University of Gdańsk

Subject card

Subject name and code	Biotechnology in industry and agriculture - Plant engineering Methodology (M06_B2), PG_00196960						
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 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	4.0			
Learning profile	academic		Assessment form	credit			
Conducting unit							
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. Aleksandra Królicka				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	0.0	12.0	42.0	0.0	0.0	54
	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	54		10.0	36.0	100	
Subject objectives	To familiarize students with the practical application of plant tissue and cell cultures and their limitations and prospects. To analyze issues related to the application of plant in vitro cultures in floriculture, vegetable, food and pharmaceutical industries.Introduction to Innovative Methods in Plant Breeding, the purpose of which is to provide students with advanced contemporary knowledge of traditional breeding and the possibility of using genetic engineering and epigenetic modifications and biotechnology in modern plant breeding with improved functional value.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[BIOTECHL3_W08] The graduate knows the principles of occupational health and safety, understands the risks associated with laboratory work, including infectious materials, GMOs and GMMs, and knows the legal regulations relating to these areas.	The student knows the rules of laboratory work, understands the danger of working in the laboratory, realizes the potential danger of working with infectious material (bacteria) and GMOs and GMMs.	[SW2] presentation/project/paper/ report [SW3] text preparation/written work
[BIOTECHL3_U04] The graduate is able to search for, analyse and use scientific information, also in English, in the field of biotechnology in the fields of exact and natural sciences and medical and health sciences; uses electronic sources; has advanced skills in using appropriate databases.	The student is able to solve a scientific problem in a group using the acquired knowledge and with the help of English-language scientific information.	[SU2] presentation/project/paper/ report [SU3] text preparation/written work [SU8] observation of student's independent or team work
[BIOTECHL3_K05] The graduate is willing to understand the need to inform the society about the achievements of biotechnology important for the improvement of health and quality of life.	The student is able to prepare and discuss an issue on the use of in vitro plant cultures and genetic modifications for use in the pharmaceutical, medical, food industry.	[SK2] presentation/project/paper/ report [SK3] text preparation/written work [SK8] observation of student's independent or team work
[BIOTECHL3_U07] The graduate is able to prepare and present a short oral presentation in Polish and/or English, covering detailed issues in the field of biotechnology, using scientific language, and is able to conduct discussions	The student is able to develop a research question in writing.	[SU2] presentation/project/paper/ report [SU3] text preparation/written work [SU8] observation of student's independent or team work
[BIOTECHL3_U01] The graduate possesses practical skills in performing laboratory procedures, documenting results, and applying techniques necessary in biotechnology, including methods of isolation, modification, selection, and analysis of organisms, tissues, cells, and molecules; has the ability to operate advanced laboratory.	The student is able to work in a chamber with laminar air flow while maintaining sterile conditions, is able to work with plant material (micropropagation, selection, mutation, transformation, callus cultures, artificial seeds).	[SU2] presentation/project/paper/ report [SU3] text preparation/written work [SU8] observation of student's independent or team work
[BIOTECHL3_K04] The graduate is aware of the importance of occupational safety rules, is able to apply them and react in hazardous situations, ensuring their own safety and the safety of others.	The student listens to the instructor's instructions and performs the assigned work with full awareness of his and other students' safety.	[SK2] presentation/project/paper/ report [SK3] text preparation/written work [SK8] observation of student's independent or team work
[BIOTECHL3_K02] The graduate is willing to work in a team, in particular to carry out joint laboratory work.	The student is able to distribute the various tasks to be solved among the other members of the team so as to achieve the final result (for example, isolate plasmid DNA).	[SK2] presentation/project/paper/ report [SK3] text preparation/written work [SK8] observation of student's independent or team work

Subject contents	**Methodology - Laboratory exercises** **M1. Plant tissue and cell cultures.** - Familiarization with the specifics of tissue culture laboratory work. - Preparation of various types of media for in vitro plant cultures. - Effects of media, growth regulators and light on plant growth and differentiation. - Micropropagation of plants. - Derivation of axenic cultures from plants obtained from the environment. - Extraction of secondary metabolites from plant tissues, chromatographic analysis: TLC and HPLC. - Elicitation of secondary metabolites in plant cultures and cell suspension. - Analysis of biological properties of secondary metabolites: antimicrobial and antioxidant properties. - Induction and maintenance of callus and cell suspension cultures. Induction of mutations and selection in callus cultures. Somaclonal variation. **Methodology - Auditing exercises.** **M2. Molecular methods in plant biotechnology.** - Cloning strategies in vectors (in silico cloning). - Phenotype-genotype correlations on the example of Arabidopsis mutants showing disorders in biosynthesis and perception of selected compounds. - Epigenetic methods of plant modification: - The use of microRNAs, induced DNA methylation, and CRISPR-Cas technology as a tool for editing of plant genomes. - Active problem-solving 1. Group work (active problem-solving confers; Waldrop, Nature 2015) - Human population growth increases the demand for food. What direct benefits can we achieve by growing genetically modified crops? - Active problem-solving 2. Group work - Use of transgenic plants with increased resistance to abiotic stresses which is the content of toxic micronutrients in the soil. Examples of natural hyperaccumulator plants and transgenic plants used for phytoremediation. - Active problem solving 3. Group work - Can genetically modified plants cause health problems?
Prerequisites and co-requisites	Knowledge and skills from modules 01-05.
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
Part M1	51.0%	25.0%
Part M2	51.0%	75.0%

Recommended reading	Basic literature	- Kawinski A, Ihnatowicz A, Królicka A. 2014. Plant in vitro cultures - theoretical introduction and instructions for exercises.- Materials prepared by the instructor- Biotechnology of plants. Collective work edited by St. Malepszy. Scientific publishing house PWN 2009 or later.- Zenkteler M. Plant tissue and cell culture. PWN Warsaw 1984.- Plant Cell Culture - Essential Methods. Editors: Davey M.R. and Anthony P. Wiley-Blackwell, 2010. Counotte A, Leach CK, van Dam-Mieras MCE. In vitro cultivation of plant cells. Biotechnology by open learning. Butterworth Heinemann, Nederland1993. Doods JH, Roberts LW. Experiments in plant tissue culture. Cambridge University Press 1995. Dixon RA. Plant cell culture a practical approach. IRL Press, Oxford University 1987. Buchanan BB, Gruissem W, Jones RL.
	Supplementary literature	None
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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