BIOLOGY /ANIMAL BIOLOGY

MASTER AND BACHELOR STUDY PROGRAMME, WS 2024 – 2025

PRACTICAL LESSONS

1. INTRODUCTION, MICROSCIPIC TECHNIQUE. Seminar organization, work protocol management, light microscopes, principles of microscopy, dry objectives, stopping the object in the field of view, optical planes, centring the object.
2. EUKARYOTA - ANIMAL CELL AND PROTOZOA. Cell shape, organelles, shape and number of nuclei. Genetics: monohybridism.
3. CELL CYCLE, MITOSIS. Plant cell (onion root), animal cell (tissue culture, intestine, uterus, testis). Genetics: dihybridism.
4. REPRODUCTION AND DEVELOPMENT. Meiosis, spermiogenesis, oogenesis, oestrous cycle, development of individuals, the genetic experiment of *Drosophila melanogaster* crossing – initiation. Genetics: heredity and sex.
5. CYTOGENETICS, MOLECULAR BIOLOGY I. Polythene chromosome, meiosis, karyotypes, the genetic experiment of *Drosophila melanogaster* crossing – removal of adults. Preparation of tissue for DNA isolation. Genetics: gene linkage.
6. MOLECULAR BIOLOGY II. Genetic experiment of *Drosophila melanogaster* crossing – evaluation. Isolation of DNA, PCR preparation and performance. Genetic – consultation.
7. MOLECULAR BIOLOGY III. DNA electrophoresis, visualization, and evaluation of PCR product. **Credit test 1.** Genetics: gene interactions.
8. CHEMICAL COMPOSITION OF THE CELL, PROKARYOTE. Provement of fats, proteins, starch, bacterial smears and staining, immersion observations, measurements. Genetics: non-mendelian inheritance.
9. BLOOD EXAMINATION. Blood smear and staining, avian and mammalian erythrocytes, size measurement, osmotic phenomena – hemolysis, plasmorhisis, phagocytosis, determination of blood groups, blood groups in humans and animals. Genetics: population genetics.
10. EUKARYOTE – PLANT CELL. Cell wall, chloroplasts, vacuoles, anthocyanins, osmotic events – plasmolysis, turgor. Genetics: quantitative genetics.
11. MOVEMENT AND TAXA, NATIVE PREPARATIONS. Brownian molecular movement, amoeboid movement, ciliated movement, flagella, cells with ciliated epithelium, striated muscle, oxygenotaxis in protozoa. Genetic – consultation.
12. GENETICS, CELL CULTURES. Cell cultures, work with an inverse microscope. **Credit test 2.**
13. CREDIT AWARDING.

All materials are available at MOODLE (syllabi, conditions for granting credit, handbook with theory for preparation for practicals, protocols, multimedia, lectures, exam questions).

LECTURES

1. Introduction to the study of biology. The essence of life, general characteristics and organization of living systems, hierarchical systems. History of biology, J. E. Purkyně.
2. Cell theory, cell as a system, flow of substances, energy, information. Prokaryotic and eukaryotic cells. Cell structures. Evolution of eukaryotic cells (endosymbiotic theory). Non-cellular life forms. Microbiom.
3. Chemical composition of living systems. Life and cell hypotheses, replicative ribozyme hypercycle. Period of carbon dioxide, methane, oxygen. Elemental and substance composition of bioplasm, water, biopolymers (proteins, nucleic acids, polysaccharides, lipids).
4. Cell cycle. Cell cycle phase. Mitosis, meiosis, cytokinesis. Cell cycle regulation. Cyclins, cyclin-dependent kinases. Cell cycle arrest. Regulation of the number of cells in a multicellular organism. Types of programmed cell death. Apoptosis, cell necrosis. Cell differentiation.
5. Cell memory system, genetic information. Structural gene, genes for rRNA, tRNA, non-gene regions of DNA. Genome, gonophores, plasmids, eukaryotic, prokaryotic (mitochondrial, chloroplast, nuclear) chromosomes. Replication of genetic information. Correction of mistakes in DNA. Transposition, transposons (prokaryotes, eukaryotes – retroelements), repetitive DNA.
6. Methods of molecular biology: DNA isolation; enzymes in molecular biology; amplification of DNA segments by PCR – principle and use; restriction analysis. Separation methods – gel electrophoresis. Sequencing – principle and application.
7. Chromosome theory of heredity. Morphology and characteristics of chromosomes, genomes, genes, and alleles. Cytogenetics, numerical and structural aberrations of chromosomes. Mendelism and non-Mendelism. Quantitative genetics. Population genetics.
8. Expression of genetic information. Transcription, translation. Posttranscriptional modifications. Posttranslational modifications of proteins. Ubiquitination. Regulation of gene expression. RNA-silencing, siRNA. Epigenetics.
9. Cell signalling. Signal forms. Types of extracellular signals (hormones, cytokines, neurotransmitters). Intracellular signalling cascade (in general). Types of receptors on the cell surface and intracellular signalling pathways. G-protein-coupled receptors, enzyme-linked receptors. Ras protein.
10. Cell membrane system. Lipid double layer. Membrane synthesis. Membrane proteins. Plasma membrane amplification. External cell protection. Transfer of substances across membranes. Passive transport, active transport. Transport membrane proteins. Intracellular compartments and vesicular transport. Endocytosis, pinocytosis, phagocytosis. Lysosomes.
11. Cytoskeletal principle of the cell. Cytoskeleton. Intermediate filaments. Microtubules. Centrosome. Actin fibres. Molecular motors (kinesins, dyneins, myosins). Actin-dependent cell movement, muscle contractions. Cytoskeleton in bacteria.
12. Energy, catalysis, biosynthesis. Cell energy acquisition, photosynthesis, respiration. Activated carrier molecules. Catabolism. Principle of energy acquisition in mitochondria and chloroplasts, chemiosmotic couplings.
13. Basics of evolutionary biology. Development of evolutionary theories, Ch. Darwin, a modern synthetic theory of evolution. Basic mechanisms of evolution, development of genetic information, natural selection. Microevolution, speciation, macroevolution. Man as a source of evolutionary change.

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