

MINISTRY OF HEALTH OF UKRAINE
ODESA NATIONAL MEDICAL UNIVERSITY

APPROVED
Acting rector of ONMedU
Stanislay SHNAIDER



PROGRAM
OF ENTRANCE EXAM FOR THE COMPONENT **“BIOLOGY”**
IN A DISTANCE FORMAT
FOR FOREIGN APPLICANTS

Odesa 2026

Explanatory note

The main purpose of the entrance exam in distant format is an objective and impartial assessment of the level of academic achievement of applicants who graduated general educational institution and desire to enter the Odesa National Medical University.

The biology entrance exam program is based on current biology curricula for students in grades 6-11 of secondary schools (standard level). The material of the program is divided into three sections: "Introduction. Chemical composition, structure and functioning of cells. Realization of hereditary information", "Regularities of heredity and variation".

An entrance exam in distant format biology takes place orally. Total number of questions - 2.

The program was discussed and approved at the sitting of the admission board of Odesa National Medical University (Record No. 5 of May 01, 2026).

The program was approved by the order of Acting Rector of ONMedU № 292-o of May 04, 2026

EVALUATION CRITERIA

The entrance exam in distant format consists of 5 questions, each of which is rated at 100 points.

Competitive score based on the results of entrance examinations in the form of an oral interview is determined by the formula: $(Q1 + Q2)$. Thus, the maximum number of points that an entrant can receive in an individual oral interview in biology is 200 points.

CRITERIA FOR EVALUATION OF TASKS ON BIOLOGY

General requirements (recommendations) for the tasks:

- to show a certain level of awareness of the topic being discussed;
- reflect the main idea, differentiating the material into primary and secondary;
- to present the material logically, consistently;
- argue the views expressed;

Biology tasks are evaluated according to the criteria set out in the table.

Answering the question is correct, reasonable and complete.	100
The answer to the question is complete, but 1-2 insignificant mistakes were made, which the applicant corrects himself. Some of the key points are not grounded enough. For a complete answer applicant needs additional questions that he is able to answer.	90
The applicant reproduces most of the theoretical material, shows knowledge and understanding of the basic principles. Some of the key points are insufficiently substantiated or not substantiated. With the help of the examiner, the applicant can analyze the educational material and correct mistakes, among which there are significant ones.	70
The answer may be partially incorrect or incomplete (only part of the task is explained correctly). Some stages in explaining theoretical issues are not given. The key points of the explanation are not substantiated.	60
There are only a few steps in the explanations. The key points of the question are not substantiated. The answer has significant mistakes.	40
The applicant doesn't answer or the answer is completely incorrect.	0

BASIC REQUIREMENTS FOR THE APPLICANTS

The questions test the following knowledge and skills of applicants:

- to characterize the basic biological concepts, laws, regularities and theories, biological phenomena and processes, the structure of biological objects.

- use modern biological terminology and symbols; compare the processes of life at different levels of the organization (molecular, cellular, organism, population-species, ecosystem, biosphere) and identify the relationships between them.

- to establish causal, functional, structural interactions and regularities in animate nature.

GENERAL DESCRIPTION OF THE MAIN COMPONENTS OF THE INTERVIEW IN BIOLOGY

The distant entrance exam on “Biology” component includes two theoretical questions from mentioned above sections of the discipline. The answers require knowledge of biology to the extent determined by the program of secondary school.

BIOLOGY ENTRANCE EXAM IN DISTANT FORMAT PROGRAM

Section 1. Introduction. Chemical composition, structure and functioning of cells.	
1.1 Chemical composition of cell	Organic and inorganic compounds and their role in the body. Water, its main properties and role in the body. Water as a solvent, hydrophobic and hydrophilic compounds. Biopolymers: the concept 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 protein monomers. Levels of structural organization of proteins. Denaturation and renaturation of proteins. Basic biological functions of proteins. Enzymes, their properties and principles of functioning. Nucleic acids. Nucleotide structure. Structure and functions of DNA. The principle of complementarity. Nucleotide sequence and the concept of gene. Properties of DNA. RNA and its types (mRNA, rRNA, tRNA). ATP. The role of ATP in energy supply..
1.2. Structure and functioning of eukaryotic cells	The cell as an elementary unit of life. Cell membranes: chemical composition, structure, properties and basic functions. Transport of substances across cell membranes. Cytoplasm, its components: cytoskeleton, organelles and inclusions. Single-membrane organelles: endoplasmic reticulum, Golgi

	<p>apparatus, lysosomes, vacuoles. Double-membrane organelles: mitochondria, plastids (chloro-, leuco - and chromoplast). Mitochondria: structure, functional role. Chloroplasts: structure, functional role of chloroplasts. Autonomy of mitochondria and chloroplasts in the cell. Non-membranous organelles. Ribosomes: structure, functional role. Centrioles. Locomotory organelles (flagella, cilia). Nucleus: structure, functional role. Chromosomes: chemical composition, structure, functional role. 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 karyotype. Nucleolus, its functional role.</p>
1.3. Cell metabolism	<p>Metabolism, its general characteristics. The unity of the processes of synthesis and breakdown of substances in the body. Autotrophic and heterotrophic types of nutrition. Mixotrophic organisms. Breakdown of substances in the body (anaerobic, aerobic). The concept of glycolysis, fermentation. The concept of cellular respiration. Mitochondria as the energy station of the cell. Photosynthesis. The main processes occurring in light-dependent and light-independent reactions / light and dark phases /of photosynthesis. The role of chlorophyll in light-dependent reactions of photosynthesis. Importance of photosynthesis for the existence of the biosphere. The concept of chemosynthesis.</p>
1.4. Storage and realization of hereditary information	<p>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 main properties. The role of mRNA, tRNA and ribosomes in protein biosynthesis. DNA replication: a semi-conservative 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 peculiarities in comparison with mitosis. Functional role of meiosis. The concept of DNA recombination during meiosis. Crossing over. Sexual reproduction. Gametogenesis. Fertilization. The main forms of asexual reproduction of organisms (mitosis, budding, spore reproduction, vegetative reproduction). Individual development of the organism (ontogenesis). Embryonic development. The main stages of embryonic development in chordates (cleavage, gastrulation, organogenesis). 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).</p>
Section 2. Realization of hereditary information	
2.1. Genetics - the science of heredity and variation of organisms	<p>Classical methods of genetic research. Basic concepts of genetics. Basic regularities of gene functioning in prokaryotes and eukaryotes.</p>
2.2. Regularities of heredity	<p>Laws of heredity established by G. Mendel. Method of checking the genotype of hybrid individuals (test cross). Multiple alleles. Inheritance of ABO and Rh blood groups. Gene interactions. Gene allelic and non-allelic genes interaction. Pleiotropy. 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 of diagnosis of hereditary disorders. Examples of chromosomal and single-gene disorders. Notion of multifactorial diseases. Modern molecular genetic methods for human heredity studying.</p>
2.3. Regularities of variation	<p>Modification (phenotypic) variation, its causes. Norm of reaction rate. Genetic</p>

	variation and its types: recombination and mutations. Sources of recombination. Mutations and their properties. Types of mutations (genome, chromosomal, gene; somatic and germ). Mutagenic factors (physical, chemical and biological).
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Questions on Biology for entrance exam

1. Organic and inorganic compounds and their role in the body. Water, its main properties and function. Water as a solvent, hydrophobic and hydrophilic compounds.
2. Proteins. Amino acids as protein monomers. Levels of structural organization of proteins. Denaturation and renaturation of proteins. Basic biological functions of proteins. Enzymes, their properties and principles of functioning.
3. Nucleic acids. Nucleotide structure. Structure and functions of DNA.
4. RNA and its types (mRNA, rRNA, tRNA). ATP. The role of ATP in energy supply.
5. The concept of prokaryotic and eukaryotic cells. Fundamental differences.
6. Cell membranes: chemical composition, structure, properties and basic functions. Transport of substances across cell membranes.
7. The structure of the eukaryotic cell. Double-membrane organelles: mitochondria, plastids. Structure, functional role.
8. The structure of the eukaryotic cell. Single-membrane organelles: endoplasmic reticulum, Golgi apparatus, lysosomes, peroxisomes. Structure, functional role.
9. The structure of the eukaryotic cell. Non-membranous organelles: ribosomes, centrosome. Structure, functional role.
10. Nucleus: structure, functional role. Chromosomes: chemical composition, structure, functional role. Characteristics of the human karyotype.
11. Autotrophic and heterotrophic types of nutrition. Photosynthesis. The main processes occurring in light-dependent and light-independent reactions / light and dark phases / of photosynthesis.
12. Breakdown of substances in the body (anaerobic, aerobic). The concept of glycolysis, fermentation. Cell respiration.
13. The concept of gene, genome. Genetic code and its properties.
14. Biosynthesis of proteins: transcription, translation.
15. Cell cycle. Interphase and cell division. The number of DNA molecules and chromosomes at different stages of the cell cycle.
16. Mitosis. The main processes, biological significance.
17. Meiosis, difference from mitosis. Functional role of meiosis. Crossingover.
18. Gametogenesis. Peculiarities of oogenesis and spermatogenesis. Fertilization.
19. Sexual and asexual reproduction of organisms: fundamental differences, basic forms.
20. Individual development of the organism (ontogenesis). Embryonic development. The main stages of embryonic development in chordates (cleavage, gastrulation, organogenesis).
21. Individual development of the organism (ontogenesis). Post-embryonic development and its main types (indirect and direct) in animals.

22. Subject and tasks of genetics. Basic concepts of genetics: heredity and variation, allelic genes, homozygotes, heterozygotes. Genotype, phenotype.
23. Monohybrid cross. Law of dominance (first law of Mendel). Mendelian traits.
24. Monohybrid cross. Law of dominance (first law of Mendel). (second law of Mendel). Mendelian traits.
24. Di- and polyhybrid crossing. Law of independent assortment (third law of Mendel).
25. Multiple alleles. Inheritance of AB0 and Rhesus factor human blood groups.
26. Interaction of allelic genes: complete dominance, incomplete dominance, overdominance, codominance.
27. Interaction of non-allelic genes: complementary action, epistasis, polygenic inheritance.
28. Linked inheritance (Morgan's law). Crossing over.
29. Chromosomal theory of heredity.
30. Genetics of sex. Chromosomal diseases caused by changes in the number of sex chromosomes.
31. Sex-linked inheritance.
32. Variation, its forms, significance in ontogenesis and evolution.
33. Modifications (phenotypic variation), its characteristics. Norm of reaction. Phenocopy.
34. Genetic variation, its forms.
35. Recombination. Mechanisms and significance.
36. Mutations. Classification by the level of changes in hereditary information (numerical and structural chromosomal aberrations, gene mutations).
37. Gene mutations, mechanisms. The concept of single gene diseases.
38. Structural chromosomal aberrations. Mechanisms, examples of diseases.
39. Numerical chromosomal aberrations (polyploidy, aneuploidy). Examples of diseases.
40. Mutations in germ and somatic cells, their significance. Mosaicism.
41. Spontaneous and induced mutations. Mutagenic factors, their types.
42. Man as a specific object of genetic analysis. Genealogical method of studying human heredity.

LIST OF RECOMMENDED LITERATURE

1. Campbell biology in focus / Lisa Urry, Michael Cain, Peter Minorsky, Jane Reece. – 4th ed.: Pearson Higher Education, 2024. - P.969
2. Biology: textbook / R. J. Brooker; E. P. Widmaier; L. E. Graham; P. D. Stiling. – 4th ed. – NY: McGraw-Hill Education – 2021. - P.1438
3. Biology: textbook for Class XI / A. K. Rajput; S. Uppal; A. Chitkara [et al]. – 1st ed., reprinted. – New Delhi: National Council of Educational Research and Training – 2021. - P.356
4. Biology: textbook for Class XII / M. S. Anwar; S. Uppal; A. Chitkara [et al]. – 1st ed., reprinted. – New Delhi: National Council of Educational Research and Training – 2019. – P.296

5. Biological Science 1 & 2: Third Edition /Taylor D. J., Green N. P. O., Stout G. W., Soper, R. [Ed.] – Cambridge: Cambridge University Press - 2008. – P. 984
6. Essential Cell Biology: textbook / B.M. Alberts, D. Bray, K. Hopkin [et al]. – 4th ed., rev. and upd. – NY: Garland Publishing, Inc., 2019. – 862 p.

The executive Secretary

of the admission board of ONMedU



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