, culture media, dewar). Learning how to work under sterile conditions. Health and safety in working with mammalian cells, - microscopic observations of mammalian cells in in vitro culture: comparison of cell morphology; observation of fluorescence (GFP, mCherry); fluorescence staining of vivo (mitotracker, lysotracker, DNA stain) and observation of stained cell organelles; staining of the actin cytoskeleton of the cell, - trypsinization and passage of cells, counting of cells with assessment of their viability in the presence of trypan blue and neutral red, seeding of cells, - cryopreservation and banking of cells, thawing of cells.

Plants:

observation and discussion of types of plant in vitro cultures (plant cultures, transformed root cultures, callus cultures, cell suspension), - encircling plant explants - pseudo-artificial seeds, - observation of biologically active compounds contained in plant tissues using thin-layer chromatography, - *Arabidopsis thaliana* mutants - comparison of hydroponic, in-ground and in vitro culture, - study of the effect of plant extracts on the growth of *Escherichia coli*, - isolation of chlorophyll-protein complexes from thylakoid membranes.

Nematode *Caenorabditis elegans*:

discussion of the principle of culture of the nematode *Caenorabditis elegans*, - isolation of nematode eggs from culture, - observation of nematode culture on solid medium using a stereomicroscope, - determination of nematode survival in liquid culture.

Yeast *S. cerevisiae* and *P. pastoris*:

During the course of the course, laboratory work performed by students and demonstrations conducted by the instructor will be implemented. Students will independently prepare microscopic preparations of yeast and conduct their observation (diploid cells, sporulation bags, fluorescently stained organelles). In addition, students will measure enzymatic activity in a suspension of cells. A demonstration of tetrad separation using a micromanipulator will also be performed.

Other eukaryotic expression systems

LEXSY-*Leishmania tarentolae* protozoa, insect cells/baculovirus system: - microscopic observation of insect and protozoan cells, - learning to work in sterile conditions, health and safety of working with viruses, - cell counting and passage, infection with fluorescent baculovirus; observation of fluorescent markers of recombinant gene expression, - discussion of differences in prokaryotic and eukaryotic gene expression

	systems.		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Part M2	51.0%	35.0%
	Part M1	51.0%	65.0%
Recommended reading	Basic literature	<p>1. George W. Rainbolt, Sandra L. Dwyer, Critical Thinking. The Art of Argument, Wadsworth 2012</p> <p>2. R. A. Ankeny, S. Leonelli (2011) Whats so special about model organisms? Studies in History and Philosophy of Science 42; 313323 (DOI: 10.1016/j.shpsa.2010.11.039)</p> <p>3. S. Leonelli and R. A. Ankeny (2013). What makes a model organism? Endeavour 37; 209-212 (DOI: http://dx.doi.org/10.1016/j.endeavour.2013.06.001)</p> <p>4. B. Tang, Y. Wang, J. Zhu, W. Zhao (2015). Web resources for model organism studies. Genomics, Proteomics and Bioinformatics 13; 64-68 (DOI: 10.1016/j.gpb.2015.01.003)</p> <p>5. J. Górska-Andrzejak, P. Grzmil, M. Labocha-Derkowska, J. Rutkowska, W. Strzałka, K. Tomala, D. Włoch-Salamon (2016) Poczta modelowych organizmów badawczych. Wszechświat 117 nr 7-9/2016</p>	
	Supplementary literature	none	
	eResources addresses		
Example issues/ example questions/ tasks being completed			
Work placement	Not applicable		

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