



**MICROORGANISMS, IMMUNITY
AND TUMORS**

SECOND YEAR

2023/2024.

FUNDAMENTALS OF ONCOLOGY

Subject:

FUNDAMENTS OF ONCOLOGY

The course is evaluated with 5 ECTS. There are 4 hours of active teaching per week (2 hours of lectures and 2 hours of work in a small group).

TEACHERS:

	Name	E-mail	Title
1.	Ivan Jovanović	ivanjovanovic77@gmail.com	Full professor
2.	Gordana Radosavljević	perun.gr@gmail.com	Full professor
3.	Vladislav Volarević	drvolarevic@yahoo.com	Full professor
4.	Marija Milovanović	marijaposta@gmail.com	Full professor
5.	Jelena Pantić	panticjelena55@gmail.com	Associate professor
6.	Sladana Pavlović	sladjadile@gmail.com	Associate professor
7.	Aleksandar Arsenijević	aleksandar@medf.kg.ac.rs	Associate professor
8.	Nevena Gajović	gajovicnevena@yahoo.com	Assistant professor
9.	Vladimir Marković	vladimirmarkovic.vlad@gmail.com	Teaching assistant
10.	Anđela Petrović	petrovicandjela9944@gmail.com	Junior teaching assistant
11.	Isidora Stanisavljević	isidorastanisavljevic97@gmail.com	Junior teaching assistant

COURSE STRUCTURE:

Module	Name of the module	Week	Lectures weekly	Work in a small group per week	Teacher
1	Molecular basis of oncology	6	2	2	Ivan Jovanović
2	Etiology, progression and tumor immunology	9	2	2	
					$\Sigma 30+30=60$

EVALUATION:

The student masters the subject in modules. The grade is equivalent to the number of earned points (see tables). Points are earned in two ways:

PRE-EXAM ACTIVITY: In this way, the student can earn up to 30 points by actively participating in small group and answering questions related to this week's lesson. Based on demonstrated knowledge, the student can earn between 0-2 points per week. To pass the module, student needs to 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.

FINAL EXAM: In this way, student can earn up to 70 points. Student takes the test which includes 70 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 pre-exam activities on 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:

The name of the textbook	Authors	Publisher	The library
Basic immunology: Functions and disorders of the Immune System, sixth edition	Abul K.Abbas and Andrew H. Lichtman	Elsevier Science. 2019	Has
The biology of cancer	Robert A. Weinberg	Garland Science, 2014	Has
The Molecular Basis of Cancer	John Mendelsohn, Peter M. Howley, Mark A. Israel, Joe W. Gray	ELSEVIER, Expert Consult, 2014	Has
Cancer, Principles and practice of Oncology	DaVita, Hellman, Rosenberg	Williams & Wilkins	Has
<i>Il-33/ST2 axis, galectin 1 and 3 in colorectal pathology</i>	<i>Marina Jovanovic, Milan Jovanovic</i>	<i>LAP LAMBERT Academic Publishing 2022 ISBN: 978-620-5-49679-8</i>	Has
Autophagy in health and disease-potential therapeutic approaches	Kursad Turksen	Humana Press Springer Nature 2018. ISBN: 978-3-319-98146-8	
<i>Cytokine production in inflammatory diseases and malignancy of colon</i>	<i>Jovanovic Marina, Jovanovic Milan</i>	<i>LAP LAMBERT Academic Publishing 2019 ISBN: 978-620-0-08148-3</i>	

The presentations and accompanying document in *Word* can be found on the website of the Faculty of Medical Sciences: www.medf.kg.ac.rs

PROGRAM

MODULE 1: MOLECULAR BASIS OF ONCOGENESIS

TEACHING UNIT 1 (FIRST WEEK)

PROLIFERATION AND DIFFERENTIATION

Proliferation

Phases of the cell cycle

Cell cycle regulation

Cyclins. Cyclin-dependent kinases. Inhibitors of cyclin-dependent kinases.

DNA damage control.

Differentiation.

TEACHING UNIT 2 (SECOND WEEK)

MECHANISMS OF CELL DEATH

Necrosis

- Mechanism, role and significance

Apoptosis

- Mechanism, role and significance
- Difference between apoptosis and necrosis
- Basic principles of receptor-mediated cell death (external signal)
- Basic principles of cell death due to loss of survival signals (internal signal)

Necroptosis

Autophagy

- Mechanism, role and significance
-

TEACHING UNIT 3 (THIRD WEEK)

SIGNALING PATHWAYS IN THE CELL

Biochemical activation pathways in the cell

Biochemical mediators

Transcription factors

- NFAT
 - NF κ B
 - AP-1
-

TEACHING UNIT 4 (FOURTH WEEK)

ONCOGENES

Oncogenes. Protooncogenes.
PDGF
VEGF
Ras
c-myc
HER2/neu
Cyclin D
Bcl-2

TEACHING UNIT 5 (FIFTH WEEK)

TUMOR SUPPRESSOR GENES 1

Antioncogenes.
Tumor phenotype.
Retinoblastoma.
Loss of heterozygosity.
NF1 protein as a negative regulator of the Ras signaling pathway.
APC.
BRCA1 и BRCA2.

TEACHING UNIT 6 (SIXTH WEEK)

TUMOR SUPPRESSOR GENES 2

Inhibitors of cyclin-dependent kinases.
pRb- Guardian of the restriction point.
p53- Guardian of the genome.
Immortalization and oncogenesis

- Telomeres
- Telomerases

Apoptosis inhibition
Autophagy and oncogenesis

MODULE 2: ETIOLOGY, PROGRESSION AND TUMOR IMMUNOLOGY

TEACHING UNIT 7 (SEVENTH WEEK)

PHYSICAL AND CHEMICAL ETIOLOGICAL FACTORS

Physical and chemical etiological factors in oncogenesis.
Types and mechanisms of action of ionizing radiation, ultraviolet radiation and chemical carcinogens.
Correlation between radiation dose, age, genetic predisposition and tumors.

TEACHING UNIT 8 (EIGHT WEEK)

ONCOGENIC VIRUSES

Transformation and basic characteristics of transformed cells.
Types and basic characteristics of RNA and DNA oncogenic viruses.
Mechanism of action of RNA oncogenic viruses.
Mechanism of action of DNA oncogenic viruses.

TEACHING UNIT 9 (NINTH WEEK)

TUMOR ANGIOGENESIS

Tumor vasculature.
Mechanisms of neoangiogenesis.
Mediators of angiogenesis

TEACHING UNIT 10 (TENTH WEEK)

INVASIVENESS AND METASTASIS

Basic principles of invasive tumor growth (invasiveness, cell mobility, intravasation).
Metastasis, genetic basis and mechanisms of metastasizing.
Basic principles of site-specific metastasis, survival of malignant cells in circulation, and growth in a distant organ.

TEACHING UNIT 11 (ELEVENTH WEEK)

TUMOR STEM CELLS

Stem cells.
Tumor stem cells, basic characteristics and role in carcinogenesis.

TEACHING UNIT 12 (TWELFTH WEEK)

INFLAMMATION AND ONCOGENESIS

Oncogenesis in inflammation tissue.
Cells involved in inflammatory reactions and stromal cells. Role in tumor initiation and progression

- Tumor associated fibroblasts
- Tumor associated macrophages

TEACHING UNIT 13 (THIRTEENTH WEEK)

TUMOR IMMUNE RESPONSE

Tumor antigens.
Anti-tumor immunity.
Role of individual immune cells in defense against tumors.
How tumors avoid the immune response.

TEACHING UNIT 14 (FOURTEENTH WEEK)

TUMOR IMMUNOTHERAPY

Non-specific immunotherapy.
Cytokines.
Monoclonal antibodies.
TIL.
LAK.
Vaccination.

TEACHING UNIT 15 (FIFTEENTH WEEK)

METABOLISM OF TUMOR CELLS

Oncogenesis.
Tumor progression.
Tumor immunology.

WEEKLY COURSE SCHEDULE

COURSE	FRIDAY
FUNDAMENTALS OF ONCOLOGY (2+2)	<p>LECTURES 08:00 - 09:30 Anatomical Hall (H2)</p> <p>PRACTICE 10:00 -13:00 (R31, R32, R32, R9)</p> <p>Physiological practice room (R31) Pathophysiological practice room (R32) Pathohistological practice room (R33) Biochemical practice room (R9)</p>

module	week	date	time	place	type	Method unit name	Teacher
1	1				L	Proliferation and differentiation.	Prof. Dr Ivan Jovanović
					P		Prof. Dr Ivan Jovanović Assoc.Prof. Dr Slađana Pavlović Assis. Prof. Dr Nevena Gajović Dr Isidora Stanisavljević
	2				L	Mechanisms of cell death.	Prof. Dr Ivan Jovanović
					P		Prof. Dr Ivan Jovanović Prof. Dr Marija Milovanović Assis. Prof. Dr Nevena Gajović Dr Isidora Stanisavljević
	3				L	Signaling pathways in the cell.	Assoc. Prof. Dr Jelena Pantić
					P		Prof. Dr Gordana Radosavljević Assoc. Prof. Dr Jelena Pantić Assoc. Prof. Dr Aleksandar Arsenijević Dr Vladimir Marković
	4				L	Oncogenes.	Assoc. Prof. Dr Aleksandar Arsenijević
					P		Prof. Dr Vladislav Volarević Assoc. Prof. Dr Aleksandar Arsenijević Dr Anđela Petrović Dr Isidora Stanisavljević
	5				L	Tumor suppressor genes 1.	Assoc. Prof. Dr Aleksandar Arsenijević
					P		Prof. Dr Gordana Radosavljević Assoc. Prof. Dr Jelena Pantić Assoc. Prof. Dr Aleksandar Arsenijević Dr Vladimir Marković

module	week	date	time	place	type	Method unit name	Teacher
	6				L	Tumor suppressor genes 2.	Assoc. Prof. Dr Aleksandar Arsenijević
					P		Assoc.Prof. Dr Slađana Pavlović Assoc. Prof. Dr Aleksandar Arsenijević Assis. Prof. Dr Nevena Gajović Dr Vladimir Marković
2	7				L	Physical and chemical etiological factors.	Assoc. Prof. Dr Aleksandar Arsenijević
					P		Prof. Dr Vladislav Volarević Prof. Dr Marija Milovanović Assoc. Prof. Dr Aleksandar Arsenijević Dr Vladimir Marković
	8				L	Oncogenic viruses.	Prof. Dr Marija Milovanović
					P		Prof. Dr Marija Milovanović Dr Vladimir Marković Dr Anđela Petrović Dr Isidora Stanisavljević
	9				L	Tumor angiogenesis.	Prof. Dr Gordana Radosavljević
					P		Prof. Dr Gordana Radosavljević Prof. Dr Marija Milovanović Assoc. Prof. Dr Jelena Pantić Assoc. Prof. Dr Slađana Pavlović
	10				L	Invasiveness and metastasis.	Prof. Dr Gordana Radosavljević
					P		Prof. Dr Gordana Radosavljević Prof. Dr Marija Milovanović Assoc. Prof. Dr Jelena Pantić Dr Anđela Petrović

module	week	date	time	place	type	Method unit name	Teacher	
	11				L	Tumor stem cells.	Prof. Dr Vladislav Volarević	
					P		Prof. Dr Vladislav Volarević Dr Vladimir Marković Dr Anđela Petrović Dr Isidora Stanisavljević	
	12				L	Inflammation and metastasis.	Assoc.Prof. Dr Sladana Pavlović	
					P		Prof. Dr Vladislav Volarević Assoc.Prof. Dr Sladana Pavlović Dr Anđela Petrović Dr Isidora Stanisavljević	
	13				L	Tumor immune response.	Assis. Prof. Dr Nevena Gajović	
					P		Prof. Dr Ivan Jovanović Assoc.Prof. Dr Sladana Pavlović Assis. Prof. Dr Nevena Gajović Dr Anđela Petrović	
	14				L	Tumor immunotherapy.	Assoc. Prof. Dr Aleksandar Arsenijević	
					P		Prof. Dr Gordana Radosavljević Prof. Dr Marija Milovanović Assoc. Prof. Dr Jelena Pantić Assoc. Prof. Dr Aleksandar Arsenijević	
	15				L	Metabolism of tumor cells	Assoc. Prof. Dr Aleksandar Arsenijević	
					P		Prof. Dr Ivan Jovanović Prof. Dr Vladislav Volarević Assoc. Prof. Dr Aleksandar Arsenijević Assis. Prof. Dr Nevena Gajović	

module	week	date	time	place	type	Method unit name	Teacher
					E	FINAL EXAM	