Biology MSc final exam topics 2019

Cell and tissue culture: theory and practice (Cellbiol., Dr. Légrádi Á.)

1. Biology of cultured animal cells: adhesion, proliferation, differentiation, signaling, energy metabolism. Culturing media and supplements, mitogens.
2. Preparation and maintenance of animal cell cultures. Types of cultures: primary cultures, subcultures, cell lines. Cell separation.
3. Morphological and functional characterizations of cultured cells (flow cytometry, immunocytochemistry, image analysis, motility, proliferation, phagocytosis, gene expression, etc.).

Molecular medicine (Cellbiol., Dr. Gulya K.)

1. Molecular and cell biological methods for potential human therapies: RNA silencing, telomerase inhibition, virotherapy, stem cell therapy, etc.
2. Characteristics and functions of embryonic and adult stem cells.
3. Generation of pluripotent stem cells and their potential therapeutic benefits.

Advanced genetics (Genetics, Dr. Deák P.)

1. Eukaryotic Chromosomes: Packaging of DNA into Chromosomes, Structure of Interphase and mitotic chromosomes, Euchromatin and Heterochromatin, Structure of Centromere, Structure of Telomere.
2. Genetic Control of Development: Early embryogenesis of Drosophila, Identification and mutant phenotypes of genes regulating A-P polarity, Maternal Effect Genes, Gap Genes, Pair-rule Genes, Segment Polarity Genes, Homeotic Genes.
3. Cancer as a Genetic disease: Clonal Inheritance, Induction of Cancer by Carcinogens, Viral induction of cancers, Oncogenes, Cancers Run in Families, Tumor Suppressors, Epigenetic Effects.

Biotechnology (Biotech., Dr. Kovács Kornél – Dr. Bagi Zoltán)

1. Biotechnological production of renewable energy carriers.
2. Biotechnological production of organic solvents.
3. Biotechnological production of organic acids.

Molecular biotechnology (Biotech., Dr. Rákhely Gábor – Dr. Tóth András)

1. Recombinant protein expression in E. coli.
2. Protein production with Gram+ bacteria and yeast.
3. Insect and mammalian expression systems.

Bioinformatics (Biotech., Dr. Kós Péter)

1. Sequence alignment methods.
2. Function prediction in the Twilight Zone.
3. Genome assembly and genome alignment.

Advanced microbiology 1 and 2 (Micro., Dr. Vágvölgyi Cs.)

1. General features of viruses: structure and chemical composition. The infection process.

Transduction.
2. The structure of the prokaryotic cell. Differences between Bacteria and Archaea. Reproduction of bacteria and the conjugation process.
3. Pathogenic microbes. Virulence factors, infection. The normal microbial flora of humans.
4. Metabolic processes in microorganisms: energy production and conservation.
5. The thallus organisation in Fungi. Reproductive strategies of fungi. Sexual and parasexual cycle.

Molecular biology: from genes to genomes (Biochem. Mol. Biol., Dr. Boros I.)

1. Compare the characteristics of pro- and eukaryotic genomes (size, number of genes, structure of transcription units, type of non-coding DNA)
2. Describe the process of DNA replication (general characteristics, enzymes, proteins in the replication fork).
3. Describe the process of transcription, compare pro- and eukaryotic RNA synthetizing enzymes and regulatory DNA regions.

Advanced molecular biology: qualitative and quantitative analysis of macromolecules (Biochem. Mol. Biol., Dr. Bodai L.)

1. Introduce the Sanger and Next Generation Sequencing methods. Genome sequencing approaches on the example of the Human Genome Project.
2. Describe applications of next generation sequencing for functional genomics: high-throughput transcriptome analysis, DNA methylation analysis and transcriptional factor binding site identification.
3. Detection of nucleic acids by hybridization methods: Southern-blot, Northern-blot, FISH, and RNA in situ hybridization.

Tumorbiology (Biochem. Mol. Biol., Dr. Boros I.)

1. Describe the type of genes which can play role in tumor development and give examples for their action (proto-oncogenes, oncogenes, tumorsuppressors, oncogene activation).
2. Describe mechanisms by which viruses can play role in tumor development (type of DNA and RNA tumor viruses and the mechanisms of their action with the examples of EBV, SV40, HPV, Raus sarcoma virus, ALV, HTLV).
3. Describe the traditional and modern approaches of cancer therapy, and give examples for the types drugs used.

Macromolecule design and manipulation (Biochem. Mol. Biol., Dr. Boros I.)

1. What are plasmids, describe how they are used in recombinant DNA technology.
2. Describe techniques which can be used for expressing foreign proteins in bacteria and for the investigation of protein-protein interactions.
3. Describe how a PCR reaction is done, some of the specific variations of PCR technique and that for what are those used.

Gene technology 1

1. List the enzymes which are most frequently used in recombinant DNA technology, and describe methods of DNA fragmentation, fragment separation and size determination.
2. Describe methods of introducing recombinant DNA into bacteria. (types of vectors, methods of transformation, clone selection methods, types of recombinant DNA libraries).

3. Describe methods of site directed mutagenesis and in vivo gene manipulation techniques.

Gene technology 2

1. Plant cell and tissue culture techniques, in vitro plant regeneration. *Yeasts as cell factories - expression systems. - Introducing DNA into plant cells and tissues; direct and indirect gene transfer methods (biolistic transformation, Agrobacterium-mediated gene transfer).* Filamentous fungi as cell factories - expression systems.
2. The main applications of plant genetic modifications with examples. *The process of heterologous protein production by fungi: from vector cloning to large-scale expression. Advanced immunology (Micro, Dr. Gácser A.) - History and concept of immunity, basic definitions and components. - Describe the basic concept of Innate and adaptive immunity. - Cells and tissues of the immune system. Molecular plant physiology (Plant Biol., Dr. Fehér A.) - How the flowering of plants is regulated? - Describe the specificities of signal transduction (hormonal, intracellular) in plants. - List and characterize briefly the main steps of plant photosynthesis.*