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**THE PROGRAM OF THE ENTRANCE EXAM
IN THE GENERAL EDUCATION SUBJECT "BIOLOGY"**

for applicants to study in educational programs of higher education - bachelor's degree,
specialty programs

The program is compiled in accordance with the requirements of the federal state educational standard of secondary general education and the federal state educational standard of basic general education.

The program of the entrance exam was approved at the meeting of the Academic Council of the Institute of Nature and Technical Sciences on October 25, 2023, Protocol No. 9.

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I. GENERAL PROVISIONS

1. This program is compiled in accordance with the requirements of the federal state educational standard of secondary general education and the federal State educational standard of basic general education and defines the general content of the entrance exam for applicants to study in educational programs of higher education – bachelor's degree programs and specialty programs at the Surgut State University (hereinafter – the University).

2. The entrance exam is aimed at assessing the knowledge of applicants obtained during the development of secondary general education and basic general education programs, and at selecting among applicants the most capable and prepared for the development of bachelor's degree and specialty programs at the University.

3. The entrance exam is conducted within the framework of several competitions (in the relevant areas, forms and fundamentals of education) and is given once.

4. The entrance exam is conducted in Russian.

5. The entrance exam is conducted in person and (or) using remote technologies (provided that applicants are identified when they pass the entrance exams).

6. The duration of the entrance exam is 120 minutes.

II. CONTENTS OF SECTIONS

Section I. Fundamentals of cytology

A cell is an elementary living system underlying the structure and development of organisms.

The main structural components of a eukaryotic cell are the outer cell membrane, cytoplasm and nucleus. Structure and functions.

Organelles and inclusions of cytoplasm. Structure and functions. Similarities and differences between plant and animal cells. Prokaryotic and eukaryotic cells: similarities and differences. The structure and vital activity of bacteria.

The significance of bacteria.

The chemical organization of the cell. Comparison of plant, animal and fungal cells. Non-cellular life forms. Viruses and bacteriophages. Metabolism and energy in the cell.

Energy metabolism in the cell. Nutrition of the cell. Autotrophic nutrition. Photosynthesis. Chemosynthesis.

The genetic code. Transcription. Synthesis of proteins in the cell. Regulation of transcription and translation in the cell and the body.

Organic substances. Carbohydrates. The functions of carbohydrates in the cell.

Lipids (fats and lipoids). The functions of fats and lipids in the cell.

Proteins. The functions of proteins in the cell.

Nucleic acids and their functions.

Metabolism and energy in the cell. Plastic and energy metabolism are the basis of the cell's vital activity.

The interrelation of the processes of energy and plastic metabolism in the cell.

Cell division is a biological process underlying the reproduction and individual development of organisms. The commonality of the mitotic cell division process in eukaryotes. The mitotic cycle. DNA doubling before mitosis. The biological meaning of mitosis. Phases of mitosis. The species constancy of the number of chromosomes. The individuality of chromosomes. Their structure. Haploid and diploid sets of chromosomes.

Forms of reproduction of organisms. Asexual and sexual reproduction. Germ cells: eggs and spermatozoa (morphology).

Individual development of organisms. A laying of organ systems. Postembryonic development.

Section II. Fundamentals of genetics

Genetics is the science of the laws of heredity and variability. The significance of genetics.

The main patterns of transmission of hereditary traits. A hybridological method for studying heredity. The patterns of inheritance established by G. Mendel. Monohybrid crossing. G. Mendel's First Law. The uniformity of the first generation. Dominant and recessive traits. Homozygosity and heterozygosity. Allelic and non-allelic genes. Phenotype and genotype. Mendel's Second Law. Splitting in the second generation. An intermediate type of inheritance. G. Mendel Third Law. Dihybrid and polyhybrid crossing. Independent combination of hereditary traits in di- and polyhybrid crossing. The statistical nature of the splitting phenomena.

The genotype as an integral historically developed system. The interaction of allelic genes. Inheritance of blood groups. The interaction of non-allelic genes.

Patterns of variability. The role of the genotype and environmental conditions in the formation of the phenotype.

The main methods of selection and biotechnology. Selection of plants, animals, and microorganisms. The current state and prospects of biotechnology.

Section III. Botany

Botany is the science of plants. A plant is a complete organism. The structure of the plant cell. Tissues of plant organs in connection with the functions performed in the whole organism. The interrelation of organs. The main vital functions of a plant organism.

Vegetative organs of a flowering plant: root, stem, leaf. Types of roots and types of root systems. Root modifications. Shoot and buds. The external structure of the leaf. The cellular structure of the leaf. Modifications of the leaf. The structure of the stem. Modified shoots.

Generative organs: flower (inflorescences), fruit, seed. Fetus. Fetal functions. A variety of fruits. Distribution of fruits and seeds. Formation of fruits and seeds. The structure of plant seeds. Seed germination. The structure of the flower. Inflorescences. Fruits.

Elementary notions of systematic categories (species, genus, family, class, rank). Unicellular algae. Multicellular algae. Lichens. Mosses. Ferns. Horsetails. The plants. Gymnosperms. Angiosperms.

General characteristics of fungi. Cap fungi. Mold fungi. Yeasts. The role of fungi in nature and human life.

The chemical composition of plants. Mineral nutrition of plants. Photosynthesis. Plant respiration. Evaporation of water. The movement of water along the stem. The plant organism as a whole. Reproduction of spore and gymnosperm plants. Vegetative reproduction of angiosperms. Fertilization in angiosperms. Pollination methods in flowering plants.

Section IV. Zoology

Zoology is the science of animals. The significance of animals in nature and human life.

Classification of animals.

The simplest type. General characteristics of the type. Taxonomy.

Type of Coelenterates. General characteristics of the type. Taxonomy. Living environment.

The type of shellfish. General characteristics of the type. Taxonomy.

The type is arthropods. General characteristics of the type. Taxonomy.

The Crustacean class. General characteristics of the class.

Class Insects. General characteristics of the class. The external and internal structure of an insect on the example of a May beetle. Features of life activity. Reproduction.

Types of insect development. Insects with complete transformation.

The type is chordate. General characteristics of the type. Taxonomy.

A class of Fish. General characteristics of the class. The external and internal structure of fish on the example of a river bass. Reproduction and development. The initial concept of unconditional and conditioned reflexes.

Class Amphibians. General characteristics of the class. Taxonomy.

The Reptiles class. General characteristics of the class. Taxonomy.

The Bird class. General characteristics of the class.

The class is Mammals. General characteristics of the class. Taxonomy.

The development of the animal world on Earth. The main stages of the development of the animal world. Relations between classes of vertebrates. Reflection of kinship relationships in the natural system of the animal world.

Section V. Human anatomy, physiology and hygiene

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

A general overview of the human body.

The main types of tissues (epithelial, connective, muscular, bone, nervous) and their properties. The concept of nervous and humoral regulation.

The musculoskeletal system.

Functions of the musculoskeletal system. The structure of the human skeleton. The peculiarities of its structure in connection with upright walking and work.

Muscles, their structure and functions. The human muscular system. The reflex nature of muscle activity. Fatigue.

Blood. Blood functions. Blood composition: plasma, shaped elements. The role of erythrocytes in the transfer of gases. Blood clotting as a protective reaction of the body. The functions of leukocytes.

Immunity and its types. Blood groups. Blood transfusion and its significance.

The circulatory system. Functions of the circulatory organs. Large and small circles of blood circulation. Arteries, capillaries and veins. The heart, its structure and work. The concept of nervous and humoral regulation of the heart and blood vessels. The concept of the internal environment of the body: blood, lymph, tissue fluid – as the internal environment of a living organism. Blood is connective tissue. The meaning of blood and its composition. Blood cells: erythrocytes, platelets, leukocytes. Blood functions: transport, informational, protective, maintaining constant body temperature, maintaining the constancy of the internal environment (homeostasis). Blood diseases. Human

hematopoietic organs. The human immune system. The body's immune response. Discovery and substantiation of the phagocytosis process by I.I. Mechnikov. Vaccination. Infectious diseases. Allergic human diseases. The Rh factor.

The respiratory system.

Respiratory functions. Respiratory tract. The structure of the lungs. Gas exchange in lungs and tissues. Nervous and humoral regulation of respiration.

The digestive system.

Functions of the digestive organs. Food products and nutrients. The significance of food. The content of proteins, fats and carbohydrates in the main food groups. Examples of unconditional and conditional food reflexes. Nervous and humoral regulation of digestion. Hygienic conditions of normal digestion. The concept of prevention of foodborne infections.

Metabolism.

The absorption of proteins, fats, and carbohydrates in the body. Assimilation and dissimilation as two sides of a single metabolic process.

Vitamins. The value of vitamins.

The system of excretory organs.

Functions of the excretory organs. Allocation of exchange products. Organs of the urinary system. The importance of the excretory organs in maintaining the constancy of the internal environment of the body.

Skin. Skin functions. The structure of the skin. Skin derivatives. The role of the skin in the regulation of heat transfer.

The nervous system.

Functions of the nervous system. The central nervous system. The structure and functions of the spinal cord. The composition of reflex arcs. The structure and functions of the brain departments: the medulla oblongata, bridge, cerebellum, middle, intermediate. The highest part of the brain is the cerebral cortex. Peripheral and autonomic nervous systems. Sympathetic and parasympathetic divisions of the autonomic nervous system.

Analyzers. I.P. Pavlov's teaching about analyzers. Visual analyzer. The structure of the eye. The light-sensitive apparatus of the eye. Building an image on the retina. Visual hygiene.

An auditory analyzer. The structure and hygiene of the hearing organ. The mechanism of sound perception. Otolith apparatus and semicircular channels.

The sense of touch. Sense of smell and taste.

The role of I.M. Sechenov in the development of the doctrine of higher nervous activity. I.P. Pavlov's teaching on conditioned reflexes. Conditional and unconditional reflexes. Formation and inhibition of conditioned reflexes. The first and second alarm systems.

The glands of internal secretion.

Functions of the endocrine glands. Hormones and their importance for the body. The role of humoral regulation in the body.

The development of the human body.

The sex glands. Germ cells, their structure and development. Fertilization. The role of chromosomes in the transmission of hereditary properties. Postembryonic human development.

The body is a single whole. Coordination of the activity of all organ systems (humoral and nervous mechanisms of regulation and self-regulation).

Section VI. General Biology

Introduction. General biology is the science of the basic and common patterns of life phenomena for all organisms.

The development of the organic world. The main evidence for the evolution of the organic world is comparative anatomical, embryological, biogeographic and paleontological.

The main directions of evolution are the ways of development of the organic world. The division of the Earth's history into eras and periods. The development of the organic world in the Archean, Proterozoic and Paleozoic eras. The development of Darwinism. The type, its criteria. A population is a structural unit of a species, a unit of evolution. The driving forces of evolution, their impact on the gene pool of the population. The genetic composition of the population. The struggle for existence. Natural selection. Speciation. Conservation of species diversity as the basis for sustainable development of the biosphere. Causes of species extinction. Biological progress and biological regression. Macroevolution. The main directions of evolution.

The origin of man. Great apes and man. C. Darwin on the origin of man from animals. The role of labor in the transformation of ancient monkeys into humans. The driving forces of anthropogenesis: social and biological factors.

Fundamentals of ecology.

Ecology is the science of patterns of relationships of organisms with the environment. The problems of ecology. Environment and environmental factors.

The adaptation of the organism (species) to abiotic and biotic environmental factors. The complex effect of factors on the body. The main climatic factors (light, temperature, humidity) and their effect on the body. The main types of environmental interactions. Ecological

characteristics of the population. Population dynamics. Ecological communities. The relationship of organisms in communities. Food chains. Ecological pyramids. Environmental pollution. Fundamentals of rational environmental management.

Biogeocenosis. Examples: freshwater reservoir, oak grove. The relationship of populations in the biogeocenosis.

Basics of biosphere science. The biosphere and its boundaries. The role of man in the biosphere.

III. LIST OF RECOMMENDED LITERATURE

1. Biology. Human anatomy and physiology. Grade 8: textbook for schools with in-depth study of biology / M.R. Sapin, Z.G. Bryksina, V.I. Sivoglazov. – M.: Bustard, 2018. - 336 p.
2. Biology. Human. 8th grade: textbook / N.I. Sonin, M.R. Sapin. – M.: Bustard, 2018. – 304 p.
3. Biology : human : 9th grade: textbook for general education institutions / A.S. Batuev [et al.]; ed. by A.S. Batuev. – 8th ed., ster. – M.: Bustard, 2002. – 240 p.
4. Biology: Man and his health. Grade 9: textbook / A.M. Tzuzmer, O.L. Petrishina. - 26th ed. – Moscow: Prosveshchenie, 2001. – 240 p.
5. Biology. For school graduates and those entering universities: a textbook / A.G. Mustafin; edited by V.N. Yarygin. — M.: Knorus, 2015. — 584 p.
6. Biology. Grade 7: textbook for students of general education organizations / V.M. Konstantinov, V.G. Babenko, V.S. Kuchmenko. – 6th ed., stereotype. – M.: Ventana-Graf, 2018. – 288 p.
7. Biology. Animals: a textbook for students of grades 7 of general educational institutions / A.I. Nikishov, I.H. Sharova. – M.: VLADOS, 2012. – 255 p.
8. Biology, Animals, 7th grade / D.I. Traitak, S.V. Sumatokhin. – 6th ed., ispr. and add. – M.: 2012. – 272 p.
9. Biology. Animals: a textbook for grades 7-8 of general education institutions / B.E. Bykhovskiy, V.R. Dolnik, M.A. Kozlov. – St. Petersburg: Special literature, 2004. – 335 p.
10. Biology: plants, bacteria, fungi, lichens: textbook for grades 6-7 of general education institutions / T.I. Serebryakova, A.G. Elenevsky, M.A. Gulenkova et al. – 7th ed. – M.: Prosveshchenie, 2001. – 224 p.
11. Biology: Plants, bacteria, fungi, lichens: textbook for grades 6-7 of primary school / V.A. Korchagina. – St. Petersburg: Special literature, 2000. – 270 p.
12. Biology. Grade 6: textbook for students of general education organizations / I.N. Ponomareva, O.A. Kornilova, V.S. Kuchmenko; ed. by I.N. Ponomareva. – 2nd ed., dorab. - M.: Ventana-Graf, 2015. – 191 p.
13. Biology. General biology. Grades 10-11: textbook for general education institutions: profile level. In 2 hours / P.M. Borodin, L.V. Vysotskaya, G.M. Dymshits et al.; edited by V.K. Shumny, G.M. Dymshits. – 10th ed. – Moscow: Prosveshchenie