

Topics for MSc diploma exam

1. Protein structure, folding, structural motifs, post-translational modifications, and intramolecular interactions.
2. Protein biosynthesis and degradation.
3. Biophysical properties of proteins and protein thermodynamics.
4. Biological functions of proteins and experimental methods to study protein functions.
5. Enzymes (mechanisms of action, kinetics, specificity, activity regulation).
6. Methods of intermolecular interaction studies (e.g. protein-protein and protein-nucleic acid interactions).
7. Production of recombinant proteins and expression systems.
8. Basic principles and techniques used in the purification/isolation of proteins and nucleic acids.
9. Nucleic acids structure and topology.
10. Chromatin structure and topology.
11. DNA repair mechanisms.
12. Basic techniques used in molecular biology (e. g. restriction enzymes and their application, vectors, cloning and subcloning).
13. The structure of prokaryotic and eukaryotic genes.
14. Regulation of gene expression.
15. Regulation of transcripts splicing and maturation.
16. Methods of gene expression analysis.
17. Regulation of transport of proteins and complexes between cell nucleus and cytoplasm.
18. Methods of genetic manipulation in Eukaryotic cells and in Vertebrates.
19. Basic bioinformatic analyses (biological databases, searching for protein-coding genes in prokaryotes and eukaryotes, sequence alignment, searching for homologous sequences, practical application of bioinformatics and genomics).
20. Principles of phylogenetic analyses.
21. Genome evolution (reduction, rearrangement, duplication, poliploidization, pangenome concept).
22. Concept of systems biology as scientific approach based on “omics” types of research.
23. Technologies and databases based on the “omics” approaches used in systems biology, especially in genomics, transcriptomics, proteomics, metabolomics.
24. Relations between genome, transcriptome and proteome.
25. Human microbiome.
26. Mechanisms of bacterial pathogenesis.
27. Antibiotic targets, mechanism of action and resistance.
28. Mechanisms of genetic change and diversification in bacteria.
29. Visualisation of subcellular structures.
30. Principles of human immunity.
31. Cultures of animal cells and tissues.
32. Biological drugs, examples and application.
33. Application of biotechnology in diagnostics and therapy.
34. Structure, biosynthesis and biological significance of glycoconjugates.
35. Examples of glycosylation-related disorders.
36. Nanocarriers - methods of preparation and applications.