University of Gdańsk

Subject card

Subject name and code	Unicellular organisms - Genetics Methodology (M03_B2), PG_00197613		
Field of study	Biotechnology		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
Education level	Bachelor's studies	Subject group	Obligatory subject group in the field of study Optional 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	2	Language of instruction	Polish
Semester of study	3	ECTS credits	6.0
Learning profile	academic	Assessment form	credit
Conducting unit	Intercollegiate Faculty of Biotechnology UG-MUG -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Dorota Krzyżanowska	
	Teachers	dr Natalia Kaczyńska dr hab. Katarzyna Węgrzyn dr Anna Karłowicz dr n. med. Dorota Pomorska Nitu Devi Nitu Devi dr Alessandro Negri prof. dr hab. Michał Obuchowski mgr Daria Horoszkiewicz dr Anna Kawiak	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	12.0	74.0	0.0	0.0	86
	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	86	10.0	54.0	150

Subject objectives	
	The course aims to familiarize students with the genetics of unicellular organisms and the practical use of the molecular biology of microorganisms. The practical classes is to use the acquired knowledge and develop skills and competencies for proper planning and conducting experiments in genetics of unicellular organisms. The student will gain awareness of the risks and benefits of using genetically modified microorganisms. The student will gain awareness of the safety rules in working with microorganisms and care for their own and others' safety.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOTECHL3_W07] The graduate has advanced knowlegde of the rules of operation and the possibilities of using research techniques and tools used in biotechnology.	The student knows basic research techniques used in microbial genetics and genetic engineering.	[SW4] test/exam - oral or written
[BIOTECHL3_W01] The graduate possesses structured and advanced knowledge of biological phenomena at the molecular level and understands their importance for biotechnology.	The student understands fundamental biological processes at the molecular level occurring in unicellular organisms and is familiar with the practical applications of microbial molecular biology in biotechnology.	[SW4] test/exam - oral or written
[BIOTECHL3_U07] The graduate is able to prepare and present a short oral presentation in Polish and/or English, covering detailed issues in the field of biotechnology, using scientific language, and is able to conduct discussions	The student is able to use scientific language and conceptual frameworks relevant to biotechnology and microbial genetic engineering, and demonstrates the ability to engage in substantive discussion using appropriate terminology.	[SU3] text preparation/written work [SU5] implementation of a problem task
[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 able to search for and use scientific information, including English-language sources, in the field of bacterial and yeast genetics. The student demonstrates basic skills in using relevant databases and electronic resources, including for designing cloning experiments with the use of bioinformatic tools.	[SU1] oral statement/conversation/ discussion
[BIOTECHL3_U01] The graduate possesses practical skills in performing laboratory procedures, documenting results, and applying techniques necessary in biotechnology, including methods of isolation, modification, selection, and analysis of organisms, tissues, cells, and molecules; has the ability to operate advanced laboratory.	The student is able to perform basic experiments in microbial genetics and genetic engineering, documents results, applies appropriate research techniques and tools, and operates basic laboratory equipment in a genetic engineering laboratory.	[SU3] text preparation/written work [SU4] test/exam - oral or written [SU6] demonstration of practical skills
[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 knows and follows safety rules for laboratory work with microorganisms, including GMM organisms; identifies hazards and responds appropriately in risky situations, ensuring the safety of self and others.	[SK8] observation of student's independent or team work
[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 understands ethical and practical aspects of designing experiments involving genetically modified microorganisms and is able to identify potential risks associated with their use in biotechnology.	[SK8] observation of student's independent or team work
[BIOTECHL3_W08] The graduate knows the principles of occupational health and safety, understands the risks associated with laboratory work, including infectious materials, GMOs and GMMs, and knows the legal regulations relating to these areas.	The student knows the safety principles in molecular biology and microbial genetics laboratories, including the requirements for working with GMMs.	[SW4] test/exam - oral or written

Subject contents

Laboratory classes (group selection - Polish or English)

M1. Bacterial genetics (42 h) (IFB MUG 36 h, IFB UG 6 h)

- Antibiotic resistance genes - plasmids as carriers of genetic information
- Titration of bacteriophages
- Transposon mutagenesis + Transduction with SPP1 phage
- One-step experiment the lysis vs. lysogeny decision
- Spores - resistance of spores to drying, temperature, UV, spore germination
- Induction and measurement of the general stress response

M2.Yeast genetics (14 h) (IFB UG)

- Conjugation + Transformation + Plasmid Loss Two-hybrid test + plasmid loss CD Two-hybrid test + plasmid loss

Methodology **Laboratory and classroom-based tutorials (18 h in a computer lab and 12 h in a seminar room)**

M3. Fundamentals of Genetic Engineering (30 h) (IFB MUG, IFB UG)

- Gene and genomic libraries
- Cloning (restriction and other enzymes, vectors, Gibson assembly)
- Mutagenesis Recombination
- Phage transdcution
- Designing *in silico*
- Cloning project

Depending on the chosen group, students attend classes in either Polish or English, gaining subject knowledge in the selected language while building discipline-specific vocabulary.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Part M1	51.0%	35.0%
Part M2	51.0%	25.0%
Part M3	51.0%	40.0%

Recommended reading

Basic literature

A.1. Literature used during classes

- Biologia molekularna bakterii Redakcja naukowa: Jadwiga Baj, Zdzisław Markiewicz, PWN 2006 i nowsze
- Molecular Cell Biology, wydanie IX, 2021, W.H. Freeman and Co.
- Molecular Biology of the Gene, wydanie 7, 2014, Pearson
- Genomes 4 T.A. Brown, 2018, Garland Science
- Skrypt Pracownia inżynierii genetycznej materiały do ćwiczeń Katarzyna Węgrzyn
- Materiały przygotowane przez prowadzącego zajęcia

A.2.Literature for self-study

- Mikrobiologia - Jadwiga Baj (red. nauk.), Wydawnictwo Naukowe PWN SA, Warszawa 2018.
- Biologia molekularna bakterii PWN 2006
- Molecular cloning - A laboratory manual. 4thedition, (2012) Green, Sambrook

	Supplementary literature	Chapters dedicated to the genetics of microorganisms: • Microbiology: an introduction. Gerard J. Tortora, Berdell R. Funke, Christine L. Case, 2016, Pearson • Prescotts MicrobiologyJoanne Willey[10th ed.] 2016. McGraw-Hill Education, • Mikrobiologia Murray Rosenthal Wydanie 2018 EDRA URBAN & PARTNER • Brock biology of microorganisms, global edition, 15/e M. T. Madigan, K. S. Bender, D. H. Buckley, W. M. Sattley,D. A. Stahl, 2018. Pearson. • Principles of Biochemistry, Lehninger, wydanie VII, 2017, Freeman • Concepts of Genetics, wydanie 10, 2012, Pearson • Sherman F., (2002) Getting started with yeast. Methods Enzymol. 350: 3-41. • The Yeasts: Yeast Technology (2012)Anthony H. Rose, J. Stewart Harrison • Guide to Yeast Genetics and Molecular Biology. (2004) Christine Guthrie, Gerald R. Fink
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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