University of Split  
School of Medicine  
Department of Medical Biology  
Program: lectures (L=34 h), seminars (S=34 h) and practical courses (P=32 h).

1. CELL BIOLOGY AND MEDICINE.  
S - Cell research methods.  
   Slides:  
   1. arrow  
   2. cork cells  
   3. frog blood cells

2. THE NUCLEUS.  
L - The nucleus (structure and organisation)  
S - Nuclear transport. Nucleolus.  
P - Nucleus in prokaryotes and eukaryotes. Cell size measurement (M).  
   Slides:  
   1. Prokaryotes: different types of bacteria  
   2. Eukaryotes: human tongue squamous cells  
   3. Cellular fragmentation and centrifugation: animal liver cells

3. MEMBRANE – STRUCTURE AND TRANSPORT.  
S - Plasma membrane transport principles.  
P - Human erythrocyte membrane isolation and biochemical analysis (M).  
   Slides:  
   1. Human erythrocytes in physiological solution  
   2. Human erythrocytes in hypotonic solution: „white ghosts“  
   3. Human erythrocyte membrane: protein and lipid detection  
   4. Human hemoglobin crystals

4. BIOENERGETICS. PROTEIN SORTING AND TRANSPORT I.  
L - Mitochondria, Chloroplasts and Peroxisomes.  
S - Endoplasmic reticulum.  
P - Membrane - transport. Mitochondria (M).  
   Slides:  
   1. Human erythrocytes in hypo-, iso- and hypertonic NaCl solution  
   2. Onion cells: plasmolysis and deplasmolysis  
   3. Rat liver cells mitochondria

5. CYTOSKELETON AND CELL MOVEMENT. PROTEIN SORTING AND TRANSPORT II.  
L - Cytoskeleton and cell movement.  
S - Golgi apparatus and lysosomes (+ Gaucher disease).
P - Muscle cells (M)
   Slides:
   1. Skeletal muscle
   2. Smooth muscle
   3. Cardiac muscle

6. NUCLEIC ACIDS - DNA.
   L - Deoxyribonucleic acid - DNA.
   S - DNA structure and replication.
   P - DNA isolation. (M)

7. NUCLEIC ACIDS - RNA.
   L - Ribonucleic acid - RNA. Transcription in eukaryotes and prokaryotes.
   S - Regulation of transcription in prokaryotes and eukaryotes.
   P - Methods of DNA analysis. DNA electrophoresis. (M).

8. DNA - RNA - PROTEINS.
   L - From DNA to proteins. Genetic code. Translation.
   S - Chromosome structure. mRNA processing.
   P - Chromosomes and sex chromatin. (M).
   Slides:
   1. Drosophila melanogaster polytene chromosomes
   2. Amphibian oocyte chromosomes
   3. Human leucocyte chromosomes
   4. Human buccal interphase cell sex chromatin

9. CELL SIGNALING. FERTILIZATION.
   L - Intracellular signal transduction. Apoptosis.
   S - Meiosis, fertilization and early embryonic development. Stem cells.
   P - Gametogenesis, fertilization, and early development (M).
   Slides:
   1. Rat ovaries, follicular maturation
   2. Rat testis
   3. Rat epididymis
   4. Sea urchin fertilized oocytes and early stages of development

10. CELL CYCLE. CANCER. CANCER MOLECULAR GENETICS.
    L - Cell cycle.
    S - Basics of molecular and cancer biology.
    P - Embryonic and fetal developmental stages in rats. Tumors: teratoma and teratocarcinoma. (M).
    Slides:
    1. Rat embryo: 9 days old
    2. Rat fetus: 20 days old
    3. Rat fetus and placenta (*fetus in toto*)
    4. Rat experimental teratoma
    5. Human teratocarcinoma
11. MEDICAL GENETICS BASICS.
L - Classical and molecular genetics. Basic principles of medical genetics.
S - Monohybrid inheritance. Autosomal recessive and dominant disorders in humans.
Multiple alleles. Sickle-cell disease. Eye color.
P - Cell cycle. Interphase and mitosis. Mitotic index (M).
Slides:
1. Onion root cells
2. Yeast cells
3. Rat follicular ovarian cells
4. Human cervical cancer cells (HeLa)

12. X-LINKED INHERITANCE. LINKED GENES.
L - X-linked inheritance and inheritance of sex.
P - PTC-test (Phenyl Thio Carbamide). Problem-solving (M).

13. DNA RECOMBINATION IN BACTERIA AND VIRUSES.
L - Gene therapy.
P - DNA: PCR (Polymerase Chain Reaction) (M).

14. MUTATIONS.
L - Recombinant DNA technology, application in medicine.
S - Mutations and human health.
P - DNA: RFLP (Restriction Fragment Length Polymorphism). Problem-solving (M).

15. DNA REPAIR. CLINICAL CYTOGENETICS.
L - DNA repair mechanisms. Polygenic disease in humans.
P - Human karyotype and metaphase plate formation from leucocytes (M).

16. GENE THERAPY. GENOME ORGANISATION.
L - Gene and chromosomal aberrations
S - The organisation and sequences of cellular genomes.
P - PubMed and genome databases (CR).

17. MOLECULAR BIOLOGY IN MEDICINE.
S - Prenatal diagnostics. Case report (Ion channels).

Teachers:
Prof. Tatijana Zemunik, MD, PhD
Marijana Popović, PhD
Benjamin Benzon, MD, PhD
Ivana Gunjača, MSc.
Dean Kaličanin, MSc.
Jolanda Kunjašić, lab. technician
**Obligatory literature:**

**Supplementary literature:**

**Subject aims:** Understanding the basics of contemporary biological science on the molecular level, as per medical student's aspiration and future medical practice.

**Subject goals:** To demonstrate theoretical and practical knowledge of cell structure and function, developmental biology, genetics, and basic principles of molecular biology.

**Subject components:** Basics of molecular biology (DNA structure, replication, transcription and translation), cell biology (cell structure and function, cell organelles, cell signalling, cell-to-cell communication, cell cycle, apoptosis), developmental biology, genetics (fertilization and early embryonic stage, teratogenesis, human genome, principles of inheritance, gene mutations, population genetics, molecular biology of cancer cells, gene therapy).

**Knowledge and skills that students need to obtain:** microscopy of prepared and wet-mount biological sample slides; cell analysis by fragmentation and centrifugation; plasma membrane analysis: osmosis, plasmolysis, hemolysis, isolation and biochemical analysis; DNA isolation and electrophoresis; performance of molecular biology methods: PCR and RFLP; biomedicine database search.

**Curriculum:** All classes (lectures, seminars, and practicals) are interconnected, and attendance to each is mandatory. Students are expected to be prepared for the class and to actively participate in the pre-assigned discussion topic.

**Exams:** Written exam at the end of the course (minimum of 60% is required for a positive grade).

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<th>WINTER term</th>
<th>SUMMER term</th>
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Medical biology course starts on 30. 1. 2020. (timetable can be found on www.mefst.hr and bulletin board). Department for Medical Biology wishes successful medical studies at our School to all students!

Split, September 2019.

Prof. Tatijana Zemunik, MD, PhD
Chair of Department for Medical Biology