University of Gdańsk

Subject card

Subject name and code	Advanced chemistry laboratory - bioorganic chemistry, PG_00054410		
Field of study	Chemistry		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
Education level	postgraduate studies	Subject group	Obligatory subject group 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 Polish
Semester of study	1	ECTS credits	1.0
Learning profile	academic	Assessment form	
Conducting unit	Pracownia Chemii Medycznej -> Katedra Chemii Biomedycznej -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Irena Bylińska	
	Teachers	dr inż. Irena Bylińska	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	20.0	0.0	0.0	20

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	20	1.0	4.0	25

Subject objectives

Familiarization students with modern techniques used in bioorganic chemistry, including chemical modifications of biologically active compounds and research on intermolecular interactions.Preparing students to conduct experiments in the field of bioorganic chemistry and analyze the obtained results.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[CHEMMU2_U01] Plans and implements chemical experiments of medium complexity.	The student demonstrates the ability to chemically modify biologically active compounds (fluorescent labeling) and assess the efficiency of this process (determines the degree of protein labeling). The student, alone or in a team, prepares samples and performs spectrophotometric and spectrofluorimetric measurements, based on which he/she determines the binding constant for the inclusion complex (cyclodextrin-protein/peptide) or assesses the enzymatic activity of the isolated enzyme and its kinetic parameters (Michaelis constant, maximum rate). The student follows the rules of safe work when performing experiments.	[SU2] presentation/project/paper/ report [SU8] observation of student's independent or team work
[CHEMMU2_W01] Uses knowledge of spectroscopic methods of chemical compound analysis.	The student names and characterizes each experimental technique used during the laboratory exercises (absorption and fluorescence spectroscopy). The student knows how to determine the degree of protein labeling with a fluorophore, the binding constant of the inclusion complex and the kinetic parameters of the enzyme based on spectrophotometric or spectrofluorimetric measurements.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/ report
[CHEMMU2_K01] Knows the limitations of her/his own knowledge; understands the need for further education and can inspire other people to do so.	The student is able to cooperate and work in a group, taking on various roles in it. The student takes care of work safety and complies with the arrangements made regarding experiments.	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work
[CHEMMU2_W03] Demonstrates extended knowledge in the field of modern measuring techniques used in chemical analysis.	The student knows and characterizes each measurement technique used during laboratory classes (absorption and emission spectroscopy). The student names and knows the principles of operation of the equipment used during laboratory classes (spectrophotometer, spectrofluorimeter).	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[CHEMMU2_U02] Critically assesses the results of conducted, performed observations and theoretical calculations and discusses errors.	The student analyzes and verifies the results of his/her experiments, drawing conclusions from them. The obtained and developed results are presented in the form of a written report, which also includes the purpose and a detailed description of the experiment, the adopted methodology, as well as a discussion of the results and conclusions.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report
[CHEMMU2_W07] Selects experimental and theoretical techniques to the extent necessary to understand the description and modelling of medium complexity chemical processes.	The student names and describes the methods of chemical modification of biologically active compounds (fluorescencet labeling) and measurement techniques (absorption and emission spectroscopy) used during laboratory classes .	[SW4] test/exam - oral or written [SW1] oral statement/ conversation/discussion
[CHEMMU2_W10] Uses knowledge of the principles of operation of the basic scientific and research apparatus used in chemistry.	The student knows the elements and principle of operation of a spectrophotometer and spectrofluorimeter.	[SW1] oral statement/ conversation/discussion [SW5] implementation of a problem task
[CHEMMU2_U08] Prepares and presents oral presentations in various fields of chemistry in Polish and English, using acquired knowledge and skills as well as basic sources of scientific information.	The student is prepared for classes and is able to formulate a short oral answer to a question asked during classes.	[SU1] oral statement/conversation/ discussion

Subject contents	Chemical modification of a protein with a fluorophore carried out under various conditions (pH, reaction time, presence of denaturant) and determination of the degree of protein labeling by spectrophotometric method.Study of intermolecular interactions between a ligand (fluorescent amino acid or peptide) and cyclodextrin (drug carrier or model receptor binding cavity system) using the spectrofluorimetric method.Isolation of an enzyme from a vegetable or fruit, determination of its activity and kinetic parameters using the spectrophotometric method.
Prerequisites and co-requisites	Knowledge of organic and physical chemistry and biochemistry at the bachelor level. Ability to conduct simple organic syntheses based on procedures in Polish.Knowledge of basic safety rules in a chemical laboratory. Ability to perform basic chemical calculations.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Final work (performing experiments included in the course program and presenting their results with a discussion in the form of a written report)	51.0%	50.0%
Exit test (written test with closed and open questions)	51.0%	50.0%

Recommended reading

Basic literature	M. Rosiński, D. Piasecka-Kwiatkowska, J. R. Warchlewski, Review of protein separation and purification methods useful in food research and analysis. FOOD. Science. Technology. Quality, 2005, 3 (44), 5 22. J.R. Lakowicz, Principles of Fluorescence Spectroscopy, 3rd edition, Springer 2006. K. Guzow, W. Wiczk, Interaction of cyclodextrins with amino acids, peptides and proteins; Chapter 7, pp. 233-262, in: Macrocyclic Chemistry: New Research Developments. Eds. D.W Fitzpatrick, H. J. Ulrich, Nova Publishers Inc., 2010. M.E. Friedman, H.H. Daron, J. Chem. Educ., 54, 1977, 256-257. L. Stryer, Biochemistry, Polish Scientific Publisher PWN, Warsaw 1997.
Supplementary literature	J. Mrozek, K. Guzow, M. Szabelski, J. Karolczak, W. Wiczk, Influence of methanol and cyclodextrin cavity size on stoichiometry and binding constant of 3-[2-(9-anthryl)benzoxazol-5-yl]-alanine, J. Photochem. Photobiol. A: Chemistry **153** (2002) 121128. C.N. Pace, F. Vajdos, L. Fee, G. Grimsley, T. Gray, How to measure and predict the molar absorption coefficient of a protein. *Protein Sci.* **4** (1995) 2411-2423.

	eResources addresses	Podstawowe https://link.springer.com/book/10.1007/978-0-387-46312-4 - J.R. Lakowicz, Principles of Fluorescence Spectroscopy, 3rd edition, Springer 2006. (access date - 06.06.2024) http://tools.invitrogen.com/content/sfs/manuals/mp00143.pdf - Amino group labelling procedure (access date - 06.06.2024) https://sci-hub.se/10.1021/ed054p256 - M.E. Friedman, H.H. Daron, J. Chem. Educ., 54, 1977, 256-257. (access date - 06.06.2024) https://www.thermofisher.com/pl/en/home/global/forms/mp-handbook-download-request-form-2014.html - Molecular Probes™ Handbook, A Guide to Fluorescent Probes and Labeling Technologies, 11th Edition (2010), on-line version (access date - 06.06.2024) https://bibliotekanauki.pl/articles/826575 - M. Rosiński, D. Piasecka-Kwiatkowska, J. R. Warchlewski, Review of protein separation and purification methods useful in food research and analysis. FOOD. Science. Technology. Quality, 2005, 3 (44), 5 – 22. (access date - 06.06.2024) Uzupełniające Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed	In order to purify the protein after the labeling reaction, the following methods can be used:a) molecular filtration,b) "salting" the protein,c) dialysis,d) none of the above techniques. Propose and describe a method for spectrophotometric determination of the kinetic parameters of the enzymatic reaction carried out during classes for an enzyme isolated from a fruit or vegetable.	
Work placement	Not applicable	

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