

**Subject card**

<b>Subject name and code</b>	Practical application of spore forming bacteria, PG_00197698						
<b>Field of study</b>	Biotechnology						
<b>Date of commencement of studies</b>	October 2024	<b>Academic year of realisation of subject</b>			2026/2027		
<b>Education level</b>	Bachelor's studies	<b>Subject group</b>			Obligatory subject group in the field of study Optional subject group Subject group related to scientific research in the field of study		
<b>Mode of study</b>	full-time studies	<b>Mode of delivery</b>			at the university		
<b>Year of study</b>	3	<b>Language of instruction</b>			Polish		
<b>Semester of study</b>	6	<b>ECTS credits</b>			2.0		
<b>Learning profile</b>	academic	<b>Assessment form</b>			credit		
<b>Conducting unit</b>							
<b>Name and surname of lecturer (lecturers)</b>	<b>Subject supervisor</b>		dr hab. Krzysztof Hinc				
	<b>Teachers</b>						
<b>Lesson types</b>	<b>Lesson type</b>	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	<b>Number of study hours</b>	16.0	0.0	0.0	0.0	0.0	16
	E-learning hours included: 0.0						
<b>Learning activity and number of study hours</b>	<b>Learning activity</b>	Participation in didactic classes included in study plan		Participation in consultation hours		Self-study	SUM
	<b>Number of study hours</b>	16		5.0		29.0	50
<b>Subject objectives</b>	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 <i>Bacillus</i> , <i>Clostridium</i> , <i>Sporosarcina</i> , particularly the sporulation stage leading to the formation of spores (resting forms enabling microorganisms to survive unfavorable environmental conditions) (KW_02_B) will gain knowledge on the use of spore-forming bacteria in biotechnology, medicine, and related sciences.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[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 has awareness and understanding of the risks and dilemmas, including ethical dilemmas, associated with conducting scientific research and implementing advanced technologies utilizing the achievements of biotechnology; they understand and appreciate the importance of intellectual property; they act ethically.	[SK4] test/exam - oral or written
	[BIOTECHL3_W02] The graduate knows and understands selected processes at the cell, tissue and organism level, important from the biological point of view	The student possesses in-depth knowledge in related fields and scientific disciplines, enabling them to recognize connections and relationships in nature, particularly those that are significant for biotechnology.	[SW4] test/exam - oral or written
	[BIOTECHL3_W01] The graduate knows and understands basic biological phenomena at the molecular level, he/she is familiar with their significance for biotechnology.	The student understands complex biological phenomena at the molecular level and recognizes their significance for biotechnology, as well as their connections to other fields and scientific disciplines.	[SW4] test/exam - oral or written
[BIOTECHL3_K01] The graduate is willing to know the limitations of his/her own knowledge and skills; constantly improve, update knowledge, and raise qualifications in biotechnology in the science and natural sciences, as well as medical sciences and health sciences	The student is aware of the limitations of their own knowledge; they demonstrate a willingness to continuously improve, update their knowledge, and enhance their qualifications in the field of biotechnology and related disciplines and scientific fields.	[SK4] test/exam - oral or written	
Subject contents	<p>During the lecture, the following topics will be presented:</p> <ol style="list-style-type: none"> <li>1. Basic information about Gram-positive bacteria belonging to the <i>Firmicutes</i> phylum (<i>Bacillus</i>, <i>Clostridium</i>, <i>Sporosarcina</i>)</li> <li>2. Sporulation of bacterial cells using the model bacterium <i>B. subtilis</i> (the life cycle of <i>B. subtilis</i>, particularly the sporulation stage, sporulation in natural environments, and in the human digestive system)</li> <li>3. Structure and properties of bacterial spores (the structure of individual protective layers of spores, resistance of spores to physicochemical factors).</li> <li>4. Production of enzymes, bacteriocins, antibiotics, and other compounds by bacteria from the <i>Bacillus</i> genus (commercial production of enzymes and other substances, cultivation of bacteria and spores on an industrial scale, production costs of compounds produced by bacteria).</li> <li>5. Production of bioinsecticides by <i>Bacillus thuringiensis</i> (production of insecticidal proteins, application as pesticides, development of genetically modified plants resistant to pests, advantages and disadvantages of using <i>B. thuringiensis</i> toxins).</li> <li>6. <i>Bacillus</i> species as probiotics (<i>B. coagulans</i>, <i>B. clausii</i>) (what probiotics are, mechanisms of action, safety of use).</li> <li>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)</li> <li>8. <i>Bacillus anthracis</i> as a biological weapon (Anthrax sources of infection and pathogenesis, development of a "military" version of anthrax)</li> <li>9. Spores of <i>Bacillus subtilis</i> 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)</li> <li>10. Applications of recombinant spores of <i>B. subtilis</i> (a review of existing research on the use of recombinant spores in biotechnology)</li> <li>11. Use of <i>Clostridium</i> spores in cancer therapy</li> <li>12. Advantages and disadvantages of using spore-forming bacteria in biotechnology</li> </ol>		
Prerequisites and co-requisites	Written justification for the choice of lecture (up to 100 words)		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	written test exam	51.0%	100.0%
Recommended reading	Basic literature	<ol style="list-style-type: none"> <li>1. used during classes</li> <li>2. studied independently by the student</li> </ol>	

	Supplementary literature	<ol style="list-style-type: none"> <li>1. Higgins D, Dworkin J, (2012) Recent progress in <i>Bacillus subtilis</i> sporulation. FEMS Microbiol Rev. 36:131-48</li> <li>2. Setlow P, (2014) Spore Resistance Properties. Microbiol Spectr. 2:5</li> <li>3. Wang H, Wang Y, Yang R, (2017) Recent progress in <i>Bacillus subtilis</i> spore-surface display: concept, progress, and future. Appl Microbiol Biotechnol. 101:933-949</li> <li>4. Jouzani GS, Valijanian E2, Sharafi R (2017). <i>Bacillus thuringiensis</i>: a successful insecticide with new environmental features and tidings. Appl Microbiol Biotechnol. 101:2691-2711</li> <li>5. Kubiak AM, Minton NP, (2015) The potential of clostridial spores as therapeutic delivery vehicles in tumour therapy. Res Microbiol. 166:244-54</li> </ol>
Example issues/ example questions/ tasks being completed	eResources addresses	
Work placement	Not applicable	

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