MINISTRY OF SCIENCE AND HIGHER EDUCATION OF THE RUSSIAN FEDERATION
Federal State Autonomous Educational Institution of Higher Education
Far Eastern Federal University
(FEFU)
INSTITUTE OF LIFE SCIENCES AND BIOMEDICINE (SCHOOL)

AGREED	CLAIM
Head of Educational Program	Director of the Production Company Structural subdivision
_____ V.V. Kumeiko	_____ V.V. Kumeiko
(Signed) (Surname)	(Signed) (Surname)
	April 12, 2023

WORK PROGRAM OF THE DISCIPLINE
Methods of Molecular and Cellular Biology
Area of study 06.03.01 Biology
Form of training: full-time

The work program is drawn up in accordance with the requirements of the Federal State Educational Standard in the field of training 06.03.01 Biology, approved by the order of the Ministry of Education and Science of Russia dated 07.08.2020 No. 920

The work program was discussed at the meeting of the Department of Medical Biology and Biotechnology, Minutes No. 3 dated April 12, 2023.

Director of the Department of Medical Biology and Biotechnology V.V. Kumeiko

Compiled by: Ph.D. Kumeiko V.V.

Vladivostok
2022

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1. *The work program was revised at the meeting of the Department/Department/Division (implementing the discipline) and approved at the meeting of the Department/Department/Division (graduating structural unit), minutes of "*
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2. *The work program was revised at the meeting of the Department/Department/Division (implementing the discipline) and approved at the meeting of the Department/Department/Division (graduating structural unit), minutes of "*
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Abstract of the discipline

Methods of Molecular and Cellular Biology

The total labor intensity of the discipline is 4 credit units / 144 academic hours. The curriculum provides for 18 hours of lectures, *36* hours of practical work, *18* hours of laboratory work, and *72 hours* of independent work for the student.

Language: Russian.

Objective: to master the basic methods used in modern biological sciences that study the structure and functions of proteins; to study their theoretical foundations and apply them in practical classes for the further use of universal technologies by students in their future scientific work.

Tasks:

1. To form students' knowledge of the methods used in the study of cell and molecular biology.
2. To develop students' ability to choose the most suitable method(s) for solving a specific problem from the group of methods of cell and molecular biology.
3. To provide students with the skills necessary to carry out the methods used in the study of cell and molecular biology.

For successful study of the discipline, students should have the following preliminary competencies:

- Provides knowledge of the basics of interaction between organisms and their environment, environmental factors and mechanisms of response of organisms, principles of population ecology, ecology of communities; fundamentals of the organization and stability of ecosystems and the biosphere as a whole;
- developsmethods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems;
- comprehends the principles of structural and functional organization of biological systems.

Competencies are obtained as a result of studying the disciplines of general biology, *medical parasitology*, developmental biology, the student must be prepared to study such disciplines as microbiology, methods of molecular and cell biology, medical microbiology and epidemiology, Iomedical Cell Technologies That Form Competencies:

- has an idea of the features of the structure, vital activity, classification of viruses and microorganisms;
- Methodsof virological, microbiological and epidemiological analysis;
- understandsthe molecular features of the structure of viruses and

microorganisms, knows the mechanisms of their interaction with cells and their role in pathological processes;

- Provides knowledge of the basics of interaction between organisms and their environment, environmental factors and mechanisms of response of organisms, principles of population ecology, ecology of communities; the basics of the organization and stability of ecosystems and the biosphere as a whole.

Students' Competencies, Indicators of Their Achievement and Learning Outcomes in the Discipline

Code and name of the competency (result of mastering)	Code and name of the competency indicator
PC-6 Able to use modern knowledge and methods of genetics, molecular and cellular biology to solve professional problems	PP-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems
	PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes
	PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology
	PC-6.4 Able to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis
PC-3 Capable of conducting experimental studies of biologically active substances and developing medicines and medical devices	PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances
	PC-3.2 Able to apply molecular modeling methods for the development of drugs and medical devices
	PC-3.3 Capable of developing medicines and medical devices using pharmacological research methods and pharmaceutical technologies
	PC-3.4 Capable of developing nanosystems for the creation of medicines and medical devices
	PC-3.5 Capable of conducting preclinical trials of drugs and medical devices

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
PP-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems	Knows Modern methods of genetics and molecular and cellular biology for the study of living systems. Can Conduct research in genetics and molecular and cellular biology to study living systems. Owns skills in the use of research methods in the field of genetics and molecular and cellular biology for the study of living systems.

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes	Knows Methods of diagnosing pathological conditions. Can to use fundamental knowledge and biophysical methods to diagnose pathological conditions. Owns skills in the application of fundamental knowledge and biophysical methods for the diagnosis of pathological conditions.
PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology	Knows Methods of diagnosing pathological conditions. Can to use fundamental knowledge and biophysical methods to diagnose pathological conditions. Owns skills in the application of fundamental knowledge and biophysical methods for the diagnosis of pathological conditions.
PC-6.4 Able to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis	Knows research methods in the field of clinical laboratory diagnostics, molecular-genetic and cytological research methods. Can perform research in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies. Owns ability to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis.
PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances	Knows Methods of Physiology, Biochemistry, Molecular and Cellular Biology. Can use the methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances. Owns skills of knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances.
PC-3.2 Able to apply molecular modeling methods for the development of drugs and medical devices	Knows Molecular Modeling Methods. Can Apply molecular modeling methods. Owns molecular modeling methods for the development of medicines and medical devices.
PC-3.3 Capable of developing medicines and medical devices using pharmacological research methods and pharmaceutical technologies	Knows methods of pharmacological research and pharmaceutical technologies. Can Apply pharmacological research methods and pharmaceutical technologies. Owns ability to develop medicines and medical devices.
PC-3.4 Capable of developing nanosystems for the creation of	Knows methods of pharmacological research and pharmaceutical technologies.

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
medicines and medical devices	Can apply development methods to the creation of medicines and medical devices. Owns the ability to develop nanosystems for the creation of medicines and medical devices.
PC-3.5 Capable of conducting preclinical trials of drugs and medical devices	Knows methods of preclinical testing of medicines and medical devices. Can conduct preclinical trials of medicines and medical devices. Owns skills in conducting preclinical trials of medicines and medical devices.

To form the above competencies within the framework of the discipline "Methods of Molecular and Cellular Biology", the following educational technologies and methods of active/interactive learning are used: a business game, work in small groups, a round table.

I. Goals and objectives of mastering the discipline

Objective: to master the basic methods used in modern biological sciences that study the structure and functions of proteins; to study their theoretical foundations and apply them in practical classes for the further use of universal technologies by students in their future scientific work.

Tasks:

1. To form students' knowledge of the methods used in the study of cell and molecular biology.
2. To develop students' ability to choose the most suitable method(s) for solving a specific problem from the group of methods of cell and molecular biology.
3. To provide students with the skills necessary to carry out the methods used in the study of cell and molecular biology.

For successful study of the discipline, students should have the following preliminary competencies:

-Provides knowledge of the basics of interaction between organisms and their environment, environmental factors and mechanisms of response of organisms, principles of population ecology, ecology of communities; fundamentals of the organization and stability of ecosystems and the biosphere as a whole;

•develops methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems;

-comprehends the principles of structural and functional organization of biological systems.

Students' Competencies, Indicators of Their Achievement and Learning Outcomes in the Discipline

Code and name of the competency (result of mastering)	Code and name of the competency indicator
PC-6 Able to use modern knowledge and methods of genetics, molecular and cellular biology to solve professional problems	PP-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems
	PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes
	PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology
	PC-6.4 Able to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis
PC-3 Capable of conducting experimental studies of biologically active substances and developing medicines and	PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances
	PC-3.2 Able to apply molecular modeling methods for the

medical devices	development of drugs and medical devices
	PC-3.3 Capable of developing medicines and medical devices using pharmacological research methods and pharmaceutical technologies
	PC-3.4 Capable of developing nanosystems for the creation of medicines and medical devices
	PC-3.5 Capable of conducting preclinical trials of drugs and medical devices

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
PP-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems	Knows Modern methods of genetics and molecular and cellular biology for the study of living systems. Can Conduct research in genetics and molecular and cellular biology to study living systems. Owns skills in the use of research methods in the field of genetics and molecular and cellular biology for the study of living systems.
PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes	Knows Methods of diagnosing pathological conditions. Can to use fundamental knowledge and biophysical methods to diagnose pathological conditions. Owns skills in the application of fundamental knowledge and biophysical methods for the diagnosis of pathological conditions.
PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology	Knows Methods of diagnosing pathological conditions. Can to use fundamental knowledge and biophysical methods to diagnose pathological conditions. Owns skills in the application of fundamental knowledge and biophysical methods for the diagnosis of pathological conditions.
PC-6.4 Able to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis	Knows research methods in the field of clinical laboratory diagnostics, molecular-genetic and cytological research methods. Can perform research in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies. Owns ability to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis.
PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances	Knows Methods of Physiology, Biochemistry, Molecular and Cellular Biology. Can use the methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances. Owns

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
	skills of knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances.
PC-3.2 Able to apply molecular modeling methods for the development of drugs and medical devices	Knows Molecular Modeling Methods. Can Apply molecular modeling methods. Owns molecular modeling methods for the development of medicines and medical devices.
PC-3.3 Capable of developing medicines and medical devices using pharmacological research methods and pharmaceutical technologies	Knows methods of pharmacological research and pharmaceutical technologies. Can Apply pharmacological research methods and pharmaceutical technologies. Owns ability to develop medicines and medical devices.
PC-3.4 Capable of developing nanosystems for the creation of medicines and medical devices	Knows methods of pharmacological research and pharmaceutical technologies. Can apply development methods to the creation of medicines and medical devices. Owns the ability to develop nanosystems for the creation of medicines and medical devices.
PC-3.5 Capable of conducting preclinical trials of drugs and medical devices	Knows methods of preclinical testing of medicines and medical devices. Can conduct preclinical trials of medicines and medical devices. Owns skills in conducting preclinical trials of medicines and medical devices.

II. Labor intensity of the discipline and types of training in the discipline

The total labor intensity of the discipline is 4 credit units (144 academic hours).

Types of training sessions and work of a student in the discipline can be:

Designation	Types of Study Sessions and Student Work
Mild	Lecture
Lab	Labs
Ave	Practical exercises
WED	Student's independent work during the period of theoretical training
Control	Independent work of the student and contact work of the student with the teacher during the period of intermediate certification

III. Structure of the discipline

The form of study is full-time.

№	Section Name Discipline	Semester	Number of hours by type of training and work of the student						Forms of intermediate attestation
			Mild	Lab	Ave	OK	WED	Control	
1	Section 1. Genetic Engineering	6	4	4	8	-	45	27	Exam Questions
2	Section 2. Protein expression.	6	5	5	10	-			Exam Questions
3	Section 3. Protein purification.	6	5	5	10	-			Exam Questions
4	Section 4. Crystallization of proteins.	6	4	4	8	-			Exam Questions
	Total:	6	18	18	36	-	45	27	exam

IV. THE CONTENT OF THE THEORETICAL PART OF THE COURSE

Lecture

Section 1. Genetic Engineering

Gene Expression Machinery in Pro and Eukaryotic Cells. Transcription, translation, post-translational modifications, transport of membrane proteins after translation in pro- and eukaryotes. Replication, origin of replication, horizontal transfer, vectors for genetic engineering, plasmid compatibility groups, plasmid copying, site-directed mutagenesis. Polymerase chain reaction. Primer design. Point mutations, superimposition/overlap PCR, agarose gel electrophoresis.

Section 2. Protein expression.

Types of expression systems. Expression in E. coli, yeast systems, baculovirus expression, expression in mammals, cell-free expression. Signal sequences, expression drivers, sequences for detection and purification of recombinant proteins. Expression conditions: temperature, pH, duration, metabolic and non-metabolic additives. Baculovirus expression system. Flow cytometry. Colloidal solutions of polymers

(DNA, proteins, PEGs), detergents, lipids, fats, and their mixtures. Finely dispersed foams.

Section 3. Protein purification.

Methods for isolating a homogeneous protein preparation. Lysis methods. Solubilization. The main detergents, their CCM, HLB, and features. Typical chromatographic resins. Affinity resins. Principle C-P-P. Non-chromatographic methods: density gradient SCF, selective CA deposition, preparative electrophoresis in immobilized and mobile media. Immunoblotting, affinity, and monoclonal antibodies. Protein stabilization methods, ligands, cross-linking agents, proteases and their inhibitors. Refolding. Methods for measuring the ligand binding constant. Methods for testing the functionality of a protein produced by heterologous expression.

Section 4. Crystallization of proteins.

Basic methods of protein crystallization. Cubic mesophase and its properties. Diffusion of proteins in it, FRAP. Crystal visualization methods. Elements of nonlinear optics. SONICC. Structural studies. X-ray, NMR, transmission cryo-electron microscopy. Methods for studying the dynamics of proteins. (19F-NMR, HDX).

V. CONTENT OF THE PRACTICAL PART OF THE COURSE AND INDEPENDENT WORK

Practical exercises

Topic 1. Polymerase chain reaction. Primer design. Point mutations, overlap/overlap PCR, agarose gel electrophoresis.

Topic 2. Flow cytometry. Colloidal solutions of polymers (DNA, proteins, PEGs), detergents, lipids, fats, and their mixtures. Fine foams.

Non-chromatographic methods: density gradient SCF, selective CA deposition, preparative electrophoresis in immobilized and mobile media.

Topic 3. Immunoblotting, affinity, and monoclonal antibodies.

Topic 4. Protein stabilization methods, ligands, cross-linking agents, proteases and their inhibitors. Refolding. Methods for measuring the ligand binding constant.

Topic 5. Methods for testing the functionality of a protein produced by heterologous expression.

Topic 6. X-ray, NMR, transmission cryo-electron microscopy. Methods for studying the dynamics of proteins. (19F-NMR, HDX).

Labs

Topic 1. DNA extraction.

Topic 2. DNA quality analysis by spectrophotomerism and electrophoresis.

Topic 3. RNA isolation.

Topic 4. RNA quality analysis by spectrophotomerism and electrophoresis.

Topic 5. Reverse transcription, cDNA acquisition

Topic 6. Polymerase chain reaction on the gDNA and cDNA template.

Topic 7. Analysis of the results of the PCR reaction by electrophoresis, determination of the molecular weight of fragments.

Topic 8. Fixation of cells and tissues.

Topic 9. Pouring tissue samples into paraffin, preparing blocks.

Topic 10. Microtome and cryotome device. Obtaining thick and semi-thin tissue sections.

Topic 11. Fabrication of cell and tissue preparations.

Topic 12. Cell structure, methods of morphological staining of cells and tissues.

Topic 13. Analysis of microscopic specimens.

Topic 14. Staining of cells and tissues with fluorescent dyes.

Topic 15. Analysis of fluorescent microscopic specimens.

Self-paced work

Topics for self-study:

1. Bacteriophages T7, T4, lambda and their lytic cycles.
2. Transposons and retrotransposons. Their structure and functions in the genome.
3. How the diversity of antibodies is formed".
4. Features of molecular dynamics of eukaryotic cytoskeletal components.
5. Composition of human DNA.
6. Mutations, types of mutations.
7. Adaptive hypothesis of the implementation of the genetic code. Structure and properties of transfer RNAs.
8. Diseases caused by different types of mutations.

Abstract Topics

1. Structure and physicochemical properties of DNA. Characterization of the B-form of DNA.

2. Alternative forms of the DNA double helix. Characteristics of the Z-form and its biological significance.

3. DNA supercoiling. Characterization of DNA topoisomerases.

4. Nucleosomal structure of chromatin. Euchromatin and heterochromatin.

5. Characterization of DNA polymerases in prokaryotes.

6. Characterization of DNA polymerases in eukaryotes.

7. Replication fork structure. Characterization of proteins involved in *replication in E. coli.*

8. Telomerase, the mechanism of replication of the ends of linear chromosomes.

9. Replication of circular DNA molecules: θ-structure, D-loop formation, and rolling ring-type replication.

10. Regulation of replication initiation in E.coli. Structure of the replication start area (ori C).

11. Mechanism of lambda phage integration into bacterial chromosome (site-specific recombination).

12. Homologous Recombination Model: Formation of Holliday Structures, Heteroduplecs, Branch Migration, and Resolution of Formed Structures.

13. Role of RecA, Rec BCD and Ruv ABC proteins in recombination in E. coli.

14. The role of recombination in post-replicative repair.

15. Excision repair with uvr ABC proteins.

16. Direct repair of thymine dimers and alkylated bases.

17. SOS reparation mechanism.

18. Repair of improperly paired bases with the help of the Mut HLS protein complex.

19. Characteristics of mobile genetic elements of prokaryotes: structure, genes and their products.

20. Characteristics of mobile genetic elements of eukaryotes: structure, genes and their products.

21. Mechanism of transposition of retrovirus-like retrotransposons.

22. Characteristics and method of moving LINE and SYNE elements.

23. Structure and functioning of Ty-elements of yeast.

24. Structure and functioning of Ac- and Ds-elements of maize.

1. Features of the structure of E. coli RNA polymerase: cort-enzyme and holoenzyme. Alternative sigma factors.

2. Stages of the transcription cycle: initiation, elongation, and termination.

3. The structure of the bacterial promoter and the mechanism of its recognition.

4. Regulation of transcription in prokaryotes on the example of the lactose operon: the role of the protein repressor and the BAC protein.

5. Transcription of eukaryotic genes by RNA polymerase I.

6. Transcription of eukaryotic genes by RNA polymerase II.

7. Transcription of eukaryotic genes by RNA polymerase III.

8. Protein domain that recognizes specific DNA sequences - helix-helix: structure, occurrence in regulatory proteins of pro- and eukaryotes.

9. Structure of DNA-binding domains of eukaryotic transcription factors (homeodomain, "leucine lightning", "zinc fingers").

10. RNA processing: modification of the 5′ and 3′ ends of transcripts (in mRNA, tRNA molecules); The value of these modifications.

11. Small Nuclear RNAs (snRNAs) and Small Nuclear Particles – Structure and Functions.

12. Structure and mechanism of spliceosome functioning.

13. Mechanism of RNA autosplicing in lower eukaryotes.

14. tRNA processing in prokaryotes and eukaryotes

15. rRNA processing in pro- and eukaryotes. Aminoacylation of tRNA as an initial stage of translation. Aminoacyl-tRNA synthetase, mechanism of action.

16. Characterization of ribozymes (L-19 RNA, RNase P, etc.) and reactions catalyzed by them.

17. Initiation of translation in prokaryotes.

18. Initiation of translation in eukaryotes.

19. Elongation and termination, broadcasting.

20. Synthesis of proteins with N-signal sequence; A PSA particle and its receptor.

21. Transmission of information across the cell membrane: the role of G-proteins and protein kinases.

22. Molecular chaperones of the Hsp 60 family.

23. Molecular chaperones of the Hsp 70 family.

24. Genome Organization: Homologous Gene Families and Their Characteristics.

VI. MONITORING THE ACHIEVEMENT OF THE COURSE OBJECTIVES

Item No.	Supervised sections/topics of the discipline	Code and name of the indicator of achievement	Learning Outcomes	Evaluation Tools	
				Current control	Intermediate Certification
1	Section 1. Genetic Engineering	PP-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems	Knows Modern methods of genetics and molecular and cellular biology for the study of living systems. Can Conduct research in genetics and molecular and cellular biology to study living systems. Owns skills in the use of research methods in the field of genetics and molecular and cellular biology for the study of living systems.	Oral questioning, practical lesson	Test, exam
		PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes	Knows Methods of diagnosing pathological conditions. Can to use fundamental knowledge and biophysical methods to diagnose pathological conditions. Owns skills in the application of fundamental knowledge and biophysical methods for the diagnosis of pathological conditions.		
2		PC-6.3 Able to develop clinical diagnostic	Knows Methods of diagnosing pathological conditions.	Oral questioning,	Test, exam

	Section 2. Protein expression. Section 3. Protein purification.	systems using knowledge and methods of genetics, molecular and cellular biology	Can to use fundamental knowledge and biophysical methods to diagnose pathological conditions. Owns skills in the application of fundamental knowledge and biophysical methods for the diagnosis of pathological conditions.	practical lesson	
		PC-6.4 Able to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis	Knows research methods in the field of clinical laboratory diagnostics, molecular-genetic and cytological research methods. Can perform research in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies. Owns ability to perform studies in the field of clinical laboratory diagnostics, molecular-genetic and cytological studies in order to identify the causes of the disease and make a diagnosis.		
3	Section 3. Protein purification.	PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances	Knows Methods of Physiology, Biochemistry, Molecular and Cellular Biology. Can use the methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances. Owns skills of knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances.	Oral questioning, practical lesson	Test, exam
		PC-3.2 Able to apply molecular modeling methods for the	Knows Molecular Modeling Methods. Can		

		development of drugs and medical devices	Apply molecular modeling methods. Owns molecular modeling methods for the development of medicines and medical devices.		
4	Section 4. Crystallization of proteins.	PC-3.3 Capable of developing medicines and medical devices using pharmacological research methods and pharmaceutical technologies	Knows methods of pharmacological research and pharmaceutical technologies. Can Apply pharmacological research methods and pharmaceutical technologies. Owns ability to develop medicines and medical devices.	Oral questioning, practical lesson	Test, exam
		PC-3.4 Capable of developing nanosystems for the creation of medicines and medical devices	Knows methods of pharmacological research and pharmaceutical technologies. Can apply development methods to the creation of medicines and medical devices. Owns the ability to develop nanosystems for the creation of medicines and medical devices.		
		PC-3.5 Capable of conducting preclinical trials of drugs and medical devices	Knows methods of preclinical testing of medicines and medical devices. Can conduct preclinical trials of medicines and medical devices. Owns skills in conducting preclinical trials of medicines and medical devices.		

VII. EDUCATIONAL AND METHODOLOGICAL SUPPORT OF STUDENTS' INDEPENDENT WORK

Guidelines for writing and formatting an abstract

Abstracting of educational and scientific literature involves an in-depth study of individual scientific works, which should ensure the development of the necessary skills for working on the book. All this will contribute to the expansion of scientific horizons, the improvement of their theoretical training, and the formation of scientific competence.

Textbooks, individual monographic studies and articles on issues provided for by the program of the academic discipline are offered for abstracting. When selecting literature on the chosen issue, it is necessary to cover the most important areas of development of this science at the present stage. Particular attention should be paid to those literary sources that (directly or indirectly) can help the specialist in his practical activities. However, this section also includes works and individual studies on issues that go beyond the discipline being studied. It is recommended to use this literature if you want to expand your knowledge in any branch of science.

Along with literature on general issues, students are supposed to read literature taking into account the profile of their professional activity, obtained independently. Not all the proposed literature is equal in content and volume, so different approaches to its study are possible. In one case, it can be a general abstract of several literary sources of different authors devoted to the consideration of the same issue, in the other case, it can be a detailed study and abstract of one of the recommended works or even its separate sections, depending on the degree of complexity of the issue (problematic). In order to decide what to do in each case, you should consult with the teacher.

The choice of a specific work for the abstract should be preceded by a detailed acquaintance with the list of all literature given in the curriculum of the discipline. It is recommended to first familiarize yourself with the selected work by looking at the subheadings, highlighted texts, diagrams, tables, and general conclusions. Then it is necessary to read it carefully and thoughtfully (delving into the ideas and methods of the author), making notes on a separate sheet of paper about the main provisions and key issues. After reading, you should think over the content of the article or a separate chapter, paragraph (if we are talking about a monograph) and briefly write it down. Only strict definitions and formulations of laws should be written out verbatim. Sometimes it's helpful to include one or two examples to illustrate. In the event that there are unclear passages, it is recommended to read the following exposition, as it can help to understand the previous material, and then return to the comprehension of the previous exposition.

The result of the work on literary sources is an abstract.

When preparing an abstract, it is necessary to highlight the most important theoretical provisions and substantiate them independently, paying attention not only to the result, but also to the methodology used in the study of the problem. Reading scientific literature should be critical. Therefore, it is necessary to strive not only to assimilate the main content, but also the method of proof, to reveal the features of different points of view on the same issue, to assess the practical and theoretical significance of the results of the reviewed work. A very desirable element of the abstract is the expression by the listener of his own attitude to the ideas and conclusions of the author, supported by certain arguments (personal experience, statements of other researchers, etc.).

As mentioned above, abstracts of monographs and journal articles of a research nature must contain a definition of the problem and specific objectives of the research, a description of the methods used by the author, as well as the conclusions that he came to as a result of the research. The proposed literature for abstracting is constantly updated.

Instructions for writing essays:

General requirements for the abstract:

The abstract should be written according to the standard scheme, including:

- Title page
-contents
-introduction
- Main part
- Conclusionof the E
- List of references.

It is desirable to include tables and (or) figures in the text of the abstract: diagrams, graphs.The volume of the abstract: 10-20 pages of A4 format computer layout in the Times New Roman editor, with 1.5 intervals, in 14 fonts. The title of the topic of the essay should fully correspond to the chosen option.

The structure of the abstract should meet the standard requirements for writing essays: introduction, justification for the choice of topic, presentation of the topic, conclusion. More detailed requirements for the written design of the abstract are presented in the Procedure "Requirements for the design of written works performed by FEFU students and attendees" http://law.wl.dvgu.ru/docs/treb_2012.pdf

Approximate list of abstract topics:

1. Mechanisms of energy production in mitochondria.
2. The liver is its role for the human body.
3. Alcoholism and drug addiction are metabolic disorders.
4. Influence of trace elements on enzyme activity.
5. Metabolic connections of the Krebs cycle.
6. Types of jaundice.

7. Biotransformation of xenobiotics in the body.
8. Cholesterol fund in the human body and ways of its consumption.
9. Biological role of iron, molybdenum and zinc.

Criteria and Indicators Used in the Evaluation of the Educational Essay

Criteria	Indicators
1. Novelty of the abstracted text Max. - 5 points	- relevance of the problem and topic;- novelty and independence in the formulation of the problem, in the formulation of a new aspect of the problem selected for analysis;- the presence of the author's position, independence of judgments.
2. Degree of disclosure of the essence of the problemMax. - 5 points	- correspondence of the plan to the topic of the abstract;- correspondence of the content to the topic and plan of the abstract;- completeness and depth of disclosure of the main concepts of the problem;- validity of ways and methods of working with the material;- ability to work with literature, systematize and structure the material;- ability to generalize, compare different points of view on the issue under consideration, argue the main provisions and conclusions.
3. Reasonableness of the choice of sourcesMax. - 5 points	- the range and completeness of the use of literary sources on the problem;- attraction of the latest works on the problem (journal publications, materials of collections of scientific papers, etc.).
4. Compliance with Registration Requirements Max. – 5 points	- correct formatting of references to the literature used;- literacy and culture of presentation;- knowledge of terminology and conceptual apparatus of the problem;- compliance with the requirements for the volume of the abstract;- culture of design: highlighting paragraphs.
5. Literacy Max. - 5 points	- absence of spelling and syntax errors, stylistic errors;- absence of typos, abbreviations of words, except for generally accepted ones;- literary style.

Guidelines for Maintenance, Submission Requirements and Criteria for Evaluating the Outline

A synopsis (from the Latin conspectus – review) is a written text in which the content of the main source of information is briefly and consistently stated. To take notes is to bring to some order the information gleaned from the original. The process is based on the systematization of what has been read or heard. Notes can be made both in the form of precise excerpts, quotations, and in the form of a free presentation of meaning. The manner of writing the synopsis, as a rule, is close to the style of the original source. If the synopsis is written correctly, it should reflect the logic and semantic connection of the information being recorded.

In well-made notes, it is easy to find specialized terminology that is clearly explained and clearly highlighted for memorizing the meanings of various words. Using the outline information, it is easier to create meaningful creative or scientific works, various essays and articles.

Note-taking rules

1. Read the text carefully. Along the way, mark incomprehensible places, new words, names, dates.

2. Make inquiries about the persons and events mentioned in the text. When recording, do not forget to put reference data in the fields.

3. When reading the text for the first time, make a simple outline. When re-reading, try to summarize the main points of the text, noting the author's arguments.

4. The final stage of note-taking consists of re-reading the previously marked passages and writing them down consecutively.

5. When taking notes, you should try to express the author's thought in your own words.

6. Strive to ensure that one paragraph of the author's text is conveyed in one, maximum two sentences.

When taking notes of lectures, it is recommended to adhere to the following basic rules.

1. Do not start writing down the material from the first words of the teacher, first listen to his thought to the end and try to understand it.

2. Start writing at the moment when the teacher, having finished the presentation of one idea, begins to comment on it.

3. In the synopsis, it is necessary to highlight individual parts. It is necessary to distinguish between headings, subheadings, conclusions, to separate one topic from another. Selection can be done with an underline or a different color (just don't turn the text into colorful pictures). It is recommended to indent paragraphs and points of the plan, white lines to separate one thought from another, and numbering. If definitions, formulas, rules, and laws can be made more visible in the text, they are framed. Over time, you'll have your own selection system.

4.Create your entries using accepted conventions. When taking notes, be sure to use a variety of signs (they are called signal signs). These can be pointers and directional arrows, exclamation and question marks, combinations PS (afterword) and NB (pay attention). For example, you can denote the word "therefore" with a mathematical arrow =>. Once you've developed your own character set, it's easier and faster to create an outline and then study it.

5. Don't forget about abbreviations (abbreviated words), equal and inequality signs, more and less.

6. Abbreviations are very useful for creating a correct outline. Be careful, though. Connoisseurs believe that abbreviations such as "d-t" (to think) and similar ones should not be used, since later a large amount of time is spent on deciphering, and after all, the reading of the synopsis should not be interrupted by extraneous actions and reflections. The best thing to do is to develop your own system of abbreviations and use them to denote the same words (and nothing else) in all entries. For example, the abbreviation

"g-t" will always and everywhere be the word "to speak," and the capital "P" will be the word "work."

7. Undoubtedly, foreign words will help to organize a good synopsis. The most common among them are English. For example, the abbreviated "ok" successfully denotes the words "excellent", "wonderful", "good".

8. Complex and lengthy reasoning should be avoided.

9. When taking notes, it is better to use declarative sentences, avoid independent questions. Questions are appropriate in the margins of the outline.

10. Do not try to record the material verbatim, in this case the main idea is often lost, and it is difficult to keep such a record. Discard secondary words, without which the main idea is not lost.

11. If there are terms in the lecture that you do not understand, leave a place, clarify their meaning with the teacher after the lesson.

Evaluation criteria:

86-100 points are given to the student if the abstract is presented in the most understandable form, has a plan, schemes and drawings in the structure, reveals all the basic concepts and questions given above;

76-85 points are given to the student if the abstract is presented in a sufficiently understandable form, has schemes and/or drawings in the structure, reveals more than half of the main concepts and questions;

75-61 points are given to the student if the abstract is presented in a relatively understandable form and reveals half of the main concepts and questions;

60-50 points are given to the student if the outline is presented in an incomprehensible form and reveals less than half of the main concepts and questions.

VIII. LIST OF EDUCATIONAL LITERATURE AND INFORMATIONAL AND METHODOLOGICAL SUPPORT OF THE DISCIPLINE

Reference citations

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Further reading

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List of resources of the information and telecommunication network "Internet"

1. http://elibrary.ru/ - Scientific Electronic Library
2. http://molbiol.ru/ - Molecular Biology Information Resource
3. http://macroevolution.narod.ru/ is an electronic resource on evolutionary biology.
4. http://science.km.ru/ - electronic resource on different sections of biology
5. http://elementy.ru/ is an informational and educational resource dedicated to natural sciences.
6. http://www.iprbookshop.ru/ is **the IPRbooks electronic library system.**
7. http://znanium.com/ - EBS "Znanium".
8. https://nplus1.ru/ - N+1, a popular science online publication about science, engineering and technology
9. http://antropogenez.ru/ is a popular science information resource about human evolution
10. http://web.a.ebscohost.com/ehost/search/basic?sid=851485f8-6200-4b3e-aaab-df4ba7be3576@sessionmgr4008&vid=1&tid=2003EB is a collection of books on various sections from the EBSCOhost database.
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14. http:// www.ebi.ac.uk- website of the European Bioinformatics Institute
15. http:// www.scopus.com – Scopus bibliographic database and citation index
16. http://thomsonreuters.com/thomson-reuters-web-of-science/ Web of Science bibliographic database and citation index

List of information technologies and software

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2. 7Zip 16.04 - free file archiver with high data compression ratio;
3. Adobe Acrobat XI Pro is a software package for creating and viewing electronic publications in PDF format;
4. ESET Endpoint Security 5 is a comprehensive protection solution for Windows-based workstations. Virtualization support + new technologies;

5. WinDjView 2.0.2 is a program for recognizing and viewing files with the same DJV and DjVu formats; SolidWorks 2016 is a CAD software package for automating the work of an industrial enterprise at the stages of design and technological preparation of production
6. Notepad++ 6.68 – Text Editor

IX. METHODICAL INSTRUCTIONS FOR MASTERING THE DISCIPLINE

Lecture

The lecture is the- main active form of classroom classes, the explanation of the fundamental and most difficult theoretical sections of molecular biology and the theory of genetic engineering, which involves intensive mental activity of the student and is especially important for mastering the subject. A lecture should always be cognitive, developmental, educational and organizing. Lecture notes help to assimilate the theoretical material of the discipline. When listening to a lecture, you need to take notes main information, preferably with your own wording, which allows you to better remember the material. An outline is useful when it is written by the student independently.

In the lecture, the teacher gives only a small part of the material on certain topics that are presented in the textbooks. In addition, the instructor informs students about what additional information can be obtained on the topics discussed, and from what sources. Therefore, when working with lecture notes, it is always necessary to use the main textbooks, additional literature and other recommended sources on this discipline. It is this serious work of the student with the lecture material that allows him to achieve success in mastering new knowledge.

To present a lecture course on the discipline "Methods of Molecular and Cellular Biology", the following are used as forms of active learning: lecture-conversation, lecture-visualization, which are built on the basis of knowledge received by students in the framework of subjects preceding the course. Electronic presentations, tables, video files, and blackboard diagrams are used to illustrate verbal information. In the course of the lecture material, problematic questions or questions with elements of discussion are posed.

Lecture – visualization

The lecture is accompanied by the demonstration of tables, electronic presentations, video files - such a combination of ways of presenting information significantly simplifies its mastering by students. Verbal presentation of the material should be accompanied and combined with the visual form. The information presented in the form of diagrams on the board, tables, slides allows you to form problematic

questions, and contribute to the development of professional thinking of future specialists.

Lecture-conversation

Lecture-conversation, "dialogue with the audience", is the most common form of active learning and allows students to be involved in the educational process, since there is direct contact between the teacher and the audience. Such contact is achieved during the lecture, when students are asked questions of a problematic or informational nature, or when they are invited to ask the teacher questions themselves. Questions are offered to the entire audience, and any of the students can offer their own answer; another can complement it. In the course of the educational process, this allows you to identify the most active students and activate those who do not participate in the work. This form of lecture allows you to involve students in the work process, attract their attention, stimulate thinking, gain collective experience, and learn how to form questions. The advantage of a lecture-conversation is that it allows you to draw students' attention to the most important issues of the topic, determine the content and pace of the presentation of educational material, as well as determine the topics that are most interesting to students, in order to possibly adjust the form of the material taught.

Labs

They are used for conducting experiments, observations of phenomena and processes by students mainly in special laboratories, classrooms and with the use of technical means. This method stimulates action both in the preparation for research and in the process of its implementation. Laboratory work improves the quality of education, contributes to the development of cognitive activity in students, their logical thinking and creative independence. In the process of laboratory work, theoretical knowledge is deepened and concretized, and the ability to apply it in practice is developed. Skills in working with microscopes, tables and atlases are acquired. The student learns to analyze the data obtained, identify the norm and deviation from it, acquires the skills of working with a living object and physiological measuring devices, performing operations, conducting a comparative analysis, summarizing the material obtained and drawing conclusions. All this allows for a deeper understanding of the mechanisms of the functioning of a living organism and the principles of its interaction with the environment. Research skills and professional competencies are formed.

Traditionally, laboratory classes are the main type of training aimed at experimental confirmation of theoretical positions. In the course of a laboratory lesson, students perform one or more laboratory works (tasks) under the guidance of a teacher in accordance with the content of the educational material being studied. Students perform laboratory work aimed at:

- generalization, systematization, deepening of theoretical knowledge on specific topics of the academic discipline;
- formation of skills to accept the acquired knowledge in practical activities;

- development of analytical, design and constructive skills;
- development of independence, responsibility and creative initiative.

Necessary structural elements of the laboratory lesson:

- instruction given by the teacher;
- independent activities of students;
- Discussion of the results of the laboratory work (task).

Before completing the laboratory task (work), the students' knowledge is tested, i.e. their theoretical readiness to perform the task.

A laboratory task (work) can be reproductive, partially exploratory and exploratory in nature.

Works of **a reproductive** nature are distinguished by the fact that when conducting them, students use detailed instructions, which indicate: the purpose of the work, explanations (theory, main characteristics), equipment, apparatus, materials and their characteristics, the procedure for performing the work, tables, conclusions (without formulations), control questions, educational and special literature.

The works, which are of a **partial-exploratory** nature, are distinguished by the fact that during the conduct of the works, students do not use detailed instructions, they are not given the order of performing the necessary actions, students are required to independently select equipment, choose ways to perform work, instructive and reference literature.

Exploratory works are distinguished by the fact that students have to solve a problem that is new to them, relying on their theoretical knowledge.

The forms of organization of students for conducting a laboratory lesson - frontal, group and individual - are determined by the teacher, based on the topic, goal, and order of work. In the frontal form of organizing classes, all students do the same work. In the group form of organizing classes, the same work is carried out in teams of 2-5 people. With an individual form of organizing classes, each student performs an individual task.

The results of the laboratory task (work) are drawn up by students in the form of a report, the grades for the performance of the laboratory task (work) are indicators of the current performance of students in the academic discipline.

Research skills and professional competencies are formed.

Colloquia

Colloquium is a collective form of consideration and consolidation of educational material. Colloquia is one of the types of practical classes designed for in-depth study of the discipline, held in an interactive mode. In the classes on the topic of the colloquium, questions are analyzed, and then, together with the teacher, they are discussed, which is aimed at consolidating the material, forming polemic skills, developing independence and critical thinking, the ability of students to navigate in large information flows, to develop and defend their own position on problematic issues of the academic discipline.

As methods of interactive learning at colloquiums, the following are used: an extended conversation, a dispute, a press conference.

An extended conversation involves the preparation of students on each issue of the lesson plan with a single list of recommended mandatory and additional literature. Reports are prepared by students on a pre-proposed topic.

A dispute in a group has a number of advantages. A dispute can be caused by the teacher during the lesson or planned by him in advance.

Press conference. The teacher assigns several students to prepare short (thesis) reports. After the presentations, students ask questions, which are answered by the speakers and other members of the expert group. Based on the questions and answers, a creative discussion unfolds together with the teacher.

Case study method**.**The case-study method is a method of active problem-situational analysis based on learning by solving specific problems (case solving). The method of specific situations (case-study method) refers to non-game imitation active teaching methods and is considered as a tool that allows you to apply theoretical knowledge to solving practical problems. At the end of the lesson, the teacher tells a series of situations and offers to find solutions for those problems that are voiced in them. At the same time, the problem itself does not have unambiguous solutions. Students must analyze the situation, understand the essence of the problems, propose possible solutions and choose the best one. Thanks to the knowledge gained at the lecture, it is easy for the student to correlate the theoretical knowledge received with a real practical situation. As an interactive teaching method, it gains a positive attitude from students, who see it as an opportunity to take the initiative, feel independent in mastering theoretical provisions and mastering practical skills. No less important is the fact that the analysis of situations has a strong impact on the professionalization of students, contributes to their maturation, forms interest and positive motivation for learning. The method is aimed not so much at mastering specific knowledge or skills, as at developing the general intellectual and communicative potential of the student and the teacher.

It is a learning method designed to improve skills and gain experience in the following areas:

- identifying, selecting and solving problems;
- working with information – comprehending the meaning of the details described in the situation;
- analysis and synthesis of information and arguments;
- working with assumptions and conclusions;
- evaluation of alternatives;
- decision-making;
- Listening to and understanding other people is a group work skill. The main function of the case method is to teach students to solve complex unstructured

problems that cannot be solved in an analytical way. The case activates students, develops analytical and communicative skills, leaving students face to face with real situations.

The case study is designed to increase the effectiveness of educational activities: as an illustration for solving a certain problem, explaining a particular phenomenon, studying the features of its manifestations in real life, developing competence aimed at solving various life and work situations (the use of the case involves individual and group work of students).

Brainstorming is a widely used way of generating new ideas to solve scientific and practical problems. Its goal is to organize collective thinking to find non-traditional ways to solve problems.

The use of the brainstorming method in the educational process allows you to solve the following tasks:

- creative assimilation of educational material by students;
- connection of theoretical knowledge with practice;
- • activation of educational and cognitive activities of students;
- formation of the ability to concentrate attention and mental efforts on the solution of an urgent task;
- formation of the experience of collective thinking activity.

The problem formulated in the brainstorming class should have theoretical or practical relevance and arouse the active interest of students. A common requirement that must be taken into account when choosing a problem for brainstorming is the possibility of many ambiguous solutions to the problem, which is put forward to students as a learning task.

Quizzes & Testing

Current control of material assimilation is assessed by oral answers, tests, as well as paper testing.

Assessments of laboratories, colloquiums, tests and testing mainly form the grade for this discipline.

MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE

Logistical and software of the discipline

Name of special rooms and rooms for independent work	Equipment of special rooms and rooms for independent work	List of licensed software. Details of the supporting document
Lecture hall: 690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 421	DLP projector, 3000 ANSI Lm, WXGA 1280x800, 2000:1 EW330U Mitsubishi; CORSA-2007 Tuarex Specialized Equipment	Windows Seven Enterprice SP3x64 (Microsoft License Number Standard Enrollment 62820593. End date: 2020-06-30. Campus 3 Parent Program 49231495. Reseller: JSC "Softline Trade"

	Fastening Subsystem; Video Switching Subsystem: Extron DXP 44 DVI Pro DVI Matrix Switcher; Extron DVI 201 Tx/Rx twisted-pair DVI extender Audio switching and sound amplification subsystem; Extron SI 3CT LP Ceiling Mount Speaker System Extron DMP 44 LC Digital Audio Processor; extension for IPL T CR48 control controller.	Reseller Order Number: Tr000270647-18.) Eset NOD32 Antivirus 4.2.76.1 (Contract No. EA-091-18 dated 24.04.2018. Microsoft Office 2010 Professional Plus 14.0.6029.1000 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Microsoft Office Professional Plus 2013 15.0.4420.1017 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Google Chrome 42.0.2311.90 (Free Software)
Computer class of the School of Biomedicine aud. M723, 15 workplaces	Electric Screen 236*147cm Trim Screen Line; DLP projector, 3000 ANSI Lm, WXGA 1280x800, 2000:1 EW330U Mitsubishi; CORSA-2007 Tuarex Specialized Equipment Fastening Subsystem; Video Switching Subsystem: Extron DXP 44 DVI Pro DVI Matrix Switcher; Extron DVI 201 Tx/Rx twisted-pair DVI extender Audio switching and sound amplification subsystem; Extron SI 3CT LP Ceiling Mount Speaker System Extron DMP 44 LC Digital Audio Processor; extension for IPL T CR48 control controller; Wireless LAN for students is provided by a system based on 802.11a/b/g/n 2x2 MIMO(2SS) access points. Моноблок HP ProOne 400 All-in-One 19.5	Microsoft Office Professional Plus 2013 is an office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.); 7Zip 16.04 - free file archiver with high data compression ratio; Adobe Acrobat XI Pro is a software package for creating and viewing electronic publications in PDF format; AutoCAD Electrical 2015 - three-dimensional computer-aided design and drafting system; ESET Endpoint Security 5 is a comprehensive protection solution for Windows-based workstations. Virtualization support + new technologies; WinDjView 2.0.2 is a program for recognizing and viewing files with the same DJV and DjVu formats; SolidWorks 2016 is a CAD software package for automating the work of an industrial enterprise at the stages of design and technological preparation of production

	(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	Compass-3D LT V12 - Three-Dimensional Simulation System Notepad++ 6.68 – Text Editor
Classrooms for self-study: Reading rooms of the FEFU Scientific Library with open access to the 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,VT,usb kbd/mse,Win7Pro (64-bit)+Win8.1Pro(64-bit),1-1-1 Wty Internet access speed 500 Mbps. Workplaces for people with disabilities are equipped with displays and Braille printers; equipped with: portable devices for reading flat-printed texts, scanning and reading machines, a video magnifier with the ability to adjust color spectrums; magnifying electronic magnifiers and ultrasonic markers.	Windows Seven Enterprice SP3x64 (Microsoft License Number Standard Enrollment 62820593. End date: 2020-06-30. Campus 3 Parent Program 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Eset NOD32 Antivirus 4.2.76.1 (Contract No. EA-091-18 dated 24.04.2018. Microsoft Office 2010 Professional Plus 14.0.6029.1000 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Microsoft Office Professional Plus 2013 15.0.4420.1017 (Microsoft License Number Standard Enrollment 62820593. End Date 2020-06-30. Parent Program Campus 3 49231495. Reseller: JSC "Softline Trade" Reseller Order Number: Tr000270647-18.) Google Chrome 42.0.2311.90 (Free Software)
Classrooms for practical and laboratory work: 690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 432, 431	Laboratory of Biochemistry: Dry-air thermostat MIR-262; Pioneer Precision Scales (PA413); Laboratory centrifuge LMC-4200R; MSH-300i Magnetic Stirrer with Thermal Regulation; Distiller GFL-2008; Electric stove Mechta 111H; Spectrophotometer with BioSpectrometer-	

	kinetic Sample Processing Accessories Mkmed-5 medical microscope, Hematology Analyzer XP-300 Panchenkov's apparatus Goryaev's Chamber Laboratory counter S-5 DocUReader 2 Pro Urine Analyzer Photometer KFK-Z-01—"ZOMZ" photovoltaic Wash StatFax 2600 Shaker Thermostat ST-3M Medical Photometers for iMark microplates	