



## Subject card

Subject name and code	BIOLOGICALLY ACTIVE PLANT SUBSTANCES, PG_00063458						
Field of study	Biotechnology						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2024/2025		
Education level	second-cycle 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	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Department of Chemistry, Technology and Biotechnology of Food -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Barbara Kusznierewicz				
	Teachers		dr hab. inż. Barbara Kusznierewicz				
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	E-learning hours included: 0.0						
Additional information: Classes will be conducted both in stationary and remotely. The implementation and assessment of the lecture and laboratory parts will be closely linked to the activities included in the course on the e-learning platform. Lectures will be conducted online. These classes will include a presentation of individual issues by the lecturer and short e-tests for students conducted during the lecture, concerning a given lecture using the e-course. Passing the lecture part is after the student obtains at least 60% of all e-tests. Laboratory classes will be conducted in stationary. At least a week before the practical classes, the student will receive materials on issues related to the topic and the course of the exercise. Information from these materials will be additionally discussed in great detail at the beginning of the classes by the teacher. After completing the exercise, each student must fill in an "exit pass" in the form of an e-test on the e-learning platform. Passing the laboratory is after obtaining at least 60% of the e-tests and after passing the e-report from the exercises. The report must be completed individually by each student on the e-learning platform.							
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	45		5.0		25.0	75
Subject objectives	The aim of the course is to familiarize students with the classification, occurrence and biological activity of plant secondary metabolites, methods of their acquisition and analysis, and to present their role in plant life, practical importance for humans and biotechnological methods of their production.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U02] uses research methods used in biotechnology and related fields	The student is able to use basic analytical procedures at the stage of sample preparation and final determinations using basic measuring devices.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment
	[K7_W02] explains the structure and function of biomolecules and the methods and instruments for determining their quantity and activity	The student knows and distinguishes different classes of phytochemicals, knows their potential applications in various industries and is able to adapt analytical procedures to qualitative, quantitative and biological activity determinations.	[SW3] Assessment of knowledge contained in written work and projects [SW1] Assessment of factual knowledge
	[K7_K03] understands the social role and importance of providing reliable information and opinions to the public	The student is able to scientifically verify knowledge regarding the use and effects of plant preparations on human health and is able to provide reliable information about them.	[SK4] Assessment of communication skills, including language correctness
[K7_U05] proposes solutions to technological and scientific problems in biotechnology and related fields using experimental methods and bioinformatics, statistics and specialized databases	The student is able to use in practice the knowledge of plant materials, their quality, biological activity and processing methods and methods of use in industry. Selects appropriate techniques and conducts analyses of individual groups of phytochemicals. Analyses the obtained results and assesses the quality of the tested material in the context of its biological activity.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU2] Assessment of ability to analyse information	
Subject contents	<p>Lectures:</p> <ul style="list-style-type: none"> <li>History of the use of plant materials by humans, definition of pharmacognosy.</li> <li>Origin of plant materials (collection of wild plants, cultivation, in vitro cultures).</li> <li>Processing of plant materials (drying, storage, standardization).</li> <li>Organographic groups of plant materials.</li> <li>Use of plant materials in industry (pharmaceuticals, cosmetics, nutraceuticals, functional food, biomaterials).</li> <li>Primary and secondary metabolites of plants (definitions and functions in plants).</li> <li>Biosynthesis of secondary metabolites of plants (shikimic acid pathway, malonic acid pathway, mevanolic acid pathway, methylerythritol phosphate pathway).</li> <li>Classification and division of secondary metabolites of plants.</li> <li>Characteristics of phenolic compounds (flavonoids, flavones, flavonols, isoflavones, flavanones, anthocyanins, flavanols, hydrolysable and non-hydrolysable tannins, phenolic acids).</li> <li>Characteristics of terpenoid compounds (hemiterpenes, monoterpenes, sesquiterpenes, diterpenes, triterpenes (saponins, steroids, sterols, cardiac glycosides), tetraterpenes).</li> <li>Characteristics of nitrogen-containing compounds (alkaloids, cyanogenic glycosides, betalains).</li> <li>Characteristics of sulphur-containing compounds (glucosinolates, sulfoxides).</li> <li>Methods of increasing the content of secondary metabolites in plant raw material (artificial selection, plant crossbreeding, elicitation, in vitro cultures, application of genetic engineering).</li> <li>Introduction to metabolomics - modern techniques for analyzing the plant metabolome</li> </ul> <p>Laboratories:</p> <ul style="list-style-type: none"> <li>Establishment of sprout cultures, application of elicitation.</li> <li>Determination of the effect of elicitation on the total phenolic content, antioxidant activity and anthocyanin biosynthesis of plant sprouts.</li> <li>Purine alkaloids - SPE isolation and quantitative determination using HPLC.</li> <li>Isolation of essential oils and application of TLC bioautography to detect terpenoids with antioxidant activity.</li> <li>Observation of the activity of defense systems of <i>Brassicaceae</i> plants (glucosinolates/myrosinase), <i>Allium</i> plants (alliin/allicin) and <i>Rosaceae</i> plants (cyanogenic glycosides/emulsin)</li> <li>Establishment and management of spirulina cultures, determination of initial culture parameters.</li> <li>Analysis of cultivated spirulina, evaluation of culture efficiency, determination of final culture conditions, determination of the content of assimilation pigments in the obtained biomass.</li> </ul>		
Prerequisites and co-requisites	<ul style="list-style-type: none"> <li>Knowledge of the basics of organic chemistry - essential when discussing the structures of bioactive phytochemicals.</li> <li>Ability to operate basic laboratory equipment and measuring devices.</li> </ul>		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lectures	60.0%	50.0%
	Laboratories	60.0%	50.0%

Recommended reading	Basic literature	<ul style="list-style-type: none"> <li>Plant Secondary Metabolites, Alan Crozier Michael N. Clifford Hiroshi Ashihara, Wiley</li> </ul>
	Supplementary literature	Latest review and original publications on phytochemicals.
	eResources addresses	Adresy na platformie eNauczenie: ZWIĄZKI BIOAKTYWNE POCHODZENIA ROŚLINNEGO - Moodle ID: 36004 <a href="https://enauczenie.pg.edu.pl/moodle/course/view.php?id=36004">https://enauczenie.pg.edu.pl/moodle/course/view.php?id=36004</a>
Example issues/ example questions/ tasks being completed	<ul style="list-style-type: none"> <li>Definition and classification of secondary plant metabolites.</li> <li>What functions do secondary metabolites perform in plants?</li> <li>Examples of applications of phytochemicals in various industries.</li> <li>What biological activities can be expected from individual groups of secondary plant metabolites?</li> <li>Methods of isolation, analysis and detection of bioactive phytochemicals.</li> </ul>	
Work placement	Not applicable	

Document generated electronically. Does not require a seal or signature.