General biology

Biology is the science of life. The importance of biological science for agriculture, industry, medicine, hygiene, nature protection. Living systems: cell, organism, species, biocenosis, biosphere, their evolution. Signs of living systems: energy metabolism, integrity, the relationship of structure and function, the relationship with the environment, self-regulation.

The contribution of biological science in the formation of the scientific worldview, the general culture of personality.

General biological objective laws. Levels of organization of living nature: molecular, cellular, organismic, population and species, biogeocenotic, biosphere.

Cytology. The history of the discovery of the cell. The main provisions of the cell theory. Methods of studying cells. The cell is an elementary living system, the main structural and functional unit of plant and animal organisms.

Chemical composition of the cell. The content of chemical elements in living systems. Macro- and microelements of cells. Water and other inorganic substances and their roles in the life of living systems.

Organic matter of the cell. Carbohydrates. Monosaccharides, disaccharides and polysaccharides of plant and animal cells, their structure and function.

Lipids and their derivatives. Structure and functions of lipids in plant and animal organisms.

Proteins as biopolymers. Amino acids, their structure and properties. Primary, secondary, tertiary and quaternary structure of protein molecules. Examples of simple and complex proteins. Protein functions in the cell. Enzymes, their role in the processes of cellular life.

Nucleic acids. RNA and DNA as biopolymers. Nucleotides, their structure and connection in the formation of a polynucleotide chain. The structure and function of DNA, its location in a cell. Complementarity. DNA replication as a matrix synthesis reaction. Structure and types of RNA, their functions. The DNA (RNA) code.

ATP. ATP content in the cell. High-energy bonds in ATP. The role of ATP in the life of the cell.

Cell structure. The main structural components of eukaryotic cells are the outer cell membrane, the cytoplasm and the nucleus. Biological membrane, its structure and functions. Transport of substances through the membrane. Organelles and inclusions of the cytoplasm. Membrane and non-membrane cell organoids, their structure, functions, location in the cell. Features of the structure of plant and animal cells. The structure of prokaryotic cells. Prokaryotic and eukaryotic cells, their similarities and differences.

Noncellular life forms. Viruses. Ultramicroscopic organization of viruses and bacteriophages, their importance and role in nature. Viral diseases of humans, animals and plants.

Metabolism and energy in the cell. Constructive and energy metabolism - the basis of the life of the cell.

Constructive metabolism. Autotrophic, mixotrophic and heterotrophic organisms. Photosynthesis. Features of metabolism and energy in a plant cell. The biological significance of photosynthesis. Chloroplasts. Connection of structure and function. Light phase of photosynthesis. The dark phase of photosynthesis. Role of enzymes. The biological meaning of the Calvin cycle. Ways to increase the productivity of photosynthesis processes in agricultural plants. The chemosynthesis across bacteria.

Protein biosynthesis. The role of nucleic acids in protein biosynthesis. Gene and its role in protein biosynthesis. DNA code. Matrix protein synthesis reactions-transcription and translation. The role of enzymes in protein biosynthesis. The role of ATP in this process.

Energy metabolism. Stages of energy metabolism in the cell. Preparatory stage.

Anaerobic respiration. Glycolysis. Types of fermentation. Energy efficiency of glycolysis and fermentation.

Aerobic respiration. The main features of the Krebs cycle (biological meaning). Energy efficiency of aerobic respiration processes.

Mitochondria. Connection of structure and function. Oxidative phosphorylation. The relationship of anabolism and catabolism in the cell. Autoregulation of chemical processes in the cell.

Cell division. Division is a biological process underlying the reproduction and individual development of organisms. As the hereditary material in nondividing nucleus. Constancy of the amount of DNA in the nucleus. Individuality and structure of chromosomes. Haploid and diploid set of chromosomes. Species constancy in the number of chromosomes.

Mitosis. Mitotic cycle. The commonality of the process of mitotic cell division in eukaryotes. Phases

of mitosis. The behavior of chromosomes in mitosis. Biological meaning of mitosis. Cell cycle.

Meiosis. I and II divisions of meiosis. The behavior of chromosomes in meiosis. The biological meaning of meiosis.

Amitosis as a form of division of the interphase nucleus, not accompanied by a uniform distribution of hereditary material. The significance of amitosis.

Individual development of organisms. Gametogenesis-the process of formation of germ cells. Features of ovogenesis and spermatogenesis. Structure of germ cells. Fertilization is the process of restoring the diploid set of chromosomes.

Ontogenesis is an individual development of the organism. Embryonic development. The development of fertilized eggs on the example of lancelet. Fission process. Morula. Blastula stage. The process of gastrulation. Gastrula stage. Germ layers. Homology of embryonic leaves as evidence of the unity of animal origin. Formation of tissues and organ systems. Postembryonic development. Direct and indirect development in invertebrates and vertebrates. Harmful effects of alcohol and nicotine on the development of the human body.

Reproduction of organisms. Forms of reproduction of organisms - nonsexual and sexual. Types of nonsexual and sexual reproduction in plants and animals.

Basics of genetics and selection. Subject, tasks and methods of genetics. Laws of segregation and independent assortment. Basic concepts of genetics are: gene, allelic and nonallelic genes; dominant and recessive traits; homozygote and heterozygote; phenotype, genotype, genome, karyotype, linkage groups.

The main laws of transmission of hereditary characteristics. The patterns of inheritance of traits, specified by G. Mendel. Hybridological method for the study of heredity. Monohybrid crossing. The first law of Mendel. Uniformity of hybrids of the first generation. The second law of Mendel. Splitting of second-generation hybrids by genotype and phenotype. The statistical nature of scission. An intermediate type of inheritance. Analysing crossing. The statistical nature of scission. The third law of Mendel. Dihibrid and polyhibrid crossing. Independent combination of hereditary traits in dihibrid and polyhibrid crossing. Cytological basis of the Mendel laws. The hypothesis of the "purity of the gametes". Meiosis as the material basis of the laws of inheritance of signs and hypothesis of "purity of gametes". Nuclear and cytoplasmic heredity.

T. Morgan's chromosome theory of heredity. Full and incomplete linkage, the role of the crossing over in the linkage of violation. Genetics of sex, progamic, syngamic, epigamic sex determination. Chromosomal mechanism of sex determination. Sex chromosomes and autosomes. Sex-linked inheritance.

Interaction of genes. Interaction of allelic genes. Inheritance of blood groups as an example of multiple allelism and codominance. Dominance, incomplete dominance, super dominance. The interaction of nonallelic genes. Genotype as an integral historically developed system. Epistasis, complementarity, polymery. Pleiotropic effect of genes. Patterns of variability. The role of genotype and environmental conditions in phenotype formation.

Variability and its forms. Modification variability. Reaction norm. Statistical regularities of modification variability. Variation series and variation curve, methods for determining the average value of the variation series. Genotypic variability: combinations and mutations. Ways of combinative variability. Mutations: genomic, chromosomal and gene. Mutagenic factors. Experimental obtaining of mutations. Mutations as a material for artificial and natural selection. Pollution of the environment by mutagens and its consequences.

Human genetics. Methods of studying human heredity. Cytogenetic, twin, genealogical, population-species. The importance of genetics for medicine. Prevention and treatment of some hereditary diseases.

Genetics-the theoretical basis of selection. Problems of modern plant breeding.

N. I. Vavilov on the origin of cultivated plants. The main breeding methods of animals, plants, microorganisms (outbreeding, heterosis, inbreeding, polyploidy, mass selection, individual selection, induced mutagenesis). The law of homological series of N. I. Vavilov.

Selection of bacteria, fungi, its value for the microbiological industry (production of antibiotics, enzyme preparations, fodder yeast, etc.). The main areas of biotechnology (microbiological industry, genetic and cellular engineering).

Biosphere and scientific and technological progress. Biosphere during the period of scientific and technological progress and human health. Environmental problems: protection from pollution, preservation of standards and monuments of nature, species diversity, biocenoses, landscapes.

Evolutionism. General characteristics of biology in pre-Darwin period. Domination of metaphysical ideas in science about the immutability of nature and "the original feasibility". Works of Carl Linnaeus on

taxonomy of plants and animals, their importance. The studying of J. B. Lamarck on the evolution of nature and its value. The first Russian evolutionists.

Historical background of Charles Darwin's teachings. Socioeconomic background, the success of biology in the first half of the XIX century. The success of agriculture in breeding of domestic animals and cultivars of cultivated plants. Travel by ship "Beagle". Ch. Darwin's Works.

The main provisions of the evolutionary teachings of Charles Darwin. The value of the doctrine for the development of natural science. Modern ideas about the evolution of nature. Driving forces of evolution. Heredity. Variability. Types of variability. Natural selection. The leading role of natural selection in evolution. Struggle for existence. Forms of struggle for existence.

Artificial selection and hereditary variability - the basis of breeding of varieties of pets and cultural plants. Common and different between artificial and natural selection.

Ways and directions of evolutionary transformations. Microevolution. Genetics and theory of evolution. Population as an elementary evolutionary unit. Genetics of populations. Ideal and real populations. Hardy-Weinberg's Law. Reserve of hereditary variability in natural populations. Genetic processes in populations. The concept of ecological and genetic characteristics of populations. Elementary factors of microevolution. Natural selection is the guiding factor of evolution. The creative role of natural selection. Forms of natural selection, their relationship and relationship with environmental conditions. Speciation is the result of microevolution. Ways of speciation. View. View criteria. The structure of the species.

Macroevolution. The emergence of supra-species taxa. Adaptive nature of evolution. Relative appropriateness of fitness.

The main directions of evolution - biological regression and biological progress (A. N. Severtsev). Species extinction as a result of biological regression. Ways of achievement of biological progress (aromorphosis, allomorphosis, degeneration). Results of evolution: adaptability of organisms, diversity of species, gradual complication of the organization.

Basic evidence of the evolution of the organic world: comparative-anatomical, embryological, biogeographic and paleontological. Comparative study of the structure of modern animals and plants to prove their historical development. Homology and analogy. Rudiments and atavisms in the structure of modern organisms as evidence of evolution.

Similarity of embryonic development of organisms as proof of the unity of their origin. Muller-Heckel biogenetic law.

The system of plants and animals - a display of evolution. Principles of modern classification of organisms. Taxonomic units.

Development of the organic world.

Ways of development of the organic world. Division of Earth history into eras and periods. Development of the organic world in the Archean, Proterozoic and Paleozoic eras. The emergence of plants and animals - divergence in the organic world by way of food. The cosmic role of green plants. Unicellular and multicellular organisms. The emergence of plants onto land in the Paleozoic era. Psilophytes. Mosses. Causes of fern flourishing. The uprise of gymnosperms.

Animals' way to land. The emergence of vertebrates by raising the organization, development of adaptations of broad significance and expanding the habitat.

Crossopterigians as the ancestors of amphibians. The emergence and flourishing of ancient amphibians. Stegocephalia - group of ancient amphibians.

Development of the organic world in the Mesozoic era. Domination of gymnosperms. The appearance and distribution of angiosperms. The high day of reptiles. The emergence of birds and mammals. The emergence of bony fish. Causes of extinction of gymnosperms and reptiles in the Mesozoic era.

The development of the organic world in the Cenozoic era. Domination of angiosperms, insects, birds and mammals. The emergence of the evolution of numerous adaptations to a variety of habitats.

The impact of human activities on species diversity, natural communities and their protection.

The origin of human, anthropogenesis. Apes and humans. Ch. Darwin on the origin of man from animals. Driving forces of anthropogenesis: social and biological factors. The leading role of the laws of social life in the social progress of mankind. The role of biological and social factors in human evolution.

Fossils of man. The oldest people (Pithecanthropus, Sinanthropus, Heidelberg man). Ancient people (Neanderthals). Fossil people of modern type (Cro-magnons).

The leading role of the laws of social life in the social progress of mankind. The unity of the origin

of human races. Anti-scientific, reactionary essence of "social Darwinism" and racism.

The emergence of life on Earth. Life is a qualitatively new form of matter movement. Pre-scientific ideas about the origin of life. The doctrine of spontaneous generation. The works of F. Redi and L. Pasteur, proved the impossibility of spontaneous generation. The theory of the introduction of life on Earth from other space bodies.

The hypothesis of academician A. I. Oparin about the origin of life. Abiogenic synthesis of organic matter. Properties of primary organisms. Divergence in ways of power supply: autotrophs and heterotrophs.

The body and the environment. Ecology is the science of the laws of the relationship of organisms with the environment. Subject and tasks of ecology. Habitat and environmental factors. Adaptation of the organism (species) to abiotic and biotic environmental factors. Complex influence of factors on the body. The main climate factors (light, temperature, humidity) and their impact on the body. Limiting factor. Human activity as an ecological factor. Adaptation of plants and animals to the seasonal rhythm of external conditions. Seasonality in nature. State of winter dormancy. Cold resistance. The factors governing the seasonal development. The phenomena of photoperiodism in plants and animals.

Species, its ecological characteristics. Intraspecific and interspecies relations: predation, competition, parasitism, symbiosis. Rational use of species, preservation of their diversity.

Population. Factors that cause changes in population. The diversity of populations in the ecosystem, the links between them: genetic, trophic. Producers, decomposers and consumers. Food chains and nets.

Biogeocenosis. The circulation of substances and the transformation of energy in ecosystems on the example of a freshwater reservoir, oak forest. Rules of the ecological pyramid - the pyramid of numbers, the pyramid of biomass, the pyramid of energy. Self-regulation is the basis of ecosystem stability. Changes in ecosystems. Causes of ecosystem change: external (natural and anthropogenic) and internal. The concept of plant community. Tiering above ground and underground. Seasonal changes in plant communities.

Agro-ecosystems, their diversity, the differences from natural ecosystems. Creation of artificial biogeocenoses as a result of purposeful human economic activity. Agrocenosises. Increasing the productivity of agrocenoses. Protection of biogeocenoses. Conservation of biological diversity as a basis for sustainable development of ecosystems.

Biosphere. Fundamentals of the doctrine of the biosphere. The boundaries of the biosphere. V. I. Vernadsky's teaching about the biosphere as a shell of the Earth inhabited by living beings. Noosphere. Density of life. Living substance, its gas, concentration, oxidation and reduction functions. Circulation of substances in the biosphere. Biogenic migration of atoms. The role of microorganisms. The role of man in the biosphere. The nature conservancy and planned reproduction of its wealth.

Botany

Botany is the science of plants. The plant is an integral organism. Flora as an integral part of nature, its diversity and distribution on Earth.

Structure of plants. Cellular structure of the plant. The structure of the plant cell. Tissues of plant organs in connection with the functions performed in the whole body. The relationship of organs. Vegetative organs of a flower plant: root, stem, leaf. Generative organs: flower (inflorescence), fruit, seed. The main vital functions of the plant organism: nutrition, respiration, growth and development, reproduction. Movement of plants. Methods of distribution of fruits and seeds in nature. The importance of harvesting of fruits and seeds of cultivated plants. Plant life conditions (water, air, light, heat, mineral salts). Influence of different conditions on the growth and development of plants. Seasonal phenomena in the life of angiosperms. Plants in spring. Plants protection and plants wealth increase. The importance of plants and vegetation in nature, human life and in the national economy. The plant world diversity. Life forms of flowering plants: tree, shrub, herbaceous plants-annual and perennial. Plant and environment. Plant protection.

Root. Root functions. Root development from the germinal root of the seed. Types of roots (main, side, appendages). Types of root systems (rod, fibrous). Root zones. Growth of roots. Root pouch. Root hair. Root tissue. External and internal structure of the root of monocotyledons and dicotyledonous plants. Modification of roots, their structure, biological and economic value. Plant nutrition. Absorption by roots of water and mineral salts. Soil as a living environment for plants. Mineral salts necessary for the plant. The value of soil treatment - fertilization, irrigation and loosening for the life of cultivated plants. Water culture.

Stem. Functions of the stem. Shoot of a plant and its parts. Branching of a shoot. Variety of shoots: erect, creeping, curly, sprawling, clinging. Bud. Vegetative, flower, mixed buds. Their structure and location on the stem. The development of a plant shoot from a bud. Stem growth in length.

Stem tissues. The stem anatomical structure of monocotyledonous, herbaceous and tree stems of dicotyledonous. The growth of the stem in thickness. Formation of annual rings. Seasonal differences in wood. Age of trees. Movement of mineral and organic substances on the stem. Modified shoots: rhizome, stolons, tuber, bulb, their structure, biological and economic value.

Leaf. Leaf functions. External structure of the leaf (leaf blade, petiole, base, stipules). The venation of the leaves. Simple and complex leaves. Phyllotaxy. Leaf tissue. Features of the internal structure of the leaf in connection with its functions. Peel and stomata, leaf pulp (columnar and spongy tissue). Structure of leaf veins (conductive beams). Leaves of light and shadow. Leaf movement. Leaf mosaic. Formation of organic matter in the leaves in the light. Absorption of carbon dioxide by leaves and release of oxygen. Energy accumulation in the plant. Breath of leaves. Evaporation of water by leaves. Plants of wet and dry habitats. Modification of leaves. The life expectancy of the leaves. Defoliation. The value of the leaf for plants. The role of green plants in nature and human life and their protection.

Vegetative reproduction of flowering plants. Reproduction of plants through shoots, roots and leaves in nature and crop production (modified shoots, stem and root cuttings, layering, division of the bush, inoculation). Biological and economic value of vegetative reproduction.

Reproductive organs. Flower, fruit, seed. The flower is an organ of seed reproduction. Functions of a flower. Flower structure: peduncle, receptacle, perianth (calyx and corolla), stamens, pistils. Structure of stamen and pistil. Flowers are same-sex and bisexual. Monoecious and dioecious plants. Inflorescences and their biological significance. Cross-pollination by insects and wind. Self pollination. Artificial pollination. Double fertilization of flowering plants and its mechanism. The germination of pollen. Fertilization. Formation of seed and fruit.

Seed. Functions of seed. The structure of seeds (for example, dicotyledonous and monocot plants). Seed composition. Seed germination conditions. Seed germination. Seed breath. Nutrition and growth of seedling. Agricultural seed sowing and plant cultivation.

Fruit. Functions of fruit. Variety of fruits. The importance of flowers, fruits and seeds in nature and human life.

Classification of plants. Concepts of systematic (taxonomic) categories (species, genus, family, order, class, phylum). Importance of international plant names.

The main groups of plants. Diversity of the plant world. Systematic review: Bacteria, Fungi, Algae, Lichens, Mossy, Fern, Gymnosperm (Coniferous), Angiosperms.

The Kingdom of Bacteria. General characteristic. Structure and activity of bacteria. Classification of bacteria by form. Examples. Bacterial growth.

The spread of bacteria in the air, soil, water and living organisms. Bacteria of fermentation and putrefaction bacteria. Symbiotic bacteria. Pathogenic bacteria and fight against them. The role of bacteria in nature, medicine, agriculture and industry. Human use of bacteria.

The Kingdom of Fungi. General characteristic. Fungi (Mucor and Penicillium). Structure, features of life and reproduction. The value of mold fungi. Yeast. Structure, features of life and reproduction. Fungi-parasites that cause diseases of plants (smut, ergot, tinder). Structure, nutrition, reproduction. The role of fungi in nature and human life.

Selection of bacteria, fungi, its value for the microbiological industry (production of antibiotics, enzyme preparations, fodder yeast, etc.). The main areas of biotechnology (microbiological industry, cellular and genetic engineering). Pileate fungi. Structure, features of life, reproduction. Connection of fungi with plant roots (mycorhiza). The conditions of life of the fungus in the forest. Edible and poisonous mushrooms. Rules for collecting mushrooms. Prevention of poisoning by poisonous mushrooms.

Lower plants. Green and Brown algae. General characteristics of green algae. Classification. Unicellular green algae (chlamydomonade, chlorella, pleurococcus). Structure and features of life. Multicellular green algae. Filamentous algae. Spirogyra. Structure and features of life. Seaweed (kelp, fucus). Structure and features of life. Asexual and sexual reproduction of algae. Distribution of algae in water and on land. The importance of algae in nature and human life.

Lichen. Lichens as symbiotic organisms. General characteristic. The structure of the thallus of a lichen. Lichen scale, leafy, bushy. Nutrition and reproduction of lichens. The role of lichens in nature and human life.

Mosses. General characteristic. Classification. Green moss. Structure, reproduction and development cycle of common hair moss. The concepts of sporophyte and gametophyte. Sphagnum moss. Structure, reproduction and development cycle of the sphagnum. Water logging. The formation of peat, its value.

Lycopsids. General characteristic. Common clublike. The structure, reproduction, life cycle. The importance of the lycopsids.

Equisetales. General characteristic. Common horsetail. The structure, reproduction, life cycle. The importance of the equisetales.

Ferns. General characteristic. Bracken. Structure, reproduction and development cycle. Fossil fern and the formation of coal. The value of ferns in nature and human life.

Gymnosperms. General characteristic. Structure, reproduction and development cycle on the example of pine and spruce. Male and female cones. Pollen. Ovules. Pollen germination, pollen tube growth and fertilization. Distribution and biology of conifers. The value of gymnosperms in nature and economy.

Angiosperms (Flowering). Domination in modern flora of angiosperms and their advantage in comparison with other groups of plants. Adaptation of angiosperms to different conditions of life on Earth. Development cycle. Change of sporophyte and gametophyte in the development cycle. Variety of wild and cultivated flowering plants. The class of Dicotyledonous plants. General characteristic. Family: Cruciferae, Rosaceae, Legumes, Solanaceae, Asteraceae. Characteristics of families and their importance in nature and human life.

The class of Monocotyledonous plants. General characteristic. Families: Lily, Cereals. Characteristics of families and their importance in nature and human life.

Comparative characteristics of families. Monocotyledonous and Dicotyledonous plants, their biological features. Typical agricultural, wild and ornamental plants of these families. Impact of human activity on the species diversity of flowering plants. Red book. Protection of rare plant species.

Evolution of plants on Earth. The complexity of the structure of plants in the process of historical development in connection with the transition from water to land lifestyle. The main stages of development of plants on Earth (time of bacteria, algae, moss, planiform, horsetail, fern, gymnosperm and angiosperm).

Plant community. The concept of plant community. Adaptability of plants to living together: aboveground and underground tiering, different periods of development. Change of communities. Plant communities as part of the landscape. Characteristic features of the structure and biology of plants of the main types of vegetation: tundra, forests, meadows, steppes, deserts, swamps, aquatic vegetation; their relationship with the habitat and economic value. Protection of vegetation.

Zoology

Zoology is the science of animals. The importance of animals in nature and human life. The emergence of Zoology as a science and the history of its development.

Classification of animals. Concept of species, genus, family, order, class and phylum. The importance and success of modern Zoology. Similarities and differences of plants and animals.

Protozoa. Classification, General characteristics.

Phylum of Sarcodina (rhizopods). General characteristics of the type. The amoeba. Inhabitancy. External and internal structure. Movement. Food. Breath. Selection. Osmoregulation. Reproduction. Encystation. Dysenteric amoeba. Structure.Inhabitancy. Medical significance. Protection from infection.

Phylum of Flagellate. General characteristics of the type. Euglena as a single-celled organism that combines the features of animal and plant. Volvox as a colonial organism. Evolution of euglenales and volvox.

Phylum of Infusorias. General characteristics of the type. Paramecium caudatum as a more complex single-celled animal. Inhabitancy. Structure, features of life processes, reproduction. Irritability.

Phylum of Sporozoea. General characteristics of the type. The malaria parasite as the malaria agent. A way of people infection with malaria. The General concept of the change of hosts in the development cycle. Elimination of malaria as a mass disease in Russia.

Phylum of Coelenterates. Classification. General characteristics of the type. Inhabitancy.

Class of Hydrozoa. General characteristics of the class. Freshwater Hydra. External and internal structure. Inhabitancy. Hydra food. Breath. Nervous system. Movement. Reproduction asexual and sexual. Regeneration.

Class of Scyphozoa. General characteristics of the class on the example of Aurelia. Structure and development cycle.

Class of Anthozoans. General characteristics of the class. Representatives. Signs of complication in the organization.

The value of coelenterates in nature.

Phylum of Flatworm. Classification. General characteristics of the type.

Class of Turbellarian worms. General characteristics of the class. White planaria as a representative of free-living worms. Inhabitancy. External and internal structure. Bilateral symmetry. Nervous system and sensory organs. Food. Breath. Reproduction. Regeneration.

Class of Fluke. General characteristics of the class. Liver Fluke. External and internal structure. Adaptations to parasitism. Change of owners in the development cycle. Environmental ways to limit distribution. Disease prevention.

Class of Tapeworms. General characteristics of the class. Taenia (armed and unarmed tapeworm). A parasitic way of life. Features of external and internal structure. Cycles of development and change of owners. Measures to limit the spread and prevention of the disease.

Phylum of Nematode worms. General characteristics of the type. Ascarid. Inhabitancy. External and internal structure. Reproduction and development of ascarids. Measures and methods of prevention of infection. Pinworm as a representative of nematode worms. Disease prevention.

Phylum of Annelid worms. Classification. General characteristics of the type.

Class of Oligochaetes. General characteristics of the class. Earthworm. Inhabitancy. External and internal structure. Digestive, circulatory, excretory systems. Nervous system. Reproduction. Regeneration. The significance of earthworms in soil formation. **Class of Polychaetous.** Clamworm. The main differences from earthworms. The evolutionary significance of polychaete worms, their role in the diet of commercial fish.

Phylum of Mollusca. Classification. General characteristics of the type.

Class of Gastropods. General characteristics of the class. Big pond snail. French snail. Inhabitancy. External and internal structure. Movement. Features of life processes. Reproduction.

Class of Bivalvia. General characteristics of the class. Freshwater mussel and the pearl oyster. Inhabitancy. External and internal structure. Movement. Reproduction. Sea bivalve.

The importance of gastropods and bivalves in nature and for human.

Phylum of Arthropods. General characteristics of the type. Classification.

Class of Crustaceans. General characteristics of the class on the example of crayfish. Inhabitancy. External structure: chitinous cover, dismemberment of the body, limbs.Internal structure. Features of life processes. Reproduction. Other Crustaceans. Medical significance. Value in fish nutrition. Commercial Crustaceans.

The Class of Arachnida. General characteristics of the class. Inhabitancy. The external and internal structure of the cross spider. Respiration, nutrition, excretion, reproduction. Web and its construction. Acarians. The role of acarians in nature and their medical significance. Measures to protect humans from acarians.

The Class of Insects. General characteristics of the class. Inhabitancy. The external and internal structure of the insect in the example of the cockchafer. Features of life. Reproduction.

Types of insect development. The diversity of insects and their importance. The main detachments of insects. Insects with incomplete metamorphosis. The order of Orthoptera. Representatives. Locusts as a dangerous pest in agriculture. The order of Hemiptera (bugs). Representatives. Value. Patronizing color. Insects with complete transformation. The order Lepidoptera. Representatives. The cabbage white butterfly. Silkworm. Sericulture. The order Coleoptera. Harmful and helpful bugs. Cautionary coloring. The order of Diptera. Representatives. House flies, gadflies. Medical significance. The order of Hymenoptera. Representatives. The honey bee, the ants. Features of life of social insects. Instinct. Riders, as representatives of parasitic Hymenoptera.

A biological way to control harmful insects. Protection of useful insects. Aromorphosis of arthropods. Similarities and differences between arthropods and annelids.

Phylum of Chordal. Classification. General characteristics of the type.

Class of Lancelet. Lancelet as a form close to the ancestors of vertebrates. Inhabitancy. External and internal structure. Reproduction. Lifestyle. Similarity of lancelet with invertebrates and vertebrates.

Superclass (class) of Fish. General characteristic. External and internal structure of fish in the example of river perch. Environment, skin, skeletal system, skeleton structure, the structure of the heart and circulatory system, respiration, the digestive and the excretory system. Nervous system and sensory organs. Reproduction and development.

Systematic review of fish. A subclass of Cartilaginous fish: orders - Sharks and Stingrays. Characteristic. External and internal structure.

A subclass of Bony fish. Superorder Sturgeon (Cartilage). Representatives, structure feature, value

and significance. Superorder Lungfish. Representatives of lungfish. Superorder of crossopterygians. The representatives of crossopterygians. Superorder of Bony fish: orders Herring, Salmon, Carp, Flounder, Cod. General information about the way of life, adaptations to different conditions of existence. Spawning conditions. Fertility. Development of fish, migration. Protection and reproduction of fish resources.

Class of Amphibians. Classification. General characteristics of the class.

External and internal structure of the frog (on the example of any species). Features of the habitat, the skin, skeletal system, skeleton structure, the structure of the heart and circulatory system, breathing, the role of the skin in respiration, the digestive and the excretory system. Nervous system and sense organs. Reproduction and development. Wintering. The variety of amphibians and their importance. Origin of amphibians.

Class of Reptiles. General characteristics of the class.

External and internal structure of the sand lizard. Adaptations to life in the terrestrial environment. Skin, skeletal system, skeleton structure, the structure of the heart and circulatory system, respiration, the digestive and the excretory system. Nervous system and sensory organs. Reproduction and development. Regeneration.

Snakes. Poisonous and non-poisonous snakes. Poisonous glands, poisonous teeth. First aid after the bite of a poisonous snake. Modern reptiles: turtles, crocodiles. The origin of reptiles. Variety of ancient reptiles. The importance of reptiles in nature and for humans.

Class of Birds. Classification. General characteristics of the class.

External and internal structure of the pigeon. Features of life processes. Adaptability to flight. Environment, skin, skeletal system, skeleton structure, the structure of the heart and circulatory system, respiration, the digestive and the excretory system. Nervous system and sensory organs. Reproduction and development.

Reproduction and development. Origin of birds. Archaeopteryx.

Subclass of Neornithes (Modern birds). Superorder Ostrich (Ratites) and birds. Distribution. Some features of the structure and life. Superorder Penguins. Features of the structure and life in the harsh conditions of Antarctica. Superorder of Flying (Cristiform) birds. Major groups: Passerines, Charadriiformes, Anseriformes, Daytime varmints, Galliformes, Ciconiiformes, Columbiformes, Piciformes, Stereopony, Cuckoos. A variety of flying birds - forest birds; birds of steppes and deserts; birds of open air spaces; birds of bogs, fresh waters and their coasts. Lifestyle, adaptation to different conditions of existence. Nutrition, reproduction, development. Seasonal phenomena in the life of birds: flights, nesting. Protection and attraction of birds (winter feeding, production and placement of artificial nests). The role of birds in nature and their importance in human life.

Class of Mammals. Classification. General characteristics of the class. Features of external and internal structure of mammals in the example of a dog. Reproduction and development. The origin of mammals. Diversity of mammals and their importance.

Subclass of Egg-Laying (monotremes). General characteristic. The platypus and the echidna. Similarity of egg-laying (monotremes) and reptiles.

Subclass of Theria. Placental mammals are the most progressive group of modern vertebrates. Their diversity.

Mammal review by groups: Insectivores, Bats, Rodents, Lagomorphs, Carnivora (canids, felids), Pinnipeds, Cetaceans, Artiodactyls, Solipeds, Primates. The anthropoid apes. Family – Old world monkeys and apes. Representatives of groups of mammals: forest, digging, semi-aquatic, water, flying animals and animals of open landscapes. Features of the structure and life. The importance of mammals in nature and human life. The role of mammals in nature and human life. Protection of useful and rare animals. The spread of animals on Earth. Causes of differences in fauna in different parts of the globe.

The development of animal life on Earth. Main stages of development of the animal world: from unicellular to multicellular, from the lowest to the highest by eras and periods. Relations between classes of vertebrates. Reflection of related links in the natural system of the animal world.

Human

Human anatomy, physiology and hygiene are interrelated Sciences that study the structure, functions of the human body and the conditions for maintaining its health. The importance of knowledge of human anatomy, physiology and hygiene.

General overview of the human body.

Structure and functions of the human body. Comparison of the structure of the human body and mammals.

Basic types of tissues (epithelial, connective, muscle, nerve tissue) and their properties. **Nervous system.** Functions of the nervous system. Concepts of nervous regulation. Processes of excitation and inhibition in nerve cells. Structure of the neuron. Types of nerve fibers. Receptors. Reflex. The scheme of the reflex arc.

Central nervous system. Structure and functions of the spinal cord. Spinal cord reflexes. Structure and functions of the brain: oblong, cerebellum, middle, intermediate, final. The higher part of the brain is the cerebral cortex. Peripheral nervous system. Somatic and autonomic (Autonomous) nervous systems. Sympathetic and parasympathetic parts of the autonomic nervous system.

Endocrine glands. The concept of humoral regulation. Hormones and their role in the regulation of growth, development, differentiation and metabolism. Pituitary hormones, their role in the regulation of growth and development of the human body. Thyroid and its hormones. Adrenal and gonadal hormones. Role of pancreatic hormones in the regulation of carbohydrate metabolism.

Musculoskeletal system. Functions of the musculoskeletal system. Structure of the human skeleton. Features of the skeleton structure in connection with the upright position and labor activities of man. Structure and composition of bones. Organic and inorganic bone matter. Bone growth in thickness. Bone joint: continuous, joints, symphysis. First aid for fractures, dislocations and sprains.

The human muscular system. Muscles, their structure and functions Movement in joints. Reflex nature of muscle activity. Coordination of movements. The influence of rhythm and load on muscle performance. Fatigue. Features of the musculoskeletal system of children and adolescents. The importance of physical education and sports for the proper formation of the skeleton and muscles. Prevention of curvature of the spine and the development of flat feet. Proper seating, posture and working position. Internal environment: blood, lymph, tissue fluid. Relative constancy of the internal environment of the body.

Blood. Function of blood. Composition of blood: plasma, formed elements. Role of erythrocytes in transfer of gases. Blood clotting as a protective reaction of the body. Leukocyte function. I. I. Mechnikov's teaching about the protective properties of blood. Pathogens: bacteria and viruses. Struggle against epidemics. Immunity and its types. Blood group. Blood transfusion and its value.

Lymph. Lymph formation. Lymphatic movement in lymphatic vessels. The difference between lymph and plasma. Tissue fluid, its value.

Circulatory system. Functions of the circulatory system. Large and small circles of blood circulation. Arteries, capillaries and veins. The heart, its structure and work. Heart valve. Properties of the heart muscle. Pulse, its definition. Blood pressure and blood velocity in different parts of the blood stream. First aid for arterial and venous bleeding. The concept of nervous and humoral regulation of the heart and blood vessels. Training of the heart. The impact of physical education and sports on the cardiovascular system.
Respiratory system. Functions of the respiratory system. Structure of the respiratory tract. Vocal apparatus. Structure of the human lungs. Gas exchange in lungs and tissues. The mechanism of respiratory movements. Lung capacity. Transfer of gases by blood. The value of respiratory gymnastics. Artificial respiration. Nervous and humoral regulation of breathing. Protective respiratory reflexes. The concept of clinical and biological death. First-aid methods of restoring breathing and cardiac activity (breathing mouth to mouth, chest compressions). Respiratory hygiene. The value of proper breathing. The struggle for clean air at home, at school and at the workplace. Dangers of smoking. Transmission of infectious diseases (influenza, tuberculosis, diphtheria) through the air and their prevention.

Digestive system. Functions of the digestive system. General overview of the digestive organs: organs of the mouth (teeth, tongue, salivary glands), esophagus, stomach, intestines, pancreas, liver. Changes of eaten food in different parts of the digestive tract. Chewing. Experiments of I. P. Pavlov to study the activity of the salivary glands. The effect of saliva enzymes on carbohydrates. Swallow. The secretion of gastric juice. Experiments on dogs with gastric fistula, with an isolated ventricle. Digestion of food in the stomach and small intestine. Enzymes. Influence of food composition on the activity of the digestive glands. The role of the liver and pancreas in digestion. Absorption of nutrients. Functions of the large intestine. Examples of unconditional and conditional food reflexes. Pavlov's work on the study of digestion, nervous regulation of digestion. Nervous and humoral regulation of digestion. Hygienic conditions of normal digestion. The concept of the prevention of foodborne infections.

Metabolism. Food and nutrients. The value of food. Protein, fat and carbohydrate content in the main food groups of products. Absorption of proteins, fats, carbohydrates in the body. Intracellular

metabolism. Absorption of nutrients (assimilation). The processes of decomposition (dissimilation). Assimilation and dissimilation as two sides of a single metabolic process. Self-renewal of the body in the process of metabolism. Transformation of energy in the body. Body temperature. The value of maintaining a constant body temperature. The body's need for proteins, fats, carbohydrates, water and salts. Food standards. Calorie diet. Vitamins. Value of vitamins. Diseases associated with a lack of vitamins in food. Features of nutrition during growth. The value of proper nutrition for the body.

The excretory system. Excretory system functioning. The metabolic products excretion. Organs of the urinary system. The structure and work of the kidneys. Importance of excretory organs in maintaining the constancy of the internal environment of the body.

Skin. Skin function. Skin structure. Derivatives of the skin. The role of the skin in the regulation of heat transfer. First aid for frostbite, burn, heat and sunstroke. Body hardening value.

Natural factors of hardening and the rules of using them. Hygiene of skin and clothing. Analyzers. I. P. Pavlov's theory of analyzers. The value of analyzers for the perception of the world.

Visual analyzer. Eye structure. Photosensitive apparatus of the eye. Construction of the image on the retina. Nearsightedness, farsightedness and their correction. Hygiene of vision.

Auditory analyzer. Structure and hygiene of the hearing organ. The mechanism of perception of sounds.

Vestibular analyzer. Touch. Mechanisms of perception of touch, cold, heat. Smell. The mechanism of smell perception. Taste. The mechanism of perception of food.

Higher nervous activity. The role of I. M. Sechenov in the development of the doctrine of higher nervous activity. The doctrine of I. P. Pavlov on conditioned reflexes. Conditional and unconditional reflexes. Formation and inhibition of conditioned reflexes. Reflexes are the basis of animal behavior. Features of the higher nervous activity of man. Direct and speech conditioned stimuli. Speech functions. First and second signal systems. Mental health. Day regime. Work and rest. Sleep hygiene. Influence of alcohol, tobacco and drugs on the nervous system.

Development of the human body. Male and female reproductive systems. Sex cell. Fertilization. The role of chromosomes in the transmission of hereditary properties.

Similarity of early stages of embryo development in humans and vertebrates. Nutrition of the human embryo.

Post-embryonic human development. Features of development of children and adolescent organisms. The importance of physical culture and sports for the normal development and strengthening of a body. Influence of alcohol, tobacco and drugs for human cells, organs and systems in embryonic and post-embryonic periods.

The body as an integral whole. Coordination of activities of all organs (humoral and nervous mechanisms of regulation).