

**Molecular Biology**  
**1st year MD 2025/2026**  
**Topics to be covered for the quizzes**

## **SEMINARS**

Seminar 1. DNA damage, repair, and recombination.

**Topics to be covered for the quiz:** nucleic acid structure; DNA replication; enzymes involved in replication (DNA polymerases, helicase, topoisomerases, ligase), control of DNA replication, replication inhibitors; types of DNA damage; types of DNA mutation; cell cycle and its control; apoptosis

Seminar 2. Gene-based therapeutic approaches.

**Topics to be covered for the quiz:** the structure of DNA and RNA (nucleotides and polynucleotides, features of the DNA double helix); processing of precursor RNA; organization of nuclear DNA (nucleosome, chromatin, chromosomes)

Seminar 3. Stem cells and their application in medicine

**Topics to be covered for the quiz:** types of cell division, stem cells, potency of stem cells, characteristic features of stem cells, stem cell life span, telomere length, Hayflick limit

4. Genetic Analysis Techniques.

**Topics to be covered for the quiz:** the structure of DNA and RNA (nucleotides and polynucleotides, features of the DNA double helix); processing of precursor RNA; organization of nuclear DNA (nucleosome, chromatin, chromosomes); types of DNA mutation

## **PRACTICALS**

Practical 1. RT-qPCR for COVID-19 diagnostics.

**Topics to be covered for the quiz:** DNA and RNA structure; replication: molecules involved in DNA replication, mechanism of replication; organization of human gene; transcription: molecules involved in transcription, mechanism of transcription; PCR: principles and stages of the reaction, application of the method

Practical 2. Production of recombinant human insulin.

**Topics to be covered for the quiz:** structure of DNA, RNAs, and proteins; gene structure; restriction enzymes, mechanism of transcription and translation

Practical 3. Gene therapy in oncology.

**Topics to be covered for the quiz:** genes and alleles, small-scale mutation ; large-scale chromosome abnormalities: alteration of chromosome structure, change in number of copies of chromosomes; causes of mutation; karyotype, patterns of inheritance

Practical 4. Diagnostic and therapy with computational molecular biology.

**Topics to be covered for the quiz:** structure of DNA, RNAs, and proteins; features of the genetic code; types of mutations; heritable *vs de novo* mutations, stages of oncogenesis; biological properties of cancerous cells; oncogenes and tumor suppressor genes