BIOLOGY

Botany

Botany as the science of plants. Plants as a whole organism. Plants as a part of nature, their diversity and expansion on Earth.

Root. Functions of roots. Root development from the seed root. The types of roots (primary, lateral, secondary). Types of root systems (tap root and fibrous root). The root areas. Root cap. External and internal structure of the root. Root growth. Soil as environment for plant life. Water and mineral salts absorption by roots. Fertilizer. The importance of soil treatment, fertilizing.

Shoot. Bud as a germinative shoot, its structure. The development of a shoot from a bud.

Stem. Stem growth in length. The internal structure of tree stem in connection with its functions. Stem growth in width. The formation of annual rings. The age of the trees. The movement of mineral and organic substances in the stem. Modified shoots: rhizome, tuber, bulb.

Leaf. The external structure of the leaf. The venation of the leaves. Simple and compound leaves. Phyllotaxy. Features in the internal structure of the leaf in connection with its functions: Exodermis (skin and stomata), the basic, conductive and mechanical tissue. The role of green plants in nature, human life and the protection thereof.

Vegetative reproduction of flowering plants, its role in nature and plant cultivation. Flower as an organ of seed reproduction. The perianth, stamens, pistil. Inflorescences and their biological significance. Cross-pollination by insects and wind. Self-pollination. The germination of pollen. Fertilization. The formation of seed and fruit.

Seed. The structure of seeds (for example, dicotyledonous and monocotyledonous plants). The conditions of seed germination. Seed respiration.

The main groups of plants.

Algae. Unicellular and multicellular algae. Structure and characteristics of life. Reproduction of algae. Sea algae. The role of algae in nature and agriculture.

Mosses. Green mosses. Structure, reproduction, for example, hair cap moss (Polytrichum commune). Sphagnum moss. The formation of peat, its importance.

Ferns. Structure and reproduction. Horsetails and Lycopodium. The role in nature and human life.

Gymnosperms. The structure and reproduction by example of pine. Expansion of conifers, their role in nature and the economy.

Angiosperms (flowering). Features of structure, reproduction and life.

Domination in the modern flora of angiosperms and their advantage in comparison with other groups of plants. The main families of angiosperms and their importance.

The impact of human activities on the species diversity of flowering plants. IUCN Red List. Protection of rare species of plants.

Bacteria. Fungi. Lichens.

Bacteria. The structure and vital activity of bacteria. The growth of bacteria. The spread of bacteria in air, soil, water and living organisms. Pathogenic bacteria and fight against them. The role of bacteria in nature, medicine, agriculture and industry.

Fungi. General characteristics of fungi. Pileate fungi, their structure, nutrition and reproduction. Symbiosis of fungi with plants. Edible and poisonous mushrooms. Mold fungi. Penicillium, its use to obtain antibiotics. Yeast. Parasitic fungi that cause diseases of plants and animals. The role of fungi in nature and economy.

Lichens. The structure of lichens. Nutrition. Reproduction. The role of lichens in nature and human life.

Zoology

Zoology as the science of animals. The role of animals in nature and human life.

Protozoa. General description of the type.

Amoeba vulgaris. Habitat. Movement. Nutrition. Breath. Excretion. Reproduction.

Encystment.

The diversity of single-celled animals (Euglena viridis, Paramecium caudatum, Malaria parasite).

Coelenterata. General description of the type. Diversity of coelenterates, their role. Freshwater Hydra. External and internal structure. The radial symmetry. Nutrition of Hydra. Breath. Regeneration. Reproduction.

Flatworm. General description of the type. Liver Fluke. External and internal structure. Adaptations to parasitism. Bovine tapeworm. A parasitic way of life. Features external and internal structure. The cycle of development. Protection against infection.
Roundworms. General description of the type. The human Ascaris as a human parasite. Reproduction and development of Ascardis. Measures of protection against infection.
Annelid worms. General description of the type. Earthworm. Habitat. External and internal structure. Organ systems. Reproduction. Regeneration. The role of earthworms in soil formation.
Shellfish. General description of the type. The diversity of shellfish (Anodonta, Colymbetes, Helix pomatia, slug, oysters). The role in nature and human life.
Arthropods. General description of the type.
Arachnida. Habitat. External and internal structure of Araneus diadematus. Respiration, nutrition, reproduction. Ticks. The role of ticks in nature and their medical importance. Measures of protection against ticks.
Insects. External and internal structure of the insect on the example of May beetle. Features of life. Reproduction. The types of insects development. The diversity of insects and their importance. Lepidoptera. Silkworm. Sericulture. Diptera. Housefly. Hymenoptera. Honey bee.
Chordates. General description of the type.
Lancelet as a form close to the ancestors of vertebrates. Habitat. Features of the structure of lancelet as Cephalochordate.
Fish. General characteristics of the class. External and internal structure of fish, the example of river perch. Reproduction and development. The diversity of fishes: Chondrichthyean and bony fish. Economic importance and protection of fish.
Amphibians. General characteristics of the class. External and internal structure of a frog. Habitat. Reproduction and development. The diversity of amphibians.
Reptiles. General characteristics of the class. External and internal structure of the lizard. Reproduction. Regeneration. The diversity of reptiles.
Birds. General characteristics of the class. External and internal structure of a pigeon. Fitness to fly. Features of the processes of life. Reproduction and development. The role of birds in nature and human life. The protection of birds.
Mammals. General characteristics of the class. Features of the external and internal structure of mammals, for example, a dog. Reproduction and development. Prototheria. Marsupials. Placental mammals as the most advanced group of modern vertebrates. Their diversity. The role of mammals in nature and human life. Protection of useful and rare animals.

Human and health

Human anatomy, physiology and hygiene as related sciences that study the structure, body functions and the conservation of its health. The importance of knowledge of human anatomy, physiology and hygiene.
An overview of the human body.
The structure and function of the human body. The main types of tissues (epithelial, connective, muscular, nervous tissue) and their properties.
The musculoskeletal system. The functions of the musculoskeletal system. The structure of the human skeleton. Features of its structure in connection with bipedalism and labor activity. The structure and composition of bones. Bone growth. Bone connection. First aid for fractures, dislocations and sprains.
Muscles, their structure and function. The main muscle groups of the human body. The work of the muscles. The influence of rhythm and loads on muscle performance. Fatigue. Reflex activities of muscles. The role of physical education and sport for proper formation of the skeleton and muscles. Prevention of spinal curvature and the development of flatfoot. Proper seat, posture and working position.
The internal environment of the body: blood, tissue fluid and lymph. The relative constancy of the internal environment of the body. Blood, functions of blood. Blood composition: plasma, blood corpuscles. The red blood cells. The role of erythrocytes in the transport of gases. Anemia. Leukocytes. The structure and functions. Theory of I.I. Mechnikov on the protective properties of blood. Pathogens: bacteria and viruses. AIDS. The fight against epidemics. Immunity and its types. Blood coagulation as a protective reaction of the organism. The blood groups. Blood transfusion and its significance. Donation.
Circulatory system: the heart and blood vessels (arteries, capillaries and veins). Systemic circulation and pulmonary circulation. The movement of blood through the vessels. Heart, its structure and work. The concept of neural and humoral regulation of the heart and blood vessels. Training of the heart. The impact

of physical education and sport on the cardiovascular system. The harmful effects of smoking and alcohol on the heart and blood vessels.
Breath. The structure and function of the respiratory system. Voice box. Gas exchange in lungs and tissues. Breathing movements. Vital capacity of the lungs. Nervous and humoral regulation of breathing. Hygiene of respiration. The importance of proper breathing. The harm of smoking. Airborne transmission of infectious diseases (influenza, tuberculosis, diphtheria) and their prevention.
Digestion. The structure and function of the digestive system. Teeth, prevention of dental diseases. The digestive enzymes. Change of food in different parts of the digestive tract. I. P. Pavlov's experiments on the study of the activities of the digestive system. The role of liver and pancreas in digestion. Absorption. Regulation of the digestive processes. Hygienic conditions of normal digestion. Prevention of helminthic and gastrointestinal diseases, food poisoning, first aid in these cases. The effects of smoking and alcohol consumption on digestion.
Metabolism. Assimilation and dissimilation as two sides of a single process of metabolism. Vitamins. The importance of vitamins. Diseases associated with lack of vitamins in food. Ways to preserve vitamins in foods. The role of excretion of the end products of metabolism from the body.
Organs of the urinary system, their functions.
Skin. Structure and functions of the skin. The role of skin in thermoregulation. First aid for frostbite, burns, heat and sunstroke. The role of tempering of the body. Hygiene of skin, clothes and shoes.
The nervous system. The functions of the nervous system. The central nervous system. The parts of the brain: medulla oblongata, mesencephalon, thalamencephalon, hemispheres of the forebrain, and cerebellum. The structure and functions of the spinal cord. The peripheral nervous system. The role of the autonomic nervous system in the regulation of the internal organs. Cerebral cortex. The role of I. M. Sechenov and I. P. Pavlov in the development of the theory of higher nervous activity. Conditional and unconditional reflexes. Formation and inhibition of conditioned reflexes. The influence of nicotine, alcohol and drugs on the nervous system. The analysers. The visual analyzer. The structure of the eye. Hygiene of vision. The auditory analyzer. The structure and hygiene of the organ of hearing.
Endocrine glands. The functions of the endocrine glands. Hormones and their importance for the organism. The role of humoral regulation in the body.

General biology

General biology as a subject about the laws of the vital phenomena which are basic and common to all organisms. The role of General biology to medicine, agriculture, forestry and other sectors of the economy.

The evolution theory

Brief information about the period of development biology before Darwin theory. The main provisions of evolution theory of C. Darwin. The role of the theory for the development of natural science.
Species. Criteria of species. The population as the unit of species and evolution. The driving forces of evolution.
Heredity. Variability, types of variability. Natural selection. The leading role of natural selection in evolution. The struggle for existence and its form.
Artificial selection and hereditary variability as a basis of breeding of domestic animals and cultivars of cultural plants.
The adaptive nature of evolution. The relative viability.
Microevolution. Species formation. Macroevolution.
Results of evolution: organic viability, fitness of the organisms, the diversity of species.

The evolution of the organic world

The emergence and development of life on Earth.
The main directions of evolution. Aromorphosis. Idioadaptation. General degeneration. The ratio of different directions of evolution. Biological progress and regress.
A brief history of the development of the organic world. The main aromorphosis in the evolution of the organic world.

The origin of human

C. Darwin on the origin of man from animals. F. Engels on the role of labour in the transformation of the ancient apes in people. Driving forces of anthropogenesis: social and biological factors. The role of biological and social factors in human evolution.
The earliest people, the ancient people, fossil people of modern type.
The unity of origin of human races. Unscientific, reactionary nature of "social Darwinism" and racism.

Fundamentals of ecology

The subject and objectives of ecology. Environmental factors: abiotic, biotic, anthropogenic factors, and their effects on the body.

Photoperiodism.

Species, its ecological characteristics. Population, change its size, ways of regulation of its size. Rational use of species, conservation of their diversity.

Ecosystems. The diversity of populations in the ecosystem and their interrelationships. Food chains. The rule of ecological pyramid. Self-regulation. Changes in ecosystems. Succession of ecosystems.

Agrocoenosis. Protection of ecosystems.

The fundamentals of theory of biosphere.

The theory of V.I. Vernadsky about biosphere. The biosphere and its borders. Noosphere. The density of life. The biomass of the land surface, soil, oceans. Living matter, its gas, concentration, oxidizing and reducing functions. The circulation of substances and energy in biosphere.

Fundamentals of cytology

Cell is an elementary living system, underlying the structure and the development of organisms.

The main provisions of the cell theory. Prokaryotic and eukaryotic cells. The structure and function of the nucleus. The cytoplasmic membranes. The cytoplasm, the organelles of the cell.

Chemical organization of cells. The content of chemical elements in the cell. Water and other inorganic substances and their role in the life of the cell.

Organic substances: carbohydrates, lipids, proteins, nucleic acids, ATP, and their role in the cell. Enzymes, their role in the regulation of life processes. DNA autoreduplication.

Metabolism and energy in the cell. Plastic and energy metabolism as the basis of life of cells. Energy metabolism, its nature, the role of ATP. Plastic exchange. Photosynthesis. Protein biosynthesis.

The gene and its role in protein biosynthesis. The DNA code. Reactions of matrix synthesis. The relationship of plastic processes and energy metabolism.

Viruses. Their submicroscopic organization, importance and role in nature. Viral diseases of humans, animals and plants. AIDS.

Reproduction and individual development of organisms. Cell division as the basis of reproduction and individual development of organisms. Chromosomes, their haploid and diploid set, number and shape constancy. Preparation of cells for division. Reduplication of DNA molecules. Mitosis. Phases of mitosis.

Sexual and asexual reproduction of organisms. Sex cells. Meiosis. The development of eggs and sperm. Fertilization.

Individual development of organisms. The development of fertilized eggs (the example of lancelet).

Postembryonic development. Harmful effects of alcohol, nicotine and drugs on the development of the human body.

Fundamentals of genetics

Genetics as the science about laws of heredity and variability. Importance of genetics.

The subject, objectives and methods of genetics. Genetic terms: gene, allelic and nonallelic genes, homo - and heterozygote, dominant and recessive traits, genotype and phenotype.

The main regularities of the transmission of hereditary characteristics. Hybridological method for the study of heredity. Patterns of inheritance established by G. Mendel. Monohybrid breeding. The first law of G. Mendel. The uniformity of first generation hybrids. The second law of Mendel. The segregation in the second generation. Incomplete dominance. Then intermediate type of inheritance of characters. Dihybrid crossing. The third law of G. Mendel. Independent combination of hereditary traits in dihybrid crossing. The statistical nature of laws of G. Mendel.

Genetic linkage. Linkage group. Linkage failure. Chromosome crossing. The chromosomal theory of heredity.

The genotype as a whole system. Interaction of genes. Genetics of sex. Sex chromosomes and autosomes. Sex-linked inheritance.

Variability and its forms. Modification variability. Norm of reaction. Statistical regularities of modification variability. Genotypic variability. Mutations and their causes. The law of homological rows in hereditary variability of N. I. Vavilov.

Experimental mutations. Mutations as a material for artificial and natural selection. Pollution of the environment with mutagens and its implications. The importance of genetics for medicine and health. The harmful effects of nicotine, alcohol and drugs on heredity. Genetics and theory of evolution.

Genetics of populations. Forms of natural selection: driving and stabilizing.

REFERENCES

Basic textbooks:

1. General biology. ed. by Polyansky, Y. I. M., Prosveschenie, 1992.
2. General biology, Ed. by A.O. Ruvinsky, M. Prosveschenie, 1993.
3. Zakharov V. B., Mamontov S. G., Sonin, V. I. General biology Textbook for grades 10-11 of the secondary schools 10-11. M., Drofa, 2000.
4. Tsuzmer A. M., Petrushina O. L. Biology. Human and health Textbook for grade 9 of the secondary school. M., Prosveschenie, 1994.
5. Naumova, D. V. Zoology Textbook for grades 6-7 of the secondary school. M., Prosveschenie, 1985.
6. Korchagina V. A. Botany. Textbook for grades 5-6 of the secondary school. M., Prosveschenie, 1984.

Additional textbooks:

1. Biology (Student Handbook). Developed and compiled by Vlasova Z. A. M., Slovo, 1995.
2. Bobrova T. A. Gufeld, I. M. Botany. Zoology Human Anatomy and Physiology. General biology Tutorial. Ed. by L. A. Panfilova. M.: "RIPOL CLASSIC", 1999.
3. Bogdanova T. L. Biology (tasks and exercises). Tutorial for prospective students. M., Vysshaya Shkola, 1991, 2001.
4. Willie K., Detier V. Biology. M., Mir, 1975.
5. Vorontsov N. N., Sukhorukova L. N. The evolution of the organic world: optional course. Tutorial for grades 9-10 of high school. M., Prosveschenie, 1991.
6. Green N., Stout, W., Taylor. Biology (in 3 volumes). M., Mir, 1991.
7. Zakharov V. B., Mamontov S. G., and others. Biology: General regularities. M., Schkola - Press, 1996.
8. Zayats, R.G., et al. Tutorial on biology for prospective students. Minsk. Vysshaya Shkola, 1996.
9. Kemp P., Arms K. Introduction to biology. M., Mir, 1988.
10. Mednikov B. M. Biology: forms and levels of life. Handbook for students. M., Prosveschenie, 1994.
11. Sidorov E. P. General biology for prospective students. M., Unicum-centre, 1997.
12. Sidorov E. P. Anatomy for prospective students. M., Unicum-centre, 1997.
13. Sidorov E. P. Zoology for prospective students. M., Unicum-centre, 1997.
14. Chebyshev N.V. et al. Biology, M., Novaya volna, ONYX, 1999.
15. Helevin N. V., Lobanov A. M., Kolesova O. F. Problem book in General and medical genetics. M., Vysshaya Shkola, 1984.
16. Encyclopedic dictionary of the young biologist. M., Pedagogika, 1986.

Sample questions:

- Adaptation of animals to a parasitic lifestyle is associated with a simplification of the body structure, which is an example of:

1) aromorphosis
2) idioadaptation
3) degeneration
4) biological regress

- Genes are called allelic:

1) which are located nearby on the same chromosome
2) any genes of homologous chromosomes
3) which are located in homologous chromosomes, and determine the development of one sign
4) which are located in the same chromosome at a considerable distance

- When the temperature of the environment decreases, the person has:

2) contracted blood vessels of the skin
2) dilated blood vessels of the skin
3) the increased number of platelets in the blood
4) the increased number of red blood cells