University of Gdańsk

Subject card

Subject name and code	Practical application of spore forming bacteria, PG_00196964		
Field of study	Biotechnology		
Date of commencement of studies	October 2026	Academic year of realisation of subject	2028/2029
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	3	Language of instruction	Polish
Semester of study	6	ECTS credits	2.0
Learning profile	academic	Assessment form	credit
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Krzysztof Hinc	
	Teachers		

Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	16.0	0.0	0.0	0.0	0.0	16
	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	16	5.0	29.0	50

Subject objectives	The subject aims to familiarize students with the topic of the importance of spore-forming bacteria in biotechnology. The student: (KW_01_B) will learn about the physiology of Gram-positive bacteria from the families *Bacillus*, *Clostridium*, *Sporosarcina*, particularly the sporulation stage leading to the formation of spores (resting forms enabling microorganisms to survive unfavorable environmental conditions) (KW_02_B) will gain advanced knowledge on the use of spore-forming bacteria in biotechnology, medicine, and related sciences.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[BIOTECHL3_W02] The graduate knows and understands at an advanced level selected processes at the cell, tissue, and organism level, important from the biological point of view	The student knows the detailed structure of spore-forming bacteria cells and the mechanisms of spore formation and germination, understands the metabolic and physiological processes occurring in spore-forming bacteria cells and their importance for the functioning of microorganisms in various environmental conditions, is able to discuss the mechanisms of interaction of spore-forming bacteria with other organisms and their role in the environment and in biotechnological applications.	[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 describes the molecular mechanisms regulating the process of sporulation and germination of spore-forming bacteria, understands the importance of molecular processes occurring in the cells of spore-forming bacteria for their ability to survive in unfavorable environmental conditions, and characterizes the molecular basis of the metabolic activity of spore-forming bacteria used in biotechnological processes.	[SW4] test/exam - oral or written
	[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 is able to list and discuss biological hazards associated with working with spore-forming bacteria and the principles of biosafety applied in microbiology laboratories, understands the benefits and potential environmental and health consequences of using microorganisms in scientific research and biotechnological applications, lists the basic principles of intellectual property protection and presents the importance of scientific integrity in biotechnological research.	[SK4] test/exam - oral or written
	[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 recognizes the limitations of his or her own knowledge and skills in the field of spore-forming bacteria; demonstrates a willingness to continually improve and update his or her knowledge and skills in the lecture topic, including through independent research of scientific information.	[SK4] test/exam - oral or written

Subject contents	During the lecture, the following topics will be presented: 1. Advanced information about Gram-positive bacteria belonging to the *Firmicutes* phylum (*Bacillus*, *Clostridium*, *Sporosarcina*) 2. Sporulation of bacterial cells using the model bacterium *B. subtilis* (the life cycle of B. subtilis, particularly the sporulation stage, sporulation in natural environments, and in the human digestive system) 3. Structure and properties of bacterial spores (the structure of individual protective layers of spores, resistance of spores to physicochemical factors). 4. Production of enzymes, bacteriocins, antibiotics, and other compounds by bacteria from the *Bacillus* genus (commercial production of enzymes and other substances, cultivation of bacteria and spores on an industrial scale, production costs of compounds produced by bacteria). 5. Production of bioinsecticides by *Bacillus thuringiensis* (production of insecticidal proteins, application as pesticides, development of genetically modified plants resistant to pests, advantages and disadvantages of using *B. thuringiensis* toxins). 6. Bacillus species as probiotics (*B. coagulans*, *B. clausii*) (what probiotics are, mechanisms of action, safety of use). 7. Bacterial spores in procedures for assessing the effectiveness of decontamination and sterilization (reference organisms for studies on the microbicidal and sporicidal efficacy of disinfectants and sterilization agents, research procedures evaluating the activity of disinfectants and antiseptics in medical, food, and industrial sectors) 8. *Bacillus anthracis* as a biological weapon (Anthrax sources of infection and pathogenesis, development of a "military" version of anthrax) 9. Spores of *Bacillus subtilis* as carriers for heterologous proteins (designing shuttle vectors for surface exposure of peptides and proteins on spore surfaces, adsorption of molecules on bacterial spore surfaces) 10. Applications of recombinant spores of *B. subtilis* (a review of existing research on the use of recombinant spores in biotechnology) 11. Use of *Clostridium* spores in cancer therapy 12. Advantages and disadvantages of using spore-forming bacteria in biotechnology
Prerequisites and co-requisites	
Assessment methods and criteria	

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

Recommended reading	Basic literature	1. used during classes 2. studied independently by the student
	Supplementary literature	1. Higgins D, Dworkin J, (2012) Recent progress in *Bacillus subtilis* sporulation. FEMS Microbiol Rev. 36:131-48 2. Setlow P, (2014) Spore Resistance Properties. Microbiol Spectr. 2:5 3. Wang H, Wang Y, Yang R, (2017) Recent progress in *Bacillus subtilis* spore-surface display: concept, progress, and future. Appl Microbiol Biotechnol. 101:933-949 4. Jouzani GS, Valijanian E2, Sharafi R (2017). *Bacillus thuringiensis*: a successful insecticide with new environmental features and tidings. Appl Microbiol Biotechnol. 101:2691-2711 5. Kubiak AM, Minton NP, (2015) The potential of clostridial spores as therapeutic delivery vehicles in tumour therapy. Res Microbiol. 166:244-54
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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