IMMUNOLOGY	
GENERAL INFORMATION	
Course coordinator	Professor Ines Drenjančević, MD, PhD
Assistant/Associate	Associate Professor Ana Stupin, MD, PhD Associate Professor Martina Mihalj, MD, PhD Assistant Professor Ivana Jukić, MD, PhD Assistant Professor Aleksandar Kibel, MD, PhD Assistant Professor Marko Stupin, MD, PhD Assistant Professor Zrinka Mihaljević, PhD Nataša Kozina, PhD Petar Šušnjara, MMedLabDiag
Study Programme	Integrated undergraduate and graduate university study of Medicine
Status of the course	Mandatory
Year of study, semester	2nd year, 3rd semester
ECTS	**3**
Workload (hours)	Lectures (22); Seminars (30); Exercise (18)
Expected number of students	70
COURSE DESCRIPTION	
Course objectives	
Acquisition of knowledge and skills related to the structure of the immune system, components of the immune system and cytokines and chemokines that regulate the immune response. The goal is to apply the learned theoretical knowledge through exercises in practical work, but also later in clinical practice, whether through patient diagnostics or laboratory / scientific work.	
Enrolment requirements and entry competencies	
Acquired conditions for enrollment in the second year of study- adopted learning outcomes of anatomy and biology	
Learning outcomes at the Programme level	
1.1., 2.1., 3.3., 4.2.	
Learning outcomes (5-10)	
1. Present and organize the molecular, cellular and tissue structure of the immune system, and the mechanisms of primary maturation and selection of immune cell clones 2. To link the biological characteristics and normal development of innate and acquired immunity with the outcomes of impaired development and / or deficiency of immune components. 3. Identify and compare the mechanisms of antigen recognition (molecules, microorganisms, cells, tissues and organs) 4. Classify and compare specific and non-specific mechanisms of immunoreaction and immunoregulatory mechanisms of stimulation and suppression of immune response 5. Classify and compare the humoral and cellular executive mechanisms of the immune response 6. Compare the consequences of excessive or insufficient immune response and diseases resulting from the immunopathophysiological process (autoimmune diseases, hypersensitivity reactions, immune deficiency) and conclude on the principles for therapeutic modulation of the immune system. 7. To connect the mechanisms of basic immunity with the principles of transplant immunology 8. Assess the possibilities of action on the immune response (vaccination, immunostimulation and	

immunosuppression)
9. Integrate information on the mechanisms by which the immune system is involved in the prevention / development of neoplasms and critically evaluate and select approaches to the treatment of malignancies based on immune system modulation.
10. Describe and compare the mechanisms by which innate and acquired immunity suppress bacterial, fungal and viral infections as well as the consequences of ineffectiveness of individual actions.

Course content

Introduction to Immunology, Immune Recognition I. Fundamentals of Immunology. The role of lymphocytes in maintaining homeostasis. Chemokines. Cytokines. Recognition of one's own and another's.
Cells, tissues and organs, adhesion molecules - cellular roadmaps. Bone marrow, thymus, spleen, lymph nodes. Immune tissue associated with mucous membranes. The way lymphocytes move to the target site.
T and B cell development, clonal selection, immune tolerance, lymphocyte homeostasis. Differentiation of immune cells. The importance of the microenvironment. Clone selection. Immunological tolerance. Lymphocyte homeostasis.
Immune cells, tissues and organs, determination of blood groups and Rh-factors. On the model see the location of the lymphatic organs. Isolation of lymphatic organs. Preparation of isolated organs for immunofluorescence. Determination of blood groups and Rh factors. Transfusion.
Structure of antibodies and lymphocyte B receptors, T cell receptor.
Structure of MHC molecules, immune recognition II. and antigen presentation.
Intercellular communication: cytokines and chemokines; complement.
Nonspecific immunity, inflammation.
Antibody use in diagnosis and research: ELISA and immunofluorescence. Staining of immune cells on cryostatic sections of immune organs. Application of ELISA in immunology.
Physiological course of the immune response.
Cellular immunity and T lymphocyte activation.
Humoral immunity and regulation of the immune response.
Lymphocyte differentiation. Normal and abnormal lymphocyte proliferation. Leukemia
Immune tolerance and autoimmunity. Peripheral and central tolerance
Immune hypersensitivity.
Flow cytometry, cell markers. Application of flow cytometry. Staining staining. Data analysis. Apoptosis. Cell proliferation. Phenotyping.
Tissue and organ transplantation.
Immune defense against viruses, bacteria, fungi, parasites.
Use of monoclonal antibodies in therapy; effect on the immune response.
Tumor immunology, immunotherapy in oncology, chronic infections.
Immunological parameters in clinical medicine.
Immunodeficiency.
Immune memory, application in practice - vaccines. Types of vaccines. Method of application. Vaccine calendar.
Experimental models in immunology. Types of models. Cell culture, organ culture. Model animals. "Rule of three Rs". legislation. Visit to the Vivarium of the Medical Faculty Osijek.

Mode of teaching

Lectures; Seminars; Laboratory exercises

Student obligations

Attendance at all forms of classes is mandatory, and the student must access all knowledge tests. A student may justifiably miss 30% of each form of instruction. Absence from exercise must be colloquial. Successful performance of seminars and exercises requires prior student preparation. To work in the laboratory, he must have the prescribed work clothes (white coat) and literature. Classes are held at the prescribed time and it is not possible to enter after the teacher enters. It is not allowed to bring food and drinks to classes and to enter or leave unnecessarily during classes. The use of mobile phones during classes as well as during knowledge tests is prohibited.

Monitoring student work *(alignment of learning outcomes, teaching methods and grading)*

Teaching activity	ECTS	Learning outcome	Student activity	Assessment methods	Grade points	
					Min.	Max.
Class attendance	0,5	1-10	Class attendance	Evidence	2	4
Exercises	0,5	1-10	Attendance and active participation in exercises	Exercise diary	3	6
Seminar	0,5				5	10
Final exam	1,5	1-10	Learning for the oral exam	Oral exam	40	80
Total	**3**				**50**	**100**

Evaluation of student obligations

Class attendance

The student must attend a minimum of 70% of all forms of teaching (seminars and lectures, exercises are not allowed to be absent) and access all forms of knowledge testing. A student who is justifiably absent from the seminar must make up for the missed material by colloquium.
Student work is evaluated during classes and at the final exam. In order for a student to be able to take the final exam, he / she must pass all the seminars he / she missed. During the tour, the student will be able to collect a maximum of 100 points. Students can earn a maximum of 20 points during their classes through various forms of activities (Table 1). The final grade is the sum of grade points achieved during classes and at the final exam.

Table 1. Evaluation of student teaching obligations

	EVALUATION	MAX. NUMBER OF POINTS

Exercises	**In total**	
	Active participation	6
	In total	**6**
Seminars	Active participation	10
	In total	**10**
Lectures	Attendance	4
	In total	**4**
	IN TOTAL	**20**
Final exam	Written exam	80
	Oral exam	-
	In total	**80**
IN TOTAL		**100**

Lectures

During the classes, there will be 8 lectures during which the student can collect a maximum of 4 grade points by attending (max. 0.5 points per lecture).

Practical work (exercises)

During the laboratory exercises, the student can achieve a maximum of 6 assessment points (1 from each exercise for active participation). Students must prepare for the exercise from previously obtained materials.

Seminars

During the classes, there will be 10 seminars during which the student can collect a maximum of 10 grade points through active participation and attendance (max. 1 point per seminar).

Table 3. Evaluation of the written part of the final exam

% of correctly solved tasks	Score points:
95-100	80
90-94,99	75
85-89,99	70
80-84,99	65
75-79,99	60
70-74,99	55
65-69,99	50
60-64,99	45
55-59,99	40
<55	0

Final exam

A student who has duly completed all forms of teaching and achieved a total of at least 10 grade points from exercises (3), seminars (min. 5) and attending lectures (min. 2 points) gained the right to sign and take the final exam.

The final exam is **mandatory** and consists of a written part. During the final exam, the student can receive a maximum of 80 points (Table 3).

Forming the final grade:

Grades earned during the oral exam are added to the points earned during the oral exam. The evaluation is performed by absolute distribution, ie on the basis of the final achievement and is compared with the numerical system as follows:

A - excellent (5): 80-100 points; B - very good (4): 70-79.99 points; C - good (3): 60-69.99 points; D - sufficient (2): 50-59.99 points

Required reading (available in the library and through other media)		
Title	Number of copies in the library	Availability through other media
1. Abul K. Abbas et all Cellular and Molecular Immunology, 2018.	5	Yes
2. practical exercises in immunology, teaching materials, Faculty of Medicine in Osijek, 2008 and M. Taradi (ed.): Manual for exercises in physiology, Medicinska naklada, Zagreb, 2003	20	
3. Lecture notes (teaching texts - synopses)	70	
Additional reading		
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Course evaluation procedures		
Anonymous, quantitative, standardized student survey on the subject and work of teachers conducted by the Office for Quality of the Medical Faculty Osijek.		
Note /Other		
E-learning is not included in the norm of subject hours, but it is used in teaching and contains links on various pages, video and audio materials available on the website.		