

BIOLOGY PROGRAM

Botany

The structure of the plant cell. Tissues and organs of plants in connection with the functions performed in the plant organism.

Root. Types of roots and types of root systems. Root zones. Root functions. Root modifications, their structure, biological and economic significance.

Stem. The definition of stem and shoot. The shoot and its parts. Buds. Leaf buds, flower buds, mixed buds. The structure of the buds and their location on the stem. The development of bud into a branch. Stem growth in length and in thickness. Stem functions. Shoots modifications, their structure, biological and economic significance.

Leaf. The external structure of the leaf. Leaf venation. The simple leaves and complex leaves. Features of the internal structure of the leaf in connection with its functions. Sheet functions. Leaf modifications.

Vegetative propagation of flowering plants.

Flower, fruit, seed. A flower is an organ of sexual reproduction. Flower parts, their structure and functions. Inflorescences, their types, biological significance. Flower functions. Types of pollination. Double fertilization in flowering plants, its mechanism. The structure of seeds on the example of monocotyledonous and dicotyledonous plants. The functions of the seeds. Fruits: their classification, structure, examples. Fruit functions. The importance of flowers, fruits and seeds in nature, human life and medicine.

Classification of plants. The concept of systematic categories, the significance of international plant names. The main groups of plants. The diversity of the plant world.

Algae. General characteristics. The structure and vital activity of unicellular algae. Filamentous algae, structure and features of their vital activity. Asexual and sexual reproduction in algae. The significance of algae in nature and agriculture.

Mosses. General characteristics. Taxonomy. Green mosses. The structure, reproduction and life cycle. The concept of sporophyte and gametophyte.

Ferns. General characteristics. Structure, reproduction and life cycle.

Gymnosperms. General characteristics. Structure, reproduction and life cycle on the example of pine.

Angiosperms. Comparative characteristics of Monocotyledonous and Dicotyledonous.

The Kingdom of Bacteria. General characteristics. The structure of the prokaryotic cell of bacteria. The processes of vital activity of bacteria. Classification and reproduction of

bacteria. The role of bacteria in nature, medicine, agriculture and industry. Pathogenic bacteria and the struggle against them.

The Kingdom of Fungi. General characteristics. Features of the structure and processes of vital activity. The role of fungi in nature and in human life.

Lichens as symbiotic organisms. General characteristics. The processes of vital activity. Reproduction. The role of lichens in nature and human life.

Zoology

Phylum Protozoa. General characteristics of the type: habitat, structure, vital processes. Irritability. Incystation. Methods of reproduction. Division of the type into classes. Diversity and significance of protozoa.

Class Sarcodina. General characteristics of the class using the example of free-living amoeba. Dysentery amoeba: habitat, structure, protection from infection. The significance of Sarcodina in nature, human life and medicine.

Class Flagellates. General characteristics of the class using the example of euglena green. The evolutionary significance of Flagellates, their role in nature, medicine and human life.

Class Infusoria. General characteristics of the class using the example of a paramecium. The importance of ciliates in nature, human life and medicine.

Class Sporozoa. General characteristics of the class. Malaria plasmodium as a causative agent of malaria. Structural and vital features. Mode of human infection with malaria. The general concept of host change. Life cycle of malarial plasmodium.

Phylum Coelenterates. General characteristic of the phylum. Vital processes. Nutrition. Breathing. Reflex. Regeneration. Methods of reproduction: asexual and sexual. Systematics.

Phylum Flatworms. General characteristics of the phylum. Habitat and external structure. The internal structure. The processes of vital activity. Reproduction. Taxonomy.

Class Turbellaria. General characteristics of the class on the example of a planarian. Features of life processes. Nutrition, respiration, excretion, nervous system and sensory organs. Reproduction. Regeneration.

Class Flukes. General characteristics of the class on the example of a liver fluke. Adaptations to a parasitic lifestyle. The change of hosts in the life cycle. Prevention of infection.

Class Tapeworms. General characteristics of the class on the example of a beef tapeworm. Adaptations of tapeworms to a parasitic lifestyle. The life cycle and the change of the hosts. Prevention of infection.

Phylum Roundworms. General characteristics of the phylum on the example of human ascaris. Habitat, external and internal structure. Reproduction and life cycle of ascaris. Prevention of infection. The variety of roundworms.

Phylum Annelid worms. General characteristics of the phylum. Taxonomy. The evolutionary significance of annelids. General characteristics of the class on the example of an earthworm.

Phylum Shellfish. General characteristics of the phylum. External and internal structure. Features of vital processes. Reproduction. Taxonomy.

Phylum Arthropods. General characteristics of the phylum. External and internal structure. The processes of vital activity. Reproduction and development. Taxonomy. The medical and practical significance of arthropods.

Phylum Chordate. General characteristics of the phylum. Taxonomy.

Class Fish. General characteristics of the class. External and internal structure. Reproduction and development. Traits of adaptability to an aquatic lifestyle.

Class Amphibians. General characteristics of the class. External and internal structure. The processes of vital activity. Features of adaptation to the environment. The diversity of amphibians.

Class Reptiles. General characteristics of the class. External and internal structure. Reproduction and development. Regeneration. Traits of adaptability to a terrestrial lifestyle. Taxonomy of the class. Venomous reptiles.

Class Aves. General characteristics of the class. External and internal structure. Features of life processes. Reproduction and development. Signs of fitness for flight.

Class Mammals. General characteristics of the class. External and internal structure. Reproduction and development. Taking care of the offspring. The diversity of mammals.

Human anatomy, physiology and hygiene

A general overview of the human body. The main types of tissues, their structure and functions.

The musculoskeletal system. Functions of the musculoskeletal system. The structure and composition of bones. Bone growth in length and thickness. Bone joints, their types. The structure of the human skeleton. Features of the structure of the human skeleton in connection with upright walking and work. First aid for fractures, dislocations and sprains.

Muscles, their structure and functions. The reflex nature of muscle activity. An overview of the human muscular system. Prevention of curvature of the spine and the development of flat feet.

The internal environment of the body: blood, tissue fluid and lymph. The relative constancy of the internal environment of the body. Tissue fluid, its meaning. Lymph.

Blood, blood functions. Blood composition. Plasma. Cellular components of the blood: red blood cells, white blood cells, platelets, their structure and functions. Blood clotting. Blood types. Immunity and its types.

Circulatory system. Arteries, veins, capillaries, features of their structure. Systemic and pulmonary circulations. Heart, its structure. Cardiac cycle. Neural and humoral regulation of heart and blood vessel function. First aid for arterial and venous bleeding. Cardiovascular hygiene.

Respiratory system. Functions of respiratory system. Airways, their structure and functions. Lung structure. Gas exchange in lungs and tissues. Mechanism of respiratory movements. Neural and humoral regulation of respiration. Respiratory hygiene, prevention of respiratory diseases.

Digestive system. Structure of digestive organs: organs of oral cavity, esophagus, stomach, parts of small and large intestine. Digestive glands. Functions of digestive system. Food alteration in various parts of the digestive tract. Neural and humoral regulation of digestion. Prevention of food-borne infections.

Excretory system. Organs of the excretory system. Structure of kidney. Functions of excretory organs, mechanism of urine formation. Regulation of kidney function.

Skin. Structure and function of skin. The role of skin in thermoregulation. First aid for frostbite, burns, heat shock and sunstrokes. Skin and clothing hygiene.

Nervous system. Functions of nervous system. Central nervous system. Structure and function of spinal cord. Parts of brain, their functions. Peripheral nervous system. Autonomic nervous system.

Sense organs. Structure of visual sense organ. Visual impairment: myopia and hyperopia, their correction. Vision hygiene. Structure of the hearing sense organ. Sound perception mechanism. Hearing hygiene. Structure and functions of the equilibrium organ. Touch. Sense of smell. Taste.

Conditional and unconditional reflexes. Formation and inhibition of conditioned reflexes. Features of higher human nervous activity. Effects of nicotine and alcohol on the nervous system.

Endocrine glands. Significance of endocrine glands. Hormones, their properties and significance for the body. Diseases associated with impaired functions of the endocrine glands. Role of humoral regulation in the body.

Cell. The history of the discovery of the cell. The cell theory of T.Schwann. The provisions of modern cell theory. Methods of cell research.

Non-cellular life forms: viruses and phages. Viral diseases of plants, animals and humans, examples.

Cellular forms of life. Similarities and differences in the structure of prokaryotic cells and eukaryotic cells. The main structural components of the eukaryotic cell: structure and functions. Similarities and differences between plant cells and animal cells.

The chemical organization of the cell. Elemental composition of the cell. Inorganic substances, their role in the vital activity of the cell. Organic substances: carbohydrates, lipids, proteins, their structure and functions. Nucleic acids as biopolymers. The composition of the nucleotide. The principle of complementarity. DNA replication. The DNA code. The structure and types of RNA. The importance of ATP in the vital activity of the cell.

Metabolism of the cell. Catabolic reactions and anabolic reactions are the basis of the cell's vital activity.

Catabolic reactions. Stages of catabolic reactions in the cell. Glycolysis. Cellular respiration. Oxidative phosphorylation.

Anabolic reactions. Autotrophs and heterotrophs. Photosynthesis, its stages and biological significance. Chemosynthesis.

Protein biosynthesis. The role of nucleic acids in the process of biosynthesis of protein. Gen. The genetic code. Matrix synthesis reactions. Stages of protein biosynthesis.

Reproduction and individual development of organisms. The mitotic cycle. Cell preparation for division, DNA replication. Phases of mitosis, their characteristics. The biological significance of mitosis. The individuality of chromosomes, their structure. Haploid and diploid sets of chromosomes. Asexual and sexual reproduction, their types. Germ cells: eggs and spermatozoa, their structure. Features of the development of eggs and spermatozoa. Meiosis. The biological significance of meiosis. Fertilization is the process of restoring a diploid set of chromosomes.

Individual development of organisms on the example of animals: definition, stages. Periods of embryonic development, their characteristics. The homology of germ layers as evidence of the unity of animal origin. Types of postembryonic development.

Basics of genetics

Genetics is the science of the laws of heredity and variability. Significance of genetics. Types of heredity: chromosomal, cytoplasmic; their characteristics, examples. The gene is a

structural and functional unit of heredity. Gene implementation into a trait. Genotype and phenotype.

The main patterns of inheritance. Monohybrid, dihybrid and polyhybrid hybridization. Dominant and recessive traits. Allelic and nonallelic genes. Homozygote and heterozygote. Phenotype and genotype. The patterns of inheritance established by G. Mendel. An independent combination of hereditary traits in di- and polyhybrid crossing. The reasons for the independent inheritance of traits in dihybrid crossing.

Linked inheritance. T.Morgan's experiments on the study of linked inheritance. Complete linkage, incomplete linkage. Crossing over, its biological significance. The provisions of T. Morgan's chromosomal theory.

The genetics of sex. Sex chromosomes and autosomes. A homogametic and heterogametic sex. T.Morgan's experiments on the study of sex-linked inheritance.

The interaction of genes. The interaction of allelic genes. Inheritance of blood groups. The interaction of non-allelic genes.

Patterns of variability. Phenotypic variability. Genotypic variability: combinations and mutations, significance in evolution. Classification of mutations. Mutagens. Mutations as a material for artificial and natural selection. Environmental pollution by mutagens and its consequences.

Human genetics. Methods of studying human heredity. The importance of genetics for medicine.

Evolutionary teaching

The main provisions of the evolutionary theory of C. Darwin. The driving forces of evolution: heredity, variability, struggle for existence, natural selection, divergence. Types of natural selection. Artificial and natural selection: similarities and differences.

Genetics and theory of evolution. Modern notion of species. Criteria of species. Structure of species. Microevolution. Characteristics of the population as an elementary evolutionary structure. Gene pool of a population. Conditions for stability of gene pool. Elementary evolutionary material, its characteristic. Elementary evolutionary factors, their characteristics, significance for evolution. Ways of speciation.

Origin of living organisms on Earth. Properties of living organisms. The theory of the origin of life on Earth from the bodies of inanimate nature (A.I. Oparin).

The main evidence for the evolution of the organic world comes from comparative anatomy, embryology, biogeography, and paleontology. Analogy and homology. Rudiments and atavisms. Fossil forms. Phylogenetic series. Principles of modern classification of organisms.

The division of the Earth's history into eras and periods. The development of the organic world in the Archean, Proterozoic, Paleozoic, Mesozoic and Cenozoic eras.

Charles Darwin about the origin of man from animals. The role of biological and social factors in human evolution. Evidence of animal origin of human. Stages of anthropogenesis. The unity of the origin of human races.

Basics of ecology

Ecology. Subject and tasks of ecology. Environment and environmental factors. Adaptations of organisms to abiotic and biotic environmental factors.

Ecosystem. Relationship of populations in ecosystems. Food chains. The concept of ecological pyramid rules. Self-regulation in the ecosystem. Natural and man-made ecosystems.

Basics of the doctrine of the biosphere. Biosphere and its boundaries. Living matter and its functions. Substance cycling and energy conversion in the biosphere. Biogenic migration of atoms. Human role in the biosphere. Conservation and planned reproduction of its wealth.