



MICROORGANISMS, IMMUNITY, AND TUMORS

SECOND YEAR

2024/2025.

IMMUNOLOGY, INFECTION, INFLAMMATION

Subject:

IMMUNOLOGY, INFECTION, INFLAMMATION

The course is evaluated with 6 ECTS. There are 6 hours of active teaching per week (3 hours of lectures and 3 hours of work in a small group).

Teachers:

N	name	email	title
1.	Ivan Jovanovic	ivanjovanovic77@gmail.com	Full professor
2.	Gordana Radosavljevic	perun.gr@gmail.com	Full professor
3.	Vladislav Volarevic	drvolarevic@yahoo.com	Full professor
4.	Marija Milovanovic	marijaposta@gmail.com	Full professor
5.	Jelena Pantic	panticjelena55@gmail.com	Full professor
6.	Sladjana Pavlovic	sladjadile@gmail.com	Associate professor
7.	Aleksandar Arsenijevic	aleksandar@medf.kg.ac.rs	Associate professor
8.	Nevena Gajovic	gajovicnevena@yahoo.com	Assistant professor
9.	Vladimir Markovic	vladimirmarkovic.vlad@gmail.com	Teaching assistant
10.	Isidora Stanisavljevic	isidorastanisavljevic97@gmail.com	Junior teaching assistant

COURSE STRUCTURE:

Module	Week	Lectures weekly	Work in a small group per week	Teacher
1	8	3	3	Prof. dr Ivan Jovanovic
2	7	3	3	
				$\Sigma 45+45=90$

EVALUATION:

The grade is based on the number of earned points (maximum 100). Points are earned in two ways: through pre-exam activities and final exam:

PRE-EXAM ACTIVITIES: In this way, the student can earn up to 30 points by actively participating in small group activities and answering questions related to the week's lesson. Based on demonstrated knowledge, the student can earn between 0-2 points per week. To pass the module, student must acquire more than 50% of the total points for that module (see table).

Students who do not earn more than 50% of the points in pre-exam activity will take the exam by answering 2 questions from each module that they have not passed.

MODULE	MAXIMUM POINTS
	Activity during work in a small group
1	16
2	14
Σ	30

FINAL EXAM: In this way, the student can earn up to 70 points. The student takes the test which includes 35 questions that are covering the entire subject material. If the student does not achieve more than 50% correct answers, he/she has not passed the final exam.

The final grade is formed as follows:

In order to pass the course, the student must obtain a minimum of 51 points, pass the pre-exam activities for all modules, and pass the final exam (test).

number of points won	grade
0 - 50	5
51 - 60	6
61 - 70	7
71 - 80	8
81 - 90	9
91 - 100	10

LITERATURE:

module	the name of the textbook	authors	publisher	the library
1 and 2	Basic Immunology: Functions and Disorders of the Immune System, 6th edition.	<i>Abul K.Abbas and Andrew H. Lichtman</i>	Elsevier, Philadelphia 2019.	Yes
1 and 2	Essentials of Clinical Immunology. 6th edition. Chichester:	<i>Chapel H, Haeney M, Misbah S, Snowden N.</i>	Wiley Blackwell; 2015.	Yes
1 and 2	Case Studies in Immunology: a Clinical Companion. 7th edition.	<i>Geha RS, Notarangelo L.</i>	New York: Garland Science; 2016.	No
1 and 2	Schaechter's Mechanisms of Microbial Disease	<i>N. Cary Engleberg</i>	Walters Kluwer, 2012	Yes
1 and 2	Schaechter's Mechanisms of Microbial Disease	<i>N. Cary Engleberg</i>	Walters Kluwer, 2021	No

PowerPoint presentations of lectures and handouts are available on the website of the Faculty of Medical Sciences: www.medf.kg.ac.rs

PROGRAM:

FIRST MODULE

TEACHING UNIT 1 (FIRST WEEK)

INTRODUCTION TO THE IMMUNE SYSTEM

3 hours lecture

Concepts, dictionary.
Innate and acquired immunity.
Types of acquired immunity.
Properties of the acquired immune response: specificity and diversity, memory.
Cells of the immune system: lymphocytes, antigen-presenting cells, effector cells.
Tissues of the immune system: peripheral lymphoid organs, lymphocyte recirculation and migration to tissues.

TEACHING UNIT 2 (SECOND WEEK)

INNATE IMMUNITY

3 hours lecture

General properties and specificity of the innate immune response.
Cell receptors for microorganisms and damaged cells: Toll-like receptors, NOD-like receptors, and inflammasome.
Components of innate immunity: epithelial barriers, phagocytes, dendritic cells, mast cells, NK cells, complement system, cytokines of innate immunity.
Reactions of innate immunity: inflammation, antiviral defense.
How microorganisms evade innate immunity.
The role of innate immunity in stimulating acquired immune response.

TEACHING UNIT 3 (THIRD WEEK)

ANTIGEN CAPTURE AND PRESENTATION TO LYMPHOCYTES

3 hours lecture

What do T cells see?
Antigens recognized by T cells.
How antigen-presenting cells capture protein antigens.
Structure and function of major histocompatibility complex (MHC) molecules.
Properties of MHC genes and proteins.
Binding of peptides to MHC molecules.
Processing and presentation of protein antigens in the context of MHC class I.
Processing and presentation of protein antigens in the context of MHC class II.
Cross-presentation of internalized antigens to CD8⁺ T cells.
Physiological significance of antigen presentation in the context of MHC molecules.
Other functions of antigen-presenting cells.
Antigens recognized by B cells.

TEACHING UNIT 4 (FOURTH WEEK)

RECOGNITION OF ANTIGENS IN ACQUIRED IMMUNITY

3 hours lecture

Antigen receptors of B and T cells.
Antibodies; antibody classes; monoclonal antibodies.
TCR (T cell receptor).
Development of the immune repertoire.
Early maturation of lymphocytes.
Formation of different antigen receptors.
Maturation and selection of B cells.
Maturation and selection of T cells.

TEACHING UNIT 5 (FIFTH WEEK)

CELLULAR IMMUNE RESPONSE

3 hours lecture

Phases of T-cell response.
Antigen recognition and co-stimulation.
Recognition of peptides within MHC molecules.
Role of adhesion molecules in T-cell response.
Role of co-stimulation in T-cell activation.
Stimulatory signals for activation of CD8⁺ T cells.
Biochemical pathways of T-cell activation.
Functional response of T cells to antigen and co-stimulation.
Cytokine secretion and expression of cytokine receptors.
Clonal expansion.
Differentiation of naïve T cells into effector cells.
Generation of memory T cells.
Weakening of the immune response.

TEACHING UNIT 6 (SIXTH WEEK)

EFFECTOR MECHANISMS OF CELLULAR IMMUNITY

3 hours lecture

Types of cellular immune reactions.
Migration of effector T cells in cellular immune reactions.
Effector functions of CD4⁺ helper T cells.
Role of Th1, Th2, and Th17 cells in organism defense.
Pathogenesis of tuberculosis and leprosy.
Effector functions of CD8⁺ cytotoxic T cells.
Resistance of pathogens to cellular immune mechanisms.

TEACHING UNIT 7 (SEVENTH WEEK)

HUMORAL IMMUNE RESPONSE

3 hours lecture

Phases and types of humoral immune response.
Stimulation of B cells by antigen.
Antigen-induced signal transduction in B cells.
Role of complement proteins and other innate immunity signals in B cell activation.
Functional consequences of B cell activation.
Function of helper T cells in humoral immune response to protein antigens.
Activation and migration of helper T cells.
How B cells present antigens to helper T cells.
Mechanisms of B cell activation mediated by helper T cells.
Reactions occurring outside follicles and in germinal centers.
Antibody class switching.
Affinity maturation.
Humoral response to T-independent antigens.
Regulation of humoral immune response: antibody feedback regulation.

TEACHING UNIT 8 (EIGHTH WEEK)

EFFECTOR MECHANISMS OF HUMORAL IMMUNITY

3 hours lecture

Properties of antibodies determining their effector function.
Neutralization of microorganisms and their toxins.
Opsonization and phagocytosis.
Antibody-dependent cellular cytotoxicity (ADCC).

IgE and reactions mediated by mast cells and eosinophils.
Complement system: activation pathways, functions, and regulation.
Functions of antibodies at specific anatomical sites.
Mucosal immunity.
Neonatal immunity.
How microorganisms evade humoral immunity.

SECOND MODULE

TEACHING UNIT 9 (NINTH WEEK)

IMMUNE TOLERANCE AND AUTOIMMUNITY

3 hours lecture

Immune tolerance, significance, and mechanisms.
Central tolerance of T cells.
Peripheral tolerance of T cells: anergy, immune suppression mediated by regulatory T cells, deletion, apoptosis of mature lymphocytes.
Tolerance of B cells: Central tolerance of B cells, Peripheral tolerance of B cells.
Autoimmunity: pathogenesis, genetic factors, the role of infections, and the influence of other environmental factors.

TEACHING UNIT 10 (TENTH WEEK)

IMMUNOLOGY OF TUMORS AND TRANSPLANTATION

3 hours lecture

Immune response to transplanted tissues: transplant antigens, induction of immune response against grafts, immune mechanisms of graft rejection.
Prevention and therapy of graft rejection.
Transplantation of blood cells and hematopoietic stem cells.
Tolerance of the mother to fetal tissues.

TEACHING UNIT 11 (ELEVENTH WEEK)

HYPERSENSITIVITY

3 hours lecture

Types of hypersensitivity reactions.
Immediate hypersensitivity (Type I hypersensitivity): activation of Th2 lymphocytes and IgE antibody production, mast cell activation and mediator release, clinical syndromes, and therapy.
Diseases caused by antibodies and antigen-antibody complexes: etiology of antibody-mediated diseases, mechanisms of tissue damage and diseases, clinical syndromes, and therapy.
Diseases caused by T cells: etiology of T cell-mediated diseases, mechanisms of tissue damage, clinical syndromes, and therapy.

TEACHING UNIT 12 (TWELFTH WEEK)

CONGENITAL AND ACQUIRED IMMUNODEFICIENCIES

3 hours lecture

Concept of immunodeficiency.
Innate and acquired immunodeficiencies (genetic defects, malnutrition, infections).
Disorders of nonspecific immunity (barriers, phagocyte functions, complement component deficiencies).
Disorders of specific cellular and humoral immune response.
Acquired immunodeficiency syndrome (AIDS).

TEACHING UNIT 13 (THIRTHEENTH WEEK)

IMMUNE RESPONSE TO MICROORGANISMS. SEPSIS AND SEPTIC SHOCK

3 hours lecture

Concept of systemic inflammatory response and multiple organ dysfunction as a consequence of infection.

Etiology and pathogenesis of sepsis and septic shock.

Inflammatory mediators and regulatory cytokines in sepsis and shock, major tissue damage.

Treatment of sepsis and septic shock.

TEACHING UNIT 14 (FOURTEENTH WEEK)

IMMUNIZATION AND VACCINATION

3 hours lecture

Concept of immunization and vaccination.

TEACHING UNIT 15 (FIFTEENTH WEEK)

MICROBIOME AND THE IMMUNE SYSTEM

3 hours lecture

Microbiome.

The connection between the microbiome and the immune system.

LECTURE SCHEDULE

INTERNAL CLINIC HALL

MONDAY

12:15 – 14:15

SCHEDULE OF PRACTICE

YELLOW HALLS	
MONDAY	
14:30 – 16:45	
I group R31	II group R32
III group R33	

LESSON SCHEDULE FOR THE SUBJECT IMMUNOLOGY, INFECTION, INFLAMMATION

module	week	type	method unit name	teacher
1	1	L	Introduction to the immune system	Prof. dr Ivan Jovanovic
		P		Prof. dr Ivan Jovanovic Assoc. prof. dr Sladjana Pavlovic Assis. prof. dr Nevena Gajovic
	2	L	Innate immunity	Prof. dr Marija Milovanovic
		P		Prof. dr Marija Milovanovic Assis. dr Vladimir Markovic Assoc. prof. dr Sladjana Pavlovic
	3	L	Antigen capture and presentation to lymphocytes	Prof. dr Gordana Radosavljevic
		P		Prof. dr Gordana Radosavljevic Assis. dr Vladimir Markovic Prof. dr Jelena Pantic
	4	L	Recognition of antigens in acquired immunity	Assoc. prof. dr Sladjana Pavlovic
		P		Assoc. prof. dr Sladjana Pavlovic Prof. dr Gordana Radosavljevic Prof. dr Jelena Pantic
	5	L	Cellular immune response	Prof. dr Gordana Radosavljevic
		P		Prof. dr Gordana Radosavljevic Assis. dr Vladimir Markovic Assoc. prof. dr Aleksandar Arsenijevic
	6	L	Effector mechanisms of cellular immunity	Assoc. prof. dr Sladjana Pavlovic
		P		Assoc. prof. dr Sladjana Pavlovic Assis. prof. dr Nevena Gajovic Prof. dr Ivan Jovanovic

LESSON SCHEDULE FOR THE SUBJECT IMMUNOLOGY, INFECTION, INFLAMMATION

module	week	type	method unit name	teacher
1	7	L	Humoral immune response	Prof. dr Vladislav Volarevic
		P		Prof. dr Vladislav Volarevic Assoc. prof. dr Aleksandar Arsenijevic Prof. dr Marija Milovanovic
	8	L	Effector mechanisms of humoral immunity	Prof. dr Jelena Pantic
		P		Prof. dr Jelena Pantic Assis. dr Vladimir Markovic Prof. dr Gordana Radosavljevic
2	9	L	Immune tolerance and autoimmunity	Prof. dr Jelena Pantic
		P		Prof. dr Jelena Pantic Assis. dr Vladimir Markovic Prof. dr Gordana Radosavljevic
	10	L	Immunology of tumors and transplantation	Assoc. prof. dr Aleksandar Arsenijevic
		P		Assoc. prof. dr Aleksandar Arsenijevic Assis. dr Vladimir Markovic Prof. dr Marija Milovanovic
	11	L	Hypersensitivity	Assis. prof. dr Nevena Gajovic
		P		Assis. prof. dr Nevena Gajovic Prof. dr Jelena Pantic Prof. dr Ivan Jovanovic
	12	L	Congenital and acquired immunodeficiencies	Assis. prof. dr Nevena Gajovic
		P		Assis. prof. dr Nevena Gajovic Prof. dr Ivan Jovanovic Assoc. prof. dr Sladjana Pavlovic

LESSON SCHEDULE FOR THE SUBJECT IMMUNOLOGY, INFECTION, INFLAMMATION

module	week	type	method unit name	teacher
2	13	L	Immune response to microorganisms. Sepsis and septic shock	Assoc. prof. dr Aleksandar Arsenijevic
		P		Assoc. prof. dr Aleksandar Arsenijevic Prof. dr Marija Milovanovic Prof. dr Vladislav Volarevic
	14	L	Immunization and vaccination	Prof. dr Marija Milovanovic
		P		Prof. dr Marija Milovanovic Prof. dr Vladislav Volarevic Assoc. prof. dr Aleksandar Arsenijevic
	15	L	Microbiome and the immune system	Prof. dr Ivan Jovanovic
		P		Prof. dr Ivan Jovanovic Assis. dr Vladimir Markovic Assis. prof. dr Nevena Gajovic
		E	FINAL EXAM	