

**Subject card**

<b>Subject name and code</b>	Multicellular organisms - Organization of plant structure, growth and physiology Foundations (M04_B3), PG_00196928						
<b>Field of study</b>	Biotechnology						
<b>Date of commencement of studies</b>	October 2026		<b>Academic year of realisation of subject</b>			2027/2028	
<b>Education level</b>	Bachelor's studies		<b>Subject group</b>			Obligatory subject group in the field of study 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>	2		<b>Language of instruction</b>			Polish	
<b>Semester of study</b>	4		<b>ECTS credits</b>			2.0	
<b>Learning profile</b>	academic		<b>Assessment form</b>			exam	
<b>Conducting unit</b>							
<b>Name and surname of lecturer (lecturers)</b>	Subject supervisor		prof. dr hab. Antoni Banaś				
	Teachers						
<b>Lesson types</b>	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						
<b>Learning activity and number of study hours</b>	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
<b>Subject objectives</b>	The program of the block aims to provide advanced 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 principles of the interdependence of plants with their environment and obtain data about plants necessary in the broadly understood plant biotechnology.						
<b>Learning outcomes</b>	<b>Course outcome</b>		<b>Subject outcome</b>			<b>Method of verification</b>	
	[BIOTECHL3_W03] The graduate possesses structured and advanced knowledge of organism-environment relationships and their importance for understanding biological processes and biotechnological applications.						
	[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 advanced knowledge on plants necessary in the broad sense of plant biotechnology.			[SW4] test/exam - oral or written	

Subject contents	<p>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)</p> <p>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)</p> <p>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)</p> <p>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)</p> <p>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)</p> <p>Mineral management 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)</p> <p>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)</p> <p>Growth regulators (auxins, gibberellins, cytokinins, growth inhibitors - structure and biological activity)</p> <p>Plant movements (tropisms, nasties, other types of movements)</p> <p>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)</p>		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	final test: 60% of points, including bonus points for high attendance during lectures	51.0%	60.0%
	Comprehensive integrating exam	50.0%	40.0%
Recommended reading	Basic literature	<ul style="list-style-type: none"> <li>Fizjologia roślin. J. Kopcewicz i S. Lewak, edytorzy. Wydanie 3, 2012 lub nowsze. Wydawnictwo Naukowe PWN Warszawa</li> <li>Fizjologia Roślin. A. Szejnkowska. 2004. Wydawnictwo Naukowe Uniwersytetu im. Adama Mickiewicza w Poznaniu</li> </ul>	
	Supplementary literature	<ul style="list-style-type: none"> <li>Plant Physiology. L.Taiz, E. Zeiger, Eds. Wydanie 5, 2010 lub nowsze. Sinauer Associates, Inc.</li> </ul>	
	eResources addresses		

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

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