University of Gdańsk

Subject card

Subject name and code	Principles of biotechnology - Introduction Methodology (M01_B1), PG_00193181		
Field of study	Biotechnology		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2025/2026
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	3.0
Learning profile	academic	Assessment form	credit
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Stanisław Ołdziej	
	Teachers	dr hab. Stanisław Ołdziej dr hab. Artur Szutta mgr Nikodem Lewandowski dr Gabriela Brzuska dr n. med. Dorota Pomorska mgr Ewa Wiśniewska dr Marta Krychowiak-Maśnicka prof. dr hab. Aleksandra Królicka dr Anna Ihnatowicz Natalia Paluch dr hab. Krzysztof Hinc mgr Marcin Borowicz	

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	2.0	20.0	45

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_U08] The graduate is able to learn independently and in a targeted manner, develop his or her competences and plan their improvement.	The student knows selected aspects of the philosophy of science and the art of critical (scientific) thinking	[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 is familiar with the idea and application of model organisms in scientific research with particular emphasis on the application of model organisms in biotechnology	[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 familiar with the organization of a research laboratory and 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 knows selected aspects of the philosophy of science and the art of critical (scientific) thinking	[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 knows selected aspects of the philosophy of science as a part of philosophy - a discipline of humanities	

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, basic 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 basics 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-Leischmania 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

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<tr><td></td><td colspan="3">systems.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td colspan="3"></td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Part M1</td><td>0.0%</td><td>65.0%</td></tr>
<tr><td>Part M2</td><td>0.0%</td><td>35.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. George W. Rainbolt, Sandra L. Dwyer, Critical Thinking. The Art of Argument, Wadsworth 2012

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)

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)

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)

5. J. Górska-Andrzejak, P. Grzmil, M. Labocha-Derkowska, J. Rutkowska, W. Strzałka, K. Tomala, D. Włoch-Salamon (2016) Poczet modelowych organizmów badawczych. Wszechświat 117 nr 7-9/2016</td></tr>
<tr><td>Supplementary literature</td><td>none</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3"></td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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