

MINISTRY OF HEALTH OF UKRAINE
ODESSA NATIONAL MEDICAL UNIVERSITY

"APPROVED"

Rector of Odessa National Medical University



Ad.

B.M. Zaporozhan

2021

BIOLOGY PROGRAM

For people who want to get a higher education
on the basis of complete general secondary education

Odessa - 2021

The biology program is developed on the basis of current programs for secondary schools: Biology, grades 7-11 (K. Perun, 2005) and Biology, grades 10-11 (Ternopil, Mandrivets, 2011).

The task of evaluating biology is:

to check the compliance of students' knowledge and skills with program requirements;

to identify the level of student achievement;

to assess the degree of preparedness graduates of secondary schools for the future study in higher educational institutions.

The content is structured by levels of life organization and consists of "Introduction" and sections: "Molecular level of life organization", "Cellular level of life organization", "Non-cellular life forms", "Organismal level of life organization", "Superorganic levels of life organization", "Historical development of the organic world", which in turn are divided into topics. Each topic defines the scope of requirements for knowledge and subject skills of participants in external independent assessment in biology.

The program of external independent assessment is aimed at identifying the level of knowledge and skills in the school subject "Biology" on the basis of which the participant of external independent assessment will be able to:

1. characterize the basic biological concepts, patterns, laws and theories, biological phenomena and processes;
2. operate with concepts, if necessary, to explain the processes and phenomena of wildlife, confirming examples from human life and activity, health, the achievements of biological science;
3. compare the processes of life at different levels of organization (molecular, cellular, organismal, population-species, ecosystem, biosphere) and identify the relationships between them;
4. establish causal, functional, structural connections and patterns in wildlife, classify objects;
5. identify the effects of bad habits on the body;
6. apply biological knowledge to analyze situations that arise in various spheres of life;
7. perform calculations using a mathematical apparatus;
8. apply the acquired knowledge in the analysis of biological information presented in various forms (graphic, tabular, textual);
9. substantiate the conclusions.

The program was discussed and approved at the meeting of the admissions committee of Odessa National Medical University (Minutes № 3 of January 25, 2021)

The program was approved by the order of the rector of Odessa National Medical University № 35 of January 26, 2021.

CONTENTS

Title of the section, topics	The student must know	Subject skills and methods of educational activity
Introduction	The main signs of life. Levels of life organization: molecular, cellular, organismal, population-species, ecosystem, biosphere.	<p><i>Know</i> the basic features of living things, levels of organization of life and their structure. <i>Assess</i> the importance of biological knowledge in human life and society.</p> <p><i>Distinguish</i> levels of organization the life</p>
Molecular level of life organization		
Elemental composition of organisms	Classification of chemical elements according to their content in organisms (macroelements, including organogenic elements, microelements). Consequences of insufficient or excessive intake of chemical elements (I, F, Fe, Ca, K) and ways to eliminate their deficiency. The concept of endemic diseases.	<p><i>Know</i> organogenic elements and trace elements. Evaluate the role of organogenic elements in the construction of molecules of proteins, nucleic acids, carbohydrates, lipids.</p> <p><i>Apply</i> knowledge about the excess or deficiency of chemical elements (I, F, Fe, Ca, K) to prevent human diseases.</p>
Inorganic compounds in organisms	The role of water, salts and other inorganic compounds in the body. Hydrophilic compounds. Hydrophobic compounds.	<p><i>Characterize</i> the biological role of water, oxygen, Na⁺, K⁺, Cl⁻, Ca²⁺, Mg²⁺, PO₄³⁻ ions.</p> <p><i>Establish</i> the relationship between physicochemical properties and the biological role of water.</p>
Organic compounds in organisms	<p>Structure, properties and functions of organic compounds. The concept of biopolymers and their monomers. Carbohydrates: monosaccharides, oligosaccharides, polysaccharides. Features of structure, basic properties and functions in organisms of living beings. Lipids. Features of structure, basic properties and functions in organisms. Proteins: structure features. Amino acids, peptides and polypeptides. Levels of structural organization of proteins. Properties of proteins. Denaturation, renaturation, destruction of proteins. Functions of proteins in living beings. Enzymes, their structure, properties and application in human economic activity.</p> <p>Nucleic acids. Structure, nucleotides. Structure, properties and functions of DNA, the principle of complementarity. The concept of gene. RNA and their types. ATP, the concept of macroergic bonding. Biologically active substances (vitamins, hormones, neurohormones, phytohormones, alkaloids, phytoncides), their</p>	<p><i>Determine the limits</i> of the use of enzymes in human economic activity. <i>Know</i> the functions of organic compounds (lipids, carbohydrates, proteins, nucleic acids, ATP) and features of the spatial organization of proteins. Nucleic acids, polysaccharides (starch, cellulose).</p> <p><i>Determine</i> the role of chemical bonds in the structural organization of macromolecules.</p> <p><i>Compare</i> DNA and RNA by composition and levels of structural organization. <i>Solve</i> basic exercises in molecular biology: determine the molecular weight of a substance by the mass of one of its components, the length of a nucleic acid molecule, its composition; to model replication processes.</p>

	biological role.	Assess the importance of biologically active substances in ensuring the vital processes of organisms.
Cellular level of life organization		
Organization of cells	<p>Modern cell theory.</p> <p>Membranes, their structure, properties and basic functions. Plasma membrane. Transport of substances across membranes.</p> <p>Supramembrane complexes (cell wall, glycocalyx). Submembrane complexes (microfilaments, microtubules). Cytoskeleton, its functions. Cytoplasm and its components. Organelles. Single-membrane organelles: endoplasmic reticulum, Golgi apparatus, lysosomes, vacuoles. Double-membrane organelles: mitochondria, plastids and their types (features of their structure and functions). Mutual transformations of plastids. Autonomy of mitochondria and chloroplasts in the cell. Other organelles: ribosomes, polyribosomes, cell center, movement organelles. Cellular inclusions.</p> <p>The structure and functions of the kernel. Chromosomes, features of structure and chemical composition. Homologous chromosomes. Autosomes and sex chromosomes(heterochromosomes). Human karyotype. Chromosomal set of nucleus (haploid, diploid, polyploid). Types of cell organization (prokaryotic and eukaryotic).</p>	<p><i>Know</i> the basic principles of modern cell theory. Recognize the mechanisms of transport of substances across membranes.</p> <p><i>Compare</i> the structure and functions of the surface apparatus of cells of animals, plants, fungi, bacteria.</p> <p><i>Evaluate</i> the role of membranes in cell interaction.</p> <p><i>Characterize</i> the structure and functions of cell components. Establish a relationship between the structure and function of cell components.</p> <p><i>Recognize</i> cells and their components in schematic drawings and micrographs.</p> <p><i>Explain</i> the role of the nucleus in the storage, transmission and sale of hereditary information; the value of karyotype stability for the existence of the species.</p> <p><i>Know</i> the features of the organization of eukaryotic cells; features of the organization of prokaryotic cells (surface apparatus, nucleoid, plasmids, ribosomes, flagella).</p> <p><i>Compare</i> prokaryotic and eukaryotic cells. <i>Determine</i> the causes of differences in the structure of prokaryotic and eukaryotic cells (plants, animals, fungi).</p>
Cell division	<p>Cell cycle. Interphase. Mitotic cell division in eukaryotes, its phases.</p> <p>Meiotic cell division, its phases. Conjugation of homologous chromosomes. Crossingover.</p>	<p><i>Explain</i> the nature and biological significance of mitosis, meiosis, crossover.</p> <p><i>Compare</i> mitotic and meiotic cell divisions. Recognize (in diagrams or schematic drawings) the cell at different phases of mitotic division.</p> <p><i>Analyze</i> the stages of the cell cycle; phases of mitosis and meiosis.</p>
Metabolism and energy conversion	<p>Metabolism. Plastic (assimilation) and energy (dissimilation) exchange. Energy sources for</p>	<p><i>Recognize</i> autotrophic (photo- and chemo-) and heterotrophic organisms.</p>

	<p>organisms. Autotrophic (phototrophic, chemotrophic) and heterotrophic organisms. Stages of energy conversion in the body: preparatory, anaerobic (oxygen-free) and aerobic (oxygen). Aerobic and anaerobic respiration. Protein biosynthesis and its stages. Genetic code and its properties. Codon, anticodon, start codon, stop codons. Transcription. Genes (structural and regulatory). Exons, introns. Broadcasting. Matrix synthesis reactions (replication, transcription, translation).</p> <p>Photosynthesis. The main processes occurring in the light and dark phases of photosynthesis. The value of photosynthesis.</p>	<p><i>Explain</i> the essence and meaning of: assimilation and dissimilation; biosynthesis of proteins and nucleic acids; glycolysis; fermentation; aerobic respiration; photosynthesis; the influence of environmental conditions on the intensity of the process of photosynthesis; the role of ATP in energy metabolism; the role of enzymes in ensuring metabolic processes.</p> <p><i>Write</i> the total equations of the processes of photosynthesis and respiration.</p> <p><i>Compare</i> photosynthesis in pro- and eukaryotes, respiration and glycolysis, transcription and replication.</p> <p><i>Analyze</i> the process of photosynthesis, stages of energy and plastic metabolism.</p> <p><i>Model</i> the processes of translation, transcription. <i>Use</i> the table "Genetic code".</p>
Non-cellular life forms		
Viruses, prions, viroids	<p>Viruses, their chemical composition, structure and reproduction. The mechanism of penetration of viruses into the body and host cells. The effect of viruses on the host. Prevention of human viral diseases.</p> <p>The role of viruses in nature and human life. Prions. Viroids.</p>	<p><i>Know</i> the structure of viruses; mechanisms of penetration of viruses into human cells, animals, plants, bacteria; human diseases caused by viruses (polio, influenza, AIDS, hepatitis, encephalitis, measles, mumps, SARS) and prions (spongy encephalopathy); ways of infection with viruses and prions.</p> <p><i>Assess</i> the impact of viruses on the host; the role of viruses in nature and human life; prospects for the use of viruses in biotechnology.</p> <p><i>Recognize</i> viruses (bacteriophages; tobacco mosaic viruses, influenza, human immunodeficiency viruses) in drawings and diagrams.</p> <p><i>Apply</i> knowledge about the features of viruses and prions for the prevention of viral and prion diseases.</p> <p><i>Compare</i> the properties of viruses, viroids and prions.</p>
Organic level organization of life		

	<p>generative).</p> <p>Generative organs of angiosperms: (flower, seed, fruit).</p> <p>A flower is an organ of sexual reproduction of plants. The structure and function of the flower. Flower formula. Inflorescences, their biological significance. Types of inflorescences (tassel, beginning, head, basket, shield, umbrella, simple ear, complex ear, panicle, complex shield, complex umbrella).</p> <p>Seed and fruit: structure and functions. Seed and fruit formation. Types of fruits (bean, stone fruit, box, pod, pod, achene, grain, berry, apple, nut). Fruits, their biological significance. Period of rest and conditions of seed germination.</p> <p>Plant nutrition (mineral nutrition, air nutrition - photosynthesis). Plant respiration.</p> <p>Transpiration.</p> <p>Movement of substances on the plant. Ascending and descending flow of substances in plants.</p> <p>Forms of plant reproduction: sexual and asexual.</p>	<p><i>Recognize</i> the elements of the shoot on the diagrams and drawings; types of branch branching; shoot modification.</p> <p><i>Determine</i> the biological significance of shoot modifications.</p> <p><i>Recognize</i> the features of the internal structure of the stem in diagrams and drawings.</p> <p><i>Establish</i> a relationship between the internal structure and stem functions.</p> <p><i>Recognize</i> in diagrams and drawings the elements of the external and internal structure of the leaf, the types of veining and leaf placement; simple and complex leaves. Establish the relationship between the internal structure and functions of the leaf</p> <p><i>Determine</i> the biological significance of changes in the leaf, November.</p> <p><i>Recognize</i> the elements of the kidney structure in diagrams and drawings; types of kidneys.</p> <p><i>Compare</i> generative and vegetative buds in structure and function.</p> <p><i>Assess</i> the biological significance of the kidneys.</p> <p><i>Recognize</i> the elements of the flower structure in diagrams and drawings; types of inflorescences.</p> <p><i>Distinguish</i> bisexual, unisexual and asexual flowers; monoecious and dioecious plants; flowers with simple and double perianth; simple and complex inflorescences. Establish the relationship between the structure and functions of the parts of the flower.</p> <p><i>Determine</i> the method of pollination by the structure of the flower</p> <p><i>Know</i> the features of the structure: seeds of monocotyledonous and dicotyledonous plants; different types of fruits.</p> <p><i>Distinguish</i> between dry (opening and non-opening) and juicy; monoecious and multi-seeded fruits.</p> <p><i>Recognize</i> the types of fruits in</p>
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		<p>diagrams and drawings. Determine the method of distribution of fruits by their structure.</p> <p><i>Evaluate</i> the value of the dormancy period of the seed.</p> <p><i>Know</i> the features of mineral nutrition of plants; photosynthesis; breath; transpiration; fertilization in higher spore and angiosperms; growth; movement of substances on the plant.</p>
<p>Processes of life, reproduction and development of plants</p> <p>Variety of plants</p>	<p>Fertilization. Pollination and its methods. Plant growth and development. The concept of the life cycle of higher plants (alternation of generations, sporophyte, gametophyte). Irritability and movements of plants. Regulation of vital processes in angiosperms. Adaptation of plants to living conditions. Green algae: unicellular (chlorella, chlamydomonas) and multicellular (spirogyra, ulva, ulotrix). Brown algae (kelp, fucus). Red algae (phylophora, porphyry, coralline). Diatoms (navicula, pinularia). Moss-like (polytrich, marshantia, sphagnum). Plaunopodobny (selaginela, lamb ordinary, plaun mace-shaped). Horsetail (horsetail, horsetail). Ferns (male shield, ostrich feather, salvinia). Angiosperms (ginkgo, yew, thuja, pine, spruce, larch, juniper, cedar, welwitschia, cycad). Angiosperms. Classification of angiosperms. Classes: Monocotyledons and Dicotyledons. Cabbage family (Crucifers) (representatives: buckthorn, wild radish, cabbage, mustard, canola). Family Pink (representatives: strawberries, dog rose, rowan, apple, cherry, currant). Bean family (representatives: peas, beans, soybeans, clover, robinia (white acacia), alfalfa). Solanaceae family (representatives: petunia, nightshade, tobacco, potatoes, tomato, pepper); Aster (Compositae) (representatives: sunflower, dandelion, thistle, chamomile, cornflower). Onion (representatives onion, garlic, leek) Lily (representatives tulip, snowdrop, hyacinth, lily) Cereals (representatives of corn, rice, wheat, rye, oats, reeds, wheat).</p> <p>General characteristics and features of plant distribution of different taxa.</p>	<p><i>Distinguish</i> plant movements (tropisms, infusions, nutations); forms of plant reproduction; methods of vegetative propagation (grafting, grafting, layering, root sprouts, modified shoots); ascending and descending flow of substances in plants.</p> <p><i>Determine</i> the patterns of plant life processes; features of plant adaptations to terrestrial, aquatic and parasitic lifestyles.</p> <p><i>Explain</i> the importance of double fertilization in angiosperms; biological significance vegetative reproduction, pollination, photosynthesis, respiration, transpiration.</p> <p><i>Assess</i> the impact of fertilizers on plant growth and development; the role of phytohormones (auxins, cytokinins, gibberellins, abscisic acid) in the regulation of vital functions of multicellular plants.</p> <p><i>Know</i> the essential features of plants of these taxa; reproductive organs of higher spore plants (sporangia, gametangia: antheridia, archeogonia).</p> <p><i>Determine</i> the features of the structure and life processes of algae, higher spore plants, gymnosperms and angiosperms; features of the structure of plants of the classes Monocotyledons and Dicotyledons, of the Cabbage (Cruciferous), Pink, Bean, Solanum, Aster (Compositae), Lily, Onion, Cereal families; reasons that determine the dominance of angiosperms in modern flora and the</p>

		<p>spread of plants of different taxa on the globe.</p> <p><i>Recognize</i> in drawings and diagrams of representatives of different departments of plants.</p> <p><i>Distinguish</i>: representatives of different systematic groups (departments, families, classes of angiosperms from among the above) of plants on the basis of external structure.</p> <p><i>Explain</i> the need to create protected areas.</p> <p><i>Compare</i> plants of different systematic groups. <i>Assess</i> the importance of plants in nature and life</p>
Mushrooms. Lichens	<p>General characteristics of the kingdom Mushrooms. Habitats. Features of structure and processes of vital activity (nutrition, reproduction) of cap, mold fungi, yeast, fungi-parasites.</p> <p>Variety of mushrooms: cap (buttercup, grasshopper, porcini, honeysuckle, mushroom, oyster mushroom, toadstool, pale toadstool); molds (mucor, penicillin, aspergillus); parasitic fungi (smut, rust, powdery mildew and coppice). Mycorrhiza. The importance of fungi in nature and human life.</p> <p>Lichens are symbiotic organisms. Structure and features of lichen life. Variety of lichens (graphis, parmelia, xanthoria, usneya, yagel, cetraria).</p> <p>The importance of lichens in nature and human life.</p>	<p><i>Know</i> the peculiarities of the structure of nutrition, growth and reproduction of fungi and lichens.</p> <p><i>Recognize</i> the main groups of fungi and lichens in drawings and diagrams.</p> <p><i>Distinguish</i> cap and plate mushrooms; calcareous, deciduous and bushy lichens.</p> <p><i>Identify</i> the relationship between fungi and higher plants; reasons that determine the endurance of lichens.</p> <p><i>Compare</i> the principles of organization, features of the structure and life processes of fungi and plants.</p>
Animals	<p>General characteristics of the animal kingdom. Principles of animal classification.</p>	<p><i>Know</i> the essential features of the animal kingdom; basic units of classification of Animals (type, class, series, family, genus, species).</p> <p><i>Assess</i> the role of animals in ecosystems.</p> <p><i>Compare</i> the features of the structure and life processes of animals, plants and fungi.</p>
Animal diversity	<p>Unicellular animals.</p> <p>General characteristics. Features of the structure and processes of life (nutrition, respiration, excretion, osmoregulation, movement, irritability, reproduction, incisors).</p>	<p><i>Recognize</i> the above taxa in drawings and diagrams of animals.</p> <p><i>Know</i> the features of the external and internal structure of the representatives of these taxa; ways of</p>

	<p>Freshwater (amoeba proteus, euglena green, ciliate-shoe) and marine (foraminifera, radiolarians) unicellular, their role in nature and human life. The role of marine unicellular organisms in the formation of sedimentary rocks and as "guiding minerals". The role of unicellular animals in soil formation. Symbiotic unicellular animals: mutualists, commensals, parasites (dysenteric amoeba, trypanosomes, Plasmodium falciparum).</p> <p>Diseases of humans and domestic animals caused by parasitic unicellular animals. The role of unicellular animals in nature and human life. Multicellular animals. Characteristic features of multicellular animals, their difference from unicellular.</p> <p>Sponge type. General characteristics of the type. Features of the structure and processes of life. Cell differentiation, to tissue type of organization. Variety (barberry, Venus basket, Greek sponge). Role in nature and human life. Type Intestinal, or Poor. General characteristics of the type. Features of the structure and processes of life. Variety of intestinal (jellyfish and polyps). The role of intestinal cavities in nature and human life. Coral polyps and the formation of coral reefs. Type Flatworms. General characteristics of the type. Variety of flatworms: classes Ciliated worms (milky-white planaria), Mammals (hepatic and feline mammals), Tapeworms (bovine and porcine tapeworms, echinococcus, broad stalk); features of distribution, structure and processes of life. development cycles. Adaptation of flatworms to the parasitic way of life. The damage that parasitic flatworms cause to the host organism.</p> <p>Type Primary cavities, or Roundworms (Nematodes). General characteristics of the type. Variety of roundworms and habitats. Free-living roundworms, their role in soil formation processes. Roundworms - parasites of plants, animals and humans (roundworm, pinworm, Trichinella), diseases caused by them. Harmful effects of helminths on the host. Prevention of diseases caused by helminths.</p> <p>Type Ringworms, or Ringworms. General characteristics of the type. Variety of roundworms, habitats. Class Polychaete worms (nereis, sandpiper). Class Small-bristled worms (earthworm, tubeworm). Habitats, way of life. The role of earthworms in soil formation processes. Leech class (medical leech). The role</p>	<p>infecting humans with parasitic animals;</p> <p><i>Identify</i> the features of adaptation of animals to the conditions of existence; relationships between animals and other organisms. <i>Explain</i> the patterns of distribution of animal species in nature; the importance of behavioral reactions of animals.</p> <p><i>Distinguish</i> the characteristic features of animals of these taxa. Compare the features of the structure of animals of different systematic groups.</p> <p><i>Determine</i> the characteristics of the structure of the representatives of these taxa, the features of complications in the structure of animals of different taxa; reasons for the spread of animals of different taxa on the globe.</p> <p><i>Analyze</i> changes in the structure, in the process of life of animals that have arisen as a result of their adaptation to habitats.</p>
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of roundworms in nature and human life.
 Protection of roundworms.

Type Mollusks, or M 'yakuns. General characteristics of the type, diversity, habitat and way of life Classes Red-legged (pond, grape snail), Bivalves (toothless, oysters, pearl mussel), Cephalopods (squid, cuttlefish, octopus). Characteristic features of the structure, life processes, distribution. The role of mollusks in nature and human life. Protection of mollusks.

Arthropod type. General characteristics of the type. Diversity of arthropods, their habitat and way of life.

Crustaceans. General characteristics, features of external and internal structure, life processes, habitat. A variety of crustaceans (crayfish, crabs, shrimp, woodlice, daphnia, thyroid, cyclops, carp). Their role in nature and human life.

Protection of crustaceans Arachnids.
 General characteristics, features of external and internal structure, life processes, habitat.
 Variety of arachnids (rows of spiders, mites).
 Their role in nature and human life.

Insects. General characteristics, habitats.
 Features of external and internal structure, life processes. Types of oral apparatus. Fat body functions. Adaptation of insects to flight.
 Features of behavior of insects. Types of development. Doll phase and its biological significance. Variety of insects. Rows of insects with incomplete (Straightwings, Lice) and complete (Hardwings, or Beetles, Lepidoptera, or Butterflies, Hymenoptera, Diptera, Fleas) transformation. Characteristics of series, typical representatives, role in nature and human life.
 Domestic insects. The use of insects in the biological method of control. Insect protection.

Chord type. General characteristics, habitats.
 Variety of chordates.

Subtype Skullless. General characteristics. Class Holovochordovy. Features of external and internal structure, life processes of lanceolate.

Subtype Vertebrates, or Cranial. General characteristics. Cartilaginous fish class. Features of structure, life processes. Variety of cartilaginous fish (sharks and stingrays). Role in nature and human life.

Class Bone fish. Features of external and internal structure, life processes. Features of fish behavior. Spawning, care for offspring. Variety of bony fish: rows

Sturgeon, Herring, Salmon, Perch, Crustacean; subclasses Kisteperi and Dvodishny.

Characteristics and typical representatives. Role in nature and human life. Fishing. Rational use of fish resources. Artificial breeding of fish. Fish protection.

Class Amphibians. General characteristics. Features of the structure and processes of life in connection with access to land. Variety of amphibians: series of Tailless, Legless and Tailed. Features of the organization, representatives, role in nature and human life. Protection of amphibians.

Class Reptiles. Features of external and internal structure, life processes. Seasonal phenomena in the life of reptiles. Adaptation of reptiles to life on land. Variety of reptiles: scaly, turtles, crocodiles; features of the organization, representatives, role in nature and human life. Protection of reptiles.

Class Birds. Features of external and internal structure, life processes. Birds are warm-blooded animals. Adaptation of birds to flight. Seasonal phenomena in the life of birds. Sedentary, nomadic and migratory birds. Birds' flights and methods of their research. Reproduction and development of birds: mating behavior, nesting. The structure of bird eggs and its incubation. Breeding and nesting birds. Variety of birds: orders Keelless (ostriches, cassowaries, kiwis), Penguins, Kilegrudy (rows of Woodpeckers, Chickens, Geese, Falcons, Owls, Storks, Cranes, Sparrows); features of the organization, representatives, role in nature and human life. Poultry breeding. Protection of birds.

Class Mammals. General characteristics. Habitats. Features of external and internal structure. Features of reproduction and development of mammals. Mammal behavior. Seasonal phenomena in the life of mammals. Diversity of mammals. Primordial animals are oviparous mammals. Marsupials. Placental mammals: series Insectivorous, Bats, Rodents, Predators, Pinnipeds, Cetaceans, Even-toed ungulates, Even-toed ungulates, Primates; features of the organization, representatives, role in nature and human life. Livestock. Mammal protection.

Lifestyle, features of external and internal structure, distribution in the nature of representatives of the resulted taxa, their variety. The value of animals of different taxa in nature and human life.

<p>Human</p>	<p>The position of man in the system of the organic world. Tissues of the human body (epithelial, muscular, nervous, internal tissues: connective, blood, skeletal), their structure and function. Functional systems of organs. Musculoskeletal system. Bone and cartilage tissues. Chemical composition, structure, growth and connection of bones. Muscle tissue. Skeletal muscle structure and function. Mechanism of muscle contraction. Muscle work, tone, strength and fatigue. Hypodynamia. The internal environment of the human body. Homeostasis. Composition and functions of blood. Structure and functions of erythrocytes, leukocytes and thrombocytes. Blood groups. Blood Transfusion. Blood coagulation. Immunity, its types. Phagocytosis. Immune system. Allergic reactions of the body. Hematopoiesis and anemia. Functions and structure of the circulatory and lymphatic systems. Circulation. The structure of the heart. Properties of the heart muscle. Automation of the heart. Cardiac cycle. Heart function and its regulation. Heart rate, systolic and cardiac output. Blood vessels, their structure and function. Circulation of blood circulation. The movement of blood through the vessels. Vascular tone. Blood pressure. Lymphatic circulation. Lymph, its composition. Lymphatic system, its structure and function. External and cellular respiration. Functions and structure of the respiratory system. Gas exchange in the lungs and tissues. Respiratory movements and their regulation. Voice machine. Nutrition and digestion. Structure and functions of the digestive system. Digestive glands. Digestion in the mouth, stomach, intestines. Parietal digestion. Absorption. Regulation of digestion. Energy needs of the body. Norms and hygiene of food. Vitamins, their properties. Avitaminosis, hypo- and hypervitaminosis. Systems that provide the release of metabolic products (urinary, respiratory, digestive, skin). Functions and structure of the kidneys. Formation and excretion of urine. The structure and function of the skin. Thermoregulation. Hardening. Regulation of functions. Humoral regulation. Endocrine system. Hormones. Functions of endocrine and mixed secretion glands. Consequences of endocrine gland dysfunction. Nervous regulation. Reflex. Reflex arc. Nervous system: central and</p>	<p><i>Know</i> the structure of the glands of external, internal and mixed secretion; endocrine hormones; digestive glands, digestive juices and their enzymes; vitamins; unconditioned and conditioned reflexes; skills, habits, emotions; human biorhythms.</p> <p><i>Recognize</i> in drawings and diagrams of tissue, individual organs and systems of human organs.</p> <p><i>Characterize</i> tissue types; the internal environment of the human body; principles of the nervous and endocrine systems; mechanisms of heart function, blood flow through blood vessels; mechanisms of muscle contraction, respiratory movements; protective reactions of the body (immune, allergic, blood clotting, stress, maintaining body temperature, etc.); processes of digestion, absorption, gas exchange in cells and tissues, urine formation, thermoregulation; the role of vitamins, bacterial flora of the gastrointestinal tract in human life; physiological nature of sleep.</p> <p><i>Explain</i> the role of components of the internal environment of the human body and functional systems; the essence and significance of neuro-humoral regulation; mechanisms of neuro-humoral regulation of digestive processes, respiration, blood circulation, thermoregulation, excretion, support and movement, metabolism and energy; the importance of signaling systems in the perception of the environment; biological significance of sleep.</p> <p><i>Compare</i> the structure of the skeleton of humans and animals; nervous and humoral regulation of functions; mechanisms of unconditioned and conditioned reflexes; operation of the first and second signal system; temperament types. <i>Determine</i> the physiological causes of muscle fatigue; causes and consequences of hypodynamics; causes of hypertension</p>
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	<p>peripheral. Structure and functions of the spinal cord and brain. Regulation of motor activity. Autonomic nervous system (sympathetic and parasympathetic). The influence of the autonomic nervous system on the body and its functions.</p> <p>Sensory systems their value. Functions and structure of sensor systems. General properties of sensor systems. Sense organs. Receptors. Structure and functions of sight, hearing and balance. Perception of the image of objects, light, color, sound and body balance. Hearing and vision hygiene.</p> <p>Higher human nervous activity. Unconditioned and conditioned reflexes. Formation of conditioned reflexes. Temporary neural connection. Inhibition of conditioned reflexes. Dynamic stereotype. Physiological bases of speech. The first and second signaling systems. Thinking and consciousness. Feelings, perception, attention, memory and its types, emotions. Personality. Types of temperament. Nature. Giftedness, ability. Sleep and its meaning.</p> <p>Exposure to alcohol, drugs, and toxins smoking on the human body.</p>	<p>and hypotension; causes of diseases that lead to dysfunction and blood composition; diseases of the endocrine glands, circulatory system, respiration, digestion, excretion, musculoskeletal system, visual and hearing disorders; factors influencing the formation of personality values of motor activity; physiological bases of a rational food; hygiene rules; harmful effects of alcohol, drugs, toxins and smoking on the human body.</p> <p><i>Establish</i> the relationship between the structure and functions of organs, organ systems; the relationship between the basic properties of the nervous system and temperament.</p> <p><i>Assess</i> the role of organ systems in metabolism, ensuring homeostasis and mechanisms for its maintenance.</p>
<p>Reproduction organisms</p>	<p>Forms of reproduction of organisms (asexual, sexual). Methods of asexual reproduction of unicellular (division, schizogony, budding, spore formation) and multicellular organisms (vegetative reproduction, spore formation). Clone. Cloning of organisms. Parthenogenesis. Polyembryony. Genetic combinatorics during reproduction - conjugation, copulation. Sexual reproduction. Processes of germ cell formation. Fertilization and its forms. Heterosexual and hermaphroditic organisms. Parthenogenesis.</p> <p>Ontogenesis. Periods of individual development of organisms. Embryonic (embryonic) period of development, its stages in animals.</p>	<p><i>Explain</i> the essence and biological significance of sexual and asexual reproduction, parthenogenesis, polyembryony, fertilization.</p> <p><i>Distinguish</i> methods of reproduction; forms of fertilization; methods of vegetative propagation of plants and animals.</p> <p><i>Compare</i> sexual and asexual reproduction; structure of male and female gametes.</p> <p><i>Analyze</i> the stages of germ cell formation. <i>Describe</i> the differences in the structure and processes of formation of male and female gametes.</p>
<p>Individual development of organisms.</p>	<p>Stem cells. Post-embryonic (post-embryonic) period development, its types and stages in animals and humans. Human puberty. Features of post-embryonic development in plants. Growth, its types and regulation. Regeneration. Life cycle. Simple and complex life cycles. Alternation of different generations in the life cycle. Embryotechnology.</p>	<p><i>Characterize</i> the stages of embryonic development in animals (crushing, formation of morula, blastula, gastrula, cell differentiation, histogenesis, organogenesis, the phenomenon of embryonic induction); mechanisms of growth, puberty.</p>

		<p><i>Explain</i> the essence and biological significance: the alternation of generations in the life cycle of organisms; direct and indirect development of animals.</p> <p><i>Classify</i> the types of growth of organisms of different kingdoms. <i>Analyze</i> the periods of ontogenesis in plants and animals; basic life cycles in plants and animals (on the example of the above taxa); causes of seasonal changes in plant and animal life.</p> <p><i>Compare</i> direct and indirect development of multicellular animals; plant life cycles; possibilities and mechanisms of regeneration of an organism at plants and animals.</p> <p><i>Evaluate</i> the results of the action of external and internal environmental factors that affect human ontogenesis; possibilities of correction of defects of human development.</p>
Heredity and variability	Genetics. Methods of genetic research (including human heredity). Basic concepts of genetics: genes (structural and regulatory), gene allele, gene locus, dominant and recessive traits, homozygote, heterozygote, genotype, phenotype, gene pool, heredity, variability, pure line.	<p><i>Know</i> the basic methods of genetic research; gene structure; basic concepts of genetics.</p> <p><i>Recognize</i> allelic and non-allelic genes; homozygotes and heterozygotes; dominant and recessive traits, types of gene interaction.</p>
Regularities heredity	Patterns of heredity established G. Mendel and their statistical nature. Gamete purity law. Methods of genotype testing of hybrid individuals. Intermediate nature of inheritance. Linked inheritance. Chromosomal theory of heredity. Genetic basis of sex determination in different groups of organisms. Sex ratio in populations. Inheritance linked to the article. Gene interaction and its types. Genome organization in different groups of organisms. Cytoplasmic heredity.	<p><i>Explain</i> the cytological basis of Mendel's laws of heredity; principles of interaction of allelic and non-allelic genes; influence of lethal alleles; gender determination mechanisms; the value of linked (including sex) inheritance; multiple action of genes; basic patterns of gene function in prokaryotes and eukaryotes; biological significance of cytoplasmic heredity.</p> <p><i>Determine</i> the causes of deviations in the splitting from the typical quantitative ratios established by Mendel.</p> <p><i>Compare</i> homozygotes and heterozygotes; genotype and</p>

		<p>phenotype; genomes of different groups of organisms (prokaryotes, eukaryotes, viruses).</p> <p><i>Analyze</i> the main provisions of chromosomal theory; schemes of monohybrid and dihybrid crossing; pedigrees; hereditary traits of the family.</p> <p><i>To make</i> schemes of monohybrid and dihybrid crossing.</p> <p><i>Solve</i> genetic problems monohybrid and dihybrid crossing, interaction of allelic genes: complete and incomplete dominance, codominance, linked to the sex of inheritance.</p> <p><i>Justify</i> the integrity of the genotype; the role of heredity in the evolution of organisms; the importance of studying the laws of heredity for the practical activities of mankind.</p>
Laws minlity.	<p>Modification (non-sagging) ministry, power and statistical laws. Reaction rate. Variation row. Variation curve. Spadkova smallness of the type: combinative and mutational. Tipi mutations. Mutagenic factors. Spontaneous mutations. The law of homologous series in decaying diminution.</p>	<p><i>Recognize</i> the decline and non-fallability; see the decline; tipi mutations.</p> <p><i>Explain</i> the role of the relationship between the genotype and the mind of the dovkill in the form of the phenotype; adaptive nature of modifications; the meaning of combinative minority; the role of mutagenic officials.</p> <p><i>Characterize</i> the laws of combinative and mutational minority; the power of mutations.</p> <p><i>Beginning</i> the reasons for the modification; dzherela combinative minlivosti; cause the discovery of mutations. Adjust the mutation and modification of the economy.</p> <p><i>Analyze</i> a variable row and a variable curve.</p> <p><i>Explane</i> meaning mutations in nature and life of people; come in to get the organisms out of the inflow of mutagenic officials; the role of mutations in the evolution of</p>

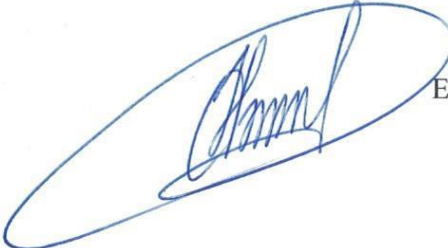
		organisms; meaning the law of homologous series in decaying diminutiveness.
Selection	Tasks and methods of selection. Variety, breed, strain. Artificial selection, its forms. Systems of crossing of organisms: intraspecific hybridization (related - inbreeding, and unrelated - outbreeding crossing), interspecific (remote) hybridization. Heterosis. Features of selection of plants, animals, microorganisms. Polyploidy. Centers of diversity and origin of cultivated plants. Areas of domestication of animals. Biotechnology, genetic and cell engineering. Genetically modified and bizarre organisms.	<p><i>Distinguish</i> forms of artificial selection; systems of crossing organisms.</p> <p><i>Characterize</i> features of selection of plants, animals, microorganisms; directions of research and modern achievements of biotechnologies; principles of creation and application of genetically modified and chimeric organisms.</p> <p><i>Compare</i> classic and latest methods of biotechnology.</p> <p><i>Explain</i> the importance of the laws of genetics for selection, the biological significance of the phenomenon of heterosis; the importance of polyploidy in plant breeding; the role of achievements of modern biotechnologies in human life and economic activity.</p> <p><i>Determine</i> the genetic consequences of different systems of crossing organisms; causes of heterosis; ways to overcome the sterility of interspecific hybrids; consequences of application of modern biotechnologies.</p>
Superorganic levels of life organization		
Environmental factors	Environmental factors: abiotic, biotic, anthropogenic. The concept of limiting (limiting) factor. The law of optimum. Ecological valence of the species (endurance limits). Eurybiont and stenobiont organisms. Interaction of ecological factors. Forms of biotic relationships (competition, predation, eating, mutualism, commensalism, parasitism). Adaptation. Adaptive biological rhythms of organisms. Photoperiodism. Seasonal changes in plant and animal life.	<p><i>Know</i> environmental factors; biological rhythms.</p> <p><i>Classify</i> environmental factors; forms of biotic connections; adaptive biological rhythms of organisms.</p> <p><i>Explain</i> the role of a limiting factor in the spread of organisms; dependence of changes in the intensity of environmental factors on the characteristics of the environment; biological significance of biological rhythms, photoperiodism.</p> <p><i>Analyze</i> the effect of environmental factors on organisms, their impact on the dynamics and fluctuations in population size.</p> <p><i>Establish</i> causal relationships between phenomena and processes in wildlife;</p>

		causes and significance of biological rhythms.
Habitat	The main habitats of organisms: terrestrial-aerial, aquatic, soil. The organism of living beings as a special habitat. Life forms of organisms.	<p><i>Know</i> the adaptation of organisms to living conditions; similarities in the adaptation of different species to the same living conditions; features of the main habitats.</p> <p><i>Compare</i> the conditions of different habitats. <i>Explain</i> the ways of adaptation of organisms to habitats.</p>
Population-species level of organization of life Ecosystems	<p>Kind. Type criteria. Area. Ecological niche. The structure of the species. Population. Characteristic population. Population structure (age, spatial, sexual). Population waves. Homeostasis of the population. Population gene pool. Ecosystems, their composition and diversity. Relationships between populations in ecosystems (direct and indirect; antagonistic, neutral and mutualistic; trophic and topical). Transformation energy in ecosystems. Producers. Consumers. Reducers. Power circuits. Trophic level. Trophic grid. The rule of the ecological pyramid. Types of ecological pyramids. Ecosystem development. Successions. Self-regulation of ecosystems. Agrocenoses.</p>	<p><i>Identify</i> the factors that affect the number and population density.</p> <p><i>Characterize</i> the criteria of the species; indicators that characterize the population (number, density, biomass, fertility, mortality, growth); species and population structure.</p> <p><i>Explain</i> the significance of population waves; the need to protect the gene pool of populations.</p> <p><i>Establish</i> relationships between populations in ecosystems; changes of groups in one location.</p> <p><i>Identify</i> organisms that are producers, consumers, reducing agents.</p> <p><i>Classify</i> different ecosystems; types of chains nutrition; types of ecological pyramids.</p> <p><i>Explain</i> the relationships between organisms in ecosystems; the impact of environmental factors on changes in ecosystems; mechanisms of self-regulation of populations and ecosystems; features of functioning of agrocenoses, ways of increase of their productivity.</p> <p><i>Identify</i> the causes of ecosystem changes.</p> <p><i>Compare</i> natural and artificial ecosystems. Justify the need to protect the gene pool of populations; the role of organisms of producers, consumers, reducers and humans in artificial and natural ecosystems.</p> <p><i>Solve</i> environmental problems (structure, productivity and sustainability of different ecosystems).</p>

Biosphere	<p>Biosphere. The noosphere. Living matter of the biosphere, its properties and functions. The cycle of substances and energy flows in the biosphere as necessary conditions for its existence. Modern environmental problems: population growth planets, erosion and soil pollution, growth of large cities, deforestation, irrational use of water and energy resources, possible climate change, negative impact on biodiversity.</p> <p>The teachings of VI Vernadsky on the biosphere and noosphere, its importance for avoiding the global environmental crisis.</p>	<p><i>Know</i> the structure of the superorganismic standard of living; the role of living organisms in the transformation of the Earth's crust (creation of sedimentary rocks, soil formation, maintaining the stability of the gas composition of the atmosphere).</p> <p><i>Determine</i> the boundaries of the biosphere.</p> <p><i>Characterize</i> the properties and functions of living matter in the biosphere; forms of environmental pollution. To reveal the interrelationships of the constituent superorganismic levels of the organization of life.</p> <p><i>Justify</i> ways to overcome the ecological crisis (the need for rational use of nature development of alternative energy sources; the need to preserve biodiversity).</p>
Protection of species diversity of organisms	<p>Red and green books. Protected areas (reserves (biosphere), reserves, national and landscape parks). The concept of ecological network. Environmental protection legislation of Ukraine. Basic documents on human environmental activities (Red Book, Green Paper, white and black lists). International cooperation in the field of nature protection.</p> <p>The role of plants in nature and in human life. Endangered plant species in Ukraine.</p>	<p><i>Know</i> the protected areas; forms of international cooperation in the field of nature protection.</p> <p><i>Classify</i> the species listed in the Red Book, depending on the state of their populations and the degree of threat of extinction; protected areas.</p> <p><i>Explain</i> the role of protected areas in the conservation and reproduction of biological diversity, balance in the biosphere.</p> <p><i>Substantiate</i> measures of protection of populations, ecosystems on the basis of knowledge about features of their functioning.</p>
Historical development of the organic world		
Fundamentals of evolutionary theory	<p>Evolution. Phylogeny. Phylogenetic series. The evolutionary hypothesis of J.-B. Lamarck. The main provisions of evolutionary theory Charles Darwin. Haeckel-Mueller biogenetic law. Divergence and convergence, similar to homologous organs, rudiments and atavisms, mimicry and its types.</p> <p>Synthetic theory of evolution. Microevolution. Natural selection. Species formation.</p>	<p><i>Know</i> similar and homologous organs; rudiments and atavisms; mimicry; animals that have a protective, preventive color; intraspecific and interspecific struggle for existence; aromamorphoses, idioadaptations, general degeneration.</p> <p><i>Describe</i> the main provisions of the <u>synthetic theory</u> of evolution</p>

	<p>Macroevolution. Biological progress and regress. Modern evolutionary views (hypotheses of adaptive compromise, interrupted equilibrium, neo-catastrophism, saltationism)</p>	<p>(elementary unit, elementary factors, driving forces); ways of biological progress (anamorphosis, idioadaptation and general degeneration); modern ideas about the factors of evolution (synthesis of ecology and evolutionary views).</p> <p><i>Distinguish</i> forms of natural selection; methods of speciation.</p> <p><i>Identify</i> the causes and consequences of the struggle for existence. Explain the evolutionary significance of population waves, isolation; the creative role of natural selection; formation of new species.</p> <p><i>Compare</i> the evolutionary hypotheses of Lamarck and Darwin; various forms of struggle for existence; Darwinism and the synthetic theory of evolution; macro- and microevolution.</p> <p><i>Analyze</i> the preconditions for the development of evolutionary views and evolutionary doctrine; variety of adaptations of organisms as a result of the evolutionary process; forms of natural selection.</p> <p><i>Substantiate</i> the relativity of adaptation of organisms to living conditions in a certain environment.</p>
<p>Historical development and diversity of the organic world</p>	<p>The modern system of the organic world. Principles of classification of organisms. Taxonomic units. Division of the geological history of the Earth into eras, periods and epochs. The main events that took place in certain geological periods of Earth's history</p>	<p><i>Know</i> the main evolutionary events in the Proterozoic (Vendian period), Paleozoic (Cambrian, Ordovician, Silurian, Devonian, Carboniferous, Permian periods), Mesozoic (Triassic, Jurassic, Cretaceous periods), and Cenozoic (Paleogene, Neogene, Anthropogenic) eras.</p> <p><i>Analyze</i> the complications of fauna and flora in the process of evolution.</p> <p><i>Justify</i> the unity of the organic world</p>

Executive Secretary of the
Admissions Committee of ONMedU



E.S. Buryachkivsky