University of Gdańsk

Subject card

Subject name and code	Molecular biology and genetics, PG_00146107		
Field of study	Bioinformatics		
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
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	7.0
Learning profile	academic	Assessment form	exam
Conducting unit	Department of Molecular Genetics of Bacteria -> Faculty of Biology -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Barbara Kędzierska	
	Teachers	dr Barbara Wojtasik dr hab. Barbara Kędzierska prof. dr hab. Tadeusz Namiotko dr Dariusz Nowicki	

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	45.0	0.0	30.0	0.0	0.0	75
	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	75	0.0	45.0	120

Subject objectives	To familiarize students with the molecular basis of heredity and genetic information flow. Students will learn and acquire the ability to independently use various bioinformatics tools used in molecular biology. Students will learn the principles of Mendelian, quantitative and population genetics and acquire the ability to independently analyze the results of genetic crosses. Students will learn the most important methods used in genetic analysis and acquire the ability to independently interpret published research results obtained using genetic analysis.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOINL3_U06] Graduate knows English to the extent that he can understand technical speech and read with understanding literature and scientific papers from the scientific fields and disciplines relevant to bioinformatics; he/she can prepare a short written paper and an oral presentation in English on specific topics of bioinformatics	The student is able to independently analyze the results of research published in English obtained using the methods and techniques discussed in class.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report [SU3] text preparation/written work
[BIOINL3_U05] Graduate has the ability to use scientific literature, including English-language sources on bioinformatics; has ability to use appropriate databases	The student is able to:use scientific publications and electronic resources including databases in English to obtain information necessary for the design and use of molecular tools.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report [SU3] text preparation/written work [SU8] observation of student's independent or team work
[BIOINL3_W02] Has the scientific knowledge necessary to understand the basic processes in living organisms.	The student knows: - the molecular structure of the gene and the mechanisms of genome replication.and the principles of the flow of genetic information from nucleic acids to proteins. - the most important methods and techniques used in molecular biology and genetics. - principles of Mendelian genetics and basic principles of quantitative and population genetics.	[SW4] test/exam - oral or written
[BIOINL3_U02] Graduate is able to apply knowledge of natural sciences and science to formulate, analyze and solve problems related to bioinformatics	The student is able to use various bioinformatics tools used in molecular biology and genetic engineering, as well as analyze the results of crossbreeding using Mendelian genetics.	[SU2] presentation/project/paper/ report [SU3] text preparation/written work [SU5] implementation of a problem task [SU8] observation of student's independent or team work

Subject contents

Molecular biology - lecture 30 hrs.

- Molecular structure and organization of the gene in prokaryotes and eukaryotes.
- Molecular basis of replication, repair and recombination of prokaryotic and eukaryotic DNA.
- Mutations, mutagenesis, mutagenic agents.
- Expression of genetic information: transcription, translation.
- Mechanisms of gene expression in prokaryotes and eukaryotes.
- Genetic engineering - techniques that allow modifications and changes in the expression of plasmid and chromosomal genes.
- GMOs - analysis of strategies used to modify specific organisms.

Molecular biology - computer-based exercises 20 hrs.

- DNA amplification using PCR and real time PCR - preparation of primers and development of reaction conditions, analysis of literature data.
- Methods of cloning sequences into plasmid vectors - independent planning of cloning strategies,
- Getting to know various bioinformatics programs that allow to analyze nucleic acid sequences, including searching for key genetic elements in DNA sequences.
- Getting to know programs that allow visualization of nucleic acids and proteins.

Genetics - lecture 15 hrs.

- Fundamentals of Mendelian genetics
- Genetic variation- mutations, recombination, environmental variation, genotype-environment interaction.
- Coupling and recombination of genes on a chromosome, genetic mapping, genetic markers.
- Quantitative genetics, quantitative trait location (QTL) mapping.
- Basics of population genetics.

Genetics - laboratory/computer exercises - 10 hrs

- Basic methods and techniques used in genetic research: analysis of the results of genetic crosses using Mendelian genetics, independent inheritance, coupling, recombination, sex-linked inheritance.
- Basic methods and techniques of population genetics, analysis of gene frequencies in a population.
- Quantitative genetics.

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">The student, after completing the compulsory subjects in the first two semesters, has the knowledge and skills to qualify him to participate and pass the subject.</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>writing exam</td><td>51.0%</td><td>50.0%</td></tr>
<tr><td>colloqiua</td><td>51.0%</td><td>40.0%</td></tr>
<tr><td>activity</td><td>0.0%</td><td>10.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">• W. Widlak Wprowadzenie do biologii molekularnej dla bioinformatyków, PJWSTK 2010
• P. Węgleński, Genetyka molekularna, PWN 2012
• D.L. Hartl, A.G. Clark, Podstawy genetyki populacji, Uniwersytet Warszawski, Warszawa 2009
• Publications on molecular biology methods discussed during the exercises - indicated by the lecturer</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">• Biologia molekularna. Krótkie wykłady - PC Turner i wsp., PWN 2020
• Genetyka medyczna i molekularna. J. Bal. Wyd. Nauk PWN, Warszawa 2017
• Genetyka zwierząt. K. M. Charon, M. Świtoński. PWN Warszawa, 2006.
• Genetyka i genomika zwierząt. K. M. Charon, M. Świtoński. PWN Warszawa, 2019
• Genetyka człowieka. Rozwiązywanie problemów medycznych. B. R. Korf. PWN Warszawa, 2003..
• Zbiór zadań i pytań z genetyki, cz. I Genetyka ogólna. B. Piątkowska, A. Goc, G. Dąbrowska. Wydawnictwo UMK, Toruń 1998.</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></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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