

<i>Name of the course</i>	<b>Medical Biology and Genetics</b>			<b>Code</b>	
<i>Type of study program Cycle</i>	Integrated University Study, Medicine			<b>Year of study</b>	I.
<i>Credits (ECTS) :</i>	<b>11,5</b>	<i>Semester</i>	I.	Number of hours per semester (1+e+s)	150 (75+35+40)
<i>Status of the course:</i>	mandatory	<i>Preconditions:</i>		<i>Comparative conditions:</i>	
<i>Access to course:</i>	First year medical school students			<i>Hours of instructions:</i>	According to schedule
<i>Course teacher:</i>	Professor Jurica Arapovic, MD, PhD				
<i>Consultations:</i>	By e-mail				
<i>E-mail address and phone number:</i>	<a href="mailto:mefmobiologija@gmail.com">mefmobiologija@gmail.com</a>				
<i>Associate teachers</i>	Maja Arapović, DVM, PhD Božo Šušak, MD				
<i>Consultations:</i>	By e-mail				
<i>E-mail address and phone number:</i>	<a href="mailto:mefmobiologija@gmail.com">mefmobiologija@gmail.com</a>				
<b><i>The aims of the course:</i></b>	Principal aim of this course is making an introduction for students to the basic principles of modern biological science which is of high importance for the diagnosis and therapy of human diseases, and the future of medicine. During this course students should acquire terminology necessary for understanding of modern biomedical literature. The students will learn basic cell biology, molecular biology, developmental biology and genetics with an emphasis on human biology. They will be actively involved in problem-orientated work, organized in the form of lectures, seminars and exercises in order to develop practical communication skills and understanding of fundamental biological processes, as well as critical thinking based on acquired knowledge in modern biological science.				
<b><i>Learning outcomes (general and specific competences):</i></b>	<p><u>General competences:</u></p> <ol style="list-style-type: none"> <li>1. Capacity for independent learning</li> <li>2. Development of communication skills</li> <li>3. Capacity for critical questioning and scientific reasoning</li> <li>4. Development of creative thinking</li> <li>5. Ability to use information technology and adoption of new information</li> <li>6. Ability of teamwork - group work</li> <li>7. Development of ethics and responsibility</li> </ol> <p><u>Specific competences:</u></p> <ol style="list-style-type: none"> <li>1. Remembering the basic structure and function of cells (macromolecules, cytoskeleton, transport of macromolecules, organelles, mitochondria and energy production, cell cycle, cell signaling and tumor biology)</li> </ol>				

	<p>2. Remembering the basics of molecular cell biology (cell genome, replication and repair of DNA, transcription and RNA species, regulation of transcription, RNA modification, translation, regulation of translation, synthesis and modification of proteins, transport and function of proteins)</p> <p>3. Remembering the basics of developmental biology (fertilization, meiosis, mitosis, stem cells and the molecular mechanisms of cell differentiation)</p> <p>4. Understanding the medical human genetics (basic principles of genetic inheritance, sexual and autosomal inheritance, chromosome aberrations, genetic counseling)</p>			
<b>Course content (Syllabus):</b>	During the course, knowledge of the students will be tested through seminars and exercises. Also, acquired knowledge will be verified through weekly tests, held every Monday, which will include material from the previous week.			
<b>Format of instruction (mark in bold)</b>	<b>Lectures</b>	<b>Exercises</b>	<b>Seminars</b>	<b>Independent assignments</b>
	Consultations	Work with mentor	Field work	Other
	Remarks:			
<b>Student responsibilities</b>	Students are required to attend and actively participate all classes, including five weekly tests. It is allowed to be justifiably absent from 20% of classes.			
<b>Screening student work (mark in bold)</b>	<b>Class attendance</b>	<b>Class participations</b>	<b>Seminars</b>	<b>Practical training</b>
	<b>Oral exam</b>	<b>Written exam</b>	<b>Continuous assessment</b>	Essay
<b>Detailed evaluation within a European system of points</b>				
<b>STUDENTS RESPONSIBILITIES</b>	<b>HOURS</b>	<b>PROPORTIONS OF ECTS CREDITS</b>	<b>PROPORTION S OF MARK</b>	
Class attendance and participations	150	5	0%	
Seminars	40	1.5	5%	
Written exam	75	2.5	80%	
Oral exam	75	2.5	15%	
Further explanation: The course of Medical biology and genetics is performed during the first semester in the form of lectures (75 hours), seminars (40 hours) and exercises (35 hours). All forms of education are obligatory, and the participation of students will be monitored regularly. During the course, through active participation (lectures, seminars and exercises), student can acquire up to 70% (or 70 points) of its final grade. The remaining 30% (or 30 points) can be achieved in final exam, which is organized through written and oral exams.				

A student can achieve 70 points during lectures as follow:

Seminars: up to 5 points (5%)

Test 1: up to 13 points (13%)

Test 2: up to 13 points (13%)

Test 3: up to 13 points (13%)

Test 4: up to 13 points (13%)

Test 5: up to 13 points (13%)

During seminars and exercises, students will actively discuss the topic, which usually refers to lecture held by day before. The teacher evaluates the student's participation in the seminar (demonstrated knowledge, understanding, ability to define problems and reasoning). During each seminar and exercise students can achieve a maximum of 0.5 points. Altogether, through the all seminars and exercises students can achieve up to 5 points. Weekly tests are a mandatory part of the course and are held on Mondays. Test contains 30 questions related to the material from previous week. In order to pass the test, students must correctly answer more than 10 out of 30 questions ( $> 30\%$ ) of every weekly test. Correct answers are scored according to the following key:

26 - 30 = 13 points

21 - 25 = 11 points

15 - 20 = 9 points

10 - 14 = 7 points

$<10 = 0$  points

**IMPORTANT!!!**

- The passage of the weekly test is considered if a student achieves more than 10 points on the test!

- Students who do not pass one of five weekly tests cannot access to further weekly testing, but can access the examination periods as follows (see below) and should actively participate through course.

- Students who achieve  $\geq 40$  points through class can take the final exam as indicated below in the section final exam. All those students who have  $\geq 65$  points through class are exempt from written part of the final exam, meaning that an additional 15 points are automatically added to (maximal possible number of points on final exam), and they access only the oral part of the final exam.

- Students who achieve  $< 40$  points can take a final exam divided in two part, eg. more comprehensive written exam (test consisted from 100 questions) and oral examination ("classic mode" exam, see below).

- After successfully attended courses, students who achieve  $\geq 40$  points can choose either the examination based on pointing system (points from class + weakly test scores) or the "classic mode" examination. In the later case the points gained through course are not calculated into final score. In the case that the option is "classic mode", students must inform the Head of the Department no later than 72 hours before than final exam starts.

The “**classic mode**” of final exam is combined by comprehensive test (100 questions) and oral exam. Final grade depends solely on the results from test and oral exam that are arithmetically combined.

- If a student achieves  $< 60\%$  on the “**classic mode**” written exam means that he failed the test and is not allowed to take the oral examination.

- All points scored thought course and written part of the final exam are valid until the

commission exam, when students take exam 4<sup>th</sup> time.

• **The Commission's examination** (4<sup>th</sup> time) consists of written (test of 100 questions) and oral exam. This applies to all students, regardless of scoring status through course! Passing threshold for the commission exam is 55%, whereas oral exam consist of "five oral exam questions" covering three areas of the course (two for general biology, two for molecular biology and one for genetics).

**Final exam:** (for those students who scored  $\geq 40$  points through course)

The final exam consists of a written and oral examination. The total number of points scored on the final exam is 30 (written + oral), and to pass the exam it is required to achieve at least 8 points.

**The written part** of the final exam consists of test containing 50 questions, covering and integrating material from course. Grading is performed according to the following key:

48 - 50 = 15 points

45 - 47 = 14 points

42 - 44 = 13 points

39 - 41 = 12 points

36 - 38 = 11 points

32 - 35 = 10 points

29 - 31 = 9 points

25 - 28 = 8 points

<25 = 0 points

**The oral part** of the final exam is mandatory for all students which have passed written part. Through written part students can score a maximum of 15 points. The minimum number of points to pass the oral exam is 8. Student, who scores 0-7 points, fails pass the exam, and testing must be repeated. The oral exam consists of "three oral exam questions" covering each out of three areas of the course (general biology, molecular biology and genetics). If student fails to respond sufficiently to any of those "oral exam questions" he cannot pass the oral exam.

The oral exam grading is estimated by the following key:

Excellent = 14 - 15 points

Very good = 12 - 13 points

Good = 9 - 11 points

Sufficient = 8 points

Insufficient = 0-7 points

### **IMPORTANT!!!**

- All those students who do not pass final exam (<8 points) can re-access to the final exam at the next regular examination period under the same conditions.
- All students who chose "classic mode" of examination will take this mode every time following by regular examination periods.
- Once student pass the written exam, it is valid for the next examination periods!
- If students have scored 40 or more points and could not pass the final exam through regular examination periods, they will take a commission exam under conditions described above!

(Please see part *The Commission's examination*)

**Final score:**

The final grading is formed by the sum of whole points every students score through course and points obtained in the final exam (written and oral exam). Grading is performed according to the following key:

90 - 100 = excellent (5)

80 - 89 = very good (4)

68 - 79 = good (3)

56 - 67 = sufficient (2)

0 - 55 = inadequate (1)

Regardless of the points scored through course, final grade cannot be obtained if student was not positively evaluated on the final oral exam.

The “**classical mode**” of evaluation of the test:

90 - 100 = excellent (5)

80 - 89 = very good (4)

70 - 79 = good (3)

60 - 69 = sufficient (2)

0 - 59 = insufficient (1)

According to Commision’s exam, final grade for the written part of the exam is performed according to the following key:

91 - 100% = 5 (excellent)

79 - 90% = 4 (very good)

67 - 78% = 3 (good)

55 - 66% = 2 (sufficient)

0 - 54% = 1 (insufficient)

<b>Required literature:</b>	<ol style="list-style-type: none"><li>1. Geoffrey M. Cooper and Robert E. Housman: "Cell - molecular approach," Medical Biochemists, Zagreb (2010), the Library of university textbooks, Fifth Edition, Professional editor of the Croatian edition: prof. Ph. D.. Gordan Lauc, ISBN 978-953-176-493-3</li><li>2. Turnpenny P Ellard S. Emery base medical genetike.14. edition, Medical Biochemists, Zagreb, 2011. 3rd Peruzovic M. Resnik T .: Medical Biology, Manual microscopic exercise, Department of Medical Biology, Faculty of Medicine in Split,, 2010.</li></ol>
<b>Optional literature:</b>	<ol style="list-style-type: none"><li>1. TM Cox: Molecular biology in medicine, Medical Biochemists, Zagreb, 2000.</li><li>2. Specially prepared manuscripts for seminars and exercises</li></ol>
<b>Additional information about the course</b>	<a href="http://www.mef.sve-mo.ba">www.mef.sve-mo.ba</a>

Annexes: calendar classes

<i>The number of teaching units</i>	TOPICS AND LITERATURE
<b>I.</b>	<p>Title: Cell Biology and Medicine.</p> <p>Short description: structure and function of cells. Prokaryotes vs. Eukaryote. The cell chemistry. Macromolecules.</p> <p>Literature: mandatory and additional</p>
<b>II.</b>	<p>Title: Nucleic Acids DNA</p> <p>Short description: Deoxyribonucleic acid, structure, replication and DNA repair.</p> <p>Literature: mandatory and additional</p>
<b>III.</b>	<p>Title: Nucleic acid-RNA</p> <p>Short description: ribonucleic acid-RNA. Transcription and regulation of transcription.</p> <p>Literature: mandatory and additional</p>
<b>IV.</b>	<p>Title: Nucleus and genome organization</p> <p>Short description: The core of the structure and function of the nucleus and nucleoli. Transportation to / from the nucleus. The organization and reshuffling of the genome.</p> <p>Literature: mandatory and additional</p>
<b>V.</b>	<p>Title: From DNA to proteins</p> <p>Short description: From DNA to protein. Genetic code. Translation. Protein sorting and transport. ER, Golgi apparatus and lysosomes. Vesicular transport.</p> <p>Literature: mandatory and additional</p>
<b>VI.</b>	<p>Title: Membrane-structure and transport through the membrane</p> <p>Short description: The structure of cell membranes. Transport of substances through the membrane and endocytosis.</p> <p>Literature: mandatory and additional</p>
<b>VII.</b>	<p>Title: Bioenergetics and metabolism.</p> <p>Short description: The function and structure of mitochondria and peroxisomes.</p> <p>Literature: mandatory and additional</p>
<b>VIII.</b>	<p>Title: Cytoskeleton and intercellular substance.</p> <p>Short description: The cytoskeleton and cell movement, extracellular matrix and intercellular connections.</p> <p>Literature: mandatory and additional</p>
<b>IX.</b>	<p>Title: Cell signaling.</p> <p>Short description: Signal transduction in the cell. Stem cells and apoptosis.</p> <p>Literature: mandatory and additional</p>
<b>X.</b>	<p>Title: Cell cycle. Cancer. Molecular genetics of tumors.</p> <p>Short description: Cell cycle, basics of molecular biology and genetics of tumors.</p> <p>Literature: mandatory and additional</p>

<b>XI.</b>	Title: Fundamentals of Medical Genetics
	Short description : Classical and molecular genetics. Autosomal recessive and dominant human diseases. Monogenic and polygenic diseases. Linked genes and gene recombination.
	Literature: mandatory and additional
<b>XII.</b>	Title: Sexual-linked inheritance.
	Short description: Inheritance of sex and sex-linked inheritance.
	Literature: mandatory and additional
<b>XIII.</b>	Title: Mutations
	Short description: Chromosomal and genetic mutations. Mutations and human health
	Literature: mandatory and additional
<b>XIV.</b>	Title: Cytogenetics and kariogram
	Short description: The process of obtaining and analyzing kariogram. G-banding and FISH.
	Literature: mandatory and additional
<b>XV.</b>	Title: Analysis of DNA
	Short description: solubilization, isolation, separation and visualization of DNA. Gel electrophoresis. Restriction enzymes. The plasmids and recombinant DNA technology. The application of recombinant DNA in medicine. Cloning. Genetically modified organisms. PCR. Sequencing. DNA and RNA microchips
	Literature: mandatory and additional
<b>XVI.</b>	Title: Analysis of protein
	Short description: solubilization, isolation, separation and visualization of proteins. Electrophoresis (SDS-PAGE), Commasie blu and Ponso S With meted. Western blot. Microarray. ELISA, flow cytometry. Production of monoclonal antibodies.
	Literature: supplementary.
<b>XVII.</b>	Title: Tools of cell biology.
	Description: Microscopes and microscopy. Fractionation of cells, cell culture, cell separation by centrifugation.
	Literature: supplementary.