

MEDICAL BIOLOGY	
GENERAL INFORMATION	
Course coordinator	Professor Marija Heffer, MD, PhD
Assistant/Associate	Professor Jasenka Wagner-Kostadinović, PhD Assistant Professor Vedrana Ivić, PhD Marta Balog, PhD
Study Programme	Integrated undergraduate and graduate university study of Medicine
Status of the course	Mandatory
Year of study, semester	1th year, 1th semester
ECTS	8
Workload (hours)	Lectures (40); Seminars (30); Exercises (30)
Expected number of students	70
COURSE DESCRIPTION	
Course objectives	
To introduce students to the basic principles of molecular and cell biology as a foundation for understanding the molecular nature of physiological and pathophysiological processes, implement an evolutionary way of reasoning, develop critical thinking about molecular methods and strengthen the concept of personalized molecular medicine.	
Enrolment requirements and entry competencies	
Acquired conditions for enrollment in the study program Medicine.	
Learning outcomes at the Programme level	
1.1, 2.1, 3.4, 3.5	
Learning outcomes (5-10)	
<ol style="list-style-type: none"> 1. Present the structure of the eukaryotic cell and compare it with the structure of prokaryotes, formulate conclusions about similarities and differences and put them in an evolutionary context; 2. Define cell divisions and connect them into a functional system, taking into account their molecular composition, the processes that take place in them and the mechanisms of mutual communication; 3. Analyze and interpret individual phases of the cell cycle, explain the molecular basis of the transition from phase to phase and errors that lead to tumor growth or apoptosis; 4. Classify and critically evaluate the basic mechanisms of genetic information management (replication, recombination, repair, transcription, translation) and the consequences of their deregulation; 5. Analyze and evaluate new knowledge in the field of molecular biology in terms of understanding the molecular basis of the disease, the synthesis of genetic and epigenetic mechanisms of disease and assess possible goals of therapy; 6. From the molecular aspect, define fertilization, analyze early embryonic development and conclude on the influence of harmful environmental factors on the development of the human embryo, human genome and epigenetic modifications; 7. Define cellular structural and functional characteristics in different life circumstances and adaptation to them using the concept of signaling; 8. Develop the skill of using light microscopy and argue the use of other microscopic techniques; 9. Link the analysis of human karyogram with reproductive health or general health; 	

10. Understand the biological foundations of molecular techniques, critically evaluate and understand them and recommend the application of an appropriate method for testing the hypothesis.

Course content

Lectures

Evolution of life on Earth: prokaryotes and eukaryotes. Cellular composition - four basic types of macromolecules. Basic cellular metabolic processes - everything revolves around glucose. Fundamentals of molecular biology. Basic methods in molecular biology - tools of molecular medicine. Human genome organization - function of coding, non-coding and 'junk DNA'. Biological processes involved in DNA molecule maintenance - replication, repair, recombination, rearrangement, and epigenetic modifications. Transcription in prokaryotes and eukaryotes or how to get prokaryotes to transcribe a eukaryotic gene? RNA molecule diversity. Cell membrane processes. Species specific translation features as a basis for the development of antiviral drugs and antibiotics. The nucleus as the largest cellular organelle. Trafficking of cellular molecules. Mitochondria - cellular power plant. Cytoskeleton and cellular movement. Signal processes as a mechanism of communication and adaptation to the environment. Cell cycle regulation - divide or die? Regeneration and aging - is death inevitable? How do tumours form?

Seminars

Development of prokaryotes and eukaryotes. Biological macromolecules. What methods of molecular biology are part of clinical practice? What does the human genome contain? DNA replication, mutation and repair - basics of understanding tumour biology. Epigenetics - or how does the environment affect the use of DNA material? Protein diversity - the link between structure and function. Cellular excitability function. Biological processes in the cell nucleus. Intracellular transport systems. Inheritance of mitochondrial DNA - the ancestor of the human race. Physiology and pathophysiology of the cytoskeleton. Signalling and molecular medicine. Cell cycle - regeneration or tumour growth? Precision medicine and anti-tumour drugs.

Exercises

Microscope as a tool of cell biology. Preparation of permanent and fresh slides - histological insight into the patient's condition. DNA isolation - a basic method of molecular biology. Karyogram as a tool of reproductive medicine. Electrophoresis or how to separate a mixture of charged molecules? Chromosomal aberrations - old and new techniques for monitoring somatic mutations. Immunochemical methods or antibodies = protein probes. From cell culture to organoids. Ionic balance of cell membranes and the concept of osmolality. Cell cycle monitoring techniques. Origin of male and female gametes - natural or artificial insemination? Knowledge of reproduction as a basis for genetic manipulation in animal models. Early development processes. Gastrulation and neurulation - critical developmental processes. Normal or tumour cell - determination of tumour origin.

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. Unfinished exercise must be colloquial.

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

Teaching activity	ECTS	Learning outcome	Student activity	Assessment methods	Grade points	
					Min.	Max.
Lectures	0.25	1-7	Class attendance	Record	2	4
Seminars attendance	0.25	1-7	Class attendance	Record	2	4
Seminars activity	0.25	1-7	Participation in the discussion	Tracking activity	2	4
Exercises	0.25	8,9,10	Attendance and active participation in exercises	Exercise diary submitted and signed	2	4
Essay writing	1	1-7	Writing an essay on a selected topic	Evaluation of a written essay	6	12
Partial colloquium 1	1	1,4,5	Active learning	Percentage of correct answers	6	12
Partial colloquium 2	1	2,3,6,7	Active learning	Percentage of correct answers	6	12
Final exam	2	1-8	Learning for the written exam	Written exam	12	24
Final exam	2	1-10	Learning for the oral exam	Oral exam	12	24
Total	8				50	100

Evaluation of the written exam:

Percentage of accurate answers provided (%)	Grade points
60,00-64,99	12
65,00-69,99	14
70,00-74,99	16
75,00-79,99	17
80,00-84,99	18
85,00-89,99	19
90,00-94,99	22
95-100	24

Evaluation of the oral exam:

Student answer	Grade points
The answer meets the minimum criteria	12.0
The average answer with noticeable errors	16.0
The very good answer with minor errors	20.0
The exceptional answer	24.0

Calculation of final grade:

Grades obtained during the oral exam are added to the points earned during the course. The evaluation is performed by absolute distribution, i.e. 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
Geoffrey M. Cooper i Robert E. Hausman: Stanica - Molekularni pristup, 5. ed, Medicinska naklada, Zagreb, 2010.	13	
Group of authors: Handbook of Exercises in Medical Biology, Sveučilište J. J. Strossmayer, 2015.	70	

Additional reading

Alberts B. et al. : Molecular Biology of the Cell, 6. izdanje, Garland Science, 2015.

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 to various pages, video and audio materials available on the website.