MINISTRY OF HEALTH OF UKRAINE
BUKOVINIAN STATE MEDICAL UNIVERSITY

Approved by
Head of the Admission Board,
Rector Igor GERUSH
«31» March 2026

CURRICULUM

Entrance Examination
on Biology
to apply for the educational level of Master

Field of knowledge: **I Health Care and Social Services**
Specialties: **I1 Dentistry, I2 Medicine, I8 Pharmacy**

Chernivtsi, 2026

Explanatory note

The program of entrance examinations in Biology has been developed on the basis of the program of external independent evaluation in Biology for persons who wish to obtain higher education on the basis of complete general secondary education, approved by the Order of the Ministry of Education and Science dated 20.12.2018 No. 1426, and current programs for comprehensive educational institutions: Biology syllabus for forms 6-9 of general secondary educational institutions, approved by the Order of the Ministry of Education and Science dated 07.06.2017 No. 804, and Biology and Ecology syllabus for forms 10-11 of general secondary educational institutions (standard level), approved by the Order of the Ministry of Education and Science dated 23.10.2017 No. 1407.

The tasks of entrance examinations in Biology are:

- to check the compliance of students' knowledge and skills to the program requirements;
- to evaluate the level of students' academic achievement;
- to evaluate the qualification of secondary school graduates for study at the BSMU.

The entrance examinations program is divided into thematic blocks according to the key elements of Biology syllabi for school students of general secondary educational institutions. Program consists of 5 sections "Introduction. Chemical composition, structure and functioning of cells. Realization of genetic information", "Patterns of inheritance and variation", "Biodiversity", "Human organism as a biological system", "Basics of ecology and evolutionary theory", which are subdivided by themes. The requirements for participants' knowledge and practical skills on biology of entrance examinations are determined for each theme.

The entrance examinations program is aimed for evaluation of applicants' level of knowledge and skills on school subject "Biology", on the basis of which the entrant can:

- characterize the basic biological concepts, patterns, laws and theories, biological phenomena and processes:
- operate the concepts, explaining the processes and phenomena of wildlife if required, and confirming with examples from human life and activities, health care, achievements of biological science;
- compare the processes of life at different levels of life organization (molecular, cellular, organism, population, ecosystem, biosphere) and identify the relationships between them;
- establish causal, functional, structural relationships and patterns in wildlife and classify objects;
- reveal the sequels of bad habits for the body;
- apply knowledge on biology for analysis of situations that arise in different spheres of life;
- carry out the calculations using the mathematical apparatus;
- apply acquired knowledge in the analysis of biological information presented in various forms (graphical, tabular, textual);
- support the conclusions;
- use knowledge in everyday life (justify the rules of behavior in the environment, disease prevention measures, ways to provide home care).

Introduction. Chemical composition, structure and functioning of cells. Realization of genetic information

Introduction. Fundamental properties of life. Levels of life organization and their characteristics. Research methods in Biology. The importance of biological research in human life.

***Chemical composition of cells*.** Classification of chemical compounds by their content in the organisms. Sequels of insufficient or excessive input of chemical elements (I, F, Fe, Ca, K) into the human body and management of their insufficiency.

Organic and inorganic compounds and their functions in the organism.

Water, its general properties and functions in the organism. Water as a solvent, hydrophilic and hydrophobic compounds.

Biopolymers: notion of their structure and conformation.

Carbohydrates: monosaccharides (ribose, deoxyribose, glucose, fructose), oligosaccharides (sucrose, lactose), polysaccharides (starch, cellulose, chitin, glycogen). Basic properties and functions of carbohydrates in organisms.

Lipids (fats, waxes, steroids, phospholipids). Basic properties and functions of lipids in organisms.

Proteins. Amino acids as monomers of proteins. Levels of protein organization. Denaturation and renaturation of proteins. Basic biological functions of proteins. Enzymes, their properties and principles of functioning.

Nucleic acids. Structure of nucleotides. Structure functions of DNA. Rule of base pairing. Sequence of nucleotide and notion of the gene. Properties of DNA. RNA and its types (mRNA, rRNA, tRNA).

ATP. The role of ATP in energy supply.

Structure and functioning of eukaryotic cells. The cell as the basic unit of living organisms. Cell research methods. Basic properties and principles of eukaryotic cell structure.

Cell membranes, their chemical composition, structure, properties and basic functions. Transport of substances across the cell membranes.

Cytoplasm, its components: cytoskeleton, organelles and inclusions.

Single-membranous organelles: endoplasmic reticulum, Golgi apparatus, lysosomes, vacuoles.

Double-membranous organelles: mitochondria, plastids (chloroplasts, leucoplasts and chromoplasts). Mitochondria: structure and functions. Chloropasts: structure and functions. Autonomy of mitochondria and chloroplasts in a cell.

Ribosomes: structure and function. Centrosomes. Locomotory organelles (flagella and cilia).

Cell nucleus: structure and functions.

Chromosomes: chemical composition, structure and function. Haploid and diploid sets of chromosomes. Homologous chromosomes. The main states of chromosomes: interphase non-compact and overcompact in the process of cell division. Chromosome doubling due to DNA replication. Morphology of supercompact / mitotic / chromosomes. The concept of human karyotype.

Nucleolus, its functions.

Metabolism and energy transformation. Metabolism, its general characteristics. The unity of the processes of synthesis and breakdown of substances in the organism. Autotrophic and heterotrophic types of nutrition. Mixotrophic organisms.

Breakdown of substances in the organism (oxygenless, oxygen). The concept of glycolysis, fermentation. The concept of cellular respiration. Mitochondrion as the power station of the cell.

Photosynthesis. The main processes occurring in light-dependent and lightindependent reactions / light and dark phases / photosynthesis. The role of chlorophyll in light-dependent reactions / light phase / photosynthesis. Importance of photosynthesis for the existence of the biosphere.

The concept of chemosynthesis.

Storage and realization of genetic information. *Genes*, their structure and functional role. Mosaic structure of the eukaryotic gene (exons and introns). The concept of the genome.

Transcription: template synthesis of RNA molecules. The concept of transcription regulation.

Protein biosynthesis (translation). Genetic code and its basic properties. The role of mRNA, tRNA and ribosomes in protein biosynthesis. DNA replication: semiconservative principle. The concept of DNA repair. DNA replication and cell cycle.

Interphase and cell division. The number of DNA molecules and chromosomes at different stages of the cell cycle.

Mitosis, the main processes that occur during mitosis.

Meiosis and its features in comparison with mitosis. Functional role of meiosis. The concept of DNA recombination during meiosis. Crossing over.

The formation of gametes and their fusion to produce the zygote during fertilization. Sexual reproduction. Main types of asexual reproduction of organisms (division by mitosis, budding, sporulation, vegetative propagation).

Individual development of the organism (ontogenesis).

Embryonic development. The main stages of embryonic development in chordates (cleavage, blastulation and gastrulation). The phenomenon of embryonic induction. The concept of cell differentiation during embryonic development. Stem cells.

Post-embryonic development in animals and its main types (indirect and direct).

Patterns of inheritance and variation

Genetics – the science of patterns of inheritance and variability of organisms. Classical methods of genetic research. Basic concepts of genetics. Basic patterns of gene functioning in prokaryotes and eukaryotes.

Patterns of inheritance. Laws of inheritance proposed by G. Mendel. technique to determine the genotype of hybrid organisms (testcross). Multiple effects of genes. A trait as a result of the expression of many genes. Gene interaction.

Linked inheritance. Chromosomal theory of heredity. Genetic basis of sex determination in different groups of organisms. Chromosomal sex determination. Sex-linked inheritance.

Chromosomal analysis as a method for detecting chromosome abnormalities.

Human genetic disorders and birth defects, human multifactorial diseases, their causes. Modern molecular genetics techniques for human genetics research.

Patterns of variation. Modification (non-hereditary) variation, its causes. Reaction norm. Continuous variation graphs. Hereditary variation and its types: combinatorial and mutational. Sources of combinatorial variation. Mutations and their properties. Types of mutations (genomic, chromosomal, point; somatic and germline). Mutagenic factors (physical, chemical and biological).

Selection of organisms. Biotechnology. The concept of cultivar, breed, strain. Artificial selection (individual and mass). Related and unrelated crossbreeding, interspecific (distant) hybridization, their genetic and biological consequences. Heterosis and its genetic basis.

The concept of basic methods and tasks of selection. Methods of molecular genetics as a basis of modern biotechnologies: polymerase chain reaction, genetic engineering, DNA cloning, cell engineering. Cloning of organisms. Genetically modified organisms (GMOs): principles of creation and directions of use.

Biodiversity

Systematics as the science of the diversity of organisms. Biodiversity on our planet as a result of evolution. Modern system of the organic world (domains: Archaea, Bacteria, Eukaryotes). The main taxa units used in the taxonomy of organisms. Species as the basic unit of classification. Biological concept of the species. Modern criteria of the species. The concept of phylogenetic taxonomy. Techniques of graphical representation of kinship of systematic groups of organisms.

Viruses. Viroids. Prions. Features of the organization and functioning of viruses. Hypotheses of the origin of viruses. The role of viruses in evolution, the concept of horizontal gene transfer. Viral entry into plants, animals and humans. Interaction of viruses with the host cell. Use of viruses in genetic engineering and biological methods of pest control. Prevention of human viral diseases. The concept of vaccination.

The concept of viroids, prions.

Prokaryotic organisms. The structure of prokaryotic cells. Prokaryotic organisms (archaea, bacteria), features of their organization and functioning. Types of nutrition (photo- and chemosynthesis, heterotrophic nutrition) and respiration (anaerobic and aerobic) of prokaryotic organisms. Reproduction (division and budding of cells) and exchange of hereditary information (conjugation) in prokaryotic organisms. Relationships of prokaryotic organisms with other organisms (mutualism, commensalism, parasitism). The role of prokaryotes in nature and human life. Pathogenic bacteria and human diseases caused by them. Prevention and treatment of bacterial diseases.

Algae. Features of structure and life processes of unicellular and multicellular algae. Representatives of algae: green algae (*Chlamydomonas*, *Chlorella*, *Ulothrix*, *Spirogyra*, *Ulva*), diatoms (*Pinnularia*, *Navicula*), brown algae (*Laminaria*, *Fucus*, *Sargassum*), red algae (*Porphyra*, *Phyllophora*, *Corallina*).

Plants. Vegetative organs and vital functions of plants. Plant cells. The main groups of plant tissues: permanent - integumentary (epidermis, bark), vascular (trachea, sieve tubes), ground (photosynthetic, storage, including endosperm, mechanical); apical and lateral meristems.

General characteristics of plants. Importance of plants.

Root. Types of roots (taproot, branch, adventitious). Root system and its types (taproot, fibrous). Regions of the root and their functions. Cross section of the root in the region of maturation. Specialized roots (food-storage roots, tubers, pneumatophores, buttress roots, aerial roots, parasitic roots).

Shoot, its external form (node, internode, axil). Types of shoots: erect, ascending, round, tenacious, creeping, creeping. The bud is the embryonic shoot. The structure of the bud (scales, shoot apex, embryonic leaves). Types of buds by location on the shoot (apical and lateral / axillary /), by structure (vegetative and reproductive / flower /). Shoot structure: stem and leaves. Shoot branching, crown development. Specialized stems: underground (rhizome, tuber, bulb, corm) and aerial (runner, tendrils, aerial tuber, thorns).

Stem. Internal structure of a woody plant stem (pith, wood, cambium, bast, bark, pith rays, annual rings).

Leaf: external structure (leaf base, petiole, leaf blade, stipules), internal structure (ground tissue - palisade and spongy parenchyma, stomata, veins (wood, bast), cuticle, epidermis), functions. Venation of leaves: parallel, arcuate, palmate, pinnate, dichotomous. Leaf arrangement: alternate, opposite, whorled. Specialized leaves (tendrils, spines, thorns, scales, insect-trapping leaves of insectivorous plants). Abscission.

Vital functions of plants: nutrition (mineral, photosynthesis), respiration, transpiration.

Transport of substances through the plant. Plant growth and development. Plant movements (growth, turgor). Regulation of vital functions in plants.

Reproductive organs of angiosperms. *Structure of flower*: peduncle; perianth; stamen (anther, pollen sacs, structure of pollen grain, stamen filament); sepals (calyx); petals (corolla); perianth; pistil (stigma, style, ovary (superior and inferior) with embryonic sacs in the ovules). Flower functions. Types of flowers (unisexual and bisexual, naked, simple and double perianth flowers). Flower formula. Inflorescence. Types of inflorescences (simple - raceme, spadix, head, composite, corymb, umbel, spike; compound - compound spike, panicle, compound corymb, compound umbel).

Pollination and its forms (self-pollination and cross-pollination). The main types of cross-pollination (by wind, insects). Plants adaptations to the type of pollination. Double fertilization in flowering plants.

Seed and fruit formation. Functions of seeds and fruit. Seed structure: seed coat, embryo (radicle, hypocotyl, cotyledon, hilum). Structure of the fruit (three regions and seeds). Types of fruits: dry (achene, grain, nut, legume, capsule, silique, silicle), fleshy (simple - drupe, pepo, berry, pome, apple, aggregate - raspberry, strawberry; multiple fruits). Seed dormancy and germination.

Diversity of plants. Reproduction of plants. The concept of plant life cycle (alternation of asexual and sexual generations).

General characteristics, peculiarities of distribution, importance of mosses, *Lycopodium*, horsetails, ferns, gymnosperms, angiosperms.

Diversity of plants:

Mosses (hairy-cup moss, liverworth, peat moss);

Lycopodium (club-moss, fir moss, stag's horn moss);

Horsetails (common horsetail, sylvan horsetail);

Ferns (male fern, bracken, hart's-tongue fern, ostrich fern, watermoss);

Gymnosperms (ginkgo, european yew, thuja, cypress, pine, spruce, larch, juniper, cedar, welwitschia, ephedra, cycas);

Angiosperms (Cabbage / crucifers / family (representatives: shepherd's purse, wild radish, cabbage, white mustard, rape; Rose family: strawberries, dog rose, rowan, apple, cherry; Legume family: pea plant, common bean, clover, black locust, alfalfa: Nightshade family; petunia, black nightshade, tobacco, potato, tomato, sweet pepper; Aster family / Composite / family: sunflower, dandelion, spear thistle, chamomile, cornflower; Onion family: onions, garlic, ramson; Lily family: tulip, squill, lily; Grass family: maize, rice, wheat, rye, oat, common reed, couch grass).

Forms and methods of plant propagation.

Fungi. General characteristics of fungi. Features of the structure and processes of life on the example of mushrooms, molds and yeasts. Saprotrophic, parasitic, symbiotrophic fungi. Importance of fungi in nature and human life. Diversity of fungi: mushrooms (slippery jack, brown cap boletus, cep, agaric honey, champignon, oyster, fly-agaric mushroom, death cup), molds (*Mucor*, *Penicillium*, *Aspergillum*), plant-parasitic fungi (sponk, powdery mildew, smut, ergot). Importance of fungi in the food industry and pharmacology

Lichens. Lichens as associations of true fungi with photosynthetic organisms (algae and cyanobacteria). Structure and features of life (nutrition, reproduction) of lichens. Crustose (rim lichen), foliose (hammered shield lichen), fruticose (common powderhorn) lichens. Importance of lichens in nature and human life.

Unicellular heterotrophic eukaryotic organisms. Free-living and parasitic species of unicellular heterotrophic eukaryotic organisms. Inhabitants of freshwater bodies: amoeba proteus, ciliate shoe. Features of the structure and processes of life (nutrition, respiration, excretion, osmoregulation, movement, irritability, reproduction, encystation).

Human parasites (dysenteric amoeba, malaria parasites), their features. Diseases caused by parasitic protozoans (amoebic dysentery, malaria), and their prevention.

Sponges. Sponges are the primary multicellular animals at the non-tissue level of the organization. Features of the structure and processes of life on the example of freshwater sponge. The role of sponges in nature and human life.

True multicellular animals. General features of the structure and processes of life. Animal tissues. Types of body symmetry (bilateral, radial). Types of body cavity (pseudocoelom, coelom, haemocoel). Body coverings. Organ systems: musculoskeletal (external and internal skeleton, hydroskeleton, muscles), digestive system (incomplete and complete digestive systems, digestive glands), circulatory system (closed, open), nervous system (diffuse, ganglionic, tubular), a variety of respiratory organs (gills, trachea, lung books, lungs) and excretion (kidneys, Malpighian tubes, metanephridia, protonephridia). Sensory organs. Irritability and movement.

Forms of animal reproduction. Gametes, fertilization. Animal development.

Animal behavior. Innate and acquired behavior. Types of animal behavior: research, food, protective, hygienic, reproductive (search for partners, parental care), territorial, social.

Animal orienting. Homing. Animal migration. Animal communications. Elementary mental activity.

Diversity, distribution, importance of animals. *Cnidarians,* their diversity: common jellyfish, barrel jellyfish, hydra, sea anemone, madrepore corals.

Flat worms. Diversity of parasitic flatworms: flukes (common liver fluke and cat liver fluke), tapeworms (beef, pork, dog and broad fish tapeworms).

Nematodes, or round worms. Diversity of parasitic roundworms (maw worm, pin worm, trichina worm).

Ringed worms / *annelids* /, their diversity: Polyhaeta (*Nereis*), Oligohaeta (earthworm, sludge worm), leeches (medical leech).

Arthropoda. Crustaceans. Diversity of crustaceans (crayfish, crabs, shrimp, daphnia, cyclops, woodlice), the role in nature and human life.

Arachnids, their diversity (spiders: cross spider, karakurt, tarantula; human itch mite, dog tick).

Insects, their diversity: Cockroaches (German cockroach), Orthoptera (green grasshopper, locust), Coleoptera / Beetles / (Maybeetle, ladybug, stug beetle, Colorado potato beetle), Hymenoptera (honey bee, ants), Lepidoptera / Butterflies / (cabbage butterfly, domestic silk moth, Old World swallowtail), Diptera (housefly, malaria mosquito).

Parasitic and blood-sucking insects (fleas, lice, bed bugs, mosquitoes, botflies, horseflies) as vectors of human pathogens.

Mollusks. Diversity of mollusks: gastropods (Roman snail, pond snail, slugs), bivalves (swan mussels, freshwater pearl mussels, blue mussels), cephalopods (squids, cuttlefishes, octopuses).

Chordates, general features of the structure and processes of life. Diversity of chordates.

Fish. Diversity of fish: cartilaginous fish (sharks and sea rays), bony fish (sturgeon, herring, salmon, pike perch, perch, common roach, freshwater bream, crucian carp, common carp).

Amphibians. Diversity of amphibians: frogs and toads (pond frog, common toad), caecilians (ringed caecilian), salamanders and newts (spotted salamander, common newt).

Reptiles. Diversity of reptiles: scaled reptiles (sand lizard, common European viper, grass snake), turtles (European pond turtle, green sea turtle), crocodiles (Nile crocodile, alligator).

Birds. Diversity of birds: Palaeognathae (ostriches, kiwis), Neognathae - penguins (emperor penguin), woodpecker birds (great spotted woodpecker), gallinaceous birds (quail, hazel grouse, pheasant, red junglefowl), waterfowls (mute swan, mallard, graylag goose), falcon birds (northern goshawk, golden eagle), owls (long-eared owl), storks (white stork, gray heron), crane birds (common crane), passerines (rook, hooded crow, common magpie, common house martin, great tit).

Mammals. Diversity of mammals: Prototheria - egg-laying mammals (platypus, echidna); Marsupials (kangaroos, koalas); Placental mammals: insectivorous mammals (common hedgehog, mole), bats (common noctule, common pipistrelle), rodents (marmot, squirrel, beaver, house mouse, hamster, rat, nutria), carnivorans (wolf, dog, fox, tiger, lion, lynx, domestic cat, polar bear, brown bear, forest pine marten, sable), cetaceans (blue whale, sperm whale, killer whale, common dolphin), even-toed ungulates (non-ruminant animals: wild boar, hippopotamus; ruminants: European bison, roe deer, moose, elk, sheep), odd-toed ungulates (domestic horse, Przewalski's horse, zebra, onager, rhinoceros), primates (lemurs, guenons, macaques, baboons, orangutans, chimpanzees, gorillas).

Human organism as a biological system

Structure of the human body. Tissues of the human body, their structure and function. Organs, organ systems. Regulatory systems of the human body.

Nervous regulation. Human nervous system. Neurons: structural and functional units of the nervous system. Reflex principle of the nervous system. Reflex arc, its components and functioning. Central and peripheral nervous systems. Structure and functions of the spinal cord and brain.

Autonomic (vegetative) nervous system (sympathetic and parasympathetic divisions). The effects of the autonomic nervous system on the body.

Humoral regulation. Human endocrine system. Functions and structure of the endocrine system. Endocrine glands and mixed glands.

Hormones and neurohormones, their effects on life processes. Functions of endocrine and mixed glands, sequels of their disorders.

Differences between nervous and humoral regulation of physiological functions of the body.

The internal environment of the human body. Blood. Lymph. The internal environment of the human body. Blood functions. Composition of the blood: plasma, formed elements (red blood cells, white blood cells, platelets). Blood groups of the ABO system. The concept of rhesus factor. Blood transfusion. Blood coagulation. Composition and functions of lymph.

Human circulatory and lymphatic systems. The structure of the circulatory and lymphatic systems. Blood circulation, its regulation. Structure of the heart. Properties of the heart muscle. Cardiac cycle, its phases. Heartbeat, its regulation. Blood vessels, their structure and function. Pulmonary and systemic circulation. Blood pressure.

Lymphatic system, its structure and functions. Lymphatic circulation.

Immunity. Human immune system. Immunity, its types. Immune system, its structure and features of functioning. Mechanisms of antigen-antibody reaction. Allergic reactions. The concept of immunomodulation and immunotherapy. Prevention of human infectious diseases.

Respiration. Human respiratory system. Structure and functions of the respiratory system. Gas exchange processes in the lungs and tissues. Respiratory movements. Inhalation and exhalation processes. Neurohumoral regulation of respiration. The concept of vital capacity of the lungs. Composition of inhaled, exhaled and alveolar air. Vocal apparatus and its functioning.

Digestion. Human digestive system. Structure and functions of the digestive system. Digestive glands (salivary, liver, pancreas). Digestive juices. Structure and functions of teeth. Digestion in the mouth, stomach, intestines. Parietal digestion. Absorption. Regulation of digestive processes.

Metabolism and energy conversion in the human body. Nutrition and metabolism. The concept of balanced / rational / nutrition. Protein, lipid, carbohydrate, water and mineral metabolism. The concept of drinking water quality. The role of enzymes, ATP in ensuring metabolic processes. Vitamins, their role in metabolism. Metabolic disorders associated with a lack or excess of certain vitamins. Negative effects on the metabolism of toxic substances. Neutralization of toxic compounds in the human body. Neurohumoral regulation of metabolic processes.

Excretion. Human urinary system. Structure and functions of the urinary system. Structure and function of the kidneys. Nephron as a structural and functional unit of the kidneys. Processes of urine creation and excretion, their regulation. The role of the kidneys in the regulation of water and mineral metabolism.

Skin. Thermoregulation. The structure and function of the skin. The role of the skin in the secretion of metabolic products. Thermoregulation and the role of the skin in this process.

Human musculoskeletal system. Importance, functions, and structure of the musculoskeletal system. Chemical composition, structure, and growth of bones. Types of bone connections. Human skeleton structure. Features of the human skeleton due to upright gait. Muscle tissue. Structure and functions of skeletal muscles. The main groups of skeletal muscles. The mechanism of muscle contraction. Muscular contraction, muscle tone, muscle strength and muscle fatigue. Regulation of motor activity.

Human sensory systems. General characteristics of sensory systems. The role of sensory systems in detection of environmental stimuli. Sensory systems of sight, hearing, balance, smell, taste, touch, temperature, pain. Receptors, their types. Sensory organs as peripheral parts of sensory systems. Structure and functions of organs of sight, hearing and balance.

Human higher nervous activity. Nervous processes, their indicators. Unconditional and conditioned reflexes, instincts. Formation of conditioned reflexes. Inhibition of conditioned reflexes. Physiological bases of speech. The first and second signal systems. Learning. Memory. Human higher nervous activity and its main types. Types of temperament. Sleep as a functional state of the organism, its significance.

Reproduction and human development. Structure of human reproductive system. Functions of human gonads. Structure of human gametes. Gametogenesis. Primary and secondary sexual characteristics. Periods of human ontogenesis. Development of embryo and fetus, placental function. Perinatal development.

Basics of ecology and evolutionary theory

Environmental factors. Population. Environmental factors and their classification. The concept of the optimal range of environmental factors. Regularities of influence of ecological factors on living organisms. Adaptation of living organisms to the environmental factors. Ecological valence. Ecological niche as a result of adaptation of organisms to existence in the ecosystem. The concept of population.

Structure and characteristics of populations. Population parameters. Population waves. The concept of a minimum viable population. Ecological strategies of populations.

Ecosystems. Components, properties and characteristics of the ecosystem. Biocenosis and biotope. Types of relationships between populations of different species in ecosystems. Energy transfer in ecosystems. The concept of producers, consumers and decomposers. Trophic structure of biocenosis. Ecological pyramids. Spatial heterogeneity of the biocenosis.

Structural diversity of the biocenosis. Temporal heterogeneity of ecosystems (phenological changes, succession).

Biosphere as a global ecosystem. Structure and boundaries of the biosphere. Biogeochemical cycles as a necessary condition for the existence of the biosphere. Vladimir Vernadsky's doctrine of the biosphere and noosphere and its significance for avoiding the global ecological crisis. Basic ideas about anthropogenic / human-made / impact on the biosphere. Types of pollution, their consequences for ecosystems and humans.

The concept of environmental quality. Modern global environmental problems of the world, environmental problems in Ukraine. Anthropogenic / human-made / impact on biological diversity (extinction of species, invasive species). Conservation of biodiversity as a necessary condition for the stability of the biosphere. Modern directions of nature protection and environmental protection in Ukraine and the world.

Basic provisions of nature management. The concept of sustainable development.

Adaptation as a general property of biological systems. General laws of formation of adaptations. The concept of preadaptation and postadaptation. Properties of adaptations. Formation of adaptations at the molecular and cellular levels of the organization. The principle of unity of organisms and their habitat. Strategies of adaptation of organisms. The concept of ecologically plastic and ecologically nonplastic species. The concept of adaptive radiation. Life forms of animals and plants as adaptations to the habitat. The concept of conjugate evolution / coevolution / and coadaptation. The main habitats and adaptations of organisms to them. Types of thermoregulations of organisms. Symbiosis and its forms. The body as a habitat.

The spread of parasitism among different groups of organisms. Adaptation of parasites to living in the host organism. The response of the host organism to the settlement of parasites.

Adaptive biological rhythms of biological systems of different levels of organization. Types of adaptive biological rhythms of organisms. Photoperiodism and its adaptive value.

Fundamentals of evolutionary theory. The concept of evolution. Lamarck's evolutionary hypothesis. The main provisions of Darwin's theory of evolution. The combination of Darwin's theory and genetics: a synthetic theory of evolution. Population as a unit of evolution. The concept of microevolution. Factors affecting genetic structure of the population: mutations, isolation, migration, genetic drift, natural selection.

Patterns of allele distribution in populations. Variants of speciation. The concepts of divergence, convergence and parallelism, analogous and homologous organs, vestigial organs and atavisms, biological progress and regress.

Theories on the origin of life on Earth (creationism, panspermia, abiogenesis). Contemporary theories on the initial stages of the evolution of life: the RNA world. Major stages of life evolution on Earth.

Recommended literature

1. Campbell biology / L.A. Urry, M.L. Cain, S.A. Wasserman et al. 12th edition. Boston: Pearson, 2020. 1488 p.
2. Human Biology / S.S. Mader, M. Windelspecht. 16th edition. NY: McGraw- Hill Education, 2020. 569 p.
3. Barron's AP Biology / D.T. Goldberg. 7th edition. NY: Barrons Educational Series, Inc., 2020. 600 p.

CRITERIA
assessment of applicants at the entrance exam in biology at BSMU in 2026

General

The task at the entrance Biology examination consists of 25 test assignments (to be done within 60 minutes).

Tasks No 1-25 are multiple choice questions, it is necessary to determine one correct answer out of four proposed.

Each test task is evaluated only if it is correctly solved!

Each task is considered to be solved only when one correct answer is indicated. Specifying several answers instead of one or no answer is considered an error.

Assessment criteria

The number of points for completing test tasks in Biology can range from 100 to 200 points and is determined by the sum of points for each correctly solved task, added to 100 points.

Points for each task are accrued when solving only one correct answer in accordance with the complexity of the tasks.

Assessment of test tasks No. 1-25: each of the correctly solved tasks is evaluated in 4 points. The maximum number of points for the correct answers can be 100 points (25x4 = 100).

Thus, the maximum number of points for the correct answers to all test tasks can be 100 points, to which 100 points are added.

An entrant entering a higher education institution must demonstrate:

1. Knowledge of basic biological concepts, patterns, laws and theories, biological phenomena and processes.
2. Knowledge explaining the processes and phenomena of wildlife if required, and confirming with examples from human life and activities, health care, achievements of biological science.
3. Knowledge of the processes of life at different levels of life organization (molecular, cellular, organism, population, ecosystem, biosphere) and identify the relationships between them.
4. Conducting and argue the answer.

Applicants who received less than 150 points during the entrance exam on biology are not allowed to participate in the next entrance exams and competition.

Approved:
at the meeting of the Admission Board on 31 March, 2026, Records № 3.

Chief of the department
of medical biology and genetic **Roman BULYK**