University of Gdańsk

Subject card

Subject name and code	Molecular evolution, PG_00153622						
Field of study	Biotechnology						
Date of commencement of studies	October 2026		Academic year of realisation of subject	2026/2027			
Education level	Master's studies		Subject group	Obligatory subject group in the field of study 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	2		ECTS credits	3.0			
Learning profile	academic		Assessment form	exam			
Conducting unit	Laboratory of Evolutionary Biochemistry -> UG Institute of Biotechnology -> Intercollegiate Faculty of Biotechnology UG-MUG -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Jarosław Marszałek				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	0.0	30
	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	30		5.0	40.0	75	
Subject objectives	To familiarize students with the molecular basis of evolution and the experimental and bioinformatic methods used in evolutionary research. Demonstrating that the theory of evolution constitutes the basis of biological knowledge, allowing seemingly distant fields of bio-medical research to be linked into a unified system.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOTECHMU2_W01] The graduate has in-depth knowledge of complex biological phenomena at the molecular level and knows their importance for biotechnology, is able to analyze them in an interdisciplinary approach and assess their ethical, social and environmental implications.	The student will learn how to use evolutionary methods, including natural selection, in biotechnological processes such as obtaining desired strains of microorganisms and new activities of proteins and enzymes.	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW3] text preparation/written work
[BIOTECHMU2_U04] The graduate possesses the ability to proficiently use scientific information, including English, regarding biotechnology; critically analyses and selects information; uses electronic sources; has the ability to use appropriate databases.	The student prepares for classes and the final exam by reading original scientific publications.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written [SU5] implementation of a problem task
[BIOTECHMU2_U05] The graduate has proficient knowledge of English to understand statements and read and understand literature and scientific studies in the fields of science and scientific disciplines relevant to biotechnology; is able to prepare a written study and an oral presentation in English.	Lecture is conducted in English, as well as discussions during the lecture, quizzes before each lecture and the final exam.	[SU1] oral statement/conversation/ discussion [SU4] test/exam - oral or written [SU5] implementation of a problem task
[BIOTECHMU2_W04] The graduate has in-depth knowledge of selected biotechnology problems currently discussed in the literature.	Students will gain knowledge in the field of: - interpretation of research results in the context of the theory of molecular evolution, - interpretation of phylogenetic trees - creating evolutionary scenarios of biological phenomena occurring at the molecular level	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion [SW3] text preparation/written work

Subject contents

Genetic variability at the molecular level: genes, genetic code, mutations. Genetic variability at the population level. Natural selection and neutral evolution. Dynamics of DNA sequence changes and the molecular clock. Molecular phylogeny and taxonomy: application of bioinformatic methods. Protein evolution. Evolution of genomes. Ancient DNA research. The practical applications of the natural selection: evolution in the laboratory

Prerequisites and co-requisites

Basic knowledge in the field of: Genetics, Biochemistry, Molecular Biology, Microbiology, Biophysics, General Chemistry, Organic Chemistry.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Examination	51.0%	100.0%

Recommended reading

Basic literature	Łatwe drzewa filogenetyczne. Hall Barry (2008) Warszawa, Wyd. UW Markery molekularne, historia naturalna i ewolucja. Avise John C (2008) Warszawa. Wyd. UW Bioinformatyka i ewolucja molekularna. Paul G. Higgis, Tersa K. Attwood (2008) Warszawa, PWN Bioinformatyka-podręcznik do analizy genów i białek. A.D. Baxevanisa i B.F.F. Ouellettea (2004) Warszawa PWN The lecturer provides a set of PDF files containing current review and selected experimental publications related to the content of the lecture. This set changes every year as the lecture is updated.
Supplementary literature	not applicable
eResources addresses	

Example issues/ example questions/ tasks being completed	A bacterial protein responsible for an antibiotic resistance of a hospital strain has two amino acid substitutions (S1 and S2) in comparison to the same protein from the non-resistant strain. When researchers introduced substitution S1 to the protein from the non-resistant strain and tested its effect in vivo, no increase of resistance was observed. When substitution S2 was introduced a little increase of resistance was observed in vivo. However, when both S1 and S2 substitutions were introduced to the protein from the non-resistant strain the resistance in vivo was as high as in the hospital isolate. A)What evolutionary phenomenon could explain the observed results? B) What is the possible biochemical effects of the S1 substitution?
Work placement	Not applicable

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