University of Gdańsk

Subject card

Subject name and code	Biotechnology in industry and agriculture - Plant engineering Fundaments (M06_B2), PG_00197663						
Field of study	Biotechnology						
Date of commencement of studies	October 2025		Academic year of realisation of subject		2027/2028		
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		2.0		
Learning profile	academic		Assessment form		exam		
Conducting unit	Intercollegiate Faculty of Biotechnology UG-MUG -> Rector						
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	32.0	0.0	0.0	0.0	0.0	32
	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	32		5.0		13.0	50
Subject objectives	To familiarise students with the practical application of plant tissue and cell cultures, their limitations and prospects. To analyse issues related to the application of plant in vitro cultures in floriculture, vegetable, food and pharmaceutical industries.Introduction to lectures on Innovative Methods in Plant Breeding, aimed at providing students with contemporary knowledge of traditional breeding and the possibilities of using genetic engineering and modification of epigenetic and biotechnology in modern plant breeding with improved functional value.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[BIOTECHL3_W07] The graduate has advanced knowlegde of the rules of operation and the possibilities of using research techniques and tools used in biotechnology.	Students have an understanding of the techniques used in working with plant in vitro cultures and the molecular techniques used to edit the plant genome.	[SW4] test/exam - oral or written
	[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	Students are able to explain and relate the processes in the plant cell that lead to plant growth and development, taking into account the use of plant in vitro cultures.	[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.	Students can explain and relate the use of plant in vitro cultures to the biotechnological applications of plant in vitro cultures: micropropagation, extraction of secondary metabolites from plant tissues, transformation, somatic embyogenesis and production of artificial seeds, mutagenesis, selection, cryopreservation.	[SW4] test/exam - oral or written
	[BIOTECHL3_W09] The graduate possesses structured and advanced knowledge of the terminology and concepts used in biological and medical sciences and related disciplines.	The student understands how to relate the structure of the plant cell, plant tissue and the whole plant for use in the pharmaceutical industry (antimicrobial, anticancer, antioxidant activity).	[SW4] test/exam - oral or written

Subject contents	**F1. Tissue and cell cultures - plant-based** 1. Characterisation of basic techniques used in plant in vitro culture, media used in plant tissue culture, hormones and growth regulators. 2. Micropropagation of plants; control of asepticity. 3. Mutagenesis, selection and somaclonal variation in plant in vitro cultures. 4. Carrying out cultures of plant cells and tissues in bioreactors. 5. Basics of pharmacognosy, methods of obtaining secondary metabolites, phytochemical and biological analysis of secondary metabolites contained in plant tissues. 6. Somatic embryogenesis. 7. Production of artificial seeds. 8. Use of in vitro cultures for germplasm storage, gene banks, cryopreservation. **F2. Innovative methods in plant breeding** 1. Techniques and methods used in traditional (mutagenesis, haploids) and modern ones based on genetic engineering (somatic hybrids, transformation with the help of vectors or vectorless) plant breeding. 2. Methods used to detect transgenes in plant material or products derived from it. 3. Mechanisms determining the resistance/susceptibility of plants to the development of disease processes caused by abiotic (low/high temperature/no water, hypoxia, oxidative stress) and biotic (viruses, bacteria, fungi, pests) factors. 4. Molecular biology-based methods used to detect and identify plant pathogens. 5. Methods to enable the use of plants for the production of heterologous proteins and vaccines ('molecular farming').
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
F1. Tissue and cell cultures - plant-based	0.0%	30.0%
Integrative exam	0.0%	40.0%
F2. Innovative methods in plant breeding	0.0%	30.0%

Recommended reading	Basic literature	Kawinski A, Ihnatowicz A, Królicka A. 2014. Plant in vitro cultures - theoretical introduction and instructions for exercises. Collective work edited by St. Malepszy. PWN Scientific Publishers 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.

	Supplementary literature	Counotte A, Leach CK, van Dam-Mieras MCE. In vitro cultivation of plant cells. Biotechnology by open learning. Butterworth Heinemann, Nederland 1993. 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. Biochemistry and Molecular Biology in Plants. American Society of Plant Physiologists, 2002 Materials prepared by the trainer
	eResources addresses	
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	

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