

Документ подписан простой электронной подписью
Информация о владельце:
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Должность: Ректор
Дата подписания: 20.01.2025 12:39:33
Уникальный программный ключ:
1bcb6e8dd125337659310c8c6c08f3bb1f12d77b7

Частное образовательное учреждение высшего образования
«Санкт-Петербургский медико-социальный институт»

УТВЕРЖДАЮ

Председатель Приемной комиссии,
ректор, к.м.н., доцент

_____ С.Б. Мальцев

«17» января 2025 года

ПРОГРАММА ВСТУПИТЕЛЬНОГО ИСПЫТАНИЯ
ПО ПРЕДМЕТУ
«БИОЛОГИЯ»

Санкт-Петербург
2025

Biology

Evaluation criteria

In total, the test contains 85 tasks of two difficulty levels. Points are calculated as follows:

for tasks (1-70) 1 point each (maximum $70 \cdot 1 = 70$),

for tasks (71-85) 2 points each (maximum $15 \cdot 2 = 30$),

The total points can reach 100 if all answers are correct. The minimum score for successfully passing the entrance test is 39.

PROGRAM OF ENTRANCE EXAMINATIONS IN BIOLOGY

At the biology exam, an applicant to a higher education institution must show:

- knowledge of basic concepts, leading ideas, patterns and laws that form the core of biological education: cell theory; the relationship between the structure and function of the body; levels of organization of living nature; the doctrine of the evolution of the organic world, the diversity and classification of organisms; environmental patterns;
- the ability to substantiate conclusions using biological terms, explain natural phenomena, and apply knowledge in practical activities.

Plants. General introduction to flowering plants

Flowering plant and its organs: root and shoot; shoot structure: stem, leaves, buds; flower is a modified shoot. Fruits and seeds, their adaptability to distribution in nature. Composition of plants (organic and inorganic substances).

Cellular structure of a plant organism

Magnifying devices (magnifying glass, microscope).

Cell and its structure: membrane, cytoplasm, nucleus, plastids, vacuoles. Vital activity of the cell: movement of the cytoplasm, entry of substances into the cell, its growth and division.

Root

Root. Types of roots. Types of root systems. Soil, its importance for plant life. Soil protection.

External and internal structure of the root. Root zones. Root growth. The main functions of the root: absorption of water and minerals, strengthening of plants in the soil. Root breathing. Fertilizers. The importance of tillage and fertilization. Root crops, their use by humans.

A shoot.

A shoot. A bud as an embryonic shoot, its structure. Development of a shoot from the bud. Shoot. External structure of the leaf. Venation. The leaves : simple and compound. Leaf arrangement.

Features of the microscopic structure of the leaf in connection with its functions.

Photosynthesis.

Breath. Evaporation of water by leaves. Leaf modifications. Leaf fall. The need to protect air from pollution. Greening of populated areas and premises

Stem. Stem growth in length. Crown formation. The internal structure of a woody stem in connection with its functions. Stem growth in thickness. Formation of tree rings. Movement of mineral and organic substances in the plant. Deposition of reserve substances.

Modified shoots: rhizome, tuber, bulb, their structure, biological and economic significance.

Plant propagation

Reproduction and its meaning. Reproduction methods.

Vegetative propagation. Vegetative propagation, its role in nature and crop production.

Plant propagation by seeds. A flower is a modified shoot. The importance of flowers in plant

reproduction. The structure of the perianth, stamen, pistil. Inflorescences and their biological significance. Cross pollination by insects and wind. Self-pollination.

Fertilization. The formation of seeds and fruits, their significance in nature and human life. Damage caused to nature by mass collection of wild plants. Protection of flowering plants.

The structure of seeds (using the example of dicotyledonous and monocotyledonous plants), their chemical composition. Conditions for seed germination. Breathing of seeds. Nutrition and growth of seedlings. Agricultural technology for sowing seeds and growing plants.

Plants and Environment

A plant is a complete organism. Relationships between cells, tissues and organs. Basic life processes of a plant organism. Plant community. Ecological factors of inanimate and living nature associated with human activities. The relationship between plants and factors of inanimate and living nature using the example of plants in a forest, meadow, etc. The adaptability of plants to live together in a forest, meadow, etc. The role of plants in nature and human life.

The influence of human activity on the life of plants in forests and meadows. Plant protection, protection of their habitat, nature conservation laws.

Plant Classes

Seaweed. The structure and life activity of unicellular and multicellular algae. Algae propagation. Filamentous algae. Seaweed. The role of algae in nature and the national economy, their protection.

Mosses. Structure and reproduction (using the example of local species). Peat formation, its significance. Environment-forming and resource significance of mosses in the bog community.

Ferns. Structure and reproduction, role in nature and human life. Horsetails. Moss mosses.

Gymnosperms. Structure and reproduction (using the example of pine, spruce or other conifers). Distribution of conifers, their importance in nature and the national economy. Regulation of the number of conifers. Restoration of coniferous forests.

Angiosperms (flowering plants). Features of the structure and life activity of angiosperms as the most highly organized group of plants, their dominance on Earth. Variety of flowering plants.

Class Dicotyledonous plants. Families: cruciferous (brassicaceae), rosaceae, legumes, nightshade, asteraceae (asteraceae), mallow, goosefoot, grape (depending on local conditions).

Class Monocots. Families: lily, grasses, bluegrass.

Distinctive features of plants of the listed families, their biological characteristics, national economic significance.

The influence of human activity on the species diversity of flowering plants. Preservation and

restoration of the number of rare species of flowering plants.

Agricultural plants

The most important agricultural plants (cereals, fruits and berries, vegetables, oilseeds, industrial plants, etc.), biological principles and technology for their cultivation.

Origin of cultivated plants. The concept of variety. Achievements of science in breeding new varieties of plants.

Development of the plant world

Diversity of plants and their origin. Evidence for the historical development of plants.

The main stages in the development of the plant world: the emergence of unicellular and multicellular algae; the emergence of photosynthesis; access of plants to land (psilophytes, mosses, ferns, gymnosperms, angiosperms). Complication of plants in the process of historical development. Phylogenetic connections in the plant world.

The dominance of angiosperms at the present time, their diversity and distribution on the globe. The influence of human economic activity on the plant world. Conservation of plant biological diversity

Bacteria. Mushrooms. Lichens.

Bacteria

The structure and activity of bacteria, their reproduction. Distribution in air, soil, water, living organisms. Role in nature, industry, medicine, agriculture. Pathogenic bacteria and the fight against them.

Mushrooms. Lichens

General characteristics of mushrooms. Cap mushrooms, their structure, nutrition. Symbiosis of fungi and plants. Edible and poisonous mushrooms. Rules for collecting mushrooms and their protection. Prevention of poisoning from poisonous mushrooms. Mold fungi. Penicill, its use to obtain antibiotics. Yeast. Parasitic fungi that cause plant diseases. The role of mushrooms in nature and agriculture.

The structure of lichen. Symbiosis of fungus and algae. Nutrition. Reproduction. The role of lichen in nature

Animals General information about the animal world

Diversity of the animal world. The main differences between animals and plants, their similarities. Taxonomy of animals.

Single-celled animals as the most primitive and ancient animals.

Common amoeba. Features of the cell structure of a unicellular organism. Habitat. Movement. Nutrition. Breath. Selection. Reproduction. Cyst formation.

A variety of single-celled animals: green euglena, features of its structure and nutrition, slipper ciliates,

malaria parasite, marine protozoa. Irritability.

The importance of single-celled animals in nature and human life. General characteristics.

Type Multicellular animals

Freshwater hydra. Habitat. External and internal structure. Radial symmetry. Two-layer. The structure of a multicellular animal cell. Cell specialization. Types of cells and their functions, vital processes. Nervous system. Reflex. Regeneration. Reproduction.

The diversity of coelenterates (coral polyps and jellyfish), their significance.

General characteristics of the type

Type Flatworms, their diversity. The white planaria is a free-living flatworm. Bilateral symmetry. Features of the structure and life processes of the liver fluke and other parasitic worms, control measures. General characteristics of the type.

Type Roundworms. The human roundworm and pinworm are human parasites. Preventive measures against infection with ascariasis.

Type Annelids, their diversity. Earthworm, its habitat, external structure, movement. Tissues, organs, organ systems. Life processes. Regeneration. Reproduction. The role of earthworms in soil formation.

General characteristics of the type.

Type Molluscs. Toothless. Habitat, features of external structure, nutrition, respiration, reproduction.

The variety of mollusks (large pond snail, grape snail, slugs, oyster, mussel), their significance in nature and human life.

General characteristics of the type.

Phylum Arthropod

Class Crustaceans. Habitat of crustaceans. Features of structure, life activity; reproduction, diversity of crustaceans. General characteristics of the class.

Class Arachnida. Features of the external structure, nutrition, respiration, behavior of the spider in connection with life on land. General characteristics of the class.

Ticks. External building. Mites - pests of cultivated plants and measures to combat them. Parasitic ticks are pathogens and carriers of dangerous diseases. Measures to protect against ticks. General characteristics of the class.

Class Insects. Features of the structure and vital processes of insects using the example of a beetle. Reproduction. Types of insect development.

Main orders of insects

Lepidoptera. Traits of adaptation to the environment in the external structure; reproduction and development of butterflies. Silkworm. Sericulture.

Diptera. The housefly is a carrier of pathogens of dangerous human diseases and measures to combat it.

Hymenoptera. Honey bee. The composition and life of a bee family: bee dancing, wintering. Instincts are the basis of insect behavior. Beekeeping. General characteristics of the class.

The variety of insects (Colorado beetle, ants, wasps), their role in nature; practical and aesthetic significance. A biological method of controlling insect pests of agricultural crops and its role in preserving the harvest. Insect protection.

General characteristics of the type.

Type Chordata

Lancelet. Habitat. Features of the structure of the lancelet as a lower chordate. General characteristics

of the type.

Pisces class. Fish habitat. Features of the external structure, skeleton and muscles. Body cavity. Features of the structure of internal organ systems in connection with their functions. Metabolism. Nervous system and sensory organs. Reflexes. Behavior.

Reproduction, spawning and development. Caring for offspring. Adaptation of fish to their environment. Migrations. Variety of fish (orders: herring, lobe-finned, etc.).

Economic importance of fish. Artificial fish breeding, pond farming. Fish protection.

General characteristics of the class

Class Amphibians. Frog. Features of structure, movement in connection with the habitat. Nervous system and sensory organs. Reproduction and development.

The diversity of amphibians (orders: caudate, tailless), their origin, meaning and protection.

General characteristics of the class.

Class Reptiles. Lizard. Habitat, structural features, reproduction, behavior in connection with life on land. Regeneration.

The diversity of modern reptiles (orders: squamates, turtles, crocodiles), their practical significance and protection. Origin of reptiles. Ancient reptiles: dinosaurs, wild-toothed lizards.

General characteristics of the class.

Bird class. External structure, skeleton, muscles. Features of the internal structure and metabolism of birds associated with flight. Complication of the nervous system, sensory organs; bird behavior

Origin of birds. Reproduction and development. Caring for offspring.

Adaptation of birds to seasonal natural phenomena (nesting, migrations, migrations).

Birds of parks, meadows, fields, forests, swamps, coasts, reservoirs, steppes, deserts, birds of prey.

The role of birds in nature and human life, a system of measures to protect birds. General characteristics of the class.

Poultry farming. Origin of poultry, their breeds.

Class Mammals. Features of the external structure, skeleton, muscles, internal structure, metabolism of a mammal. Complication of the nervous system, sensory organs, behavior. Reproduction and development, caring for offspring.

Origin of mammals. Primal beasts. Marsupials.

Placental orders. Insectivores and bats. Rodents. Lagomorphs. Predatory. Pinnipeds and cetaceans. Ungulates. Primates.

The role of mammals in nature and human life. Preserving the diversity of species by regulating their numbers, protecting ecosystems as habitats for mammals.

Farm animals of the mammalian class. Cattle, sheep, pigs, horses. Origin of domestic animals. Maintenance, feeding and breeding. General characteristics of the class.

Evolution of the animal world. Evidence of the historical development of the animal world: comparative anatomical, embryological, paleontological.

Charles Darwin on the causes of the evolution of the animal world. Origin of unicellular organisms. Origin of multicellular organisms. Increasing complexity of the structure and life of vertebrates in the process of historical development of the animal world. The relationship between man and animals.

Natural communities

.Habitat of organisms. The main environmental factors of the environment, their influence on plants and animals. Natural communities (for example, forests, meadows, ponds). The role of plants, animals, fungi and bacteria in the natural community. Relationships in a natural community. Power circuits.

The importance of natural communities in human life. The influence of human activities on natural communities, their protection.

Man and his health

General overview of the human body. The importance of knowledge about the structure, vital functions

of the human body and hygiene for protecting his health. Man and the environment.

Cell structure (cytoplasm, nucleus, ribosomes, mitochondria, membrane). Basic life processes of a cell (nutrition, respiration, division). Brief information about the structure and functions of the main tissues. Reflexes. Nervous and humoral regulation of body activity. The body is a single whole. Organs and organ systems.

Musculoskeletal system. The importance of the musculoskeletal system. Human skeleton, similarities between human and animal skeletons. Features of the human skeleton associated with work and upright walking. Types of bone connections. Composition, structure and properties of bones, bone growth. First aid for bruises, sprains, dislocations, fractures.

Muscles and their functions. The main muscle groups of the human body. Muscle work. Static and dynamic loads. The influence of rhythm and load on muscle function.

Blood and circulation. The internal environment of the body (blood, intercellular fluid, lymph) and its relative constancy. The meaning of blood and circulation. Blood composition. Blood plasma. Blood clotting as a protective reaction of the body. Structure and functions of erythrocytes and leukocytes. Immunity. The role of I.I.Mechnikov in the creation of the doctrine of immunity. Infectious diseases and their control. Preventive vaccinations. Prevention of HIV infection and AIDS. Blood groups. Blood transfusion. Donation.

Circulatory organs: heart and blood vessels (arteries, capillaries, veins). The heart, its structure and work. Large and small circles of blood circulation, lymph circulation. Movement of blood through vessels. Blood pressure. Nervous and humoral regulation of the activity of the heart and blood vessels. Prevention of cardiovascular diseases. First aid for bleeding. The harmful effects of smoking and drinking alcohol on the heart and blood vessels.

Breath. The meaning of breathing. Structure and functions of the respiratory organs.

Voice apparatus. Gas exchange in the lungs and tissues. Breathing movements. Vital capacity of the lungs. Nervous and humoral regulation of respiration. Artificial respiration. Infectious diseases transmitted through the air, prevention of airborne infections, hygienic regime during illness. Respiratory hygiene. The harmful effects of smoking on the respiratory system. Environmental protection.

Digestion

The meaning of digestion. Nutrients and food products. Structure and functions of the digestive organs. Teeth, prevention of dental diseases. Digestive enzymes and their importance. The role of I.P. Pavlova in the study of the functions of the digestive organs. Liver and pancreas, their role in digestion. Suction. Regulation of digestive processes. Hygienic conditions for normal digestion. Prevention of helminthic and gastrointestinal diseases, food poisoning, first aid for them. The effect of smoking and drinking alcohol on digestion.

Metabolism and energy. Selection

General characteristics of metabolism and energy. Plastic metabolism, energy metabolism and their relationship. The importance of proteins, fats and carbohydrates, water and mineral salts for the body. The influence of alcohol and toxic substances. Vitamins. Their role in metabolism. Basic hypovitaminosis. Hypervitaminosis.

Methods for preserving vitamins in food products. Nutrition standards. Rational nutrition. Schoolchildren's diet.

Organs of the urinary system, their functions, disease prevention.

Leather

Structure and functions of the skin. The role of the skin in thermoregulation. Hardening the body. Skin hygiene, hygienic requirements for clothing and footwear. Prevention and first aid for heat and sunstroke, burns and frostbite, electric shock.

Endocrine glands

The importance of endocrine glands for growth, development and regulation of body functions.

Hormones. The role of the gonads in the development of the body. Puberty. Hygiene of boys and girls.

Nervous system. Sense organs. Higher nervous activity

The importance of the nervous system in the regulation and coordination of the functions of the human body and the relationship of the body with the environment. Central and peripheral nervous system. Structure and functions of the spinal cord and parts of the brain. The role of the autonomic nervous system in regulating the functioning of internal organs.

Cerebral cortex. Sense organs, their meaning. Analyzers. Structure, functions, hygiene.

Unconditioned and conditioned reflexes. Biological significance of the formation and inhibition of conditioned reflexes. Features of human higher nervous activity. Speech and thinking.

Consciousness as a function of the brain. Social conditioning of human behavior.

The role of I.M. Sechenov and I.P. Pavlov in the creation of the doctrine of higher nervous activity.

Sleep, its meaning and hygiene. Changes in performance in the labor process. Schoolchildren's daily routine. The harmful effects of nicotine, alcohol and drugs on the nervous system.

Reproductive organ system.

Fertilization and intrauterine development. Birth of a child. Child growth and development. Hygiene of infants. The harmful effects of alcohol, nicotine and other factors on offspring.

General biology

The importance of biological science for agriculture, industry, medicine, hygiene, nature conservation. General biological patterns. Levels of organization of living nature: cellular, organismal, species, biocenotic, biosphere.

Basics of cytology.

Basic principles of cell theory. A cell is a structural and functional unit of living things. The structure and functions of the nucleus, shell, cytoplasm and its main organelles. Features of the structure of cells of prokaryotes, eukaryotes, autotrophs and heterotrophs.

The content of chemical elements in the cell. Water and other inorganic substances, their role in the life of the cell. Organic substances: carbohydrates, lipids, proteins, nucleic acids, ATP, their role in the cell. Enzymes, their role in the regulation of vital processes. Self duplication of DNA.

Metabolism and energy conversion are the basis of cell life. Energy metabolism in the cell and its essence. The importance of ATP in energy metabolism.

Plastic exchange. Photosynthesis. Biosynthesis of proteins. The gene and its role in biosynthesis. DNA code. Matrix synthesis reactions.

Viruses, features of their structure and activity, HIV infection, AIDS.

Reproduction and individual development of organisms

Cell division is the basis for reproduction and individual development of organisms. Preparing the cell for division. Chromosomes, their haploid and diploid set, constancy of number and shape. Cell division and its significance.

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

Development of the embryo (using the example of animals). Postembryonic development. The harmful effects of alcohol and nicotine on the development of the human body.

Basics of genetics

Genetics is the science of heredity and variability of organisms. Basic methods of genetics. Mono- and dihybrid crossing. Analysis of offspring.

The laws of heredity established by G. Mendel. Dominant and recessive traits. Allelic genes.

Phenotype and genotype. Homozygote and heterozygote. First generation uniformity.

Intermediate nature of inheritance. The law of splitting characteristics. Statistical nature of splitting phenomena. Cytological basis of the uniformity of the first generation and the splitting of characters in the second generation. The law of independent inheritance and its cytological foundations.

Chained inheritance. Loss of adhesion. Chromosome crossing.

Genotype as an integral historically developed system. Genetics of sex. Chromosomal theory of heredity.

The importance of genetics for medicine and healthcare. The harmful effects of nicotine, alcohol and drugs on human heredity.

The role of genotype and environmental conditions in the formation of phenotype. Modification variability. Norm of reaction. Statistical patterns of modification variability.

Mutations and their causes. The law of homological series in hereditary variability, formulated by N.I. Vavilov. Experimental production of mutations. Mutations as material for artificial and natural selection. Pollution of the natural environment with mutagens and its consequences.

Genetics and theory of evolution. Population genetics. Forms of natural selection: driving and stabilizing.

Breeding Basics

N.I. Vavilov on the origin of cultivated plants.

Main methods of selection: hybridization and artificial selection. The role of natural selection in breeding.

Plant selection. Self-pollination of cross-pollinated plants. Heterosis. Polyploidy and distant hybridization.

Animal selection. Types of crossing and breeding methods. Method for analyzing hereditary economically valuable traits in breeding animals. Distant hybridization of domestic animals.

Biotechnology and its main directions: microbiological synthesis, genetic and cellular engineering. The importance of biotechnology for breeding.

Evolutionary doctrine

Pre-Darwinian ideas about the evolution of living nature.

The main provisions of the evolutionary teachings of Charles Darwin. The importance of the theory of evolution for the development of natural science.

View. Type criteria. Population is a unit of species and evolution.

Driving forces of evolution. The leading role of natural selection in evolution. The emergence of devices. The relative nature of fitness.

Artificial selection and hereditary variability are the basis for the development of breeds of domestic animals and varieties of cultivated plants.

Microevolution. Speciation. Modern representations.

Results of evolution: fitness of organisms, diversity of species.

The main directions of evolution: aromorphosis, ideological adaptation. Biological progress and regression. Relationships between different directions of evolution. Basic laws of evolution. Results of evolution.

The emergence and development of life on Earth.

A brief history of the development of the organic world.

Origin and development of man. The most ancient, ancient, modern people.

Charles Darwin on the origin of man.

Social and biological factors of anthropogenesis. The leading role of the laws of social life in the social

progress of mankind.

Human races, their origin and unity.

Basics of ecology

Subject and tasks of ecology. Ecological factors: abiotic, biotic, anthropogenic, their complex effects on the body.

Photoperiodism. Living environments. Ecological niche.

Species, its ecological characteristics. Population, changes in its numbers, methods of regulating numbers. Rational use of species, preservation of their diversity.

Biogeocenosis. Development of populations in biogeocenosis and their relationships. Power circuits.

Fundamentals of the doctrine of the biosphere

Biosphere. V.I. Vernadsky on the emergence of the biosphere. Boundary of the biosphere. Biomass of land surface, oceans, soil. Living matter and its functions. The circulation of substances and the transformation of energy in the biosphere. Noosphere.