



MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION
Federal state autonomous educational institution
of higher education
«Far Eastern Federal University»
(FEFU)

SCHOOL OF BIOMEDICINE

«AGREED»

Head of education program
«General medicine»



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(Full name)
«09» of July 2019

«APPROVED»

Director of the Department of Clinical
Medicine





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«09» of July 2019

WORKING PROGRAM OF ACADEMIC DISCIPLINE (WPAD)

«Biology»

Educational program
Specialty 31.05.01 «General medicine»
Form of study: full time

year 1 semester 1,2
lectures 36 hours
practical classes 36 hours
laboratory works 36 hours
total amount of in-classroom work 108 hours
independent self-work 108 hours
including exam preparation 45 hours
control works ()
credit 1 semester
exam 1 year, 2 semester

The working program is drawn up in accordance with the requirements of the Federal state educational standard of higher education (level of training), approved by the order of the Ministry of education and science of the Russian Federation from 09.02.2016 № 95.

The working program of the discipline was discussed at the meeting of the Department of fundamental and clinical medicine. Protocol No. 8, 09 of July 2019

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ANNOTATION

The discipline "Biology" is intended for students of the 1st course of the specialty "General Medicine" in accordance with the requirements of the Federal State Educational Standard of Higher Education in this specialty. The discipline "Biology" is included in the basic part of the curriculum

The total complexity of the discipline is 6 credits, 216 hours. The curriculum provides lectures (36 hours), practical classes (36 hours), laboratory classes (36 hours), independent work (108 hours). Discipline is implemented on the 1 course in 1 and 2 semesters.

"Biology" is a fundamental natural science discipline for students of the specialty "General Medicine". It serves as a bridge between school biological preparation and the upcoming development of the whole complex of modern biomedical sciences.

Mastering this discipline is necessary as the preceding one for the disciplines of the natural science and professional cycles of the Federal State Educational Standard of the specialty "General Medicine". Being the theoretical basis of medicine in general, biology is of particular importance for the mastery of such disciplines as anatomy, histology and cytology, physiology, biological chemistry, biophysics, genetics, immunology, fundamentals of ecology and nature conservation. For students of this specialty, biology is especially important as the fundamental basis of medicine in general.

The purpose of the development of the discipline "Biology" is to acquaint the student with the basic provisions, laws, concepts of modern biology, identify the actual problems and prospects of biological science. Biology is designed to instill in students a natural-science view of medical problems and tasks, teach them to understand the human body as a physical and chemical systems, and the causes of diseases and pathologies as specific material factors, internal or due to the external environment.

Objectives of the discipline:

- obtaining knowledge about the manifestations of the fundamental properties of living at the main evolutionary-defined levels of the organization;
- study of the chemical composition of the cell, the structure and functions of proteins, carbohydrates, lipids, nucleic acids;
- understanding of the basics of cell theory;
- prove the physico-chemical nature of life, manifested in the process of metabolism;
- know the essence of genetic information and the mechanism of its implementation (protein biosynthesis) Central dogma of molecular biology; mechanisms of regulation of gene activity;
- consider the laws and mechanisms of cell reproduction (mitosis and meiosis) and organisms based on the replication of genetic information (DNA);
- to study the forms and mechanisms of reproduction of organisms, periodization of ontogenesis, peculiarities of human ontogenesis;
- to consider the laws of genetics and their importance for medicine, the main laws of heredity and variability, hereditary diseases of a person;
- know the current topical hypotheses of the origin of life, the basic laws and principles of biological evolution;
- understand the basics of anthropogenesis and the anthropogenic evolution of the biosphere, strategic objectives for the conservation of biodiversity and nature conservation
- consider the basic laws of the functioning of the biosphere and ecosystems;
- understanding of parasitism as a form of biotic relationships; the characteristic of the main parasitic representatives of unicellular, flat and roundworms, arthropods; knowledge of preventive measures for parasitic diseases.

The content of the discipline covers a range of the most fundamental questions of general biology: manifestations of the fundamental properties of a living person at the main evolutionarily determined levels of the organization; chemical composition, structure and functioning of the cell as an elementary living system; structure and implementation scheme of

genetic information; forms and mechanisms of reproduction of organisms; periodization and ontogeny mechanisms; laws of genetics and their importance for medicine; anthropogenesis and the theory of evolution; basic laws of the biosphere and ecology; parasitism as a form of biotic bonds, the main parasites of man.

To successfully study the “Biology” discipline, students should have the following preliminary competences established within the framework of general (school) education:

1. To know the material of the discipline "Biology" at the level of the school course.

3. To be able to formulate your thoughts logically and competently using special terms, the ability to build holistic, coherent and logical statements with competent use of biological terms and argumentation of their judgments, to be able to work with literature and keep a synopsis, highlighting the main idea from the information flow.

2. To possess common basic methods of studying the world around us, such as observation, experience, analysis; understand the essence of cause-effect relationships.

As a result of studying this discipline, students form the following professional competencies (elements of competencies):

Code and the wording of the competence of the AT FEFU	Stages of competence formation	
- the readiness to use basic physical and chemical, mathematical and other natural science concepts and methods in solving professional problems (GPC – 7)	Know	of the nature of genetic information and mechanisms of its realization and replicating, mechanisms of gene activity regulation, ontogenesis periodization, main ecological laws, principles of biosphere functioning, nature of parasitism as a form of biotic relationships.
	Can	to effectively apply natural-scientific approach in modern medical activities; ability to use biological modeling at the basic level

	Master	of general methodology of natural-scientific and biomedical research; understanding of main principles of observation, experiment. analytic/comparative approach.
the capacity for the assessment of morphological and physiological states and pathological processes in the human body for solving professional tasks (GPC – 9)	Know	fundamental principles and mechanisms of diseases in a human organism from the general biological point of view
	Can	to use knowledge of molecular and biological organization of living systems for assessment of functional state of an organism, including diagnostics of pathological processes
	Master	of analysis of biological systems functioning on the ontogenetic (cellular and organismic) level

To form the aforesaid competences in the frames of the “Biology” discipline, the following methods of active/interactive education are used:

Lecture classes:

1. Lecture-visualisation
2. Lecture-conversation

Practical classes:

1. Seminar-debate
2. Detailed conversation
3. Seminar-press-conference

I. STRUCTURE AND CONTENT OF THE COURSE OF THEORETICAL PART

Lectures (36 hours)

Module I. The main concepts of modern biology. Molecular basis of life.

Lecture 1. Subject, goals and prospects of Biology. Criteria of life (2 hours) (using the method of active education: Lecture-conversation)

Subject, and goals of biology. Definition of biology. Role of biology in modern world. Problems and prospects of biology. Criteria of life.

Lecture 2. Main concepts of modern biology (2 hours) (using the method of active education: Lecture-conversation)

Main concepts of modern biology. Materiality of life. Biological information. Systemic biology. Self-organization and self-regulation. Evolution and abiogenesis. Sustainable development.

Lecture 3. Systemic multi-level organization of life (Системная иерархическая структура жизни). Ecosystemic level of life (2 hours) (using the method of active education: Lecture-visualisation)

Theory of systems. Emergence. Subcellular level of life. Ontogenetic level of life. Population (microevolutionary) level of life. Ecosystemic level of life. Biosphere. Taxonomy.

Lecture 4. Biochemistry of life. Main types of biomolecules. (Основные типы биологических молекул) Biochemistry of life. Main types of biomolecules: proteins, nucleic acids. (2 hours) (using the method of active education: Lecture-visualisation)

Substances in living creatures. Main types of biomolecules. Biopolymers. Lipids. Self-organization of lipids. Biomembranes. Carbohydrates. Proteins – chemical composition and properties. Nucleic acids, chemical composition and functions.

Lecture 5. Materiality of life. 2nd law of thermodynamics. Metabolism. (Материальная сущность жизни. 2 закон термодинамики. Метаболизм) Energy and substances' transformation in food chains and ecosystems (2 hours) (using the method of active education: Lecture-visualisation)

Metabolism as a physical and chemical basis of life. Dissipation of energy. Autotrophic and heterotrophic types of metabolism. Accumulation and storage of nutrients in a cell. ATP and energy metabolism. Energy and substances' transformation in food chains and ecosystems. Energy and substances' transformation in food chains and ecosystems.

Module II. Cell - an elementary living system

Lecture 6. Genetic information and reproduction of life. Nature of genetic information and its realization (2 hours) (using the method of active education: Lecture-visualisation)

Synergetic view on development and functioning of life. Genetic information, genes, chromosomes, genome: who is who. Genetic code and protein synthesis. DNA replication and biosynthesis of proteins. Cell reproduction.

Lecture 7. Genetic information and reproduction of life. Replication of DNA and cell reproduction.

DNA replication. Detailed scheme of DNA replication process. Mitosis. Cell cycle and proliferation.

Module III. Biological information, reproduction and differentiation of cells

Lecture 8. Cell as a basic unit of life (. (2 hours) (using the method of active education: Lecture-visualisation)

Structure of a living cell. Cell organelles. Eukaryotic & prokaryotic cells – similarities and differences. Theory of symbiogenesis. Plant, animal and fungal cells. Various tissues. Cell differentiation and tissue genesis.

Lecture 9. Cell reproduction and differentiation. (2 hours) (using the method of active education: Lecture-visualisation)

Mitosis. Cell cycle and proliferation. Stem cells. Cell fission in bacteria. Regeneration. Asexual reproduction of organisms. Cloning.

Module IV. Self-regulation and sustainable development of living systems.

Lecture 10. Molecular and cell cloning. Genetic engineering. Different methods of molecular cloning. Bacterial cloning. Plasmids. Polymerase chain reaction. Genetic engineering. Genetically modified organisms.

Module V. Basics of genetics

Lecture 11. Reproduction and development of organisms. Ontogenesis. (2 hours) (using the method of active education: Lecture-visualisation)

Sexual reproduction of organisms. Gametogenesis. Fertilization. Embryonic development. Genetic program of development. Epigenetic factors in development. Self-organization in ontogenesis. Chaos and order in development of organisms.

Lecture 12. Self-regulation and sustainable development in living systems Immunity and immune system (Иммунная система и иммунитет) (2 hours) (using the method of active education: Lecture-conversation)

Basic principles of self-regulation and integrity. Homeostasis, homeokinesis, positive and negative feedback. Self-regulation in a body. Examples of complex neuro-humoral regulation. Immune homeostasis of human. Morphology of a human immune system and organs. Cells of an immune system. Congenital immunity. Adaptive immunity. Immunodeficiencies.

Lecture 13. Laws of Genetics. Inheritance and variability (Законы генетики. Наследственность и изменчивость. Часть 1). Part I. (4 hours) (using the method of active education: Lecture-visualisation)

Mendel's laws. Chromosome theory of heredity. Genetics of sex. Morgan genetics. Phenotype. Modification variability. Mutations. Population genetics. Isolation. Gene flow. Adaptations.

Lecture 14. Biological evolution. Modern evolutionary synthesis (2 hours)

(using the method of active education: Lecture-conversation)

Evolutionary paradigm in natural sciences. Darwinism. Struggle for survival and natural selection. Origin of species. Isolation. Modern evolutionary synthesis (Darwinism + Genetics). Prospects of evolution theory. Modern evolutionary synthesis (Darwinism + Genetics). Prospects of evolution theory.

Lecture 15. Evolution of life on Earth. Anthropogenesis (Антропогенез).

(2 hours) (using the method of active education: Lecture-visualisation)

Scientific theories of origin of life on Earth. Abiogenesis. Panspermia theory. Stages of life's development on Earth. Geological eons. Extinctions. Modern biodiversity: 6 kingdoms of life. Causes of anthropogenesis. Stages of anthropogenesis. Evolution of primates. Evolution of *Homo* genus; species, sub-species, races of humans.

Lecture 16. Biological and social nature of human. Human mind, intellect, consciousness. (2 hours) (using the method of active education: Lecture-conversation)

Biological and social aspects in human. Unity of biological and social in human. Animal origin of human. Taxonomy of human. Nature of consciousness. Reflexes and instincts in human. Human speech. Memory. Functional asymmetry of brain.

Lecture 17. Ecosystems and biological populations. Self-regulation in populations and ecosystems (2 hours) (using the method of active education: Lecture-visualisation)

Population genetics. Isolation. Development of populations. Biological species. Self-regulation in populations. Self-regulation in ecosystems. Sustainable development. Sustainable development of biosphere. Evolution of biosphere. Global cycles on Earth. Global disasters and great extinctions. Anthropogenic crises. Anthropogenic ecological crises of the human history and their resolution.

Module VI. Parasitology

Lecture 18. Parasitology Part I (2 hours) (using the method of active education: Lecture-visualisation)

Parasitism as a form of symbiosis. Abundance of parasites in nature. Types of relationships between host and parasite. Adaptations of parasites. Mechanisms of invasions. Host's reaction to parasites. Diversity of parasites. Life cycles of parasites. Feral nidal infections. Life cycles of parasites. Feral nidal infections. Diversity of parasites.

II. STRUCTURE AND CONTENT OF PRACTICAL COURSE

Laboratory lessons (36 hours)

Laboratory lesson 1: Criteria of life. (2 hours)

Manifestation of life's criteria on the various levels of life's organization. What differs living systems from non-living ones? Vitality assessments.

Laboratory lesson 2: Prospects of biology. (2 hours)

Prospectives of modern biology. Possible routes for the development of life and health science.

Laboratory lesson 3: Self-organization and synergetics in systems biology. (2 hours)

Systems biology. Synergetic approach in life science. Life as a multi-level non-linear system. Examples of self-organization directing the development of living systems. Fractals in biology.

Laboratory lesson 4: Main types of biomolecules and their chemical properties. (2 hours). Proteins. Qualitative test reaction for peptide bonds (the biuret test (Piotrowski's test)). Xanthoproteic reaction (aromatic groups' detection). Lipids. Test for saturation of lipids. Saponification test. Carbohydrates. Detection of polysaccharides (starch) by iodine. Detection of glucose by copper hydroxide. Nucleic acids. Nucleic acids isolation (alkaline/alcohol extraction). Detection of nucleic acids. Test for Deoxyribose (Dische test). Test for Purines (Murexide

Test). Test for Pyrimidines (Wheeler-Johnson Test). Ultraviolet measurement of nucleic acids and proteins).

Laboratory lesson 5: Types of metabolism. (2 hours) Autotrophic metabolism types. Photosynthesis. Detection of photosynthesis in plants. Heterotrophic metabolism: aerobic and anaerobic modes of metabolism. ATP and energy metabolism.

Laboratory lesson 6: Realization of genetic information. (2 hours)

Genetic information, genes, chromosomes, genome. Structure of genome. Chromosomes. Electronic microscopy imaging of DNA and chromosomes. Chromatin structure. Genetic code and protein synthesis. Ribosomes. Biosynthesis of proteins. Genetic code. DNA replication. Complementarity principle. Semi-conservative nature of DNA replication. Cell reproduction.

Laboratory lesson 7: Structure of cells. Diversity of cell types. (2 hours)

Basic principles of microscopy. Prokaryotic vs eukaryotic cells. Bacteria: Gram-positive and Gram-negative cells. Structure of a eukaryotic cell. Microscopic imaging of cells and cellular structures. Cell fixation, staining and microscopic preparation of cells; temporary and permanent glass slides and preparations. Cell components and sub-cell structure imaging. Various cell types and tissues.

Laboratory lesson 8: Cell reproduction and differentiation. (2 hours)

Cell reproduction. Interphase Mitosis. Phases of mitosis: prophase, metaphase, anaphase, telophase. Cytokinesis. Metaphase spreads and methods of their obtaining. Chromosome study and karyotyping. Cytogenetics. Differential staining of chromosomes. Fluorescent in situ hybridization. Stem cells and markers of differentiation.

Laboratory lesson 9: Embryonic development of mammals. (2 hours)

Fertilization. Zygote. Cleavage of an embryo. Blastula. Gastrulation. Extraembryonic membranes of mammals. Comparative embryology. Biogenetic law – repetition of phylogenesis during ontogenesis.

Laboratory lesson 10: Cancer cells and tumors. Cancer genesis. (2 hours)

Definition of cancer and tumour. Stem cells vs cancer cells. Cancer cell markers. Cancer genesis. Malignization. Cancer diagnostics.

Laboratory lesson 11: Biotechnologies. Methods in modern biomedicine. (2 hours)

Nuclear acids extraction. Molecular cloning methods. Polymerase chain reaction. Genetic engineering, vectors, plasmids, bacterial cloning. Cell cultures.

Laboratory lesson 12: Laws of inheritance. Variability of hereditary material. (2 hours) Mendel's laws. Chromosome theory of heredity. Genetic analysis. Monohybrid cross. Interaction of allelic genes. Independent inheritance. Genetics of sex. Inheritance of lethal genes. Morgan genetics. Measuring genetic linkage ("chromosomal distances"), centimorgan; chromosome mapping.

Laboratory lesson 13: Origin of life on Earth (2 hours)

Biochemical evolution (abiogenesis). Miller-Urey experiment. Coacervate model of A. Oparin. Liposomes. RNA world theory. Solid matrices theories.

Laboratory lesson 14: Main stages of evolution of life on Earth. (2 hours)

Stages of life's development on Earth. Geological eons. Extinctions. Paleontology. Geological stratification (Stratigraphy). Radiometric dating.

Laboratory lesson 15: Attention, memory, perception (2 hours)

Definition of "Human consciousness", "Awareness", "Intellect". Intellect in animals. Reflexes. Conditioning. Unconditioned and conditioned reflexes. Instincts. Senses and perception. Optic, sound, perceptual illusions. Emotions. Memory mechanisms. Functional asymmetry of cerebral hemispheres.

Laboratory lesson 16: Population genetics (2 hours)

Synthetic evolution theory (modern evolutionary synthesis). Populations. Mutations. Genetic variability. Natural selection. Vertical gene transfer. Genetic drift. Gene flow. Horizontal gene transfer.

Laboratory lesson 17: Diversity of human parasites (2 hours)

Diversity of human parasites. Morphology of parasitic worms of phyla Platyhelminthes, Nematodes. Life cycles of human parasites. Preventive measures.

Laboratory lesson 18: Sustainable development and global ecologic crisis (2 hours)

4 main anthropogenic crises of the biosphere. Overpopulation. Global famine threat. Global crisis of ecosystems stability. Prospects of human civilization.

Practical classes (36 hours)

Practical lesson 1 (seminar): Role of Biology in the modern world (2 hours) (using the method of active education: detailed conversation)

Practical lesson 2 (seminar): Unsolved problems of modern biology (2 hours) (using the method of active education: seminar-debate)

Practical lesson 3 (seminar): Theory of systems. Systems biology (2 hours) (using the method of active education: detailed conversation)

Practical lesson 4 (seminar): Self-organization at the subcellular level of life (2 hours) (using the method of active education: detailed conversation)

Practical lesson 5 (seminar): Transformation of substances and energy in ecosystems (2 hours) (using the method of active education: detailed conversation)

Practical lesson 6 (seminar): Transgenesis and genetically modified organisms (2 hours) (using the method of active education: seminar-press-conference)

Practical lesson 7 (seminar): Types of cells in different taxa (2 hours) (using the method of active education: Lecture – visualisation)

Practical lesson 8 (seminar): Cell cloning. Reproductive cloning (2 hours) (using the method of active education: seminar-debate)

Practical lesson 9 (seminar): Biological ageing (2 hours) (using the method of active education: seminar-press-conference)

Practical lesson 10 (seminar): Human health and homeostasis. Immune system. Vaccination (2 hours) (using the method of active education: seminar-debate)

Practical lesson 11 (seminar): Mendelian genetics. Main types of inheritance (2 hours) (using the method of active education: detailed conversation)

Practical lesson 12 (seminar): Laws of inheritance and variability of hereditary material. Practical work (2 hours) (using the method of active education: detailed conversation)

Practical lesson 13 (seminar): Origin of life on (2 hours) (using the method of active education: detailed conversation)

Practical lesson 14 (seminar): Main stages of evolution of life on Earth (2 hours) (using the method of active education: detailed conversation)

Practical lesson 15 (seminar): Human intellect, mind and consciousness (2 hours) (using the method of active education: seminar-press-conference)

Practical lesson 16 (seminar): Cyclicality and self-regulation of ecosystems (2 hours). (using the method of active education: Lecture – detailed conversation)

Practical lesson 17 (seminar): Lifecycles of human parasites. Ways of invasion. Regional epidemiologic aspects of parasitology ((2 hours) (using the method of active education: seminar-press-conference)

Practical lesson 18 (seminar): Sustainable development and global environmental crisis (2 hours) (using the method of active education: Lecture – detailed conversation)

EDUCATIONAL-METHODICAL SUPPORT OF STUDENTS' INDEPENDENT WORK

Educational-methodical maintenance of independent work of students on the subject «Biology» is presented in Appendix 1 and includes:

- schedule for implementation of independent work on the subject, including the approximate time standards for performance on each task;
- characterization of reference for students' independent work and guidelines for their implementation;
- requirements for the presentation and registration of results of independent work;
- criteria for assessing the performance of individual work.

IV. CONTROL GOALS OF COURSE

The subject uses the following assessment tools:

1. Oral test (OT):

OT-1 –interview (final exam interview);

OT-2 – colloquium – lesson as a collective interview, oral test;

2. Written works (WW):

WW-1 – written (or computer) test;

WW-2 – test;

WW-6 – laboratory work;

WW-11 –various tests and works.

CONTROL OF THE COURSE GOALS ACHIEVEMENTS

No	Controlled sections / topics of disciplines	Codes and stages of competence formation	Assessment tools		
			Formative assessment	Midterm control / exam	
1	Module I. The main concepts of modern biology. Molecular basis of life. Module II. Cell - an elementary living system Module III. Biological information, reproduction and differentiation of cells Module IV. Self-regulation and sustainable development of living systems. Module V. Basics of genetics Module VI. Parasitology	the readiness to use basic physical and chemical, mathematical and other natural science concepts and methods in solving professional problems (GPC – 7)	Know	Poll Test control Presentation	Question for exam 26-50
			Can	task	assignment
			Master	test	assignment
2	Module I. The main concepts of modern biology. Molecular basis of life. Module II. Cell - an elementary living system Module III. Biological information, reproduction and differentiation of cells Module IV. Self-regulation and sustainable development of living systems. Module V. Basics of genetics Module VI. Parasitology	the capacity for the assessment of morphological and physiological states and pathological processes in the human body for solving professional tasks (GPC – 9)	Know	Poll Test control Presentation	Question for exam 26-50
			Can	task	assignment
			Master	test	assignment

Control and teaching materials, as well as criteria and indicators needed to assess the knowledge, skills and competences which characterize the stages of

formation in the course of development of the educational program are provided in Appendix 2.

V. LIST OF EDUCATIONAL LITERATURE AND INFORMATION SOURCES FOR THE DISCIPLINE

Main literature

(Printed and electronic publications)

1. SpringerBriefs in Reproductive Biology 2016
<https://link.springer.com/bookseries/11053>
2. Pathology and Biology of Human Germ Cell Tumors, Francisco F. Nogales, Rafael E. Jimenez 2017 <https://link.springer.com/book/10.1007/978-3-662-53775-6>
3. Clinical Research and Practice, Mieczyslaw Pokorski, 2017
<https://link.springer.com/book/10.1007/978-3-319-65445-4#editorsandaffiliations>

Additional literature

(Printed and electronic publications)

1. Pulmonary Care and Clinical Medicine, Mieczyslaw Pokorski, 2017
<https://link.springer.com/book/10.1007/978-3-319-65469-0>
2. Current Concepts in Medical Research and Practice, Mieczyslaw Pokorski, 2016 <https://link.springer.com/book/10.1007/978-3-319-74150-5>

List of network and Internet resources

1. <http://elibrary.ru/> - scientific electronic library.
2. <http://molbiol.ru/> - molecular biology informational website.
3. <http://macroevolution.narod.ru/> - evolutionary science informational website.
4. <http://science.km.ru/> - informational website for various topics of biology.
5. <http://elementy.ru/> - media and news informational website for natural sciences.
6. <http://www.iprbookshop.ru/> - electronic library IPRbooks.
7. <http://znanium.com/> - electronic library "Znanium".

8. <https://nplus1.ru/> - N+1, popular science news website.
9. <http://antropogenez.ru/> - popular science informational website on anthropogenesis.
10. <http://web.a.ebscohost.com/ehost/search/basic?sid=851485f8-6200-4b3e-aaab-df4ba7be3576@sessionmgr4008&vid=1&tid=2003EB> –EBSCOhost book collection.
11. <http://rosalind.info/problems/locations/> - web portal for bioinformatics self-education.
12. <http://www.ncbi.nlm.nih.gov/> - National Center For Biomedical Information Institute website .
13. <http://www.mendeley.com/> - *Mendeley*: Free reference manager and PDF organizer.
14. <http://www.ebi.ac.uk> - European Bioinformatics Institute website
15. <http://www.scopus.com> –Scopus citation index and scientific literature database.
16. <http://thomsonreuters.com/thomson-reuters-web-of-science/> Web of Science citation index and scientific literature database.

LIST OF INFORMATION TECHNOLOGIES AND SOFTWARE

The location of the computer equipment on which the software is installed, the number of jobs	List of licensed software
Multimedia auditorium Vladivostok Russian island, Ayaks 10, building 25.1, RM. M723 Area of 80.3 m2 (Room for independent work)	Windows Seven enterprice SP3x64 Operating System Microsoft Office Professional Plus 2010 office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.); 7Zip 9.20 - free file archiver with a high degree of data compression; ABBYY FineReader 11 - a program for optical character recognition; Adobe Acrobat XI Pro 11.0.00 - software package for creating and viewing electronic publications in PDF; WinDjView 2.0.2 - a program for recognizing and viewing files with the same format DJV and DjVu.

In order to provide special conditions for the education of persons with disabilities all buildings are equipped with ramps, elevators, lifts, specialized places equipped with toilet rooms, information and navigation support signs.

1. For education students use the following software: Microsoft Office package (Excel, PowerPoint, Word and other д.), electronic resources of the FEFU website, including the resources of the FEFU Scientific Library.

2. Scopus and Web of Science citation index and scientific literature database, NCBI databases and PubMed citation index and scientific literature database, electronic libraries eLIBRARY, “Znanium”, IPRbooks, database and book collection of EBSCOhost. database of the FEFU Scientific Library.

3. A number of textbooks has electronic versions purchased by the University with the access via the FEFU Scientific Library website.

VI. GUIDELINES FOR THE DEVELOPMENT OF DISCIPLINE

In the process of studying “Biology” different methods and tools are suggested to facilitate the education process, including active methods of education: lecture, practical lessons, laboratory lessons, test works, independent work of students.

Lectures

Lecture is the main form of classes. It is an explanation of basic and the most complicated and important topics of “Biology”. Lecture should be presented in an informative, developing and organizing manner. Writing a summary of a lecture helps to master theoretical part of the subject. While listening to the lecture

it is highly recommended to make such a written summary of the most important information, better using own wording, which help to remember the material better. Summary can only be useful if it is written by a student himself/herself.

Spoken lectures contain only a fracture of the totality of subject material, which can be found in the books and other sources. A teacher also informs students of the additional sources of information on the certain topics. Therefore it is necessary to expand the written summary with the information from the books from the main and additional lists and other sources.

To present the lecture course in the frames of “Biology” subject different forms of active education are used: lecture-conversation, lecture-visualisation, which are structured upon knowledge acquired by students in the previously studied subjects. To facilitate the spoken material different schemes, diagrams, video files, electronic presentations, etc. are used. Questions for actual problems discussion are also put during lectures.

Lecture – visualisation

Lecture’s presenting is also accompanied by demonstration of schemes, diagrams, electronic presentation, video files – such a combined method of information presenting significantly simplifies its comprehension by students. Spoken information should correspond with the visual material. Information presented in the visual aids helps to raise questions and issues to discuss and assists in shaping the professional thinking of future professionals.

Lecture - conversation

Lecture-conversation, a dialogue with the audience is one of the most common forms of active education because it provides a direct contact of a lecturer with an audience. This contact is reached during lectures when students are asked question about actual problems touched by the topic of a lecture. Students are also encouraged to ask a lecturer questions themselves. Questions are presented to the whole audience, and any student can propose an answer, and anyone can make a

comment. This allows to reveal the most active students and to get those who don't actively participate involved. Such form of work lets lecturer to involve students in the education workflow, draw attention, stimulate mental activity, get social experience, learn to formulate questions. Advantage of the lecture-conversation lies in a possibility to attract students attention to the most urgent problems of the topic, define the content and tempo of the material's presentation, and mark out the most interesting aspects for the possible adjustment of the form of presentation.

Practical (seminar) type of lessons in «Biology»

Practical lessons – is a team form of studying. Seminar lessons are the main form of practical lessons for the intensive learning in the frames of a subject in an interactive form. Different questions are explained and investigated and then discussed on the seminars between students and a lecturer, which is supposed to consolidate the material of the general theme. This also helps to develop debate skills, critical and independent thinking in students, helps them to navigate in enormous information currents of today, form and defend their own position on the questions of the subject.

Seminar-press-conference, detailed conversation, seminar-debate are performed as forms of active education during practical lessons.

Detailed conversation. For a detailed conversation a lecturer picks themes of a vivid importance for the mastering of the subject. A lesson is usually held in the “questions-answers” form, the main role belongs to a lecturer which explains important aspects of a theme to students. Another possible form of this lesson is a colloquium.

Seminar-debate can be started by a lecturer during a lesson or planned in advance. Themes picked for discussion of proposed to students, are supposed to be the most touching and drawing the most response from the society, being interesting for students as for the ordinary people and as for the future specialists. Students are offered to express their own opinion and experience on the matter;

they are encouraged to polemicize with a lecturer and their fellow students. A lecturer is a moderator of such a discussion.

Seminar-press-conference. Lecturer gives to the small groups of students divides the group to the smaller subgroups and gives them a task to prepare short reports on certain themes. Participants of the groups make their reports, which are used to trigger questions among audience answered by the reporters and an assigned “expert group”. This is used to initiate a discussion with each other and a lecturer. Initiative belongs to students in this type of activity.

Laboratory lessons in «Biology»

Laboratory lessons are intended to improve the quality of education, facilitate the development of research activity of students, logical thinking and independence. Together with the formation of skills during the lessons, theoretical knowledge acquired during lectures is systemized and extended. Students develop ability and willingness to apply theoretical knowledge in practice.

In order to prepare for the laboratory lessons students should revise theoretical material from the lecture summary and literature. A class can start with a brief oral test on the actual topic. Then students work with microscopes, collection of micropreparations on glass slides; atlases, slides, diagrams, videos and other supplementary material. It's necessary to have an album to make sketches of the preparations observed. Analysis of preparations is done first at the low magnification (objective x4 – x10), then the higher magnification can be used with the permission from the lecturer. Students should analyze the material observed and compare it to the pictures drawn in atlases. Students have to manage to notice all necessary structures and features of the material on the preparation. Technical performance and skill of working with the microscopic equipment is vitally important and can be valued by a mark.

Test works in «Biology»

Current control students' progress is performed by holding oral tests / colloquiums, written tests, and computer tests, which all contribute to the interim attestation.

Criteria of written tests evaluation

Written or **computer test** is a form of assessment and evaluation of the progress of a student within a large theme/topic. It is used to evaluate the learning of terms, main principles, laws, connections, methods, ability to solve practical tasks.

Criteria of written tests evaluation:

Written tests are evaluated according to the percentage of the whole work successfully fulfilled.

5 points are given to a student if he/she successfully fulfills 86-100 % of all the tasks in the test;

4 points are given to a student if he/she successfully fulfills 76-85 % of all the tasks in the test;

3 points are given to a student if he/she successfully fulfills 61-75 % of all the tasks in the test;

2 points are given to a student if he/she successfully fulfills 50-61 % of all the tasks in the test;

1 points are given to a student if he/she successfully fulfills less than 50 % of all the tasks in the test.

In order to get a "pass" and for the test to be considered successfully solved, minimum 3 points are required. Sometimes these points can contribute to a joint rating.

Tests are performed during hours assigned for the practical lessons.

Criteria of oral tests and colloquia evaluation

Evaluation of oral test or report of a student on a practical lesson (seminar) or colloquium is done by giving points from 0 (unsatisfactory) to 3 (perfect).

3 point is given to a student if he/she is answering question correctly; answers are well-reasoned, logical and consistent, notable for their depth and completeness, ability to unfold a topic, make correct conclusions, generalization, and analysis.

2 point is given to a student if he/she is answering question correctly; answers are reasoned, logical and consistent, are complete, a student shows ability to unfold a topic, make correct conclusions, generalization, and analysis, but makes few non-critical mistakes.

1 point is given if a student gives incomplete answers which do not fully uncover the topic, reasoning is poor, some mistakes are made.

0 points is given if a student doesn't give satisfactory answers, which shows lack of knowledge on the topic, no reasoning is given critical mistakes are made.

Final interview (credit test and exam) of a student with a lecturer is of a vital importance for the final mark.

Criteria of a credit test mark

Credit test is a pass/fail type of exam, which is necessary to get a permission to pass other exams, alongside with credit tests in other subjects.

“Pass” mark for the credit test is given when a student fluently masters theoretical material of the subject, doesn't make mistakes while answering questions, understands logical connections between different pieces of information inside various topics, can use supplementary material and visual aids to illustrate oral answer, is able to correct minor mistakes after guiding questions. Also, a student must be able to identify and analyze given microscopic preparations.

“Fail” mark is given when a student does not answer main and/or additional questions fully enough, shows insufficient knowledge on the subject, doesn't see

and understand connections between different sections of material, can't identify microscopic preparations.

Criteria of an exam mark

Mark "5" ("perfect") is given when a student fully knows theoretical material of the subject, doesn't make mistakes while answering questions, understands logical connections between different pieces of information inside various topics, can use supplementary material and visual aids to illustrate oral answer, answers additional questions.

Mark "4" ("good") is given when a student knows most of theoretical material of the subject, makes minor mistakes while answering questions but is able to self-correct after being asked directing questions, understands logical connections between different pieces of information inside various topics.

Mark "3" ("satisfactory") is given when a student generally knows theoretical material of the subject, but makes mistakes while answering questions, doesn't fully understand logical connections between different aspects of the topic, doesn't successfully answer additional questions.

"3" is the lowest acceptable mark for the exam to be considered successfully passed.

Mark "2" ("unsatisfactory") is given when a student shows insufficient knowledge of theoretical material of the subject, makes critical mistakes while answering questions, can't self-correct after being asked directing questions.

MATERIAL AND TECHNICAL EQUIPMENT OF SUBJECT

For performing practical work, as well as for organizing independent work, students have access to the following laboratory equipment and specialized classrooms that meet applicable sanitary and fire regulations, as well as safety requirements for educational and research and production work:

For performing practical work, as well as for organizing independent work, students have access to the following laboratory equipment and specialized

classrooms that meet applicable sanitary and fire regulations, as well as safety requirements for educational and research and production work:

Name of equipped premises and rooms for independent work	List of equipment;
Computer class of the School of Biomedicine room M723, 15 seats	Screen with an electric drive 236 * 147 cm Trim Screen Line; DLP Projector, 3000 ANSI Lm, WXGA 1280x800, 2000: 1 EW330U Mitsubishi; The subsystem of specialized fixing equipment CORSA-2007 Tuarex; Video switching subsystem: DVI DXP 44 DVI Pro Extron matrix switcher; DVI extension cable for twisted pair DVI 201 Tx / Rx Extron; Audio switching and sound reinforcement subsystem; ceiling speaker system SI 3CT LP Extron; DMP 44 Extron digital audio processor; extension for the control controller IPL T CR48; Wireless LANs for students are provided with a system based on 802.11a / b / g / n access points 2x2 MIMO (2SS). Monoblock HP RgoOpe 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD +/- RW, GigEth, Wi-Fi, BT, usb kbd / mse, Win7Pro (64-bit) + Win8.1Pro (64-bit), 1-1-1 Wty
Multimedia auditory	Monoblock HP ProOne 400 G1 AiO 19.5 "Intel Core i3-4130T 4GB DDR3-1600 SODIMM (1x4GB) 500GB; Projection Screen Projecta Elpro Electrol, 300x173 cm; Multimedia Projector, 4000 Mitsubishi FD630U, 4000 ANSI Lumen, 1920x1080; Embedded Interface, Mitsubishi FD630U, 4000 ANSI Lumen, 1920x1080; Embedded, Embedded, Mitsubishi FD630U, 4000 ANSI Lumen, 1920x1080; Embedded; TLS TAM 201 Stan cables; Avervision CP355AF Document Camera; Sennheiser EW 122 G3 Microphone UHF-band microphone system as part of a wireless microphone and receiver; LifeSizeExpress 220-Codeonly-Non-AES video conferencing codec; Multipix MP-HD718 Network Video Camera; Dual LCD Panels 47 ", Full HD, LG M4716CCBA; Audio switching and sound reinforcement subsystem; central uninterrupted power supply
Reading rooms of the FEFU Scientific Library with open access to the book collection (Building A - Level 10)	HP RgoOpe 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD +/- RW, GigEth, Wi-Fi, BT, usb kbd / mse, Win7Pro (64-bit) + Win8.1Pro (64-bit), 1-1-1 Wty Internet access speed 500 Mbit / s. Jobs for people with disabilities are equipped with braille displays and printers; equipped with: portable devices for reading flat-printed texts, scanning and reading machines with a video optimizer with the ability to adjust color spectra; magnifying electronic loops and ultrasonic markers
690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax Village, 10, room M628 Multimedia-equipped room	Microscope light Alto BIO4 (20 pieces); Light microscope with digital camera BIO8 Altos (1 pc); Monoblock Lenovo C360G-I34164G500UDK (1 pc); LED TV Samsung UE40D6510WS (1 pc). A set of histological preparations (basics of cytology, cell structure of various types, main types of living tissues, embryology basics, cell multiplication, fundamentals of parasitology), slides,

	coverslips, immersion medium, Pasteur pipette, Romanovsky-Giemsa dye, glycerin, Petri dishes, test tube Falcon type 50 ml, container for samples of biomaterials
690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax Village, 10, room M627	Light microscope Carl Zeiss GmbH Primo Star 3144014501 (13 pcs.); Microscope light with a digital camera BIO8 Altos (2 pieces). A set of histological preparations (basics of cytology, cell structure of various types, main types of living tissues, embryology basics, cell multiplication, fundamentals of parasitology), slides, coverslips, immersion medium, Pasteur pipette, Romanovsky-Giemsa dye, glycerin, Petri dishes, test tube Falcon type 50 ml, container for samples of biomaterials
690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax Village, 10, room M625	Microscope light Carl Zeiss GmbH Primo Star 3144014501 (11 pcs.) A set of histological preparations ((basics of cytology, cell structure of various types, main types of living tissues, embryology basics, cell reproduction, basics of parasitology), slides, coverslips, immersion medium, Pasteur pipette, Romanovsky-Giemsa dye, glycerin, Petri dishes, test tube of Falcon type 50 ml, container for samples of biomaterials



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SCHOOL OF BIOMEDCINE

**TRAINING AND METHODOLOGICAL SUPPORT
INDEPENDENT WORK OF TRAINEES**

in discipline «Biology»

Specialty 31.05.01 Medicine

Form full-time training

**Vladivostok
2016**

Independent work includes:

1. Work in the library or homework with the literature and the written summary of lectures;
2. preparation for the practical lessons;
3. preparation for the tests and final interviews;
4. work with microscopic preparations in the laboratory.

The order to perform independent work is defined by the following schedule of execution of independent work.

Control of independent work progress is evaluated in the process of laboratory lessons, practical lessons, oral tests, test works and interviews.

The tasks for control of independent work are defined by the themes and topics of the subject's content.

The schedule of execution of independent work on discipline «Biology»

№ п/п	Date / deadlines	Type of independent work	Estimated time to complete standards	Form of control
Semester 1				
1	2 week	Work with the literature and lections summary	3 hours	Work on the practical lesson, oral test
2	3 week	Work with the literature and lections summary, preparation for the test	3 hours	Work on the practical lesson, oral test, written test
3	4 week	Preparation for the seminar, preparation for the test	3 hours	Work on the practical lesson, oral test, written test
4	5 week	Work with the literature and lections summary Preparation for the laboratory lesson	3 hours	Work on the practical lesson, oral test
5	6 week	Work with the literature and lections summary Preparation for the	3 hours	Work on the practical lesson, oral test

		laboratory lesson		
6	7 week	Work with the literature and lections summary Preparation for the laboratory lesson	3 hours	Work on the practical lesson, oral test
7	8 week	Preparation for the seminar, preparation for the test	3 hours	Work on the practical lesson, oral test, written test
8	9 week	Preparation for the colloquium	3 hours	Work on the practical lesson, oral test. test
9	10 week	Preparation for the seminar Work with the literature and lections summary	3 hours	Work on the practical lesson, oral test
10	11 week	Preparation for the colloquium	3 hours	Work on the practical lesson, oral test. test
11	12 week	Preparation for the seminar Work with the literature and lections summary	3 hours	Work on the practical lesson, oral test
12	13 week	Work with the literature and lections summary Preparation for the laboratory lesson	3 hours	Work on the practical lesson, oral test
13	14 week	Preparation for the seminar контрольной работе Work with the literature and lections summary	3 hours	Work on the practical lesson, oral test, written test
	15 week	Preparation for the seminar контрольной работе Work with the literature and lections summary	3 hours	Work on the practical lesson, oral test. test
	16 week	Preparation for the seminar , preparation for the test. Work with the literature and lections summary. Preparation for the cresit test.	3 hours	Work on the practical lesson, oral test. test
	17 week	Preparation for the seminar, preparation for the test. Work with the literature and lections summary. Preparation for the cresit test.	3 hours	Work on the practical lesson, oral test. test

	18 week	Preparation for the seminar контрольной работе Work with the literature and lections summary. Preparation for the cresit test.	3 hours	Final interview
Semester 2				
1	1 week	Work with the literature and lections summary Preparation for the laboratory lesson	0,5 hours	Work on the practical lesson, oral test
2	2 week	Work with the literature and lections summary Preparation for the laboratory lesson	0,5 hours	Work on the practical lesson, oral test
3	3 week	Work with the literature and lections summary Preparation for the laboratory lesson	0,5 hours	Work on the practical lesson, oral test
4	4 week	Preparation for the seminar Work with the literature and lections summary	0,5 hours	Work on the practical lesson, oral test, written test
5	5 week	Preparation for the seminar Work with the literature and lections summary	0,5 hours	Work on the practical lesson, oral test, written test
6	6 week	Preparation for the colloquium	0,5 hours	Work on the practical lesson, oral test, written test
7	7 week	Preparation for the seminar Work with the literature and lections summary	0,5 hours	Work on the practical lesson, oral test, written test
8	8 week	Preparation for the seminar Work with the literature and lections summary	0,5 hours	Work on the practical lesson, oral test, written test
9	9 week	Work with the literature and lections summary	0,5 hours	Work on the practical lesson, report
10	10 week	Work with the literature and lections summary	0,5 hours	Work on the practical lesson, report

11	11 week	Work with the literature and lections summary Preparation for the laboratory lesson	0,5 hours	Work on the practical lesson, oral test
12	12 week	Work with the literature and lections summary Preparation for the laboratory lesson	0,5 hours	Work on the practical lesson, oral test
13	13 week	Work with the literature and lections summary Preparation for the laboratory lesson	0,5 hours	Work on the practical lesson, oral test
14	14 week	Work with the literature and lections summary Preparation for the laboratory lesson	0,5 hours	Work on the practical lesson, oral test
15	15 week	Work with the literature and lections summary Preparation for the laboratory lesson	0,5 hours	Work on the practical lesson, oral test
16	16 week	Work with the literature and lections summary Preparation for the laboratory lesson. Preparation for the exam.	0,5 hours	Work on the practical lesson, oral test
17	17 week	Work with the literature and lections summary Preparation for the laboratory lesson. Preparation for the exam.	0,5 hours	Work on the practical lesson, oral test
18	18 week	Work with the literature and lections summary Preparation for the laboratory lesson. Preparation for the exam.	0,5 hours	Work on the practical lesson, oral test. Final exam interview



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Code and the wording of the competence of the AT FEFU	Stages of competence formation	
- the readiness to use basic physical and chemical, mathematical and other natural science concepts and methods in solving professional problems (GPC – 7)	Know	of the nature of genetic information and mechanisms of its realization and replicating, mechanisms of gene activity regulation, ontogenesis periodization, main ecological laws, principles of biosphere functioning, nature of parasitism as a form of biotic relationships.
	Can	to effectively apply natural-scientific approach in modern medical activities; ability to use biological modeling at the basic level
	Master	of general methodology of natural-scientific and biomedical research; understanding of main principles of observation, experiment. analytic/comparative approach.
the capacity for the assessment of morphological and physiological states and pathological processes in the human body for solving professional tasks (GPC – 9)	Know	fundamental principles and mechanisms of diseases in a human organism from the general biological point of view
	Can	to use knowledge of molecular and biological organization of living systems for assessment of functional state of an organism, including diagnostics of pathological processes
	Master	of analysis of biological systems functioning on the ontogenetic (cellular and organismic) level

CONTROL OF THE COURSE GOALS ACHIEVEMENTS

No	Controlled sections / topics of disciplines	Codes and stages of competence formation	Assessment tools		
			Formative assessment	Midterm control / exam	
1	Module I. The main concepts of modern biology. Molecular basis of life. Module II. Cell - an elementary living system Module III. Biological information, reproduction and differentiation of cells Module IV. Self-regulation and sustainable development of living systems. Module V. Basics of genetics Module VI.	the readiness to use basic physical and chemical, mathematical and other natural science concepts and methods in solving professional problems (GPC – 7)	Know	Poll Test control Presentation	Question for exam 26-50
			Can	task	assignment
			Master	test	assignment

	Parasitology				
2	Module I. The main concepts of modern biology. Molecular basis of life. Module II. Cell - an elementary living system Module III. Biological information, reproduction and differentiation of cells Module IV. Self-regulation and sustainable development of living systems. Module V. Basics of genetics Module VI. Parasitology	the capacity for the assessment of morphological and physiological states and pathological processes in the human body for solving professional tasks (GPC – 9)	Know	Poll Test control Presentation	Question for exam 26-50
			Can	task	assignment
			Master	test	assignment

Scale of competence level assessment

Code of competence	Stages of competence formation		Criteria	Indicators	Score
the readiness to use basic physical and chemical, mathematical and other natural science concepts and methods in solving professional problems (GPC – 7)	Know (entry level)	of the nature of genetic information and mechanisms of its realization and replicating, mechanisms of gene activity regulation, ontogenesis periodization, main ecological laws, principles of biosphere functioning, nature of parasitism as a form of biotic relationships.	A student knows the fundamental principles of the organization and functioning of living systems	knowledge of living systems criteria	65-71
	Can (intermediate level)	to effectively apply natural-scientific approach in modern medical activities; ability to use biological modeling at the basic level	A student effectively apply the natural science approach in modern medical and biological activities	ability to plan a correct biological / medical experiment	71-84
	Master (advanced level)	of general methodology of natural-scientific and biomedical research; understanding of main principles of observation, experiment, analytic/comparative approach.	A student owns the methodology of natural science and biomedical research: owns the basic principles of observational, experimental, comparative analytical approaches	able to analyze medical data in accordance with scientific principles	85-100

the capacity for the assessment of morphological and physiological states and pathological processes in the human body for solving professional tasks (GPC – 9)	Knowledge (entry level)	fundamental principles and mechanisms of diseases in a human organism from the general biological point of view	A student knows the causes and patterns of development of diseases in the human body	knows the causes and patterns of development of pathological conditions in the human body	65-71
	Ability (intermediate level)	to use knowledge of molecular and biological organization of living systems for assessment of functional state of an organism, including diagnostics of pathological processes	A student is able to use knowledge about the molecular and cellular organization of the human body for a general assessment of the functional state of the human body	able to use knowledge about the molecular and cellular organization of the human body for a general assessment of the functional state of the human body	71-84
	Skill (advanced level)	of analysis of biological systems functioning on the ontogenetic (cellular and organismic) level	A student knows the principles of analyzing the state of the human body at the subcellular level	knows the principles of analyzing the state of the human body at the subcellular level	85-100

Credit test questions for the subject «Biology»

1 semester

1. Criteria of life. What differs living creatures from non-living objects?
2. Realization of criteria of life on different levels of life.
3. Main concepts of modern biology.
4. Systemic multi-level organization of life. Levels of life.
5. Self-organization on various levels of life. Concept of self-organization. Emergence.
6. Main types of biomolecules and their chemical properties.
7. Proteins.
8. Lipids. Self-organization of lipids.
9. Nucleic acids. Main types and their properties.
10. Carbohydrates.
11. Metabolism. Main concept. Types of metabolism.
12. Heterotrophs. Cellular respiration.

13. Autotrophs. Photosynthesis and chemosynthesis.
14. Transformation of substances and energy in ecosystems. Global cycles of chemical elements on Earth.
15. Central dogma of molecular biology.
16. Transcription and translation. Genetic code.
17. Cell as a basic unit of life. Structure of cells. Organoids.
18. Prokaryotic and Eukaryotic cells: differences and proofs of a single origin. Theory of symbiogenesis.
19. Diversity of cell types. Types of cells in different taxa. .
20. Tissues.
21. Asexual reproduction of life.
22. Mitosis. Phases of mitosis.
23. Cell proliferation and cell cycle. Cell differentiation
24. Cell transformation and cancer.
25. Cell cloning. Reproductive cloning
26. Meiosis. Sexual reproduction.
27. Gametogenesis.
28. Fertilization and basic principles of embryonic development
29. Chromosome ploidy in cells.
30. Embryonic development of mammals.

Exam questions for the subject «Biology»

2 semester

1. Self-regulation and sustainable development in living systems
2. Human health and homeostasis. Immunity.
3. Morphology of human immune system. Immune cells.
4. Heredity and variability.
5. Mendel's laws. Main types of inheritance.
6. Morgan's laws. Genetic linkage.

7. Sex linkage.
8. Genetic dominance, incomplete dominance, co-dominance
9. Gene interaction. Epistasis.
10. Phenotypic plasticity.
11. Classification of mutations. Gene mutations. Chromosome and genomic mutations
12. Population genetics. Gene flow. Isolation.
13. Main concepts of evolution. Darwinism, natural selection.
14. Origin of life: abiogenesis.
15. Modern evolutionary synthesis
16. Species. Criteria of species. Origin of species.
17. Main geological eons and main landmarks of life's evolution on Earth.
18. Taxonomy of human.
19. Main stages of anthropogenesis.
20. Biosocial nature of human. Human mind and consciousness.
21. Biological communities and populations.
22. Ecosystems. Cyclicity and self-regulation of ecosystems.
23. Parasitology. Main groups of human parasites.
24. Cestodes (Tape worms). Associated infections and life cycles.
25. Flat worms. Associated infections and life cycles.
26. Nematodes. Associated infections and life cycles.
27. Biosphere evolution. Main anthropogenic crises.

**Criteria for grading a student in the exam / test
on discipline "Biology"**

Mark	Requirements for the competences formed
«excellent / passed»	The grade “excellent” is given to the student if he has deeply and firmly mastered the program material, expounds it exhaustively, consistently, clearly and logically in a harmonious way, knows how to closely link theory with practice, freely copes with tasks, questions and other kinds of knowledge, and does not find it difficult in response to the modification of tasks, he uses the material of monographic literature in the answer, correctly substantiates the decision made, has diverse skills and techniques for performing practical

	tasks
«good / passed»	The mark “good” is given to the student, if he knows the material firmly, correctly and essentially sets it out, avoiding significant inaccuracies in answering the question, correctly applies theoretical principles in solving practical questions and problems, has the necessary skills and techniques for their implementation
«satisfactory / passed»	The grade “satisfactory” is given to the student, if he has knowledge of only the basic material, but has not learned its details, admits inaccuracies, insufficiently correct formulations, violations of the logical sequence in the presentation of the program material, has difficulty in performing practical work
«unsatisfactory» / «failed»	The rating “unsatisfactory” is given to a student who does not know a significant part of the program material, makes significant mistakes, hesitates and does practical work with great difficulty.



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The subject uses the following assessment tools:

1. Oral test (OT):

OT-1 –interview (final exam interview);

OT-2 – colloquium – lesson as a collective interview, oral test;

2. Written works (WW):

WW-1 – written (or computer) test;

WW-2 – test;

WW-6 – laboratory work;

WW-11 –various tests and works.

Oral test is the most common control method for assessment of students' knowledge. During the oral test, the direct contact between a teacher and students is established. During this process a lecturer has wide possibilities to evaluate a level of subject's mastering by students. A student can be asked various questions related to the topic, additional questions can be asked, as well as guiding questions to help and direct student's answer. Oral test is considered to be the most adequate form of control due to its complicity and transparency. Oral test includes interview, report, colloquium. Report on a practical lesson can be prepared and presented by up to 3 people at once, in this case additional questions are asked to all presenters.

Colloquium is a variation of a seminar (practical) lesson with the main activity being the answers of students to the questions related to the previous themes/topics. A lecturer evaluates students' answers as oral test answers. Colloquium serves not only as a method of evaluation of students' knowledge, but also can be used to increase and consolidate their knowledge. Themes picked for colloquiums can be those which are not touched in seminar lessons.

Written tests include various tests, essays (written reports).

Written test is a form of control of the current progress in large theme (unit) of a subject, and can be implemented as both paper test and computer test. Tests goal is to assess the level of ability to use certain terms, to explain and use laws

and rules describing theoretical material and etc. Frequency of tests is defined by the lecturer.

Tests are fulfilled on the time of practical lessons. Test marks make a significant contribution to the final mark for the subject.

Essay, or written report, is a brief and limited summary of literature concerning a given question. Theme is defined by a lecturer and can be picked by a student from a pre-defined list or assigned by a lecturer. Volume of an essay should lie within the range of 6-12 printed pages, including a title page and a list of references (books, scientific papers, etc.) on the proposed topic, reviewed on one of the lectures. The goal of an essay is to teach a student skills of making a brief written representation of the data collected from different sources according to the requirements similar to those of scientific papers and reviews. A student is usually given a theme, sources of information, formatting requirements. Using valid and adequate data sources with evidences and proofs for the information, referring and their correct representation are crucial aspects of such type of work. Essay is not a universal type of task for all students, it can be given individually as a form of working off non-attendance or as an additional work.

Methodological guidelines for performing laboratory works

1. Students should revise theoretical material from the lecture summary and literature.
2. A class can start with a brief oral test on the actual topic.
3. Students work with microscopes, collection of micropreparations on glass slides; atlases, slides, diagrams, videos and other supplementary material.
4. Sketches of the preparations observed are made in an album.
5. Analysis of preparations is done first at the low magnification (objective x4 – x10), then the higher magnification can be used with the permission from the lecturer. Students should analyze the material observed and

compare it to the pictures drawn in atlases. Students have to manage to notice all necessary structures and features of the material on the preparation.

6. Technical performance and skill of working with the microscopic equipment is vitally important and can be valued by a mark.

Methodological guidelines for performing test works

1. Paper or computer tests can be used for assessment.
2. A test can have different types of questions: picking correct variants for the questions, giving definitions of terms, correspondence between terms and definitions, correspondence between cause and effect, denoting parts and elements in different diagrams, making lists of certain features or representatives of a group of terms, writing formulas and making schemes/diagrams, and other types of questions.
3. Test questions can also be presented by solving certain tasks like genetic analysis, for example.
4. Student must come prepared: revise lection theoretical material, look through the textbooks and make a written summary if necessary.
5. Theory questions should be answered briefly yet sufficient. An answer should contain all necessary information on the topic, definition, list, description, analysis, etc.
6. Making a scheme/diagram to illustrate an answer is welcomed.
7. Students are not allowed to use any kind of pre-written notes, summaries, textbooks or copybooks, or any other information sources or technical devices to assist the work.

Methodological guidelines for work with literature

1. Students are supposed to make a preliminary list of sources (books, articles, reviews). Such a list can be provided by a lecturer; if necessary, information sources can be limited by this list. Collection of articles can be extended by a student himself using citation indices and articles web databases like PubMed, Scopus, Web Of Science. For convenience of work with academic articles students can make their own databases of literature, using reference management software like free software Mendeley. Such a personal database provides a significant advantage over conventional lists of sources because it allows to performs assortment, search by titles, authors, keywords, automatically generate a reference list.

List of literature provided can be broadened by means of electronic catalogue and search system of the FEFU Scientific Library. Also, the Library provides an online access to certain textbooks necessary for studying.

2. While working with the literature on a certain theme, a student should not only read the text in the source; a combined approach is highly recommended: a good strategy is to make short summary, algorithm, scheme or diagram of material read which helps to remember it faster. Writing an exact copy of a text is not recommended, a short summary is preferred.

Methodological guidelines for exam

1. Form of exam – written or oral test.
2. Exam and credit register sheets are taken by a lecturer in advance from administrators of education programs.
3. In case of a student using technical or other means for cheating, an examining lecturer can dismiss this student from the exam and put a mark “unsatisfactory” into the register sheet.
4. Students must have a record book at the exam, which is given to an examining lecturer, who fills all necessary boxes in the record book.

5. Students are invited into the class in groups of 5-6. Next group can enter only after an examining lecturer invites it to. Students are not allowed to leave during preparation for the answer without permission.

6. Questions taken from the list are blindly and randomly chosen by a student. A student has 20 minutes to prepare an answer during a credit oral test, and 30 minutes during an exam.

7. An examining lecturer can ask additional questions besides the main question randomly picked by a student. If a student has difficulties in answering a main question, he/she can pick another random one, but the mark will be 1 point lower.

8. Interim certification suggests marks. Credit test is a pass/fail type of exam, which is necessary to get a permission to pass other exams, alongside with credit tests in other subjects. If a student doesn't have "passes" for all subjects which suggest them, he/she cannot participate in an exam. Exam suggests marks from 2 ("unsatisfactory") to 5 ("perfect"). 3 points ("satisfactory") is the lowest acceptable mark for the exam to be considered successfully passed.

9. In case of a student missing an exam without fair excuse a mark "failure to appear" is put into the register sheet.

10. Marks given for the exam are not a subject to change. A student who doesn't agree with the mark, can make an official request to the director of the FEFU School of Biomedicine. If this request has good reasons, a special exam committee of three teachers from the corresponding department can be assembled. A mark given by this committee is final and definitive.

Variants of sets of topics for practical lessons (seminars) in the discipline «Biology»

Seminar «Prospects of Modern Biology. Technological Significance of Biology»

Some of the unsolved problems of biology:

1. Unsolved problems of modern biology: Biological ageing.
2. Unsolved problems of modern medicine: Incurable illnesses.
3. Unsolved problems of modern biology: Extraterrestrial life.
4. Unsolved problems of modern medicine: Allergy.

Technological role of biology in modern life:

5. Bionics
6. Biotechnologies in food industry
7. Genetically modified crops in agriculture
8. Mariculture
9. Antibiotics
10. Gene therapy
11. Biodegradation of pollutants

Seminar «Human Health and Immunity. Biological ageing»

1. Homeostasis and homeokinesis in a human body. Definitions of the term “Health”.
2. Factors affecting human health. Causes of disorders and illnesses.
3. Human immune system: organs and cell types.
4. Innate immunity: phagocytes and complement system.
5. Acquired (adaptive) immunity: lymphocytes, antibodies.

6. Artificial induction of immunity: vaccines and vaccination.
7. Disorder of immunity: immunodeficiencies, autoimmune diseases.
8. Inheritance and human health
9. Lifestyle risk factors
10. Lifespan in different groups of living organisms (mean and maximal).
Factors affecting longevity.
11. Cell senescence (Ageing on the cell level).
12. The telomere theory of ageing. Hayflick limit.
13. Ageing of human body. Ageing in different organ systems.
14. Role of free radicals in ageing. Mutagenesis and ageing.
15. Accelerated ageing (Progeria).
16. Immortalized cell cultures.
17. Negligible ageing and biological immortality.

Types and examples of tasks for written tests in the discipline «Biology»

- 1) Write here the main concepts (ideas) of modern biology.
 - 1.
 - 2.
 - 3.
 - 4.
 - 5.
 - 6.
 - 7.
- 2) What are the features of life? What are the qualities distinguishing living creatures and non-living things
 - 1.

2.

3.

4.

5.

6.

- 3) Correlate groups of biomolecules and their features (some features may fit several types of biomolecules at once):

<u>Groups of biomolecules:</u>	<u>Характеристики:</u>
1. Nucleic acids	a) Form double-layered membrane
2. Proteins	b) Contain coded genetic information
3. Carbohydrates	c) Are a main source of energy for the cell
4. Lipids	d) Can be stored as a stock of energy
	e) Are polymers
	f) Organized by the principle of complementarity
	g) Consist of aminoacids
	h) Perform all active functions in cells

1 -

2 -

3 -

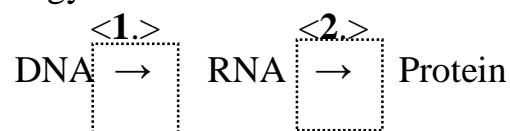
4 -

- 4). How many types of nucleotides can be included in DNA?

- 5) What type of metabolism is the main for heterotrophs?

- Cellular respiration
- Photosynthesis
- Glycolysis

- d. Autophagy
- 6). Write the chemical reaction of photosynthesis
- 7). How many types of aminoacids can make proteins?
- 8) What type of metabolism is the main for autotrophs?
- Cellular respiration
 - Photosynthesis
 - Glycolysis
 - Autophagy
- 9). Write the chemical reaction of cellular respiration.
- 10) List the functions of proteins in living cells.
- 11) Explain what translation in molecular biology is.
- 12) Explain what replication in molecular biology is.
- 13) Name these processes of biological information transfer, described by the Central Dogma of Molecular Biology:



Variants:

- | | |
|-------------------|------------------|
| a) Transgression | Process <1.> = ? |
| b) Replication | |
| c) Transduction | Process <2.> = ? |
| d) Translation | |
| e) Transformation | |
| f) Transcription | |

14) List the properties of genetic code.

15) Give a definition of the term “gene”.

16). Compose a complementary DNA chain to the presented single DNA strand.

Sign the 5' and 3' ends of a new strand.

5' G - G - T - A - G - T - T - A - G - C - C - A - T - C - G 3'

17). Compose a complementary RNA chain to the presented single DNA strand.

Sign the 5' and 3' ends of a new strand.

3' T - C - T - T - G - A - A - T - G - C - G - G - T - C - G 5'