[Medicinski fakultet u Rijeci]

Curriculum
2023/2024

[Za kolegij]

Medical Biology

Study program:	**Medical Studies in English (R)** [Sveučilišni integrirani prijediplomski i diplomski studij]
Department:	**[Katedra za medicinsku biologiju i genetiku]**
Course coordinator:	**izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing.**
Year of study:	**1**
ECTS:	**10**
Incentive ECTS:	**0 (0.00%)**
Foreign language:	**Possibility of teaching in a foreign language**

Course information:

Medical Biologyis a mandatory course conductedin the first year (II semester) of the Integrated undergraduate and graduate university study of Medicine in English. It consists of 44 hours of lectures, 40 hours of seminars and 36 hours of practicals, which totals 120 teaching hours. The course is worth 10 ECTS credits, which implies a maximum of 300 hours of student workload (1 ECTS = 30 hours of student workload), i.e. 20 hours of study work for the course per week (including all forms of mandatory classes at the Faculty and study work at home).

The aim of the course is to define, describe and explain fundamental principles of modern biological science necessary for the horizontal and vertical integration of knowledge and skills in the process of understanding, modern diagnosis and treatment of diseases in humans, and for continuous monitoring of new trends in biomedicine, including precise(personalized) and regenerative medicine.

Course content: To achieve the planned learning outcomes, course classes are organized into three large thematic units, which enable a gradual introduction to the cell structure and fundamental molecular processes, developmental biology and genetics and the occurrence of genetic and non-genetic disordersof cellular processes:

1. CELL BIOLOGY

1.1. Introduction to Cell Biology

L1 Cell and Molecular Biology in Medicine; Plan and Literature

L2 Introduction to Cell Biology: Cell Origin and Evolution

L3 Tools of Cell Biology

S1 The Basics of Structure and Function of Prokaryotic and Eukaryotic Cells

P1 The Basics of Light Microscopy. Basic Methods in Slide Preparation. Prokaryotic Cell.

1.2. Biomembranes and Cell Metabolism

L4 Structure of the Plasma Membrane

L5 Transport of Macromolecules: Endocytosis and Exocytosis

L6 Bioenergetics and Metabolism: The Role of Mitochondria and Peroxisomes

S2 Transport of Small Molecules

P2 Eukaryotic Cell

1.3. The Extracellular Interactions

L7 Cytoskeleton and Cell Movement

L8 The Extracellular Matrix

S3 Cell-Cell Interactions

S4 The Basics of Cell Signaling

1.4. Cell Nucleus, Chromatin and Chromosomes

L9 The Structure and Function of Nucleus and Nucleolus

L10 The Organization and Condensation of Chromatin

S5 Mitosis in Plant and Animal Cell. Human Chromosomes.

P3 Mitosis in Plant and Animal Cell. Human Chromosomes.

1.4. Eukaryotic Cell Cycle

L11 Regulation of the Eukaryotic Cell Cycle

L12 Programmed Cell Death

S6 Meiosis. Human Gametogenesis.

P4 Meiosis. Human Gametogenesis.

2. MOLECULAR (FUNCTIONAL) BIOLOGY

2.1. Flow of Genetic Information I: Nucleic Acids, Genome and DNA Replication

L13 The Structure and Function of Nucleic Acids

L14 Genome Organization in Prokaryotes and Eukaryotes. The Human Genome.

L15 The Structure of Eukaryotic Genes

L16 Human Genome Variation

L17 DNA Replication

P5 Genomic DNA Extraction

2.2. Flow of Genetic Information II: Transcription, Translation and Intracellular Molecules Sorting

L18 Transcription. RNA Processing.

L19 Regulation of Transcription

L20 Translation

L21 Posttranslational Modifications, Protein Sorting and Transport (The Endoplasmic Reticulum, Golgi Apparatus and Vesicular Transport)

L22 Regulation of Protein Function. Protein Degradation: The Ubiquitin-Proteasome Pathway and Lysosomal Proteolysis

S8 The Flow of Genetic Information I: DNA Replication, Transcription and RNA Processing

S10 The Flow of Genetic Information II: Translation, Protein Sorting and Transport

2.3. Epigenetic Regulation of Gene Expression

L23 The Basics of Epigenetics I: Epigenetic Modifications

L24 The Basics of Epigenetics II: Genomic Imprinting

S9 Noncoding RNA Molecules

P6 The Relationship Between Chromatin Structure and Transcriptional Activity

3. DEVELOPMENTAL BIOLOGY AND GENETICS

3.1. The Basics of Developmental Biology and Genetics

L25 Assisted Reproductive Technology Techniques

S11 Human Fertilization

3.2. The Basics of Monogenic and Polygenic Diseases, Types of Inheritance

L26 Gene Mutations

L27 DNA Repair

L28 The Basics of Mendelian Genetics

L29 The Basics of Non-Mendelian Inheritance

L30 Population Genetics

S13 Monogenic and Polygenic Diseases

P7 Patterns of Disease Inheritance

3.3. The Basics of Chromosomal Aberrations

L31 The Basics of Chromosomal Abnormalities. Cytogenetic Methods.

S14 Types and Mechanisms of Numerical Chromosomal Aberrations

S15 Types of Structural Chromosomal Aberrations

S16 Problem Assignments: Mendelian and Non-Mendelian Inheritance, Chromosomal Aberrations

P8 Aneuploidy and Polyploidy in Clinical Practice

3.4. Cancer Genetics

L32 Abnormal Cell Cycle in Malignancy

L33 The Development and Causes of Cancer

L34 The Basics of Clinical Cytology

P9 Molecular Oncogenesis in Clinical Practice

P10 Integration of skills from the practical part of the course: Recognizing Microscope Slides

3.5. Tools of Molecular Genetics

L35 Tools of Molecular Genetics in Medicine I

L36 Tools of Molecular Genetics in Medicine II

P11 Tools of Molecular Genetics

3.6. Regenerative Medicine

L38 Stem Cells. Regenerative Medicine.

L39 The Role of Medical Biology in Modern Medicine

COURSE LEARNING OUTCOMES:

The approach to teaching is based on learning outcomes that determine what students will be able to do after they have completed all study work and requirements for the course. Planned outcomes by domains are in accordance with the teaching methods and evaluation of their achievement through the constructive alignment process.

I. COGNITIVE DOMAIN – KNOWLEDGE

1. recognize, differentiate, define and describe the morphology and function of individual cell parts

2. relate, compare and integrate the structure of individual cell parts with their function

3. recognize, differentiate, define and describe the basic molecular processes in the cell

4. recognize, differentiate, define and describe the flow of genetic information through the cell

5. recognize, differentiate, define and describe epigenetic control of gene expression

6. relate, compare and integrate the role of molecular processes and their control in the regulation of gene expression

7. recognize, differentiate, define and describe the basic mechanisms of developmental biology

8. recognize, differentiate, define and describe the basic genetic mechanisms, including chromosomal aberrations and non-Mendelian inheritance

9. recognize, define and describe the basic (epi)genetic mechanisms in cancer

10. relate, compare and integrate the role of (epi)genetic mechanisms in the occurrence of monogenic and polygenic diseases, as well as cancer

II. PSYCHOMOTOR DOMAIN – SKILLS

1. use a light microscope independently and correctly
2. identify the parts of the microscope and their function during microscopy
3. discover the image of the given microscope slide
4. recognize, differentiate and draw selected microscope slides
5. recognize and implement selected basic laboratory techniques in cell and molecular biology
6. draw a pedigree chart using standardized symbols
7. recognize the possible types of inheritance in the pedigree chart using the criteria for inheritance
8. determine the genotypes for individual persons in the pedigree chart
9. classify human chromosomes by size and shape
10. solve simple problems in genetics

III. AFFECTIVE DOMAIN – VALUES AND ATTITUDES

1. integrate and revise the interdisciplinary nature of biomedical sciences
2. identify, judge and argue the importance of horizontal and vertical application of medical biology knowledge and skills in modern evidence-based medical practice

Teaching:

Teaching is conducted in the form of **lectures, seminars and practicals**. Seminars and practicals will be organized interactively in small groups with the aim of practical integration of material covered in lectures. Students will be actively included in problem-based learning with the aim of developing open, investigative and critical thinking and communication skills that will facilitate the acquisition of knowledge on modern biological science.

Lectures will define, describe and explain the basic principles (learning outcomes) from each teachingunit, which will be analyzed and elaborated during seminars and practicals.

At the **seminars**, students will actively discuss the material presented in the lectures and solve assignments/problems/cases independently and in groups. Based on guided problem-based summarization, integration and revision of the content covered, students will learn how to critically discuss with clear, unambiguous arguments and evaluate the strength of other people's arguments in real-life situations of biomedical context. This includes the application of real medical cases from our clinicalpractice.

At the **practicals**, special attention will be paid to individual work in order to better understand experimental work and develop practical skills.

List of assigned reading:

1. Cooper, Geoffrey M; Hausman, Robert E. The Cell. A Molecular Approach, Massachusetts, U.S., 7th Edition, Sinauer Associates, Inc. Publishers Sunderland, 2015.

2. Ostojić, S; Pereza, N. Medical Biology: Methodical Handbook with Problem Assignments for First-Year Students of Integrated Undergraduate and Graduate University Study of Medicine in English, 1st edition, Redak, Split, 2020.

3. Turnpenny, P; Ellard, S. Emery's Elements of Medical Genetics, London, U.K., 15th Edition, Elsevier, 2017.

List of optional reading:

1. Alberts, B et al. Molecular Biology of the Cell. Philadelphia U.S., 6th edition, Garland Publishing Co, 2014.

Curriculum:

[Predavanja] list (with titles and explanation):

Lecture 1. Cell and Molecular Biology in Medicine; Plan and Literature

- describe the importance of cell and molecular biology in medicine
- describe the Medical Biology course teaching plan
- list the literature for study

Lecture 2. Introduction to Cell Biology: Cell Origin and Evolution

• describe the basic molecular composition of the cell
• define cell theory (Schleiden and Schwann)
• define the term evolution; distinguish between the standard and extended definitions
• list the basic forces of evolution
• describe the sequence of evolution (nuclear, physical, chemical, biological)
• define the RNA world
• explain the evolution of metabolism
• explain the evolution of prokaryotes into eukaryotes (endosymbiotic theory)

Lecture 3. Tools of Cell Biology

• list the basic cell analysis methods
• define light microscopy
• describe and differentiate between the types of light microscopes
• define the concept of discernment
• define electron microscopy and types
• define the method and describe the types of cell fractionation
• define the cell culture method
• describe the role of viruses and bacteriophages in molecular biology

Lecture 4. Structure of the Plasma Membrane

• describe the main structural features of biological membranes and cell membrane
• describe the types, structure, roles and distribution of membrane lipids, proteins and sugars
• describe the organization, function and dynamics of lipid rafts
• explain the concepts of selective barrier, fluidity and asymmetry of biological membranes

Lecture 5. Transport of Macromolecules: Endocytosis and Exocytosis

• list and explain the transport of macromolecules through the cell membrane
• explain the types and plasticity of endocytotic processes
• describe the mechanisms of receptor-mediated endocytosis
• describe endosomes and their role
• describe examples of transport processes (endocytosis, exocytosis, transcytosis)
• describe exocytosis and its role
• distinguish between constitutive and regulated transport of macromolecules

Lecture 6. Bioenergetics and Metabolism: The Role of Mitochondria and Peroxisomes

• define and distinguish between the terms metabolism, anabolism and catabolism
• describe the morphological structure of mitochondria
• describe the production of energy metabolism in the cell (mitochondria, chloroplasts)
• describe and differentiate aerobic and anaerobic respiration
• define and describe the Krebs cycle (citric acid cycle) and oxidative phosphorylation
• describe the role of the inner mitochondrial membrane
• define the role of the chemiosmotic coupling in the energy generation
• define the term photosynthesis
• distinguish the role of reactions in the light and reactions in the dark in the chloroplast
• describe the function of peroxisomes

Lecture 7. Cytoskeleton and Cell Movement

• describe the organization, distribution, dynamics and various roles of cytoskeletal elements in eukaryotic cells

• explain the structural and functional integration of cytoskeletal elements
• distinguish between actin gel networks and bundles and explain their functions
• describe the organizational center of microtubules and explain its function
• define motor proteins in the eukaryotic cell, list them and describe their roles
• list the main roles of microtubules in eukaryotic cells
• distinguish the types and list the main roles of intermediate filaments in eukaryotic cells
• describe examples of instability of cytoskeletal elements and their connection with human diseases

Lecture 8. The Extracellular Matrix

• define the concept of tissue and extracellular matrix
• list the roles of the extracellular matrix
• define and explain the structure of the extracellular matrix
• differentiate the functions of parts of the extracellular matrix
• explain the remodeling of the extracellular matrix
• distinguish between focal adhesions and hemidesmosomes

Lecture 9. The Structure and Function of Nucleus and Nucleolus

• describe the morphology of the nucleus
• describe the nuclear envelope, the nuclear lamina/matrix and the organization of the nuclear pore complex
• describe the structural and functional domains of the interphase nucleus: nucleus corpuscles
• describe the structure and role of the nucleolus
• list higher-order hierarchical structures
• define chromosomal territories and interchromosomal domains

Lecture 10. The Organization and Condensation of Chromatin

• describe the organization and function of interphase chromatin (euchromatin/heterochromatin)
• describe the basic model of chromosome organization in interphase
• define the structure of nucleosomes and chromatosomes
• describe the organization of the 30-nm chromatin fiber
• define the role of histone and non-histone proteins in condensation and spiralization
• describe the formation and structure of single-chromatid and metaphase chromosomes
• define telomeres

Lecture 11. Regulation of the Eukaryotic Cell Cycle

• describe the regulation of the cell cycle – extracellular and intracellular signals
• name cell cycle checkpoints (protein kinases)
• define the terms cyclin, cyclin-dependent kinase complexes (Cdk), CDK-activating kinase (CAK) and Cdk inhibitor proteins (CKI)
• describe the G1 checkpoint – restriction point (R)
• describe the role of key checkpoints in cell cycle regulation, along with associated cyclins/Cdk molecules • explain the surveillance at the G2 checkpoint
• list the tumor suppressor genes in the regulation of the cell cycle
• define the term Weismann-Swim-Hayflick limit

Lecture 12. Programmed Cell Death

• define the term apoptosis
• differentiate apoptosis from necrosis
• explain the changes in the cell during programmed cell death
• list the proteins involved in apoptosis and describe their function
• describe the signaling pathways that regulate programmed cell death
• describe an alternative pathway of programmed cell death (autophagy)

Lecture 13. The Structure and Function of Nucleic Acids

• define the terms genome and gene
• define the central dogma of molecular biology
• list the roles of nucleotides
• describe the structure of the DNA molecule (nucleoside/nucleotide)
• distinguish the chemical bonds in the DNA molecule (hydrogen, phosphodiester, hydrophobic)
• define Chargaff’s rule
• distinguish the structure of DNA and RNA molecules
• distinguish the role of the OH group on the C2 atom of the sugar

• describe the structure and list the roles of RNA molecules

Lecture 14. Genome Organization in Prokaryotes and Eukaryotes. The Human Genome.

• compare the organization and size of prokaryotic and eukaryotic genomes
• define the concept of C-value and the C-/G-value paradox
• define the term noncoding DNA/RNA
• distinguish, list and describe types of noncoding DNA (ncDNA)
• explain the features and role of intron sequences in gene function

Lecture 15. The Structure of Eukaryotic Genes

• describe the organization of genes on human chromosomes
• describe the organization of the eukaryotic gene: define the term transcription unit (exons and introns) and regulatory DNA sequences (proximal and distal)
• describe the types and position of proximal regulatory DNA sequences (promoter sequences and termination signal)
• describe the position and shapes of distal regulatory DNA sequences (enhancers and silencers) and the mechanism of their interaction with promoter sequences
• define the term and role of specific transcription factors (activator and repressor proteins)
• describe the complexity in the transcription of the eukaryotic gene (supplement of the central dogma)

Lecture 16. Human Genome Variation

• distinguish between common and rare variants in the genome
• distinguish between qualitative and quantitative (structural) variants in the genome
• define single-nucleotide polymorphisms (SNP) and describe their main features
• define the structural variability of the human genome: copy number variations (CNV)
• describe examples of CNVs associated with normal traits, the risk for pathological conditions or with pathological conditions

Lecture 17. DNA Replication

- define the therm semiconservative DNA replication
- define the role of DNA polymerase in prokaryotes
- describe the replication fork model
- describe the sequence and explain mechanism of DNA replication in prokaryotes
- describe the corrective 3'->5' exonculease activity of DNA polymerase I/II/III
- differentiante DNA replication on telomerases, describe the role of telomerase

Lecture 18. Transcription. RNA Processing.

• define the role of RNA polymerase
• differentiate between the coding strand and template strand
• describe the sequence and explain the mechanism of DNA transcription in prokaryotes: initiation, elongation, termination
• define the term promoter and explain its role
• explain the transcription in eukaryotes
• define the role of transcription factors
• define general and specific transcription factors and their binding sites
• describe the formation of the preinitiation and initiation complex of RNA polymerase II

Lecture 19. Regulation of Transcription

• define the term operon
• describe transcription regulation in prokaryotes: Lac operon of E. coli
• describe the transcription regulation in eukaryotes
• describe the central role of transcription factors in the regulation of gene expression
• explain the role of chromatin structure modification mechanisms
• describe mRNA processing in eukaryotes: modifications of the 5’ and 3’ ends of eukaryotic mRNA
• describe the pre-mRNA splicing process

Lecture 20. Translation

• define the genetic code and the translation method
• describe the structure of tRNA and its activation mechanism
• describe how to determine the reading frame of the genetic instruction (translation initiation)
• describe translation elongation

• describe translation termination
• define post-transcriptional control of gene expression
• describe RNA interference (RNAi) and gene silencing mechanisms

Lecture 21. Posttranslational Modifications, Protein Sorting and Transport (The Endoplasmic Reticulum, Golgi Apparatus and Vesicular Transport)

• define the concept and sequence of the secretory pathway
• describe the structure and role of rough and smooth endoplasmic reticulum
• explain the mechanisms and roles of cotranslational and posttranslational translocations
• describe protein modifications in the ER: glycosylation, folding and proteolysis
• describe cargo selection mechanisms, define the role of coat proteins and explain vesicle budding
• describe the structure and role of the Golgi apparatus

Lecture 22. Regulation of Protein Function. Protein Degradation: The Ubiquitin-Proteasome Pathway and Lysosomal Proteolysis)

• explain the regulation of protein function by means of other molecules
• describe the regulation of proenzyme/enzyme enzymatic activity
• explain reversible and irreversible interactions in protein regulation
• explain the programmed protein degradation
• describe the pathway of protein degradation in the ubiquitin-proteasome system
• describe the importance of autophagy in the regulation of protein function

Lecture 23. The Basics of Epigenetics I: Epigenetic Modifications

• define epigenetics and epigenomics
• list, define and distinguish between DNA methylation, histone modifications and noncoding RNA molecules
• explain the role of DNA methylation, histone modifications and noncoding RNA molecules
• explain the effect of external and internal factors on epigenetic modifications

Lecture 24. The Basics of Epigenetics II: Genomic Imprinting

• define genomic imprinting and its roles
• explain the characteristics of genomically imprinted genes
• explain epigenetic reprogramming during gametogenesis, after fertilization and in various diseases
• list the sequence of genomic imprinting clinical disorders and name examples of diseases
• explain and differentiate uniparental disomy syndromes

Lecture 25. Assisted Reproduction Technology Techniques

• define types of infertility
• distinguish the causes of infertility
• define the concept of medically assisted reproduction
• list, define and differentiate medically assisted reproduction procedures
• explain the role of medically assisted reproduction in fertility treatment

Lecture 26. Gene Mutations

• classify and distinguish types of mutations
• list, define and distinguish types of gene mutations
• relate the type of gene mutation with the consequences for gene expression and phenotype
• relate the causes with the appropriate type of DNA damage

Lecture 27. DNA Repair

• classify and distinguish types of DNA repair
• list, define and differentiate types of excision repair
• list, define and differentiate types of DNA double-strand breaks repair
• relate the types of DNA damage to the corresponding type of DNA repair

Lecture 28. The Basics of Mendelian Genetics

• define classical (Mendelian) genetics
• list, define and differentiate the basic concepts of classical genetics
• explain the role of Mendelian crosses
• define monogenic disorders
• list and distinguish between monogenic disorders according to the position of the causative gene and its effect on the

phenotype
• explain and differentiate the possible genotypes of people with monogenic disorders
• list examples of autosomal dominant and recessive disorders and X-linked dominant and recessive monogenic disorders

Lecture 29. The Basics of Non-Mendelian Inheritance

• list and distinguish deviations from classical inheritance
• define terms: multiple alleles, epistasis, genetic anticipation, heteroplasmy
• list atypical modes of inheritance (dynamic mutations, gonadal mosaicism, genomic imprinting, mitochondrial inheritance) with examples
• list examples of polygenic traits
• explain the basic principles of multifactorial inheritance on examples of diseases
• distinguish between monogenic and polygenic/multifactorial diseases from the aspect of inherritance

Lecture 30. Population Genetics

• describe the fundamental characteristics of the population (genetic structure, frequency of alleles and genotypes, gene balance of the population through the Hardy-Weinberg principle)
• explain deviations from the Hardy-Weinberg equilibrium on the example of a monogenic disease
• relate basic evolutionary factors with changes in the genetic structure of the population
• relate the concept of consanguinity with the risk of disease occurrence in the population and the impact on genetic variability

Lecture 31. The Basics of Chromosomal Abnormalities. Cytogenetic Methods.

• define chromosomal aberrations
• list, define and differentiate numerical chromosomal aberrations
• explain the mechanisms of aneuploidy
• list the most common autosomopathies and gonosomopathies
• explain the mechanisms of polyploidy
• list, define and distinguish structural chromosomal aberrations
• explain the mechanisms of intrachromosomal/interchromosomal structural aberrations
• define the terms karyogram, karyotype, mosaic karyotype
• list and define the methods of chromosome banding
• differentiate the resolution levels of banding and molecular cytogenetics
• list and define the methods of molecular cytogenetics

Lecture 32. Abnormal Cell Cycle in Malignancy

• list, define and differentiate theories of cancer origin
• distinguish and describe the genetic/epigenetic basis of cancer
• define and relate the concepts of proto-oncogenes, oncogenes and tumor-suppressor genes
• list the mechanisms of proto-oncogene transformation into an oncogene
• list and describe the functions of oncoproteins
• describe the role of cell-cycle control proteins
• list the most important tumor-suppressor genes and describe their role
• distinguish between sporadic and hereditary cancers
• describe the most common types of hereditary cancers

Lecture 33. The Development and Causes of Cancer

• define the process of oncogenesis/carcinogenesis
• describe the stages of cancer development at the cellular level
• distinguish between exogenous and endogenous carcinogens
• list and describe the properties of cancer cells

Lecture 34. The Basics of Clinical Cytology

• define the term clinical cytology
• distinguish the basic cellular elements of cytology
• describe and explain the role of basic cellular components of cytology in cytodiagnosis
• list and describe the basic characteristics of malignancy in cytology
• list and distinguish basic types of cytological staining in clinical cytodiagnosis

Lecture 35. Tools of Molecular Genetics in Medicine I

• define terms: restriction endonucleases, vector, recombinant DNA technology
• explain the principle of gel electrophoresis
• describe the methods of DNA/RNA replication
• list the polymerase chain reaction (PCR) cycles
• compare polymerase chain reaction with real-time polymerase chain reaction
• explain the application of the mentioned molecular methods in medicine and diagnosis of genetic disorders

Lecture 36. Tools of Molecular Genetics in Medicine II

• define the term hybridization probe
• describe the application of Southern-blot, Northern-blot and Western-blot methods
• explain the application of DNA microarray technology
• explain the DNA sequencing method (by Sanger)
• differentiate the application of next-generation sequencing and Sanger sequencing
• explain the application of the mentioned molecular methods in medicine and diagnosis of genetic disorders

Lecture 37. Stem Cells. Regenerative Medicine.

• define the concept of regenerative medicine
• describe the role of stem cells in regenerative medicine
• recognize the role of the integrated concept of personalized medicine in clinical practice

Lecture 38. The Role of Medical Biology in Modern Medicine

• integrate and revise the interdisciplinary nature of biomedical sciences
• identify, judge and argue the importance of horizontal and vertical application of medical biology knowledge and skills in modern evidence-based medical practice

[Seminari] list (with titles and explanation):

Seminar 1. The Basics of Structure and Function of Prokaryotic and Eukaryotic Cells

• explain the differences in the structure of eukaryotic and prokaryotic cells
• recognize parts of prokaryotic and eukaryotic cells on electron microscopy
• explain the differences in the structure of animal and plant cells
• describe the structure and function of cellular structures of prokaryotes and eukaryotes

Seminar 2. Transport of Small Molecules

• explain the differences between passive and active transport
• give examples and the role of passive and active transport in the human body
• define the principles of passive and facilitated diffusion
• explain the differences between types of transport proteins
• explain resting membrane potential and action potential
• describe the differences between active transport driven by ATP hydrolysis and ion gradient

Seminar 3. Cell-Cell Interactions

• classify the types of intercellular interactions and cell adhesion molecules
• classify the types of stable compounds and explain their structure and function
• relate disorders of the normal function of intercellular junctions with consequences for human health

Seminar 4. The Basics of Cell Signaling

• classify and explain the differences between forms of signaling between cells
• give examples of the selected types of signaling molecules in the human body
• relate the selected examples of signaling molecules with the type of signaling via secreted molecules
• explain the action of cell surface receptors and intracellular receptors and relate them with the examples of signaling molecules
• explain the intracellular signal transmission
• describe the selected signaling pathways

Seminar 5. Mitosis in Plant and Animal Cell. Human Chromosomes.

• define the cell cycle, the roles of mitosis and cell cycle checkpoints
• describe and distinguish between the events in interphase and phases of mitosis

• explain the differences in plant and animal cell mitosis
• describe the structure and dynamics of the spindle apparatus
• define karyogram, karyotype and mosaic karyotype
• describe the morphological structure of the metaphase chromosome
• classify and recognize human chromosomes according to the position of the centromere

Seminar 6. Meiosis. Human Gametogenesis.

• define the roles and divisions of meiosis
• describe and distinguish the events in interphase and phases of meiosis
• distinguish the mechanisms of genome rearrangement during meiosis
• describe the process and name the cells and their number of chromosomes during spermatogenesis
• describe the process and name follicles, cells and their number of chromosomes during oogenesis
• compare spermatogenesis and oogenesis

Seminar 7. Evaluation of achieved learning outcomes in the field of cell biology

• recognize, differentiate, define and describe the morphology of individual cell parts
• recognize, differentiate, define and describe the function of individual cell parts
• relate, compare, and integrate the structure of individual cell parts with their function

Seminar 8. The Flow of Genetic Information: DNA Replication, Transcription and RNA Processing

• compare the flow of genetic information in prokaryotes and eukaryotes
• explain the differences between nucleic acids
• recognize and name parts of nucleotides
• recognize and name enzymes in DNA replication according to their function
• describe the process of telomerase action
• explain the structure of the eukaryotic protein-coding gene
• recognize and name the participants of pre-mRNA transcription and processing in eukaryotes

Seminar 9. Noncoding RNA Molecules

• explain the difference between coding and noncoding RNA molecules
• classify noncoding RNA molecules according to roles
• relate selected types of noncoding RNA molecules with their respective roles during replication, transcription, translation and regulation of gene expression
• define the characteristics and mechanism of action of the selected types of noncoding RNA molecules

Seminar 10. The Flow of Genetic Information: Translation, Protein Sorting and Transport

• describe and explain the structure of the mature mRNA molecule
• recognize and name parts of the protein-coding gene essential for the transcription process
• write the sequence of amino acids in the polypeptide chain based on the given genetic code
• describe and distinguish events in the translation process
• compare the translation process in prokaryotes and eukaryotes
• differentiate the pathways of protein synthesis and classification for different cell parts
• recognize and distinguish types of coating molecules in vesicular transport
• list the enzymes that catalyze protein folding
• describe the process of proteolysis on the example of proteolytic processing of insulin

Seminar 11. Human Fertilization

• define the differences between asexual and sexual reproduction
• identify and explain the parts of sperm and secondary oocytes
• relate parts of sperm and secondary oocytes with the corresponding process during fertilization
• list and describe the processes of sperm preparation for fertilization
• compare primary and secondary polyspermy blocks
• list the stages of early embryonic development

Seminar 12. Evaluation of achieved learning outcomes in the field of molecular (functional) biology

• recognize, differentiate, define and describe the basic molecular processes in the cell
• recognize, differentiate, define and describe the flow of genetic information through the cell
• recognize, differentiate, define and describe epigenetic control of gene expression
• relate, compare and integrate the role of molecular processes and their control in the regulation of gene expression

Seminar 13. Monogenic and Polygenic Diseases

• determine genotypes for affected and healthy persons according to the corresponding type of inheritance in four types of monogenic diseases
• recognize the type of causative mutation according to structure and function for the selected examples of monogenic diseases
• relate the impact of the causative mutation on the cellular and clinical consequences of selected monogenic diseases
• recognize and name genetic phenomena in monogenic diseases
• calculate the recurrence risk for four types of monogenic diseases according to the patient's genotype
• list examples of multifactorial diseases

Seminar 14. Types and Mechanisms of Numerical Chromosomal Aberrations

• explain the mechanisms of occurrence of regular and mosaic aneuploidies
• write the karyotype of regular and mosaic aneuploidies

Seminar 15. Types of Structural Chromosomal Aberrations

• explain the mechanisms of intrachromosomal and interchromosomal structural aberrations
• differentiate between balanced and unbalanced intrachromosomal structural aberrations
• write the karyotype of intrachromosomal and interchromosomal structural aberrations
• determine the recurrence risk for the proband and offspring

Seminar 16. Problem Assignments: Mendelian and Non-Mendelian Inheritance, Chromosomal Aberrations

• recognize and distinguish types of inheritance based on pedigree charts
• assess the risk for the phenotypic expression of a particular trait based on the type of inheritance and genotype
• calculate the recurrence risk of multifactorial diseases
• explain and give examples of deviations from Mendel's laws of inheritance

Seminar 17. Evaluation of achieved learning outcomes in the field of developmental biology and genetics

• recognize, differentiate, define and describe the basic mechanisms of developmental biology
• recognize, differentiate, define and describe basic genetic mechanisms, including chromosomal aberrations and non-Mendelian inheritance
• recognize, define and describe the basic (epi)genetic mechanisms in cancer
• relate, compare and integrate the role of (epi)genetic mechanisms in the occurrence of monogenic and polygenic diseases, as well as cancer

[Vježbe] list (with titles and explanation):

Practical 1. The Basics of Light Microscopy. Basic Methods in Slide Preparation. Prokaryotic Cell.

• identify, name and describe the parts of a compound light microscope
• identify the parts of the microscope and their function during microscopy
• define the basic phenomena in light microscopy and their changes on eyepieces of different magnifications (diameter and brightness of the field of view, size and orientation of the image, resolution, working distance)
• use a light microscope independently
• determine the size of objects under the microscope

Practical 2. Eukaryotic Cell

• recognize and explain the differences between plant and animal cells on microscope slides
• recognize and explain the differences between cytology and histology slides
• recognize and distinguish parts of eukaryotic cells on microscope slides
• explain the procedure for the preparation of histology slides
• recognize, differentiate and draw selected microscope slides

Practical 3. Mitosis in Plant and Animal Cells. Human Chromosomes.

• recognize and explain the differences between mitosis in plant and animal cells on microscope slides
• distinguish the phases of mitosis on microscope slides
• classify methods of cytogenetics
• explain the karyotyping of human peripheral blood lymphocytes (GTG method)
• recognize the types of human chromosomes on microscope slides
• recognize, differentiate and draw selected microscope slides

Practical 4. Meiosis. Human Gametogenesis.

• recognize and distinguish different types of cells in spermatogenesis on a cross-section of a human testis • recognize and distinguish different types of follicles on a cross-section of a woman’s ovary
• recognize, differentiate and draw selected microscope slides

Practical 5. Genomic DNA Extraction

• list the indications for DNA extraction in medicine
• list possible samples for DNA extraction
• explain the specific procedure for genomic DNA extraction from peripheral blood
• demonstrate the procedure for genomic DNA extraction from peripheral blood using a protocol

Practical 6. The Relationship Between Chromatin Structure and Transcriptional Activity

• explain the structure of the X and Y chromosomes and the concept of pseudoautosomal regions
• define X-chromosome inactivation as an example of facultative heterochromatin
• distinguish between random and non-random X-chromosome inactivations
• describe the structure of the nucleus and the ratio and distribution of euchromatin and heterochromatin under a light and electron microscope
• recognize and explain the difference between lampbrush and polytene chromosomes on microscope slides
• list the causes of endopolyploidy and relate them with the selected microscope slides
• recognize, differentiate and draw the selected microscope slides

Practical 7. Patterns of Disease Inheritance

• list the reasons for drawing pedigree charts in medicine
• draw a pedigree chart using standardized symbols
• explain the criteria for recognizing different types of inheritance
• recognize the possible types of inheritance in the pedigree chart using the criteria for inheritance
• determine the genotypes for individual persons in the pedigree chart

Practical 8. Aneuploidy and Polyploidy in Clinical Practice

• name the most common clinical features of syndromes caused by aneuploidy
• distinguish between phenotypic features and karyotypes of syndromes caused by aneuploidy
• explain the clinical consequences of polyploidy

Practical 9. Molecular Oncogenesis in Clinical Practice

• explain the morphological differences between normal and malignantly transformed cells on the selected histology microscope slides
• define the algorithm for the preparation of cells for cytology slide analysis
• explain the application and result of Papanicolaou staining
• distinguish between normal and malignantly transformed cells in Pap test results
• recognize, differentiate and draw selected microscope slides

Practical 10. Integration of skills from the practical part of the course: Recognizing Microscope Slides

• recognize and name microscope slides from microscopy practicals

Practical 11. Tools of Molecular Genetics

• explain the steps and application of the polymerase chain reaction in medicine
• explain the use of restriction endonucleases and gel electrophoresis
• create a gel and perform gel electrophoresis independently
• interpret the result of the polymerase chain reaction on the example of hemochromatosis

Practical 12. Evaluation of achieved learning outcomes in practicals

• use a light microscope independently and correctly
• find and recognize the image of the given microscope slide

Student obligations:

The basic student obligations include mandatory attendance of all forms of classes, preparation and active participation in seminars and practicals, solving problems from the Methodical Handbook and taking tests that assess students' knowledge and skills with the aim of meeting the requirements for taking thetaking the final exam. Students are obligated to be informed on time about the course syllabus, i.e. all the relevant information presented in it.

Class attendance

Attendance at lectures, seminars and practicals is mandatory. Attendance at all forms of classes is recorded for each student. All forms of classes start at the exact time specified in the schedule. Students are not allowed to be late for classes or enter/exit the lecture room during classes. If the student is late for class, that will be considered an absence. Students must turn off their mobile phones during classes.

The student can be absent from up to 30% of classes scheduled for practicals, seminars and lectures solely due to health reasons, which is justified by a medical certificate (doctor's note). If there is a possibility within the same week of classes, the student should make up for absences from seminars and practicals in one of the parallel groups (in agreement with the coordinator of the group).

If the student is unjustifiably absent from more than 30% of classes (13 hours of lectures, 12 hours of seminars, 11 hours of practicals), they cannot continue to attend the course, i.e. they lose the right to take the final exam. In this way, the student obtains 0 ECTS credits and an F grade.

Preparation for seminars and practicals

The student is obligated to look over the material covered in classes according to the plan and program presented in the Methodical Handbook with problem assignments (page 8 of the Methodical Handbook contains basic literature guidelines for reviewing the material covered). Preparation is necessary so that students can be actively involved in problem-oriented learning for which prior knowledge is necessary. The above implies active use of information technology, including active search and use of materials available on the internet and critical assessment of their value.

Active solving of problem assignments from the Methodical Handbook

Coordinators of the seminar and practical groups (along with student demonstrators) will guide students in active problem-solving during classes. The completed Methodical Handbook is the basis of quality reviewing of the material covered and a prerequisite for taking the practical exam. Students are required to submit the completed Methodical Handbook at the 10th practical to the coordinator of the practical group. If the assignments are not fully completed, at the beginning of the 11th practical, the coordinators will explain to the students what was not completed and give them the opportunity to make the requested changes.

Assessment of knowledge and skills

Student work will be assessed and evaluated during the course (3 midterm exams and a practical exam) and at the final exam.

Obligation to provide continuous information

All additional teaching materials will be available on the Merlin e-learning platform. All information about the course and student obligations will also be available at the INP application and on the Merlin e-learning platform. Students are obligated to regularly check the mentioned platforms regarding all relevant information or changes made in the INP.

Exam (exam taking, description of the written/oral/practical part of the exam, point distribution, grading criteria):

Evaluation of students is carried out according to the current University of Rijeka Study Regulations and the Ordinance on Student Assessment and Evaluation at the Faculty of Medicine in Rijeka (adopted by the Faculty Council of the Faculty of Medicine in Rijeka). Students are evaluated according to the ECTS (%/A-F) and numerical grading system (1–5).

Student work is assessed and evaluated during the course and on the final exam. Out of a total of 100 grade points, the student can obtain 70 points during classes and 30 points on the final exam.

Overview of assessment of students' work during the course with the corresponding distribution of grade points:

Assessment during the course	Grade points
First midterm exam (Cell Biology)	12-24
Second midtermexam (Molecular Biology)	12-24
Third midtermexam (Developmental Biologyand Genetics)	11-22
Practical exam	+ / -
Finalexam	
Written finalexam	7-14
Oral finalexam	8-16

I. Assessment during the course (maximum of 70 grade points):

Midterm exams

During the course, the acquired knowledge from the theoretical part of classes (lectures, seminars and practicals) will be assessed with mandatory written midterm exams (Midterm exams I, II and III). At each midterm exam, the student must have a minimum of 50% of correct answers to meet the criteria for obtaining grade points.

Midterm exams I and II contain 40 questions and are worth 24 grade points (range 12–24 grade points, if the student solved ≥50% of the test). Midterm exam III has 40 questions and is worth 22 grade points (range 11–22 grade points, if the student solved ≥50% of the test). Passed midterm exams are not transferable, i.e. they are valid only for the current academic year. The duration of writing each midterm exam is 45 minutes.

Overview of course content by types and weeks of classes included in individual midterm exams:

Written test	L	S	P	Week	Questions	Grade points
Midterm examI	2–12	1–6	1–4	1–5	40	12-24
Midterm examII	13–24	8–10	5, 6	5–8	40	12-24
Midterm examIII	25–38	11–16	7–11	9–14	40	11-22

The points obtained on midterm exams are converted into grade points as follows:

Correct answers on midterm exams	Midterm exam I	Midterm exam II	Midterm exam III
0-19	0	0	0

20	12	12	11
21	13	13	11
22	14	14	12
23	15	15	13
24	16	16	14
25	17	17	15
26-27	18	18	16
28-29	19	19	17
30-31	20	20	18
32-33	21	21	19
34-35	22	22	20
36-37	23	23	21
38-40	24	24	22

Midterm exam dates:

Midterm exam I: April 11, 2025

Midterm exam II: May 2, 2025

Midterm exam III: June 13, 2025

Midterm exam retakes

Midterm exams can be retaken by students who did not successfully solve (threshold: ≥50% of correct answers) one or more midterm exams (I or II or III) or those who were justifiably absent during midterm exams (e.g. due to illness, with medical certificate).

Also, students who are not satisfied with the positive grade obtained on one or more midterm exams (I or II or III) can retake a midterm exam, and the final grade taken into account is the one the student receives on the retaken midterm exam.

Each midterm exam can be retaken only once after regular classes are finished. There are three dates offered, one for each midterm exam retake.

Midterm exam retakes are registered in person at the Department’s office by June 14, 2024.

Midterm exam III retake – June 16, 2025

Midterm exam II retake – June 18, 2025

Midterm exam I retake – June 20, 2025

Practical exam

During the course, the achieved learning outcomes from the practical part of the course will be assessed by taking a mandatory practical exam.

The prerequisite for taking the practical exam is the properly completed Methodical Handbook.

The practical exam will test the knowledge and skills of microscopy, including:

1. finding an image of one slide with the required objective

2. identifying two slides on two separate microscopes (the image will already be set)

Identification of the slides implies naming of the slide, where it is important that students name the slide exactly as written in the Handbook and on the list of slides (e.g. not “female ovary” but “transverse section of the female ovary, H&E staining”).

3. the student does not get a numerical grade, but a descriptive grade “knows/doesn’t know”.

Students who do not pass the practical exam within the stipulated time will have the opportunity to retake the practical exam in agreement with the course coordinator, considering that the passed practical exam in microscopy is a prerequisite for taking the final exam.

Practical exam dates:

on the 12th practical for each practical group (15th week of classes, from June 09 to June 13, 2025)

I. Final exam

The final exam consists of a mandatory written and oral exam. To pass the final exam and get the final grade, the student must have both parts of the final exam graded positively (threshold: ≥50% of correct answers). In this way, the student can obtain additional 15–30 grade points, which are added to the previously obtained grade points during classes.

The written exam is composed of 30 questions and is worth 14 grade points (range 7–14 grade points, if the student solved ≥50% of the test). The duration of writing the final exam is 35 minutes. A passed written final exam is a prerequisite for taking the oral final exam.

The points obtained on the written exam are converted into grade points as follows:

Points obtained on the exam (15–30)	Grade points (7–14)
0-14	0
15–16	7
17–18	8
19–20	9
21–22	10
23–24	11
25–26	12
27–28	13
29–30	14

The oral final exam is considered passed if the student obtains a minimum of 8 grade points (the equivalent of the grade sufficient, i.e. if the answer meets the minimum criteria), up to a maximum of 16 grade points (the equivalent of the grade excellent).

Success on the oral final exam is converted into grade points as follows:

Grade	Gradepoints
the answer meets the minimum criteria	8
average answer	9–11
very goodanswer	12–14
excellent answer	15–16

In this way, the student obtains a final positive grade on the final exam (in the range of 15–30 grade points), which are added to the points obtained during classes (35–70).

If the student does not pass the written final exam, they can retake it after 15 days at the earliest.

The passed written final exam does not have to be retaken in the current academic year.

Who can take the final exam:

Students who obtained ≥35 grade points during classes and who have less than 30% of justifiable absences from classes (absences from less than 13 hours of lectures or 12 hours of seminars or 11 hours of practicals). Only those students who have fulfilled the specified requirements before the Midterm retakes can take the 1st exam period.

Who cannot take the final exam:

Students who obtained less than 35 grade points even after retaking the midterm exam or who have more than 30% of justifiable absences from classes (absences from more than 13 hours of lectures or 12 hours of seminars or 11 hours of practicals).

Such a student is unsuccessful (1) / F and cannot take the final exam, i.e. they must re-enroll the course in the following academic year. Passed midterm exams and the written final exam are not transferable, i.e. they are valid only for the current academic year.

I. Final grade

Final grade is the sum of grade points obtained during classes and on the final exam.

Grading in the ECTS system is based on final success and is converted into the numerical grading system as follows:

% of obtained grade points	ECTS grade	Numerical grade
90–100	A	excellent (5)
75–89.9	B	very good (4)
60–74.9	C	good (3)
50–59.9	D	sufficient (2)
0–49.9	F	insufficient (1)

The overall grade from the course is obtained according to the type of grade converted as follows:

Type of activity	ECTS workload	Learning outcomes	Specific student activity	Assessment method	Grade points (maximum)
continuous assessment	7.0	1st domain	written midterm exams I, II and III	points are converted into grade points	70 (24+24+22)
		2nd domain	practical exam	+ / -	-
final exam	3.0	1st and 3rd domain	written and oral part	points are converted into grade points	30 (14+16)
total	10.0				100

Other notes (related to the course) important for students:

Academic integrity
The teachers are obligated to respect the University of Rijeka Code of Ethics, and the students are obligated to respect the University of Rijeka Code of Ethics for Students.

Availability of teaching content
All course materials are available on the Merlin e-learning platform.

Contacting teachers
Teachers are available every day during working hours via their e-mail addresses (available on the website of the Faculty of Medicine, University of Rijeka) for all questions regarding the course. Individual or group consultations are possible online via the MS Teams digital platform or onsite at the Faculty of Medicine.

COURSE HOURS 2023/2024

Medical Biology

[Predavanja] (Place and time or group)	**[Vježbe]** (Place and time or group)	**[Seminari]** (Place and time or group)
04.03.2024		

Lecture 1. Cell and Molecular Biology in Medicine; Plan and Literature:
• [P01] (08:15 - 09:00) [330]
  ○ MB_370
 	
Lecture 2. Introduction to Cell Biology: Cell Origin and Evolution:
• [P01] (09:15 - 10:00) [150]
  ○ MB_370		

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · prof. dr. sc. Ostojić Saša, dr. med. [150]		
05.03.2024		

Lecture 3. Tools of Cell Biology:
• [P01] (08:15 - 09:00) [328]
  ○ MB_370
	Practical 1. The Basics of Light Microscopy. Basic Methods in Slide Preparation. Prokaryotic Cell.:
	• [Katedra za medicinsku biologiju i genetiku - Praktikum] (14:00 - 16:15) [332]
	  ○ MB PG I
		Seminar 1. The Basics of Structure and Function of Prokaryotic and Eukaryotic Cells:
		• [P05] (09:15 - 10:45) [328]
		  ○ MB SGI
		• [P07] (09:15 - 10:45) [330]
		  ○ MB SG II

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · dr.sc. Mladenić Tea, mag. biotech. in med. [332] · izv. prof. dr. sc. Pereza Nina, dr. med. [328]		
07.03.2024		
	Practical 1. The Basics of Light Microscopy. Basic Methods in Slide Preparation. Prokaryotic Cell.: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [330] ○ MB PG III	
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
08.03.2024		
	Practical 1. The Basics of Light Microscopy. Basic Methods in Slide Preparation. Prokaryotic Cell.: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [332] ○ MB PG II	
dr.sc. Mladenić Tea, mag. biotech. in med. [332]		
11.03.2024		

Lecture 4. Structure of the Plasma Membrane: • [P01] (08:15 - 09:00) [307] ◦ MB_370 Lecture 5. Transport of Macromolecules: Endocytosis and Exocytosis: • [P01] (09:15 - 10:00) [307] ◦ MB_370		
prof. dr. sc. Buretić-Tomljanović Alena, dipl. inž. [307]		
12.03.2024		
Lecture 6. Bioenergetics and Metabolism: The Role of Mitochondria and Peroxisomes: • [P01] (08:15 - 09:00) [150] ◦ MB_370	Practical 2. Eukaryotic Cell: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (14:00 - 16:15) [332] ◦ MB PG I	Seminar 2. Transport of Small Molecules: • [P07] (09:15 - 10:45) [328] ◦ MB SGI • [P08] (09:15 - 10:45) [330] ◦ MB SG II
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · dr.sc. Mladenić Tea, mag. biotech. in med. [332] · prof. dr. sc. Ostojić Saša, dr. med. [150] · izv. prof. dr. sc. Pereza Nina, dr. med. [328]		
14.03.2024		
	Practical 2. Eukaryotic Cell: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [330] ◦ MB PG III	
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
15.03.2024		
	Practical 2. Eukaryotic Cell: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [332] ◦ MB PG II	
dr.sc. Mladenić Tea, mag. biotech. in med. [332]		
18.03.2024		
Lecture 7. Cytoskeleton and Cell Movement: • [P01] (08:15 - 09:00) [330] ◦ MB_370 Lecture 8. The Extracellular Matrix: • [P01] (09:15 - 10:00) [328] ◦ MB_370		
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · izv. prof. dr. sc. Pereza Nina, dr. med. [328]		
19.03.2024		
Lecture 9. The Structure and Function of Nucleus and Nucleolus: • [P01] (08:15 - 09:00) [307] ◦ MB_370		Seminar 3. Cell-Cell Interactions: • [P08] (09:15 - 10:45) [330] ◦ MB SGI • [P07] (09:15 - 10:45) [326] ◦ MB SG II
prof. dr. sc. Buretić-Tomljanović Alena, dipl. inž. [307] · izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · izv. prof. dr. sc. Vraneković Jadranka, mag. educ. biol. et chem. [326]		

21.03.2024		

		Seminar 4. The Basics of Cell Signaling:
		• [P08] (11:00 - 13:15) [332]
		  ◦ MB PG I
		• [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [330]
		  ◦ MB PG III

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · dr.sc. Mladenić Tea, mag. biotech. in med. [332]		
22.03.2024		
		Seminar 4. The Basics of Cell Signaling: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [330] ◦ MB PG II
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
25.03.2024		

Lecture 10. The Organization and Condensation of Chromatin:
• [P08] (08:15 - 09:00) [330]
  ◦ MB_370
 	
Lecture 11. Regulation of the Eukaryotic Cell Cycle:
• [P08] (09:15 - 10:00) [150]
  ◦ MB_370		

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · prof. dr. sc. Ostojić Saša, dr. med. [150]		
26.03.2024		

Lecture 11. Regulation of the Eukaryotic Cell Cycle:
• [P01] (08:15 - 09:00) [150]
  ◦ MB_370
	Practical 3. Mitosis in Plant and Animal Cells. Human Chromosomes.:
	• [Katedra za medicinsku biologiju i genetiku - Praktikum] (14:00 - 16:15) [326]
	  ◦ MB PG I
		Seminar 5. Mitosis in Plant and Animal Cell. Human Chromosomes.:
		• [P07] (09:15 - 10:45) [326]
		  ◦ MB SGI
		• [P08] (09:15 - 10:45) [317]
		  ◦ MB SG II

prof. dr. sc. Ostojić Saša, dr. med. [150] · prof. dr. sc. Starčević Čizmarević Nada, dipl. ing. [317] · izv. prof. dr. sc. Vraneković Jadranka, mag. educ. biol. et chem. [326]		
28.03.2024		
	Practical 3. Mitosis in Plant and Animal Cells. Human Chromosomes.: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [317] ◦ MB PG III	
prof. dr. sc. Starčević Čizmarević Nada, dipl. ing. [317]		
29.03.2024		

	Practical 3. Mitosis in Plant and Animal Cells. Human Chromosomes.: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (10:45 - 13:15) [332] ◦ MB PG II	
dr.sc. Mladenić Tea, mag. biotech. in med. [332]		
02.04.2024		
Lecture 12. Programmed Cell Death: • [P01] (08:15 - 09:00) [330] ◦ MB_370 Lecture 13. The Structure and Function of Nucleic Acids: • [P01] (09:15 - 10:00) [150] ◦ MB_370 Lecture 14. Genome Organization in Prokaryotes and Eukaryotes. The Human Genome.: • [P01] (10:15 - 11:00) [150] ◦ MB_370	Practical 4. Meiosis. Human Gametogenesis.: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (14:00 - 16:15) [332] ◦ MB PG I	
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · dr.sc. Mladenić Tea, mag. biotech. in med. [332] · prof. dr. sc. Ostojić Saša, dr. med. [150]		
04.04.2024		
	Practical 4. Meiosis. Human Gametogenesis.: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [330] ◦ MB PG III	Seminar 6. Meiosis. Human Gametogenesis.: • [P08] (08:15 - 09:45) [317] ◦ MB SG II • [P08] (11:15 - 12:45) [326] ◦ MB SGI
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · prof. dr. sc. Starčević Čizmarević Nada, dipl. ing. [317] · izv. prof. dr. sc. Vraneković Jadranka, mag. educ. biol. et chem. [326]		
05.04.2024		
	Practical 4. Meiosis. Human Gametogenesis.: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [2299] ◦ MB PG II	
doc. dr. sc. Saftić Martinović Lara, mag. pharm. inv. [2299]		
08.04.2024		
Lecture 15. The Structure of Eukaryotic Genes: • [P01] (08:15 - 09:00) [307] ◦ MB_370 Lecture 16. Human Genome Variation: • [P01] (09:15 - 10:00) [307] ◦ MB_370		
prof. dr. sc. Buretić-Tomljanović Alena, dipl. inž. [307]		

09.04.2024		

Lecture 17. DNA Replication:
• [P01] (10:15 - 11:00) [150]
  ◦ MB_370
	Practical 5. Genomic DNA Extraction:
	• [Katedra za medicinsku biologiju i genetiku - Praktikum] (14:00 - 16:15) [317]
	  ◦ MB PG I	

prof. dr. sc. Ostojić Saša, dr. med. [150] · prof. dr. sc. Starčević Čizmarević Nada, dipl. ing. [317]		
11.04.2024		
	Practical 5. Genomic DNA Extraction: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [317] ◦ MB PG III	
prof. dr. sc. Starčević Čizmarević Nada, dipl. ing. [317]		
12.04.2024		

	Practical 5. Genomic DNA Extraction:
	• [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [317]
	  ◦ MB PG II
		Seminar 7. Evaluation of achieved learning outcomes in the field of cell biology:
		• [P01] (10:15 - 12:30) [330]
		  ◦ MB_370

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · prof. dr. sc. Starčević Čizmarević Nada, dipl. ing. [317]		
15.04.2024		

Lecture 18. Transcription. RNA Processing.:
• [P08] (08:15 - 09:00) [330]
  ◦ MB_370
 	
Lecture 19. Regulation of Transcription:
• [P08] (09:15 - 10:00) [330]
  ◦ MB_370		

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
16.04.2024		

Lecture 20. Translation:
• [P01] (08:15 - 09:00) [317]
  ◦ MB_370
	Practical 6. The Relationship Between Chromatin Structure and Transcriptional Activity:
	• [Katedra za medicinsku biologiju i genetiku - Praktikum] (14:00 - 16:15) [332]
	  ◦ MB PG I
		Seminar 8. The Flow of Genetic Information: DNA Replication, Transcription and RNA Processing:
		• [P07] (09:15 - 10:45) [317]
		  ◦ MB SGI
		• [P08] (09:15 - 10:45) [330]
		  ◦ MB SG II

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · dr.sc. Mladenić Tea, mag. biotech. in med. [332] · prof. dr. sc. Starčević Čizmarević Nada, dipl. ing. [317]		
18.04.2024		

	Practical 6. The Relationship Between Chromatin Structure and Transcriptional Activity: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [330] ◦ MB PG III	
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
19.04.2024		
	Practical 6. The Relationship Between Chromatin Structure and Transcriptional Activity: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [2299] ◦ MB PG II	
doc. dr. sc. Saftić Martinović Lara, mag. pharm. inv. [2299]		
22.04.2024		
Lecture 21. Posttranslational Modifications, Protein Sorting and Transport (The Endoplasmic Reticulum, Golgi Apparatus and Vesicular Transport): • [P01] (08:15 - 10:00) [317] ◦ MB_370		
prof. dr. sc. Starčević Čizmarević Nada, dipl. ing. [317]		
23.04.2024		

Lecture 22. Regulation of Protein Function. Protein Degradation: The Ubiquitin-Proteasome Pathway and Lysosomal Proteolysis):
• [P01] (10:00 - 10:45) [330]
  ◦ MB_370
		Seminar 9. Noncoding RNA Molecules:
		• [P01] (08:15 - 09:45) [330]
		  ◦ MB SGI
		• [P07] (08:15 - 09:45) [328]
		  ◦ MB SG II

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · izv. prof. dr. sc. Pereza Nina, dr. med. [328]		
25.04.2024		

Lecture 23. The Basics of Epigenetics I: Epigenetic Modifications:
• [P01] (13:15 - 14:00) [328]
  ◦ MB_370
 	
Lecture 24. The Basics of Epigenetics II: Genomic Imprinting:
• [P01] (14:15 - 15:00) [328]
  ◦ MB_370
		Seminar 10. The Flow of Genetic Information: Translation, Protein Sorting and Transport:
		• [P08] (11:00 - 13:15) [326]
		  ◦ MB PG I

izv. prof. dr. sc. Pereza Nina, dr. med. [328] · izv. prof. dr. sc. Vraneković Jadranka, mag. educ. biol. et chem. [326]		
26.04.2024		

		Seminar 10. The Flow of Genetic Information: Translation, Protein Sorting and Transport:
		• [P08] (08:15 - 10:30) [332]
		  ◦ MB PG III
		• [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [317]
		  ◦ MB PG II

dr.sc. Mladenić Tea, mag. biotech. in med. [332] · prof. dr. sc. Starčević Čizmarević Nada, dipl. ing. [317]		
29.04.2024		

Lecture 26. Gene Mutations:
• [P01] (08:15 - 09:00) [328]
  ◦ MB_370
 	
Lecture 27. DNA Repair:
• [P01] (09:15 - 10:00) [328]
  ◦ MB_370		

izv. prof. dr. sc. Pereza Nina, dr. med. [328]		
30.04.2024		

Lecture 25. Assisted Reproduction Technology Techniques:
• [P01] (08:15 - 09:00) [330]
  ◦ MB_370
		Seminar 11. Human Fertilization:
		• [P07] (09:15 - 10:45) [332]
		  ◦ MB SGI
		• [P06] (09:15 - 10:45) [330]
		  ◦ MB SG II

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · dr.sc. Mladenić Tea, mag. biotech. in med. [332]		
03.05.2024		
		Seminar 12. Evaluation of achieved learning outcomes in the field of molecular (functional) biology: • [P01] (13:15 - 15:30) [330] ◦ MB_370
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
06.05.2024		

Lecture 28. The Basics of Mendelian Genetics:
• [P08] (08:15 - 09:00) [330]
  ◦ MB_370
 	
Lecture 29. The Basics of Non-Mendelian Inheritance:
• [P08] (09:15 - 10:00) [330]
  ◦ MB_370		

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
07.05.2024		

Lecture 30. Population Genetics:
• [P08] (08:15 - 09:00) [330]
  ◦ MB_370
	Practical 7. Patterns of Disease Inheritance:
	• [Katedra za medicinsku biologiju i genetiku - Praktikum] (14:00 - 16:15) [2299]
	  ◦ MB PG I
		Seminar 13. Monogenic and Polygenic Diseases:
		• [P07] (09:15 - 10:45) [328]
		  ◦ MB SGI
		• [P08] (09:15 - 10:45) [2299]
		  ◦ MB SG II

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · izv. prof. dr. sc. Pereza Nina, dr. med. [328] · doc. dr. sc. Saftić Martinović Lara, mag. pharm. inv. [2299]		
09.05.2024		
	Practical 7. Patterns of Disease Inheritance: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [330] ◦ MB PG III	
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
10.05.2024		
	Practical 7. Patterns of Disease Inheritance: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [332] ◦ MB PG II	
dr.sc. Mladenić Tea, mag. biotech. in med. [332]		
13.05.2024		
Lecture 31. The Basics of Chromosomal Abnormalities. Cytogenetic Methods.: • [P01] (08:15 - 10:00) [326] ◦ MB_370		
izv. prof. dr. sc. Vraneković Jadranka, mag. educ. biol. et chem. [326]		
14.05.2024		
	Practical 8. Aneuploidy and Polyploidy in Clinical Practice: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (14:00 - 16:15) [2299] ◦ MB PG I	Seminar 14. Types and Mechanisms of Numerical Chromosomal Aberrations: • [P07] (09:15 - 10:45) [326] ◦ MB SGI • [P08] (09:15 - 10:45) [332] ◦ MB SG II
dr.sc. Mladenić Tea, mag. biotech. in med. [332] · doc. dr. sc. Saftić Martinović Lara, mag. pharm. inv. [2299] · izv. prof. dr. sc. Vraneković Jadranka, mag. educ. biol. et chem. [326]		
16.05.2024		
	Practical 8. Aneuploidy and Polyploidy in Clinical Practice: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [2299] ◦ MB PG III	
doc. dr. sc. Saftić Martinović Lara, mag. pharm. inv. [2299]		
17.05.2024		

	Practical 8. Aneuploidy and Polyploidy in Clinical Practice: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [332] ◦ MB PG II	
dr.sc. Mladenić Tea, mag. biotech. in med. [332]		
20.05.2024		

Lecture 32. Abnormal Cell Cycle in Malignancy:
• [P01] (08:15 - 09:00) [150]
  ◦ MB_370
 	
Lecture 33. The Development and Causes of Cancer:
• [P01] (09:15 - 10:00) [307]
  ◦ MB_370		

prof. dr. sc. Buretić-Tomljanović Alena, dipl. inž. [307] · prof. dr. sc. Ostojić Saša, dr. med. [150]		
21.05.2024		

Lecture 33. The Development and Causes of Cancer:
• [P01] (08:15 - 09:00) [307]
  ◦ MB_370
		Seminar 15. Types of Structural Chromosomal Aberrations:
		• [P07] (09:15 - 10:45) [326]
		  ◦ MB SGI
		• [P08] (09:15 - 10:45) [328]
		  ◦ MB SG II
		
		Seminar 16. Problem Assignments: Mendelian and Non-Mendelian Inheritance, Chromosomal Aberrations:
		• [P08] (14:00 - 16:15) [328]
		  ◦ MB PG I

prof. dr. sc. Buretić-Tomljanović Alena, dipl. inž. [307] · izv. prof. dr. sc. Pereza Nina, dr. med. [328] · izv. prof. dr. sc. Vraneković Jadranka, mag. educ. biol. et chem. [326]		
23.05.2024		
		Seminar 16. Problem Assignments: Mendelian and Non-Mendelian Inheritance, Chromosomal Aberrations: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [330] ◦ MB PG III
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
24.05.2024		
		Seminar 16. Problem Assignments: Mendelian and Non-Mendelian Inheritance, Chromosomal Aberrations: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [330] ◦ MB PG II

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
27.05.2024		
Lecture 34. The Basics of Clinical Cytology: • [P01] (09:15 - 10:00) [330] ○ MB_370		
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
28.05.2024		

	Practical 9. Molecular Oncogenesis in Clinical Practice:
	• [Katedra za medicinsku biologiju i genetiku - Praktikum] (08:15 - 10:30) [332]
	  ○ MB PG I
	• [Katedra za medicinsku biologiju i genetiku - Praktikum] (10:30 - 12:45) [330]
	  ○ MB PG III	

izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · dr.sc. Mladenić Tea, mag. biotech. in med. [332]		
31.05.2024		
	Practical 9. Molecular Oncogenesis in Clinical Practice: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [2299] ○ MB PG II	
doc. dr. sc. Saftić Martinović Lara, mag. pharm. inv. [2299]		
03.06.2024		

Lecture 35. Tools of Molecular Genetics in Medicine I:
• [P01] (08:15 - 09:00) [317]
  ○ MB_370
 	
Lecture 36. Tools of Molecular Genetics in Medicine II:
• [P01] (09:15 - 10:00) [317]
  ○ MB_370		

prof. dr. sc. Starčević Čizmarević Nada, dipl. ing. [317]		
04.06.2024		
	Practical 11. Tools of Molecular Genetics: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (14:00 - 16:15) [317] ○ MB PG I	
prof. dr. sc. Starčević Čizmarević Nada, dipl. ing. [317]		
06.06.2024		

	Practical 11. Tools of Molecular Genetics: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [330] ◦ MB PG III	
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
07.06.2024		
	Practical 10. Integration of skills from the practical part of the course: Recognizing Microscope Slides: • [P01] (10:15 - 12:30) [330] [332] [2299] ◦ MB PG I ◦ MB PG II ◦ MB PG III Practical 11. Tools of Molecular Genetics: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [332] ◦ MB PG II	
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · dr.sc. Mladenić Tea, mag. biotech. in med. [332] · doc. dr. sc. Saftić Martinović Lara, mag. pharm. inv. [2299]		
10.06.2024		
Lecture 37. Stem Cells. Regenerative Medicine.: • [ONLINE] (12:15 - 14:00) [311] [330] ◦ MB_370		
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · prof. dr. sc. Primorac Dragan, dr. med. [311]		
11.06.2024		
Lecture 38. The Role of Medical Biology in Modern Medicine: • [P01] (08:15 - 10:00) [150] [330] ◦ MB_370	Practical 12. Evaluation of achieved learning outcomes in practicals: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (10:15 - 12:30) [330] ◦ MB PG I	
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · prof. dr. sc. Ostojić Saša, dr. med. [150]		
13.06.2024		
	Practical 12. Evaluation of achieved learning outcomes in practicals: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [330] ◦ MB PG III	
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330]		
14.06.2024		

	Practical 12. Evaluation of achieved learning outcomes in practicals: • [Katedra za medicinsku biologiju i genetiku - Praktikum] (13:15 - 15:30) [332] ○ MB PG II	Seminar 17. Evaluation of achieved learning outcomes in the field of developmental biology and genetics: • [P01] (10:15 - 12:30) [330] ○ MB_370
izv. prof. dr. sc. Dević Pavlić Sanja, dipl. sanit. ing. [330] · dr.sc. Mladenić Tea, mag. biotech. in med. [332]		

List of lectures, seminars and practicals:

[PREDAVANJA] (TOPIC)	Number of hours	Location
Lecture 1. Cell and Molecular Biology in Medicine; Plan and Literature	1	[P01]
Lecture 2. Introduction to Cell Biology: Cell Origin and Evolution	1	[P01]
Lecture 3. Tools of Cell Biology	1	[P01]
Lecture 4. Structure of the Plasma Membrane	1	[P01]
Lecture 5. Transport of Macromolecules: Endocytosis and Exocytosis	1	[P01]
Lecture 6. Bioenergetics and Metabolism: The Role of Mitochondria and Peroxisomes	1	[P01]
Lecture 7. Cytoskeleton and Cell Movement	1	[P01]
Lecture 8. The Extracellular Matrix	1	[P01]
Lecture 9. The Structure and Function of Nucleus and Nucleolus	1	[P01]
Lecture 10. The Organization and Condensation of Chromatin	1	[P08]
Lecture 11. Regulation of the Eukaryotic Cell Cycle	2	[P01] [P08]
Lecture 12. Programmed Cell Death	1	[P01]
Lecture 13. The Structure and Function of Nucleic Acids	1	[P01]
Lecture 14. Genome Organization in Prokaryotes and Eukaryotes. The Human Genome.	1	[P01]
Lecture 15. The Structure of Eukaryotic Genes	1	[P01]
Lecture 16. Human Genome Variation	1	[P01]
Lecture 17. DNA Replication	1	[P01]
Lecture 18. Transcription. RNA Processing.	1	[P08]
Lecture 19. Regulation of Transcription	1	[P08]
Lecture 20. Translation	1	[P01]
Lecture 21. Posttranslational Modifications, Protein Sorting and Transport (The Endoplasmic Reticulum, Golgi Apparatus and Vesicular Transport)	2	[P01]
Lecture 22. Regulation of Protein Function. Protein Degradation: The Ubiquitin-Proteasome Pathway and Lysosomal Proteolysis)	1	[P01]
Lecture 23. The Basics of Epigenetics I: Epigenetic Modifications	1	[P01]
Lecture 24. The Basics of Epigenetics II: Genomic Imprinting	1	[P01]
Lecture 25. Assisted Reproduction Technology Techniques	1	[P01]
Lecture 26. Gene Mutations	1	[P01]
Lecture 27. DNA Repair	1	[P01]

Lecture 28. The Basics of Mendelian Genetics	1	[P08]
Lecture 29. The Basics of Non-Mendelian Inheritance	1	[P08]
Lecture 30. Population Genetics	1	[P08]
Lecture 31. The Basics of Chromosomal Abnormalities. Cytogenetic Methods.	2	[P01]
Lecture 32. Abnormal Cell Cycle in Malignancy	2	[P01]
Lecture 33. The Development and Causes of Cancer	1	[P01]
Lecture 34. The Basics of Clinical Cytology	1	[P01]
Lecture 35. Tools of Molecular Genetics in Medicine I	1	[P01]
Lecture 36. Tools of Molecular Genetics in Medicine II	1	[P01]
Lecture 37. Stem Cells. Regenerative Medicine.	2	[ONLINE]
Lecture 38. The Role of Medical Biology in Modern Medicine	2	[P01]

[VJEŽBE] (TOPIC)	Number of hours	Location
Practical 1. The Basics of Light Microscopy. Basic Methods in Slide Preparation. Prokaryotic Cell.	3	[Katedra za medicinsku biologiju i genetiku - Praktikum]
Practical 2. Eukaryotic Cell	3	[Katedra za medicinsku biologiju i genetiku - Praktikum]
Practical 3. Mitosis in Plant and Animal Cells. Human Chromosomes.	3	[Katedra za medicinsku biologiju i genetiku - Praktikum]
Practical 4. Meiosis. Human Gametogenesis.	3	[Katedra za medicinsku biologiju i genetiku - Praktikum]
Practical 5. Genomic DNA Extraction	3	[Katedra za medicinsku biologiju i genetiku - Praktikum]
Practical 6. The Relationship Between Chromatin Structure and Transcriptional Activity	3	[Katedra za medicinsku biologiju i genetiku - Praktikum]
Practical 7. Patterns of Disease Inheritance	3	[Katedra za medicinsku biologiju i genetiku - Praktikum]
Practical 8. Aneuploidy and Polyploidy in Clinical Practice	3	[Katedra za medicinsku biologiju i genetiku - Praktikum]
Practical 9. Molecular Oncogenesis in Clinical Practice	3	[Katedra za medicinsku biologiju i genetiku - Praktikum]
Practical 10. Integration of skills from the practical part of the course: Recognizing Microscope Slides	3	[P01]
Practical 11. Tools of Molecular Genetics	3	[Katedra za medicinsku biologiju i genetiku - Praktikum]
Practical 12. Evaluation of achieved learning outcomes in practicals	3	[Katedra za medicinsku biologiju i genetiku - Praktikum]

[SEMINARI] (TOPIC)	Number of hours	Location
Seminar 1. The Basics of Structure and Function of Prokaryotic and Eukaryotic Cells	2	[P05] [P07]
Seminar 2. Transport of Small Molecules	2	[P07] [P08]

Seminar 3. Cell-Cell Interactions	2	[P07] [P08]
Seminar 4. The Basics of Cell Signaling	3	[Katedra za medicinsku biologiju i genetiku - Praktikum] [P08]
Seminar 5. Mitosis in Plant and Animal Cell. Human Chromosomes.	2	[P07] [P08]
Seminar 6. Meiosis. Human Gametogenesis.	2	[P08]
Seminar 7. Evaluation of achieved learning outcomes in the field of cell biology	3	[P01]
Seminar 8. The Flow of Genetic Information: DNA Replication, Transcription and RNA Processing	2	[P07] [P08]
Seminar 9. Noncoding RNA Molecules	2	[P01] [P07]
Seminar 10. The Flow of Genetic Information: Translation, Protein Sorting and Transport	2	[Katedra za medicinsku biologiju i genetiku - Praktikum] [P08]
Seminar 11. Human Fertilization	2	[P06] [P07]
Seminar 12. Evaluation of achieved learning outcomes in the field of molecular (functional) biology	3	[P01]
Seminar 13. Monogenic and Polygenic Diseases	2	[P07] [P08]
Seminar 14. Types and Mechanisms of Numerical Chromosomal Aberrations	2	[P07] [P08]
Seminar 15. Types of Structural Chromosomal Aberrations	3	[P07] [P08]
Seminar 16. Problem Assignments: Mendelian and Non-Mendelian Inheritance, Chromosomal Aberrations	3	[Katedra za medicinsku biologiju i genetiku - Praktikum] [P08]
Seminar 17. Evaluation of achieved learning outcomes in the field of developmental biology and genetics	3	[P01]

EXAM DATES (final exam):

1.	19.06.2024.
2.	03.07.2024.
3.	17.07.2024.
4.	05.09.2024.
5.	19.09.2024.