

Минобрнауки России

Федеральное государственное бюджетное образовательное учреждение высшего  
образования  
«Сыктывкарский государственный университет имени Питирима Сорокина»  
(ФГБОУ ВО «СГУ им. Питирима Сорокина»)

Утверждено решением  
ученого совета  
Медицинского институт  
от 26.12.2025г. протокол № 12

Программа вступительного испытания для  
поступающих на специалитет  
31.05.01 Лечебное дело. General medicine  
(на английском языке)  
**БИОЛОГИЯ**  
(на английском языке)

Сыктывкар – 2025

## **Explanatory note**

The list of topics in this program corresponds to the mandatory minimum content of basic educational programs of the Federal component of the state standard of secondary vocational education in the fundamentals of biochemistry.

The entrance test is conducted in written form in the form of a test.

It is possible to conduct an entrance test using remote technologies, subject to identification of the applicant's identity.

The entrance test lasts 60 minutes.

The maximum number of points is 100, the minimum is 30.

## **Program content**

### **Block 1. Basics of biochemistry**

#### 1. Features of nutrients and biochemical transformations

Subject, methods and objects of biochemistry. Chemical processes in highly organized systems. The cell is the main structural element of living matter. Composition of living matter.

#### 2. Water and its role in the life process

Colligative properties of water. Osmotic pressure of blood plasma. Homeostasis. Human acid-base status. Theory of acids and bases. Buffer properties of solutions. Experimental determination of acid-base properties of organic compounds by titrometry.

#### 3. Amino acids and proteins

General structural properties of amino acids. Proteins and their main biological functions.

Structure of proteins. Classification of proteins. Biological functions of proteins.

#### 4. Enzymes - biocatalysts

Catalytic activity of enzymes. Reaction and substrate specificity.

Classification of enzymes based on reaction and substrate specificity.

Active sites of enzymes. Enzyme activators and inhibitors

#### 5. Kinetics of biological processes

Kinetic equations. Order of reaction. Half-life period. Dependence of the rate of enzymatic reactions on the concentration of the substrate, medium and temperature.

Michaelis-Menten equation and its parameters.

#### 6. Carbohydrates

Features of the chemical structure of carbohydrates. Biological role of carbohydrates.

Monosaccharides. Oligo- and polysaccharides.

#### 7. Lipids and biomembranes

Biological functions of lipids. Fatty acid. Triacylglycerides are a stored form of lipids. Brief characteristics of cell membranes. Phospho- and sphingolipids are structural components of biomembranes. Steroid lipids. Lipoproteins. Micellar lipid solutions. Membrane formation

#### 8. DNA and RNA - storage and implementation of hereditary information

Structure and functions of DNA and RNA. Nitrogen bases and nucleotides. Nucleotides and their functions. Primary, secondary, tertiary and quaternary structures of DNA. Genetic code. DNA replication. Denaturation and renaturation of DNA

#### 9. Vitamins are essential food components

Nomenclature and classification of vitamins. Characteristics and physiological significance of vitamins.

#### 10. Minerals and trace elements

The role of minerals and trace elements in the process of life.

Use of macro- and microelements in biomedical practice

### **Block 2. Cytology**

#### 1. Introduction to cell biology.

Cell biology (cytology) is the basis of modern biology. Cell theory - the basic law of the structure of living organisms

#### 2. General plan of the structure of cells of living organisms.

Prokaryotes. Kingdom of Bacteria. Features of bacterial cells. Eubacteria (true bacteria). Archaeobacteria. Eukaryotes. Animal Kingdom. Features of animal cells. Eukaryotes. Kingdom of Plants. Features of a plant cell. Eukaryotes.

Kingdom of Mushrooms. Features of fungal cells.

#### 3. Main components and organelles of cells.

Plasma membrane of cells. Supramembrane formations. Cell membranes and walls. Cell cytoplasm. Cytoskeleton. Membrane cell organelles.

Endoplasmic reticulum, Golgi apparatus, lysosomes

#### 4. Metabolism and energy. Metabolic apparatus of the cell

Plastic exchange. Protein synthesis. Synthesis of lipids and carbohydrates. Photosynthesis in plant cells. Plastids and chloroplasts. Phototrophic bacteria. Energy metabolism (catabolism). Functions of cellular respiration and laws of bioenergy

#### 5. Nuclear apparatus and cell reproduction

Structure and functions of the kernel. Chromosome structure. Chromatin structure. DNA packaging. Modern understanding of the gene structure of pro- and eukaryotes. Transcription. RNA synthesis and maturation. Decoding the genome of humans and animals is the largest achievement of biology at the end of the twentieth century. Life cycle of cells. Interphase.. Stem cells. Classification, properties, application. DNA replication in eu- and prokaryotic cells.

Mitosis. Types of mitosis and cell reproduction. Meiosis. Aging and cell death.

## 6. Viruses as non-cellular life forms

The structure of viruses. Distribution in nature. Viruses and humans. Storage and transmission of genetic information by viruses. Life cycle of viruses. Ways to combat viral infections. Stability and viability of viruses. "Protective measures" of viruses

## 7. Origin and evolution of cells

Primary stages of biochemical evolution on Earth. Proteins, RNA, DNA are the molecules of life. Theories of the evolution of pro- and eukaryotic cells. Origin of multicellular organisms

### **Раздел 3. General genetics**

#### 1. Material basis of heredity of living organisms

Storage of hereditary information in viruses. Prokaryotic genome. Eukaryotic genome.

#### 2. Patterns of inheritance of traits

Hybridological method. Monogenic (Mendelian) inheritance. Inheritance with pleiotropic (multiple) gene action. Interaction of nonallelic genes

#### 3. Genetics of sex and inheritance of sex-related traits

Types of gender determination. Sex differentiation in humans. Inheritance of sex-related characteristics.

#### 4. Chromosomal theory of heredity

Inheritance due to genetic linkage and crossing over. Linkage of genes. Basic provisions of the chromosomal theory of heredity.

#### 5. Molecular basis of heredity

Nucleic acids are the substance of heredity. Structure and functions of genes.

Mobile genetic elements.

#### 6. Transfer of genetic information in cells

Protein biosynthesis. Specialized and prohibited transfer of RNA replication information.

Genomes of prokaryotic and eukaryotic viruses. Plasmons of mitochondria and plastids.

#### 7. Genetic engineering

Genetic Engineering. Microbiological production of human hormones and biologically active proteins. Cellular and genetic engineering of animals. Cellular and genetic engineering of plants

#### 8. Variability

Genotypic variability. Phenotypic variability

9. Genetic control of the development of the organism (genetic basis of ontogenesis) The genotype is an integral historically established system. Gene expression during ontogenesis.

Genes and traits. Stages of development.

#### 10. Population genetics

Genetic structure of a panmictic population. Factors of genetic dynamics of populations. Genetic characteristics of some human populations.

### **Block 4. General ecology**

#### 1. Ecology as a science. General principles of ecology

Fundamentals of general ecology. Goals and objectives facing the environment. Structural levels of matter organization and objects of ecology study. Relationship between ecology and other sciences.

Commoner's Laws and Living Systems

#### 2. Factorial ecology and ecology of populations

Environmental factors. Classification of environmental factors. Ecological adaptations. Laws of action of environmental factors. Population. Properties and parameters of the population. Population size. Types of population growth. Fluctuations in population numbers. Types of population fluctuations. Population density. Methods of natural regulation of density. The nature of the distribution of individuals in the population. Fertility, mortality, survival. Biotic potential, age and sex structure of populations.

Population strategies and their stability.

### 3. Ecology of communities (synecology)

The concept of biocenosis. Structure of biocenosis. Functional groups of populations. The concept of Volterra's laws. Food chains and food web. Ecological pyramids. The concept of the ecological niche of an organism. Ecosystem. Ecosystem structure. Ecosystem and biogeocenosis. Classification of ecosystems, their hierarchical series. Ecological successions, their patterns and types.

### 4. Biosphere

Structure and components of the biosphere. Biogeochemical cycles in the biosphere. Evolution of the biosphere. Biosphere and man. Noosphere. Preservation of the environment as a global problem.

### 5. Environmental protection

Anthropogenic impact on the biosphere: industrial toxicology; atmospheric ecology; ecology of the hydrosphere; ecology of the lithosphere.

Nature management. Basic principles of environmental protection.

Concept of environmental pollution. Consequences of anthropogenic impact on the biosphere. Environmental quality control. Environmental protection measures.

Economics of environmental protection and rational use of natural resources.

## Literature

*Biological Science 1 and 2 (v. 1&2) 3rd edition by Taylor, D. J., Green, N. P. O., Stout, G. W. (1997)*

*Holley D. GENERAL BIOLOGY I: Molecules, Cells and Genes. Dog Ear Publishing; 2017 May*

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