



**APPROVED BY**  
by the decision of the Academic Council of the USU  
Institute of Medicine, Ecology and Physical Culture

17.05.2023 Record No. 9/250

Chairman: Midenko V.I.

(Signature, Name)

17 May 2023.

**EDUCATIONAL PLAN OF THE DISCIPLINE**

Discipline:	Biology
Faculty	Medical faculty named after T.Z. Biktimirov
Department:	Biology, ecology and nature management
Course	1

Direction (specialty) 31.05.01 General medicine

the code of the direction (specialty), full name

Orientation (profile/specialty) not provided

full name

Form of training \_\_\_\_\_ full-time \_\_\_\_\_

full-time, part-time, part-time (specify only those that are being implemented)

Date of introduction into the academic process at Ulyanovsk State University

« 1 » 09 2023

Revised at the Department meeting, Record No. \_\_\_\_\_ of \_\_\_\_\_ « \_\_\_\_\_ » 20\_\_

Revised at the Department meeting, Record No. \_\_\_\_\_ of \_\_\_\_\_ « \_\_\_\_\_ » 20\_\_

Revised at the Department meeting, Record No. \_\_\_\_\_ of \_\_\_\_\_ « \_\_\_\_\_ » 20\_\_

Revised at the Department meeting, Record No. \_\_\_\_\_ of \_\_\_\_\_ « \_\_\_\_\_ » 20\_\_

Information about the authors:

Full name	Abbreviation of Department	Academic, degree, title
Mikheeva Natalya Aleksandrovna		Docent, PhD
Kurnosova Natalya Anatolyevna		Docent, PhD

Agreed	Agreed
Head of department, developing discipline	Head of the graduating Department
 Signature Full name	 Signature Full name
« 17 » May 2023 г.	« 17 » May 2023 г.



### 1. The course aims and objectives.

#### Aims:

The formation of students scientific world view based on knowledge in biology, fundamental to scientific and practical medicine. To study the fundamental biological mechanisms of life and living systems and based on them questions of anthropogenetic, ontogenesis, homeostasis, population genetics and human ecology, as well as master the skills of research and practical work in the field of anthropogenetic, anti-parasitic and vector-borne diseases.

The main **objectives** of the discipline is:

- mastering fundamental theories of biology (cell, gene, chromosomal, evolutionary theory of the origin of life on Earth, the theory of human origins);
- mastering the basic concepts of modern biology;
- studying of systematic and historical approaches to the study of multi-level living systems as a result of the evolutionary process;
- the mastery of the concept of "biological heritage of man" as the defining basis of physical and mental health;
- the study of the cognitive skills of work with biological objects, familiarization with of methods and approaches to studying them.

### 2. Place of the course in the curriculum:

- The discipline "Biology" discipline (B1.B.02.) is the basic discipline of mathematical and natural cycle of disciplines of the Federal state educational standard of higher professional education specialty "General medicine";
- Study of biology in medical schools is based on the continuity of knowledge, skills and competencies obtained in the course of biology at secondary schools, as well as knowledge of chemistry, physics, geography, mathematics, history. Students should possess the necessary amount of knowledge in specific disciplines of biology, which they mastered in secondary schools, and aimed at preparation for entrance examinations for admission to universities.
- Discipline "Biology" is the antecedent for the study subjects Biology, Anatomy, Histology, Embryology, Cytology, Biochemistry, Normal Physiology, Microbiology, Virology, Pathological Anatomy, Pathophysiology, Clinical Pathophysiology, Obstetrics and Gynecology, Forensic Medicine, Neuroanatomy, Embryonic Development of Body Tissues, Physiology of Visceral Systems, Surgical Patient Care, Diagnostic Practice, Inpatient Physician Assistant, Training to take and pass the state exam.

### 3. Proposed results

*The course is aimed at the following general professional competence:*

Competency code and name	List of planned learning outcomes in the discipline, correlated with indicators of achievement of competency
GPC – 5 - the ability to compare morphofunctional, physiological conditions and pathological processes in the human body to solve professional problems	<p><i>to know:</i>                      general laws of the origin and evolution of life, anthropogenesis. The theory of biological systems, their organization, cellular and non-cellular forms of life; Cellular organization of living organisms, the distinguishing characteristics of pro - and eukaryotic cells, the role of cellular structures in the life of the cell, the mechanisms of energy production in living systems. Regularities of processes and mechanisms for the storage, transfer and use of biological information in the cell, principles of control of gene expression; Structural and functional organization of genetic material features of the genome of prokaryotes and eukaryotes. Cytological basis of reproduction, gametogenesis, structure of germ cells. The laws of genetics and its importance for medicine. Patterns of heredity and variation in individual</p>



development, biological basis of inherited human diseases and methods of their diagnostics. Regularities of individual development of organisms, human ontogenesis, molecular mechanisms of embryonic development, critical periods of ontogenesis. Environmental category environmental health issues, bioecological disease. The phenomenon of parasitism. The morphological features of the parasites, their life cycles, ways of infection, pathogenic action, symptoms, diagnosis, prevention of diseases. Parasitological and medical characteristics of arthropod - vectors and pathogens.

**to be able to:**

use educational, scientific, popular scientific literature, the Internet for professional activities. To use biological equipment. Research with magnifying equipment (microscopes, optical and simple loops). Cooking time and explore their products under a light microscope and magnifying glass. Put a simple biological experiment and analyze the results. Read and analyze the electron diffraction pattern of cell structures. In the form of generalized diagrams show the processes occurring in the cell. Using this notation, to solve problems on mitosis, meiosis, gametogenesis. Explain the causes and possible mechanisms of birth of children with chromosomal diseases. Solve problems on genetics, molecular, make the pedigrees using standard notation, analyze pedigrees. Compile and analyze the ideograms, using the Denver classification system chromosomes. Identify the type of parasite, stage of development of the proposed drug. To solve situational problems in parasitology.

**to be skilled at:**

research with a microscope. Skills cooking time products. Skills mapping studied objects in the figures; Electron diffraction analysis skills. Skills determining of karyotype. Genetic approaches to solving problems. Standard notation for drawing pedigrees. Denver classification system for the analysis of chromosome ideograms microscopy.

**4. TOTAL EMPLOYMENT OF DISCIPLINE**

**4.1. The volume of discipline in credits (total): 6 CU.**

**4.2. By type of academic work (in hours): 216**

Type of educational work	Number of hours		
	Workload	Hours per term	
		1	2
Contact work of students with a teacher	126	54	72
Classroom:			
Lectures	36/10*	18/6*	18/4*
Tutorials and practical's work	90	36	54
Independent work	54	36	18
Scope of testing (examination, test, colloquium)	36 Exam	Not provided	36
Total course of workload	216/10*	90	126

Total workload in credit units	6	2,5	3,5
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\* If it is necessary to use partially / exclusively remote educational technologies in the educational process, in the table, through a slash, the number of hours of work of teaching staff with students for conducting classes in a distance format using e-learning is indicated.


#### 4.2. Units and formats of academic activities

Form of study: full-time

Units	Total	Format			
		Class studies			Independent work
		Lectures	Laboratory work	Tutorials and work practical's	
<b>Section 1. Cellular and molecular-genetically levels of organization of life</b>					
Unit 1. Introduction to biology. The organization of life on Earth	6	2	-	2	2
Unit 2. Cell – the basic unit of life. The most important biopolymers of the cell	6/2*	2/2*	-	2	2
Unit 3. Chemical composition of cells	8	-	-	4	4
Unit 4. Morphofunctional organization of the cell	4	-	-	2	2
Unit 5. Classification and structure of cell organelles	6/2*	2/2*	-	2	2
Unit 6. Cell nucleus	6	2	-	2	2
Unit 7. Features of the organization of the cells of plants, animals and bacteria. Non-cellular forms of life	4	-	-	2	2
Unit 8. The cell as an open system. Energy metabolism	6	2	-	2	2
Unit 9. Cell life cycle	6/2*	2/2*	-	2	2
<b>Section 2. Organismic (ontogenetic) level of organization of biological systems</b>					
Unit 10. Reproduction of organisms	6	2	-	2	2
Unit 11. Genetics – is the science of heredity and variation. Genetic	10/2*	2/2*	-	4	4



level of organization of the genetic information					
Unit 12. Types and variants of Mendelian inheritance. The interaction of genes	8		-	4	4
Unit 13. Chromosomal and genomic levels of organization of the genetic information	4	-	-	2	2
Unit 14. Modification and combined variability	5	1	-	2	2
Unit 15. Mutational variability	5	1	-	2	2
Unit 16. Individual development of organisms	8/2*	2/2*	-	4	2
Unit 17. Embryonic development of organisms	8	-	-	6	2
Unit 18. Regularities and mechanisms of ontogenesis	7	2	-	4	1
<b>Section 3. Population-specific level of organization of the living systems. Biogeocenotic and biosphere levels of organization of the biological systems.</b>					
Unit 19. Evolution	7	2	-	4	1
Unit 20. The notion of biological species.	5	-	-	4	1
Unit 21. Anthropogenesis	7	2	-	4	1
Unit 22. Ecology	7	2	-	4	1
Unit 23. Parasitology. Protists. Class Sarcodina	7	2	-	4	1
Unit 24. Protists. Class Zoomastigophora	8	2	-	4	2
Unit 25. Protists. Classes Sporozoa and Cilliophora	6	-	-	4	2
Unit 26. Class Trematoda. Class Cestoda	8	2	-	4	2
Unit 27. Nematelminthes. Medical importance of class Arachnids	8	2	-	4	2
Unit 28. Medical importance of class	5	-	-	4	1

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Insects					
TOTAL:	216/10*	36/10*		108	54

## 5. Course contents.

### **Section 1. Cellular and molecular-genetical levels of organization of life.**

**Unit 1. Introduction to biology. The organization of life on Earth.** Biology as a science of patterns, the mechanisms of functioning and development of organisms. Biology in the medical school. The definition of the essence of life. Fundamental properties of life. Evolutionary-based levels of organization of the life. Structure and working principles of the light microscope.

**Unit 2. Cell – the basic unit of life. The most important biopolymers of the cell.** The stages of development and the basic tenets (basic postulates) of cell theory (M. Schleiden and T. Schwann, R. Virchow). Modern cell theory. The most important biopolymers of the cell. Structure and function of proteins.

**Unit 3. Chemical composition of cells.** Structure and function of fats, carbohydrates, deoxyribonucleic acid in the cell. Structure, types and functions of RNA.

**Unit 4. Morphofunctional organization of the cell.** The concept of elementary biological membrane, the model of its structure and function. Transport of substances through the membrane. Characterization of active and passive transport of the membrane. The cytoplasm is the internal environment of the cell, its properties and functions.

**Unit 5. Classification and structure of cell organelles.** Classification of cell organelles. Structure and function of membrane cell organelles: endoplasmic reticulum, Golgi Complex, lysosomes, mitochondria, plastids of plant cells. Structure and function of membrane cell organelles: ribosomes, centrioles, microtubules, microfilaments. The structure and functions of organelles for specific purposes: cilia and flagella, myofibrils, neurofibril.

#### **Unit 6. Nucleus.**

The role of the cell nucleus during the life of the cell. Structure and functions of each part of the cell nucleus: nuclear shell, nucleoplasm, chromatin and nucleolus. Structural organization of chromatin.

#### **Unit 7. Features of the organization of the cells of plants, animals and bacteria. Non-cellular forms of life.**

Comparative characteristics of cells prokaryotes and eukaryotes. Comparison of the structure and functions of plant and animal cells. Non-cellular forms of life. Structure and features of vital activity of viruses.

#### **Unit 8. The cell as an open system.**

The concept of metabolism and its types. The relationship of plastic and energy metabolism. Protein biosynthesis in the cell. Energy metabolism and its stages.

#### **Unit 9. Life cycle of the cell.**

Life cycle of the cell. The interphase and its periods. DNA replication. Mitosis, its phases, and biological significance. Cell death and its phases.





## **Section 2. Organismic (ontogenetic) the level of organization of biological systems.**

### **Unit 10. Reproduction of organisms.**

Reproduction is a universal feature of living. Comparative characteristics of asexual and sexual reproduction of organisms. Types of asexual and sexual reproduction of organisms. Parthenogenesis. Meiosis, its phases and biological significance.

**Unit 11. Genetics – is the science of heredity and variation. Genetic level of organization of the genetic information.** Subject, objectives and methods of genetics. The laws of heredity of Gregor Mendel.

Cytological basis of the laws of Gregor Mendel. Evidence for the role of DNA as the hereditary material. Properties of genetic code. Gene – a functional unit of heredity. Classification, properties and localization of genes. The relationship between gene and trait. Hypothesis Beadle-Tatum. The hypothesis of Jacob-Mono (operon hypothesis). The chemical composition and structure of chromosomes.

**Unit 12. Types and variants of Mendelian inheritance. The interaction of genes.** The concept of allelic genes. Types of interaction between allelic genes: complete dominance, incomplete dominance, codominance, overdominance. Multiple allelism. Inheritance of blood groups of humans. The interaction of nonallelic genes: epistasis, complementarity, polymericity. Pleiotropy genes. Types and variants of Mendelian inheritance. Monogenic inheritance. Genetics of sex. Autosomal and sex-linked inheritance. Independent and linked recessive inheritance. Polygenic inheritance of the traits. Cytoplasmic inheritance.

**Unit 13. Chromosomal and genomic levels of organization of the genetic information.** Chromosome as a group of adhesion genes. Chromosomal theory of inheritance by Thomas Morgan. Characterization of the genome of prokaryotes and eukaryotes.


**Unit 14. Modification and combined variability.** Modification variability, especially, adaptive significance in ontogenesis and evolution. The concept of norm of the reaction. Mechanisms of combined variability (genetic recombination). The value of combined variability in ensuring genotypic diversity.

**Unit 15. Mutational variability.** Mutational variability. Classifications of mutations. The concept of the genetic, chromosomal mutations. Genomic mutations (euploidy and aneuploidy). Genetic, chromosomal and genomic of human disease.

**Unit 16. Individual development of organisms.** The concept of ontogenesis. Periods of ontogenesis. Gametogenesis (spermatogenesis, oogenesis). Fertilization, and its stages (penetration, activation, nuclei fusion). Cleavage. Yolk distribution in three kinds of egg cells. The Blastula. Types of blastula.

**Unit 17. Embryonic development of organisms.** Gastrulation, modes early and late gastrulation. The Gastrula, germ layers: ectoderm, mesoderm, and endoderm. Neurulation. Organogenesis. Extraembryonic organs (amniotic membrane, chorion, yolk sac, allantois, placenta): structure and physiological importance.

**Unit 18. Regularities and mechanisms of ontogenesis.** Differentiation in development. Stages and factors of differentiation. The mechanisms of ontogenesis. Embryonic induction as a mechanism of ontogenesis. The regeneration of organs and tissues as a process of development. The physiological and reparative regeneration. Methods of reparative regeneration.

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### **Section 3. Population-specific level of organization of the living systems. Biogeocoenotic and biosphere levels of organization of the biological systems.**

**Unit 19. Evolution.** Pre-Darwinian evolutionary ideas the period of formation. J.-B. Lamarck's theory of evolution. The main provisions of the theory of evolution of the Charles Darwin. Modern (synthesis) theory of evolution. Factors of evolution.

**Unit 20. The notion of biological species.** Microevolution. Macroevolution. Modes of speciation. The species. Criteria for the species. The main directions of evolution (biological progress and regression). Ways to achieve of biological progress (aromorphosis, idioadaptation, total degeneration) and its forms.

**Unit 21. Anthropogenesis.** The position of Homo sapiens in the animal world. The qualitative uniqueness of the person. Biological and social factors of anthropogenesis. The role of biological factors of the anthropogenesis at the present stage.  
Human races and the unity of the human species.

**Unit 22. Ecology.** Environmental factors: classification and general patterns of action of the environmental factors on a organism. The concept of trophic levels. The rule of the ecological pyramid. The biosphere. Biogeochemical cycles.


**Unit 23. Parasitology. Protists. Class Sarcodina.** Parasitism as an ecological phenomenon. Classification of animal parasitic forms. Ways of origin of the various groups of parasites. Interaction between parasite and host-level individuals. Factors of the action of parasite on the host organism. Factors action hostess on the parasite. Morphophysiological adaptation to a parasitic lifestyle. Population level of interaction of the parasites and their hosts. The life cycles of parasites. Intermediate and major host. Vector-borne and natural focal, parasitic and infectious diseases. Ecological principles to combat parasitic diseases. General characteristics of the class Sarcodina. Morphophysiology and the life cycle of Entamoeba histolytica. Diagnosis and prevention of amebiasis.

**Unit 24. Protists. Class Zoomastigophora.** General characteristics of the class Zoomastigophora. The life cycle of pathogens, pathogenesis, diagnosis and prevention of trypanosomiasis. The life cycle of pathogens, pathogenesis, diagnosis and prevention of leishmaniasis, trypanosomiasis and giardiasis.

**Unit 25. Protists. Classes Sporozoa and Cilliophora.** General characteristics of the class Sporozoa. The life cycle of Plasmodium sp., pathogenesis, diagnosis and prevention of malaria. The life cycle of pathogens, pathogenesis, diagnosis and prevention of toxoplasmosis. General characteristics of the class Cilliophora. The life cycle of pathogens, pathogenesis, diagnosis and prevention of balantidiasis.

**Unit 26. Class Trematoda. Class Cestoda.** Types of Platyhelminthes (flatworms). Class Trematoda: The Flukes. The life cycle of pathogens, pathogenesis, diagnosis and prevention of fascioliasis. The life cycle of pathogens, pathogenesis, diagnosis and prevention of opistorhosis. The life cycle of pathogens, pathogenesis, diagnosis and prevention of lung fluke disease. The life cycle of pathogens, pathogenesis, diagnosis and prevention of dicroceliasis. Morphophysiology and the life cycle of blood fluke (Schistosoma).



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Class Cestoda: The Tapeworms. The life cycle of pathogens, pathogenesis, diagnosis and prevention of teniasis and cysticercosis. The life cycle of pathogens, pathogenesis, diagnosis and prevention of teniarinhosis. The life cycle of pathogens, pathogenesis, diagnosis and prevention of hymenolepiasis. The life cycle of pathogens, pathogenesis, diagnosis and prevention of diphyllbothriasis.

**Unit 27. Nematelminthes. Medical importance of class Arachnids.** Characteristics of class Nematoda (roundworms). The life cycle of pathogens, pathogenesis, diagnosis and prevention of ascariasis, enterobiasis and trichinosis. The life cycle of pathogens, pathogenesis, diagnosis and prevention of ankylostomiasis, strongyloidosis. The life cycle of pathogens, pathogenesis, diagnosis and prevention of guinea worm, filariasis. General characteristics of the class Arachnids. Troop mites: morphology, life cycle, medical value.

**Unit 28. Medical importance of class Insects.**

Morphophysiological characteristics and life cycle of the class Insects. Morphology, life cycle and medical importance of insects - ectoparasites (lice, fleas, houses and volfartova flies). Insects - the carriers of infectious and parasitic diseases (gnats, mosquitoes, sandflies, tsetse flies, midges), morphophysiological characteristics, life cycle and medical importance.

**6. Practical's and tutorial contents.**

**Section 1. Cellular and molecular-genetic levels of organization of the life.**

**Unit 1. Introduction to biology. The organization of life on Earth.** Format-practical's.

Discussion questions:

Biology as a science of patterns, the mechanisms of functioning and development of organisms.

Biology in the medical school.

The definition of the essence of life.

Fundamental properties of life.

Evolutionary-based levels of organization of the life.

Structure and working principles of the light microscope.

**Unit 2. Cell – the basic unit of life. The most important biopolymers of the cell.** Format-practical's.

Discussion questions:

The stages of development and the basic tenets (basic postulates) of cell theory (M. Schleiden and T. Schwann, R. Virchow).

Modern cell theory.

The most important biopolymers of the cell. Structure and function of proteins.

**Unit 3. Chemical composition of cells.** Format- study discussion.

Discussion questions:

Structure and function of fats.

Structure and function of carbohydrates.

Structure and function of deoxyribonucleic acid in the cell.

Structure, types and functions of RNA.


**Unit 4. Morphofunctional organization of the cell.** Format-practical's.

Discussion questions:

The concept of elementary biological membrane, the model of its structure and function.

Transport of substances through the membrane.

Characterization of active and passive transport of the membrane.

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The cytoplasm is the internal environment of the cell, its properties and functions.

**Unit 5. Classification and structure of cell organelles.** Format-practical's.

Discussion questions:

Classification of cell organelles.

Structure and function of membrane cell organelles: endoplasmic reticulum, Golgi Complex, lysosomes, mitochondria, plastids of plant cells.

Structure and function of membrane cell organelles: ribosomes, centrioles, microtubules, microfilaments.

The structure and functions of organelles for specific purposes: cilia and flagella, myofibrils, neurofibril.

**Unit 6. Nucleus.** Format-practical's.

Discussion questions:

The role of the cell nucleus during the life of the cell.

Structure and functions of each part of the cell nucleus: nuclear shell, nucleoplasm, chromatin and nucleolus.

Structural organization of chromatin.

**Unit 7. Features of the organization of the cells of plants, animals and bacteria. Non-cellular forms of life.** Format- study discussion.

Discussion questions:

Comparative characteristics of cells prokaryotes and eukaryotes.

Comparison of the structure and functions of plant and animal cells.

Non-cellular forms of life.

Structure and features of vital activity of viruses.

**Unit 8. The cell as an open system.** Format-practical's.

Discussion questions:

The concept of metabolism and its types. The relationship of plastic and energy metabolism.

Protein biosynthesis in the cell.

Energy metabolism and its stages.

**Unit 9. Life cycle of the cell.** Format-practical's.

Discussion questions:

Life cycle of the cell.

The interphase and its periods.

DNA replication.

Mitosis, its phases, and biological significance.

Cell death and its phases.

**Section 2. Organismic (ontogenetic) the level of organization of biological systems.**

**Unit 10. Reproduction of organisms.** Format-practical's.

Discussion questions:

Reproduction is a universal feature of living.

Comparative characteristics of asexual and sexual reproduction of organisms.

Types of asexual and sexual reproduction of organisms.

Parthenogenesis.

Meiosis, its phases and biological significance.



**Unit 11. Genetics – is the science of heredity and variation. Genetic level of organization of the genetic information.** Format- study discussion.

Discussion questions:

- Subject, objectives and methods of genetics.
- Evidence for the role of DNA as the hereditary material.
- Properties of genetic code.
- Gene – a functional unit of heredity.
- Classification, properties and localization of genes.
- The relationship between gene and trait. Hypothesis Beadle-Tatum.
- The hypothesis of Jacob-Mono (operon hypothesis).
- The chemical composition and structure of chromosomes.

**Unit 12. Types and variants of Mendelian inheritance. The interaction of genes.** Format-practical's.

Discussion questions:

- The laws of heredity of Gregor Mendel. Cytological basis of the laws of Gregor Mendel.
- The concept of allelic genes.
- Types of interaction between allelic genes: complete dominance, incomplete dominance, codominance, overdominance.
- Multiple allelism. Inheritance of blood groups of humans.
- The interaction of nonallelic genes: epistasis, complementarity, polymeria.
- Pleiotropy genes.
- Types and variants of Mendelian inheritance.
- Monogenic inheritance. Genetics of sex.
- Autosomal and sex-linked inheritance.
- Independent and linked recessive inheritance.
- Polygenic inheritance of the traits.
- Cytoplasmic inheritance.

**Unit 13. Chromosomal and genomic levels of organization of the genetic information.** Format-practical's.

Discussion questions:

- Chromosome as a group of adhesion genes.
- Chromosomal theory of inheritance by Thomas Morgan.
- Characterization of the genome of prokaryotes and eukaryotes.

**Unit 14. Modification and combined variability.** Format-practical's.

Discussion questions:

- Modification variability, especially, adaptive significance in ontogenesis and evolution.
- The concept of norm of the reaction.
- Mechanisms of combined variability (genetic recombination).
- The value of combined variability in ensuring genotypic diversity.

**Unit 15. Mutational variability.** Format-practical's.

Discussion questions:

- Mutational variability.
- Classifications of mutations.
- The concept of the genetic, chromosomal mutations.
- Genomic mutations (euploidiya and aneuploidiya).
- Genetic, chromosomal and genomic of human disease.



**Unit 16. Individual development of organisms.** Format- study discussion.

Discussion questions:

- The concept of ontogenesis.
- Periods of ontogenesis.
- Gametogenesis (spermatogenesis. oogenesis).
- Fertilization, and it stages (penetration, activation, nuclei fusion).
- Cleavage. Yolk distribution in three kinds of egg cells.
- The Blastula. Types of blastula.

**Unit 17. Embryonic development of organisms.** Format-practical's.

Discussion questions:

- Gastrulation, modes early and late gastrulation.
- The Gastrula, germ layers: ectoderm, mesoderm, and endoderm.
- Neurulation.
- Organogenesis.
- Extraembryonic organs (amniotic membrane, chorion, yolk sac, allantois, placenta): structure and physiological importance.

**Unit 18. Regularities and mechanisms of ontogenesis.** Format-practical's.

Discussion questions:

- Differentiation in development.
- Stages and factors of differentiation.
- The mechanisms of ontogenesis.
- Embryonic induction as a mechanism of ontogenesis.
- The regeneration of organs and tissues as a process of development.
- The physiological and reparative regeneration.
- Methods of reparative regeneration.

**Section 3. Population-specific level of organization of the living systems. Biogeocoenotic and biosphere levels of organization of the biological systems.**

**Unit 19. Evolution.** Format-practical's.

Discussion questions:

- Pre-Darwinian evolutionary ideas the period of formation.
- J.-B. Lamarck's theory of evolution.
- The main provisions of the theory of evolution of the Charles Darwin.
- Modern (synthesis) theory of evolution. Factors of evolution.

**Unit 20. The notion of biological species.** Format-practical's.

Discussion questions:

- Microevolution.
- Macroevolution.
- Modes of speciation.
- The species. Criteria for the species.
- The main directions of evolution (biological progress and regression).
- Ways to achieve of biological progress (aromorphosis, idioadaptation, total degeneration) and its forms.

**Unit 21. Anthropogenesis.** Format-practical's.

Discussion questions:

- The position of Homo sapiens in the animal world.



The qualitative uniqueness of the person.  
Biological and social factors of anthropogenesis.  
The role of biological factors of the anthropogenesis at the present stage.  
Human races and the unity of the human species.

**Unit 22. Ecology.** Format-practical's.

Discussion questions:

Environmental factors: classification and general patterns of action of the environmental factors on a organism.

The concept of trophic levels.

The rule of the ecological pyramid.

The biosphere.

Biogeochemical cycles.

**Unit 23. Parasitology. Protists. Class Sarcodina.** Format-practical's.

Discussion questions:

Parasitism as an ecological phenomenon.

Classification of animal parasitic forms.

Ways of origin of the various groups of parasites.

Interaction between parasite and host-level individuals.

Factors of the action of parasite on the host organism.

Factors action hostess on the parasite.

Morphophysiological adaptation to a parasitic lifestyle.

Population level of interaction of the parasites and their hosts.

The life cycles of parasites. Intermediate and major host. Vector-borne and natural focal, parasitic and infectious diseases.

Ecological principles to combat parasitic diseases.

General characteristics of the class Sarcodina.

Morphophysiology and the life cycle of *Entamoeba histolytica*. Diagnosis and prevention of amebiasis.

**Unit 24. Protists. Class Zoomastigophora.** Format- study discussion.

Discussion questions:

General characteristics of the class Zoomastigophora.

The life cycle of pathogens, pathogenesis, diagnosis and prevention of trypanosomiasis.

The life cycle of pathogens, pathogenesis, diagnosis and prevention of leishmaniasis, trypanosomiasis and giardiasis.

**Unit 25. Protists. Classes Sporozoa and Ciliophora.** Format-practical's.

Discussion questions:

General characteristics of the class Sporozoa.

The life cycle of *Plasmodium* sp., pathogenesis, diagnosis and prevention of malaria.

The life cycle of pathogens, pathogenesis, diagnosis and prevention of toxoplasmosis.

General characteristics of the class Ciliophora. The life cycle of pathogens, pathogenesis, diagnosis and prevention of balantidiasis.


**Unit 26. Class Trematoda. Class Cestoda.** Format-practical's.

Discussion questions:

Types of Platyhelminthes (flatworms). Class Trematoda: The Flukes.

The life cycle of pathogens, pathogenesis, diagnosis and prevention of fascioliasis.

The life cycle of pathogens, pathogenesis, diagnosis and prevention of opistorhosis.

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The life cycle of pathogens, pathogenesis, diagnosis and prevention of lung fluke disease.  
The life cycle of pathogens, pathogenesis, diagnosis and prevention of dicrocoeliasis.  
Morphophysiology and the life cycle of blood fluke (*Schistosoma*).  
Class Cestoda: The Tapeworms.  
The life cycle of pathogens, pathogenesis, diagnosis and prevention of teniasis and cysticercosis.  
The life cycle of pathogens, pathogenesis, diagnosis and prevention of teniariniosis.  
The life cycle of pathogens, pathogenesis, diagnosis and prevention of hymenolepiasis.  
The life cycle of pathogens, pathogenesis, diagnosis and prevention of diphyllbothriasis.

**Unit 27. Nematelminthes. Medical importance of class Arachnids.** Format-practical's.

Discussion questions:

Characteristics of class Nematoda (roundworms).  
The life cycle of pathogens, pathogenesis, diagnosis and prevention of ascariasis, enterobiasis and trichinosis.  
The life cycle of pathogens, pathogenesis, diagnosis and prevention of ankylostomiasis, strongyloidosis.  
The life cycle of pathogens, pathogenesis, diagnosis and prevention of guinea worm, filariosis.  
General characteristics of the class Arachnids. Troop mites: morphology, life cycle, medical value.

**Unit 28. Medical importance of class Insects.** Format-practical's.

Discussion questions:

Morphophysiological characteristics and life cycle of the class Insects.  
Morphology, life cycle and medical importance of insects - ectoparasites (lice, fleas, houses and volfartova flies).  
Insects - the carriers of infectious and parasitic diseases (gnats, mosquitoes, sandflies, tsetse flies, midges), morphophysiological characteristics, life cycle and medical importance.

7. **Lab work.** Not provided.

8. **Suggested topics for term papers, tests, library-research.** Not provided.

**9. Suggested final test questions of the discipline "Biology"**

1. Biology as a science of patterns and mechanisms of functioning and development of organisms.
2. Defining the essence of life. The fundamental properties of living. . Evolutionary-based levels of organization of life.
3. The main stages of development of the cell theory. Cell theory of Schleiden-Schwann, Vi. Modern cell theory.
4. Structure and function of cell membrane organelles.
5. Structure and function of cell organelles nemembrannyh.
6. Structural and functional organization of the interphase nucleus.
7. Comparative characteristics of pro- and eukaryotic cells. Distinctive features of the cells of plants and animals.
8. The life cycle of the cell. Characteristics of the interphase.
9. Mitosis: phase and biological significance.
10. Morphofunctional characteristic of the hereditary apparatus of cells.
11. Reproduction - the universal property of living. The evolution of reproduction. Biological aspects of sexual dimorphism.
12. Methods of asexual and sexual reproduction.
13. Cytological and cytogenetic characterization of meiosis.





14. Subject, objectives, methods and stages of development of genetics.
15. The main provisions of the chromosome theory of heredity. Linked inheritance.
16. The gene as a functional unit of heredity. Classification, properties and localizations of gene.
17. Mendel's laws and cytological bases.
18. Sex linkage. Genetics of sex.
19. The regulation of the activity of genes in prokaryotes.
20. Modification variability, its adaptive nature, meaning in ontogeny and evolution. The concept of normal reaction.
21. Mechanisms combinative variability. The value of combinative variability in ensuring the genotypic diversity of people.
22. Mutational variability. Classification of mutations. The concept of genetic mutations. Genetic disease.
23. Chromosomal mutations (aberration). The concept of chromosomal diseases.
24. Genomic mutations. Euploidiya and aneuploidiya.
25. The concept of ontogenesis. Periodization of ontogenesis. The life cycles of organisms as a reflection of their evolution.
26. Cleavage. Types of cleavage. Types blastula.
27. Gastrulation. Methods gastrulation.
28. Primary and final organogenesis.
29. Embryonic membranes (provisionals organs): structure and physiological significance.
30. Differentiation in development. Stages and differentiation factors.
31. Embryonic induction.
32. The critical periods of development. Teratogenic agents factors.
33. General characteristics and periodization of postnatal ontogenesis of the person.
34. The regeneration of organs and tissues as a process of development. The physiological and reparative regeneration. Methods of reparative regeneration.
35. Pre-Darwinian evolutionary ideas infancy. The evolutionary concept of J.B. Lamarck.
36. Darwin's contribution to the development of evolutionary theory. The main provisions of the theory of evolution.
37. The modern synthetic theory of evolution. Population - the unit of evolution.
38. Species - qualitative stage of evolution. Criteria for the species.  
Factors evolution.
39. The main directions of evolution (biological progress and regression). Ways to achieve biological progress (aromorphosis, idioadaptation total degeneration) and its forms.
40. Macro- and microevolution. Characteristic of their results. Speciation and its forms.
41. The position of Homo sapiens in the animal world. The qualitative uniqueness of the person.
42. The ratio biological and social factors in the development of human rights.
43. Race and the unity of the human species.
44. Ecology as a science.
45. Environmental factors. Patterns of action of environmental factors on the body.
46. The concept of ecosystem biogeocoenose, antropobiogeotsenoze.
47. The principles of interaction of the parasite and the host at an individual level. Parasitism as a biological phenomenon. The origin of parasitism.
48. General characteristics of the class Sarcodina. Morphophysiology and the life cycle of dysenteric amoeba. Diagnosis and prevention of amoebiasis.
49. Morphophysiological characteristic of the class Zoomastigophora. The life cycle of pathogens, pathogenesis, diagnosis and prevention of trypanosomiasis.
50. Morphophysiological characteristic of the class Zoomastigophora. The life cycle of pathogens, pathogenesis, diagnosis and prevention of leishmaniasis.
51. Morphophysiological characteristic of the class Zoomastigophora. The life cycle of pathogens, pathogenesis, diagnosis and prevention of trichomoniasis and giardiasis.



52. Class Sporozoa. The life cycle of Plasmodium falciparum. Pathogenesis, diagnosis and prevention of malaria.
53. Morphophysiology, lifecycle and pathogenic effect of the pathogen of toxoplasmosis.
54. General characteristics of the class "Ciliates". The life cycle and pathogenic effect balantidium. Prevention balantidiasis.
55. Class Flukes. Morphological characteristics and breeding trematodes.
56. Features of biology and pathogenic action of opisthorchosis, fascioliasis and Paragonimiasis.
57. Features of biology and pathogenic action of tropical trematodes.
58. Total morphophysiological characteristic of the class Cestoda.
59. Class Cestoda. The life cycle of pathogens and pathogenic action, diagnosis and prevention and hymenolepiasis diphilobotriosis.
60. Class Cestoda. The life cycle of pathogens and pathogenic action, diagnosis and prevention of echinococcosis and alveococcosis.
61. Class Cestoda. The life cycle of pathogens and pathogenic action, diagnosis and prevention teniasis, cysticercosis and teniarinosis.
62. Morphophysiological characterization of the class Nematoda.
63. The morphology, development cycle and pathogenic effect ascaris, pinworm, whipworm. Laboratory diagnosis and prevention nematosis.
64. Class Nematoda. The life cycle of pathogens pathogenic action, diagnosis and prevention of hookworm, strongyloidiasis, trichinosis.
65. Class Nematoda. The life cycle of pathogens pathogenic action, diagnosis and prevention of dracunculiasis, onchocerciasis and wuchereriasis.
66. General characteristics of the class Arachnids.
67. Troop mites: morphology, life cycle, medical value.
68. Morphophysiological characteristics and life cycle of the class Insects.
69. Morphology, life cycle and medical importance of insects - ectoparasites (lice, fleas, houses and volfartova flies).
70. Insects - the carriers of infectious and parasitic diseases (gnats, mosquitoes, sandflies, tsetse flies. Midge), morphophysiological characteristics, life cycle and medical importance.

### 10. Self-guided work

Form of study: full-time

№	Section, unit	Number of hours	Form of control
1.	Cellular and molecular-genetical levels of organization of life	36	Questions at the exam. Interview
2.	Organismic (ontogenetic) the level of organization of biological systems	8	Questions at the exam. Interview
3	Population-specific level of organization of living systems. Biogeocoenotic and biosphere levels of organization of biological systems.	10	Questions at the exam. Interview
Total		54	



## 11. EDUCATIONAL-METHODICAL AND INFORMATION SUPPORT OF DISCIPLINE.

### List of recommended literature:

#### a) The main literature:

1. Kurnosova, N. A.

General biology : training toolkit. Part A / N. A. Kurnosova, N. A. Mischeeva ; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Электрон. текстовые дан. (1 файл : 12,5 МБ). - Ulyanovsk : ULSU, 2017. - Текст на англ. яз. - Загл. с экрана. - Текст : электронный. <http://lib.ulsu.ru/MegaPro/Download/MObject/1156>

2. Kurnosova, N. A.

Training toolkit "Cytology" / N. A. Kurnosova, N. A. Mischeeva ; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Электрон. текстовые дан. (1 файл : 31,9 МБ). - Ulyanovsk : ULSU, 2017. - Загл. с экрана. - На англ. яз. - Текст : электронный. <http://lib.ulsu.ru/MegaPro/Download/MObject/905>

3. Kurnosova, N. A.

General biology : training toolkit. Part B / N. A. Kurnosova, N. A. Mischeeva ; Ulyanovsk State University, Insitute of Medicine, Ecology and Physical culture. - Электрон. текстовые дан. (1 файл : 9,35 МБ). - Ulyanovsk : ULSU, 2017. - Текст на англ. яз. - Загл. с экрана. - Текст : электронный. <http://lib.ulsu.ru/MegaPro/Download/MObject/1157>.

#### b) Supplementary reading:

1. Kurnosova, N. A.

Atlas of Biology / N. A. Kurnosova, N. A. Mischeeva; Ulyanovsk State University, Institute of Medicine, Ecology and Physical culture. - Ulyanovsk :UISU, 2018. - Загл. с экрана; Неопубликованный ресурс. - Текст : электронный. <http://lib.ulsu.ru/MegaPro/Download/MObject/1814>

2. MedicalBiology&GeneralGenetics = Медицинская биология и общая генетика: Рабочая тетрадь для студентов, обучающихся по специальности 1-79 01 01 «Лечебное дело» (факультет иностранных учащихся с английским языком обучения) : WorkbookfortheMedicalFacultyforInternationalStudents (Englishmediumofinstruction) (speciality 1-79 01 01 «GeneralMedicine») / О. А. Дричиц, О. И. Левэ, Ю. Г. Амбрушкевич, Л. С. Кизюкевич. - 4-е, перераб. и доп.. - Гродно :ГрГМУ, 2020. - 138 с. - ISBN 9789855952610. - Текст : электронный // ЭБС "Букап" : [сайт]. - URL : <https://www.books-up.ru/ru/book/medical-biology-general-genetics-11947482/>

#### c) educational literature

1. Kurnosova N. A.

Methodical recommendations for practical work and independent work in the discipline "Biology" (specialty 060101 "Medical Care", 060103 "Pediatrics") / N. A. Kurnosova, N. A. Mischeeva; Ulyanovsk State University. - Ulyanovsk :UISU, 2021. - 77 p. - Наангл. яз.; Неопубликованный ресурс. - URL: <http://lib.ulsu.ru/MegaPro/Download/MObject/10696>.


Agreed upon:

*Leading specialist* Смажловина С.М. С.М. 16.05.2022  
The position of the worker scientific library Full name signature date

#### c) Professional databases, information and reference systems

##### 1. Electronic library systems:

1.1. Digital educational resource IPRsmart : electronic library system : website / LLC Company "AI Pi Ar Media". - Saratov, [2022]. – URL: <http://www.iprbookshop.ru>. – Access mode: for registration. users. - Text : electronic.

Ministry of science and high education RF Ulyanovsk State University	Form	
F-Educational plan of the discipline		

1.2. YURAYT educational platform : educational resource, electronic library : website / LLC Electronic publishing house YURAYT. – Moscow, [2022]. - URL: <https://urait.ru> . – Access mode: for registration. users. - Text : electronic.

1.3. Database "Electronic library of a technical university (EBS "Student's consultant") : electronic library system : website / LLC Politehresurs. - Moscow, [2022]. – URL: <https://www.studentlibrary.ru/cgi-bin/mb4x>. – Access mode: for registration. users. – Text : electronic.

1.4. Doctor's consultant. Electronic medical library : database : website / LLC Higher School of Organization and Management of Healthcare-Comprehensive medical consulting. – Moscow, [2022]. – URL: <https://www.rosmedlib.ru> . – Access mode: for registration. users. – Text : electronic.

1.5. Large medical library : electronic library system : website / LLC Bukap. – Tomsk, [2022]. – URL: <https://www.books-up.ru/ru/library/> . – Access mode: for registration. users. – Text : electronic.

1.6. EBS Lan : electronic library system : website / EBS Lan LLC. – St. Petersburg, [2022]. – URL: <https://e.lanbook.com> . – Access mode: for registration. users. – Text : electronic.

1.7. EBS Znanium.com : electronic library system : website / Znanium LLC. - Moscow, [2022]. - URL: <http://znanium.com> . – Access mode : for registration. users. - Text : electronic.

**2. ConsultantPlus** [Electronic resource]: legal reference system. /Consultant Plus LLC - Electron. dan. - Moscow : ConsultantPlus, [2023].

### 3. Databases of periodicals:

3.1. eLIBRARY.RU : scientific electronic library : website / Scientific Electronic Library LLC. – Moscow, [2022]. – URL: <http://elibrary.ru> . – Access mode: for authorization. users. – Text : electronic

3.2. Electronic Library of the Grebennikov Publishing House (Grebinnikon) : electronic library / ID Grebennikov LLC. – Moscow, [2023]. – URL: <https://id2.action-media.ru/Personal/Products>. – Access mode: for authorization. users. – Text : electronic.

**4. Federal State Information System "National Electronic Library"** : electronic library : website / FSBI RGB. – Moscow, [2023]. – URL: <https://нэб.рф> . – Access mode: for users of the scientific library. – Text : electronic.

**5. Russian education:** federal portal / founder of FG AU "FITZTO". – URL: <http://www.edu.ru> . – Text : electronic.

**6. Educational resources of UISU:** module "Electronic library" of ABIS Mega-PRO / LLC "Date Express". – URL: <http://lib.ulsu.ru/MegaPro/Web>. – Access mode: for users of the scientific library. – Text : electronic.

Agreed:

Leading engineer | Бурдун П.П. |  | 16.05.2023  
Employee position | Name | Signature | Date

d) IT software:

Standard software provided by by the Division service maintenance Service of pro-rector on scientific work and information technologies UISU.

1. OS MicrosoftWindows
2. MicrosoftOffice 2016
3. «МойОфис Стандартный»
4. StatisticaBasicAcademicforWindows 13

## 12. Course facilities:

Audiences for lectures, laboratory classes, for ongoing monitoring and intermediate certification.



The classrooms are equipped with specialized furniture, a training board. The lecture halls are equipped with multimedia equipment to provide information to a large audience. The rooms for independent work are equipped with computer technology with the ability to connect to the Internet and providing access to an electronic informational and educational environment, an electronic library system.

The list of equipment used in the educational process:

- microscopes,
- slides,
- tables,
- cytological atlases,
- research microscope.

### 13. SPECIAL CONDITIONS FOR STUDENTS WITH DISABILITIES

Training students with disabilities is carried out taking into account the peculiarities of psychophysical development, individual capabilities and health of such students. Education of students with disabilities can be organized in conjunction with other students, and separately. If necessary, students from among persons with disabilities (at the request of the student) may be offered one of the following options for the perception of information, taking into account their individual psychophysical characteristics:

- for persons with visual impairment: in printed form in large print; in the form of an electronic document; in the form of an audio file (translation of educational materials into audio format); in printed form in Braille; individual consultations with the involvement of a tiflosurdoperevodchika; individual tasks and consultations.
- for persons with hearing impairment: in printed form; in the form of an electronic document; video materials with subtitles; individual consultations with the assistance of a sign language interpreter; individual tasks and consultations.
- for persons with musculoskeletal disorders: in printed form; in the form of an electronic document; in the form of an audio file; individual tasks and consultations."

Developers

\_\_\_\_\_ docent \_\_\_\_\_ / Kurnosova N.A.

\_\_\_\_\_ docent \_\_\_\_\_ / Mikheeva N.A.