University of Gdańsk

Subject card

Subject name and code	Multicellular organisms - Organization of plant structure, growth and physiology Foundations (M04_B3), PG_00197626		
Field of study	Biotechnology		
Date of commencement of studies	October 2025	Academic year of realisation of subject	2026/2027
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	2	Language of instruction	Polish
Semester of study	4	ECTS credits	2.0
Learning profile	academic	Assessment form	exam
Conducting unit			
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Antoni Banaś	
	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	5.0	15.0	50

Subject objectives

The program of the block aims to provide detailed knowledge about the structure, growth and physiology of plants as multicellular organisms, both at the molecular level and the level of cell, organ and plant as a whole organism. The student will learn the molecular and physiological basis of the interdependence of plants with their environment and obtain basic data about plants necessary in the broadly understood plant biotechnology.

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	Knows the structure and understands the functioning of plants at the level of cells, tissues and the entire organism.	[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.	Understands the molecular and physiological basis of the interdependence of plants with their environment and has basic data on plants necessary in the broad sense of plant biotechnology.	[SW4] test/exam - oral or written

Subject contents	Plant growth and development (embryonic period, seed germination, vegetative growth, flowering, fruit and seed production, aging and death, the influence of environmental factors on plant development, meristematic tissues, correlations, regeneration) Plant sugars (monosaccharides, oligosaccharides, polysaccharides, inulins, pectic substances, hemicelluloses) Transport (definition of short and long distance transport, types of solutions, structure of a plant cell, organism as a whole, types of passive transport, types of active transport, transport of macromolecules) Water management (diffusion, swelling, osmosis, osmotic potential/water potential, cell suction force/cell water potential, organs used to take up water, water conduction paths, passive and active water uptake mechanism, plant water balance, ecological types of plants, transpiration and factors influencing its intensity, structure and mechanism of opening/closing of stomata, transport of assimilates: donors and acceptors, loading and unloading of phloem, pressure mass flow hypothesis) Photosynthesis (types of photosynthesis, organelles in which photosynthesis takes place, mechanism of the light phase of photosynthesis, mechanism of the dark phase of photosynthesis, photorespiration, influence of environmental factors on photosynthesis intensity) Plant respiration (mechanism of aerobic and anaerobic respiration in plants, malate pathway, alternative oxidase, pentose cycle, glyoxylate cycle, respiration balance, influence of environmental factors on respiration intensity) Mineral managment by plant (essential, desired, ballast elements; water and sand hydroponic cultures; importance of essential elements; concept of soil; uptake of ions from the soil; ion transport; uptake of ions by leaves; interdependencies between ions; mycorrhiza; fertilization laws) Nitrogen economy (forms of nitrogen available to plants, uptake and reduction of nitrates, incorporation of ammonium ions into amino acids, symbiotic and non-symbiotic organisms fixing atmospheric nitrogen, symbiosis of legumes with bacteria of the rhizobium genus, mechanism of fixing atmospheric nitrogen, nitrogen circulation in nature) Growth regulators (auxins, gibberellins, cytokinins, growth inhibitors - structure and biological activity) Plant movements (tropisms, nasties, other types of movements) Abiotic stress factors (definition of stress, stresses: oxidative, water, caused by oxygen deficiency, radiation, thermal, salt, caused by environmental pollutants; formation of protective mechanisms to counteract these factors
Prerequisites and co-requisites	

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
final test: 45 points	40.0%	45.0%
attendance at lectures: 15 points (0.5 points/hour of lecture	0.0%	15.0%
integration exam	50.0%	40.0%

Recommended reading

Basic literature	• Fizjologia roślin. J. Kopcewicz i S. Lewak,edytorzy. Wydanie 3, 2012 lub nowsze. Wydawnictwo Naukowe PWN Warszawa • Fizjologia Roślin. A. Szwejkowska. 2004. Wydawnictwo Naukowe Uniwersytetu im. Adama Mickiewicza w Poznaniu
Supplementary literature	• Plant Physiology. L.Taiz, E. Zeiger, Eds. Wydanie 5, 2010 lub nowsze. Sinauer Associates, Inc.
eResources addresses	

Example issues/ example questions/ tasks being completed	
Work placement	Not applicable

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