GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	MOLECULAR IMMUNOLOGY, PG_00063820		
Field of study	Biotechnology		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
Education level	second-cycle studies	Subject group	Optional subject group Specialty subject group 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	3	ECTS credits	3.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Biotechnology and Microbiology -> Faculty of Chemistry -> Wydziały Politechniki Gdańskiej		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Lucyna Holec-Gąsior	
	Teachers	dr hab. inż. Lucyna Holec-Gąsior	

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

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Moodle ID: 1228 IMMUNOLOGIA MOLEKULARNA_2025/2025
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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	3.0	27.0	75

Subject objectives

The aim of the course is to provide basic knowledge of molecular immunology, discuss the molecular basis of immune processes and learning the basic laboratory techniques which use the antigen-antibody reactions.

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K7_U05] proposes solutions to technological and scientific problems in biotechnology and related fields using experimental methods and bioinformatics, statistics and specialized databases	Students rationally select appropriate methods for their research tasks. They utilize immunodiagnostic techniques, such as ELISA, Western blotting, dot blot, and chemiluminescent enzyme-linked immunosorbent assay (CLIA). They analyze, interpret, and design experiments examining immune responses and resolve technological challenges related to protein immunodetection. They can develop a diagnostic method based on antigen-antibody reactions, utilizing available immunodiagnostic techniques.	[SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools
	[K7_W01] defines the phenomena, processes and laws of living nature applied to the production of useful goods and the carrying out of services	Students define, explain, and understand the phenomena, processes, and laws of molecular biology related to the functioning of the immune system, particularly the genetic organization and regulation of B and T lymphocyte activity, the mechanisms of differentiation, variability, and regulation of antibody production, as well as the functions of immune cells and cytokines that modulate the immune response. They distinguish and classify modern immunodiagnostic techniques (ELISA, Western blotting, chemiluminescent assays) for protein identification and analysis of immune responses in research and diagnostics.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
	[K7_K01] understands the need to constantly update knowledge based on the state of the art in accordance with the latest scientific literature, improve professional skills and the importance of teamwork	The student is able to communicate effectively within a research and scientific team, initiate activities aimed at improving their own knowledge in accordance with the latest scientific literature, and collaborate with other members of the experimental team. They make responsible decisions regarding research and adhere to ethical principles in scientific and diagnostic work. They analyze the ethical aspects of immunological experiments. They fulfill various roles within the team, ensuring continuous development of competencies and emphasizing the need to acquire new knowledge and skills as molecular immunodiagnostic methods advance.	[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work [SK5] Assessment of ability to solve problems that arise in practice

Subject contents

Lecture:

1. B cells (control expression of genes responsible for differentiation).
2. Formation of antibodies variability (organization and recombination of immunoglobulin genes, generation of variation and regulation of transcription).
3. Regulation of immunoglobulin production, maturation of the immune response and antibody isotope switching.
4. T cells (organization and recombination of TCR receptor genes, a mechanism of thymus education).
5. Major histocompatibility complex and other systems of blood cells antigens.
6. Monocytes, NK cells and dendritic cells (formation; subpopulations, receptors, mechanisms of action).
7. Cytokines modifying the function of the immune system.
8. Immunohematology.
9. Molecular immunology of cancer.
10. Molecular ground of inherited diseases of the immune system.
11. Immunodetection of proteins (ELISA, dot blot, Western blot).
12. Immunological techniques (isolation of pure antibodies, isolation of populations / subpopulations of lymphocytes, methods for measuring of cell effector function, migration of lymphocytes).

Laboratory:

1. Discussion of BHP regulations. Introduction to the basic techniques of immunodiagnostic.
2. Immunoidentification of fusion protein using the dot blot method.
3. Western blotting test with the use of a monoclonal antibody
4. Westrer blotiing test with the use of polyclonal rabbit serum.
5. Direct ELISA assay - titration of antigen and antibodies.
6. Indirect ELISA assay - detection of specific antibodies in the sera of animal with toxoplasmosis.
7. Chemiluminescent enzyme immunoassay (CLIA) principles of operation, detection of specific antibodies and antigens, and interpretation of results.

Prerequisites and co-requisites

Knowledge of immunology and molecular biology.

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
final test at the end of lectures	60.0%	60.0%
laboratory report	60.0%	20.0%
final test at the end of the laboratory	60.0%	20.0%

Recommended reading

Basic literature	1. Roitt I., Brostoff J., Male D. Immunology, Medical Publisher PZWL, Warsaw, 2008 2. Gołab J., Jakóbisiak M., Lasek W., Stokłosa T. Immunology, PWN. Warsaw, 2012 3. Ryba M. Molecular immunology textbook for students of biotechnology. AMG, Gdansk, 2008. 4. Węgleński P. Molecular genetics, PWN, Warsaw, 2012. 5. Drewa G., Ferenc T. Medical genetics. Handbook for Students, Elsevier, 2011
Supplementary literature	1. Senatorski G. Clinical Immunology, Czelej, Lublin , 2009 2. Stryer L. Biochemistry. PWN. Warsaw, 2009 3. Scientific publications on the molecular basis of immune processes
eResources addresses	

Example issues/ example questions/ tasks being completed

1. Methods for the immunodetection of proteins.

2. Control of the expression of genes involved in B cell differentiation.

3. Formation of antibodies variability and regulation of immunoglobulin production.

4. Organization and recombination of TCR receptor genes.

5. Major histocompatibility complex and other systems of blood cells antigens.

6. Immunological techniques.

Work placement

Not applicable

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