University of Gdańsk

Subject card

Subject name and code	Global regulatory mechanisms in bacteria, PG_00147777		
Field of study	Genetics and Experimental Biology		
Date of commencement of studies	October 2024	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
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	3	Language of instruction	Polish Polish
Semester of study	5	ECTS credits	2.0
Learning profile	academic	Assessment form	
Conducting unit	Department of Molecular Genetics of Bacteria -> Faculty of Biology -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr Monika Maciąg-Dorszyńska	
	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	4.0	16.0	50

Subject objectives

Understanding of the processes involved in bacterial response systems to stress and changing environmental conditions. Understanding of the metabolism of cellular allografts. Ability to analyze the literature independently.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[GBEL3_W03] The molecular mechanisms of genetic information transmission and gene expression, as well as the molecular and genetic basis of human physiology and diseases, including infectious diseases.	He/She knows the molecular mechanisms of genetic information transfer and gene expression and the molecular and genetic basis of human physiology and disease, including infectious diseases.	[SW4] test/exam - oral or written
[GBEL3_W01] Understanding the structure and properties of basic types of biological macromolecules, molecular mechanisms of metabolic pathways and genetic information flow, as well as sources of genetic variability in organisms and mechanisms of evolution; explaining the rules of inheritance, elucidating differences in the structure and functioning of prokaryotic and eukaryotic cells, and understanding the structure and functional relationships at the cellular and tissue levels.	Describes the structure and properties of the basic types of biological macromolecules, the molecular mechanisms of basal metabolic pathways and the flow of genetic information and the sources of variation in organisms; explains the rules of inheritance, explains the differences in the structure and function of the prokaryotic and eukaryotic cell.	[SW4] test/exam - oral or written
[GBEL3_W06] the development and current state of knowledge, as well as the latest trends in molecular genetics and related fields; indicating their relationship with other disciplines in the natural or medical sciences and the possibilities of their practical application.	Is familiar with the development and current state of knowledge and the latest trends in molecular genetics and related fields; indicates their relationship with other disciplines in the life sciences or medical sciences and the possibilities of their use in practice.	[SW4] test/exam - oral or written
[GBEL3_U04] Capable of reading scientific texts in English and Polish with comprehension, synthesizing the knowledge contained within them, preparing well-documented studies on biological issues, as well as those related to research commercialization.	Can read scientific texts in English and Polish with comprehension, synthesise the knowledge they contain, prepare well-documented papers on biological problems and on the commercialisation of research.	[SU4] test/exam - oral or written
[GBEL3_K07] Lifelong learning and updating knowledge in the field of molecular genetics and other disciplines.	Understands the need for lifelong learning and updating knowledge in molecular genetics and other disciplines.	[SK4] test/exam - oral or written
[GBEL3_U08] Independently study literature and plan one's own career path.	Able to study the literature independently and plan their own career path.	[SU4] test/exam - oral or written
[GBEL3_U09] Plan and pursue one's education autonomously and in a focused manner.	Can plan his/her education and learn in an independent and focused manner.	[SU4] test/exam - oral or written

Subject contents

Global systems for the regulation of gene expression in bacteria, including stringent response, catabolic response, quorum sensing, two-component systems and signalling cascades. Signalling nucleotides and cellular alarmons. Small regulatory RNAs (sRNAs). Bacterial response to environmental stresses, e.g. heat stress and nitrogen source availability.

Prerequisites and co-requisites

Basic knowledge of microbiology, biochemistry and molecular genetics, knowledge of basic microbiology and molecular biology techniques.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
obecnośći i ocena z kolokwium (Regulamin studiów UG)	51.0%	100.0%

Recommended reading	Basic literature	1. Potrykus K. & Cashel. M (2008) (p)ppGpp - still magical? Annu Rev Microbiol. 62: 35- 51 2. Dylewski M, Sobala M, Bruhn-Olszewska B, Potrykus K (2018). 50th anniversary of the discovery of magic spots - the latest developments in (p)ppGpp research. Postępy Biochemii 64 (1) 1-8 3.Fernández-Coll L, Maciag-Dorszynska M, Tailor K, Vadia S, Levin PA, Szalewska-Palasz A, Cashel M. The Absence of (p)ppGpp Renders Initiation of Escherichia coli Chromosomal DNA Synthesis Independent of Growth Rates. mBio. 2020 Mar 10;11(2):e03223-19. doi: 10.1128/mBio.03223-19. 4.. Papenfor, K. &. Bassler, B.L. (2016) Quorum sensing signalresponse systems in Gram-negative bacteria. Nature Rev. in Microbiol.,14: 576- 588 5. Lipa, P., Kozieł, M., Janczarek, M (2017) Quorum sensing phenomenon of Gram-negative bacteria: signalling molecules and inhibitors and their potential therapeutic application. Postępy Biochemii, 63 (4): 242-260 6.Groisman, E.A. (2016) Feedback control of two-component regulatory systems. Annu. Rev. Microbiol. 70:10324 7. Roncarati, D. & Scarlato, V. (2017) Regulation of heat-shock genes in bacteria: from signal sensing to gene expression output. FEMS Microbiology Reviews, 41: 549574 8. Carrier M.C., David Lalaouna, D., Massé, E. (2018) Broadening the definition of bacterial small RNAs: characteristics and mechanisms of action.Annu. Rev. Microbiol. 72:141-161 9. Cech, G.M. & Szalewska-Pałasz, A (2018) Hfq protein - new faces of a well-known riboregulator. Advances in Microbiology, 57(1): 1221 10. van Heeswijk, W.C., Westerhoff, H.V., Boogerda, F.C. (2013) Nitrogen assimilation in Escherichia coli: putting molecular data into a systemsperspective. Microbiol. and Mol. Biology Rev., 77 (4): 628695 11. Görke, B. & Stülke, J (2008) Carbon catabolite repression in bacteria: many ways to make the most out of nutrients. Nature Rev. in Microbiol.,6:613 -624 12.Additional material from current literature indicated by the instructor.

	Supplementary literature	1. Bacterial stress responses. Storz G. ASM Press, 20102. Snyder L., Peters J.E., Henkin T.M., Champness W., Molecular Genetics of Bacteria, 4th Edition, ASM Press 20133. Bruhn-Olszewska B, Molodtsov V, Sobala M, Dylewski M, Murakami KS, Cashel M, Potrykus K. (2018) Structure-function comparisons of(p)ppApp vs (p)ppGpp for Escherichia coli RNA polymerase binding sites and for rrnB P1 promoter regulatory responses in vitro. Biochim BiophysActa. 1861(8): 731-742.4. Potrykus K, Cashel M. (2018) Growth at best and worst of times. Nature Microbiology 3(8):862-863.
	eResources addresses	
Example issues/ example questions/ tasks being completed	Global systems for the regulation of gene expression in bacteria, including stringent response, catabolic response, quorum sensing, two-component systems and signalling cascades. Signalling nucleotides and cellular alarmons. Small regulatory RNAs (sRNAs). Bacterial response to environmental stresses, e.g. heat stress and nitrogen source availability.	
Work placement	Not applicable	

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