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
Head of Educational Program
_____ V.V. Kumeiko
(Signed) (Surname)

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

WORK PROGRAM OF THE DISCIPLINE
Genomic Medicine
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 the Russian Federation dated 07.08.2020 No. 9 20

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

Reverse side of the title page of the RPD

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

Genomic Medicine

The total labor intensity of the discipline is 4 credit units / 144 academic hours. It is a discipline of the elective part of the EP, studied in the 4th year and ends *with an exam.* The curriculum provides for lectures in the amount of 18 hours, practical *36* hours, and also allocated hours for independent work of the student - *90 hours.*

Language: Russian.

Objective: to form an in-depth understanding of the origins, methods and trends in the modern discipline of "genomic medicine", competencies in the implementation of molecular biology methods, as well as basic knowledge in medical genomics, either necessary for the subsequent practical activities of a doctor facing an expanding range of diseases caused by genetic disorders, or using the knowledge of genetic medicine for diagnosis and/or treatment.

Tasks:

1) acquisition by students of knowledge in the field of molecular biology, molecular genetics and genomics, a systematic understanding of the influence of the genome and genetically encoded phenotypes on health and pathogenesis;

2) to develop students' practical knowledge, skills and abilities to help them apply genomic medicine approaches, such as the identification of genetic disorders in patients;

3) mastering knowledge about promising methods of genomic medicine introduced into medical practice in the world;

4) formation of motivation for research related to genomics, transcriptomics, epigenetics, proteomics and metabolomics;

5) knowledge of the basics and trends in the development of legislation in connection with genomic information, review of international and national legal standards;

6) teaching students basic methods of working with genomic information in the context of human health and pathogenesis;

7) formation of skills in studying scientific literature and official statistical reviews.

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

- anduses the knowledge and methods of genetics, molecular and cellular biology to study living systems;

- anduses fundamental knowledge and biophysical methods to diagnose pathological conditions;

-conducts fundamental and relevant research in molecular genetics, genetic and bioengineering, and molecular and biomedical technologies.

Competencies are obtained as a result of studying the disciplines of *medical biotechnology*, human genetics*, molecular genetics*.

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

Task type	Code and name Competencies (result of mastering)	Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
Research & Development	PC-4 Able to understand and analyze, and apply the principles of cellular and tissue organization of biological objects, biochemical and molecular-biological mechanisms of the development of pathological processes in cells and tissues of the human body to preserve the health of the population	PC-4.1 Analyzes the biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body and applies the principles of cellular organization of biological objects	Knows biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body. Can apply the principles of cellular organization of biological objects. Owns skills of determining the biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body.
		PC-4.2 Understands the biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body	Knows biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body. Can to apply biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body. Owns skills in the use of biochemical and molecular-biological mechanisms of the

			development of pathological processes in the cells and tissues of the human body
		PC-4.3 Understands and investigates the physical processes underlying the functioning of the body in normal and pathological conditions, understands the influence of physical factors on the functioning of biological systems, is able to study the physical structure of biologically important molecules in order to identify the relationship between the structure of substances and their biological activity	Knows the physical structure of biologically important molecules and the physical processes underlying their functioning. Can determine the relationship between the physical structure and properties and the functions that perform them in the body. Owns skills in the study of the physical structuresof biologically important molecules and the physical processes underlying their functioning
		PC-4.4 Able to develop and apply health-saving technologies	Knows technologies aimed at preserving the health of the population. Can apply health-saving technologies. Owns Ability to develop health-saving technologies

To form the above competencies within the discipline "Genomic Medicine", the following educational technologies and methods of active/interactive learning are used: business game, work in small groups, round table.

I. Goals and objectives of mastering the discipline

Objective: to form an in-depth understanding of the origins, methods and trends in the modern discipline of "genomic medicine", competencies in the implementation of molecular biology methods, as well as basic knowledge in medical genomics, either necessary for the subsequent practical activities of a doctor facing an expanding range of diseases caused by genetic disorders, or using the knowledge of genetic medicine for diagnosis and/or treatment.

Tasks:

1) acquisition by students of knowledge in the field of molecular biology, molecular genetics and genomics, a systematic understanding of the influence of the genome and genetically encoded phenotypes on health and pathogenesis;

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4) formation of motivation for research related to genomics, transcriptomics, epigenetics, proteomics and metabolomics;

5) knowledge of the basics and trends in the development of legislation in connection with genomic information, review of international and national legal standards;

6) teaching students basic methods of working with genomic information in the context of human health and pathogenesis;

7) formation of skills in studying scientific literature and official statistical reviews.

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

Task type	Code and name Competencies (result of mastering)	Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
Research & Development	PC-4 Able to understand and analyze, and apply the principles of cellular and tissue organization of biological objects, biochemical and molecular-biological mechanisms of the	PC-4.1 Analyzes the biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body and applies the principles of cellular organization of biological objects	Knows biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body. Can apply the principles of cellular organization of biological objects.

	development of pathological processes in cells and tissues of the human body to preserve the health of the population		Owns skills of determining the biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body.
		PC-4.2 Understands the biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body	Knows biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body. Can to apply biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body. Owns skills in the use of biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body
		PC-4.3 Understands and investigates the physical processes underlying the functioning of the body in normal and pathological conditions, understands the influence of physical factors on the functioning of biological systems, is able to study the physical structure of biologically important molecules in order to identify the relationship between the structure of substances and their biological activity	Knows the physical structure of biologically important molecules and the physical processes underlying their functioning. Can determine the relationship between the physical structure and properties and the functions that perform them in the body. Owns skills in the study of the physical structuresof biologically important molecules and the physical processes underlying their functioning
		PC-4.4 Able to develop and apply health-saving technologies	Knows technologies aimed at preserving the health of the population. Can apply health-saving technologies.

			Owns Ability to develop health-saving technologies

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

The total labor intensity of the discipline is 4 credit units (1 44 academic hours), (1 credit corresponds to 36 academic hours).

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. Modern Molecular Genetics and Genomics, Their Place in Medicine	7	4	-	8	-	2	9	Exam Questions
2	Section 2. Genetic diseases		2		4		5	9	Exam Questions
3	Section 3. Genomic Therapy – The Use of Genetically Engineered DNA and Cells in Modern Medicine		2		4		5	9	Exam Questions
4	Section 4. Public health and the environment		2		4		5	9	Exam Questions
5	Section 5. Radiation Hygiene		2		4		5	9	Exam Questions
6	Section 6. Practical Applications of Epigenetics and Pluripotent Stem Cells in Medicine		2		4		5	9	Exam Questions

7	Section 7. Transplantation of genetically engineered tissues and organs into humans		2		4		2	9	Exam Questions
8	Section 8. Prospects for Genomic Medicine		2		4		2	9	Exam Questions
	Total:	7	18	-	36	-	36	54	exam

IV. CONTENT OF THE THEORETICAL PART OF THE COURSE

Lectures (18 hoursov)

Section 1. Modern Molecular Genetics and Genomics and Their Place in Medicine (4 hours)

Lecture 1. Subject and content of genomic medicine (2 hours). Introduction to the specialty. Molecular genetics as the most relevant trend in medicine. Purpose and objectives of medical genomics. Content and subject of study. Methodological Foundations of Hygiene. The place of genomics in the complex of medical research, the connection with other sciences. Main Sections of Genomic Therapy. The history of the development of genomics and its relation to medical theory and practice. The content and prospects for the development of various branches of it at the present stage. Contribution of prominent geneticists to the development of genomics in connection with medicine.

Lecture 2. Methodological Foundations of Molecular Genetics (2 hours). Methodology of Molecular Genetics. The role of genetic analysis and genomic therapy in solving the main problems of health care: reducing morbidity, increasing life expectancy, increasing the working capacity of the population, and preserving labor resources. Fundamentals and trends in the development of legislation of the Russian Federation and the world on health issues in connection with the introduction of genomics methods into medical practice.

Section 2. Genetic Diseases – Lectures, Discussions.

Lecture 3. Types of Genetic Diseases (2 hours). Types of genetic diseases and possible approaches to their treatment at present, as well as current trends in the development of these approaches.

Section 3. Genomic therapy – the use of genetically engineered DNA and cells in modern medicine (2 hours).

Lecture 4. Cell Technologies in Therapy (1 hour). Cases of therapy of patients using cell technologies based on genetically modified biological material known from the medical literature.

Lecture 5. Genetic vectors based on viruses and viral particles (1 hour). Basic properties of a viral vector. Application. Basic research. Gene therapy. Vaccines. Types: retroviruses, lentiviruses, adenoviruses.

Section 4. Public Health and Environment (2 hours).

Lecture 6. The CRISPR-Cas System and Their Prospects in Genomic Medicine (2 hours). Purchase of spacers. Expression and formation of crRNA. Interference.

Section 5. Radiation hygiene (2 hours).

Lecture 7. Genomic Diagnostics and Molecular Diagnostic Therapy in Modern Oncology (2 hours). Use of immunotherapy in the treatment of oncological diseases

Section 6. Practical applications of pluripotent stem cells in medicine (2 hours). Clinical examples of stem cell use.

Lecture 8. Epigenetics and Selected Cases of Its Application in Medicine (1 hour). Clinical examples of the application of epigenetics in medicine.

Lecture 9. Stem cell therapy. Cases known to medicine (1 hour). Stem Cell Therapy in Russia and Abroad, Clinical Examples and Consequences.

Section 7. Transplantation of genetically engineered tissues and organs into humans (2 hours).

Lecture 10. Use of genetically modified tissues in medicine (2 hours). Use of Genetically Modified Tissues and Their Transplantation with Known Examples of Treatment Practice Section 8. Perspectives on Genomic Medicine (2 hours).

Lecture 11. A historical and anthropological moment in the life of mankind on the threshold of cloning Homo sapiens. Ethical and Legal Contexts, Prerequisites and Trends in Today's Health Care in the Russian Federation and Abroad (1 hour).

Lecture 12. The Future of Genomic Medicine: Directions for the Development of Today's Trends and Possible Breakthroughs of the 21st Century (1 hour). Trends in genomic medicine of the present and future.

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

Practical exercises (36 hours)

Section 1. Modern molecular genetics and genomics, their place in medicine.

Practical Exercise 1. The history of genomic medicine is the most significant experiment to date. Structure of the human genome. Genomics, Human Genome Project (2 hours).

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Practical Exercise 2. Methods of molecular genetics related to restriction. Molecular genetics techniques related to hybridization. Genome analysis by Southern blotting. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Practical Exercise 3. Molecular genetics techniques related to PCR (2 hours).

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Practical Exercise 4. DNA sequencing and its role for medicine. Whole Genome Sequencing and Medicine. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Section 2. Genetic diseases

Practical Exercise 5. Types of genetic diseases and possible approaches to their treatment at present, as well as current trends in the development of these approaches. (2 hours)

1. Problem statement.
2. Definition of the goal.

3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Practical Exercise 6. Transcriptomics and its role in medicine. Epigenetics, epigenetic modifications, and epigenetics-related diseases. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Section 3. Genomic Therapy – The Use of Genetically Engineered DNA and Cells in Modern Medicine

Practical Exercise 7. Methods of Medical Genetics. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Practical Exercise 8. General characteristics of congenital and hereditary diseases. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Section 4. Public health and the environment

Practical Exercise 9. Analysis of the genome of parents as a method of predicting the health of the future child. Chromosomal diseases. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Practical Exercise 10. Stem cell therapy. Cases known to medicine. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Section 5. Radiation Hygiene

Practical Exercise 11. Genomic diagnostics in the service of medicine. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Practical Exercise 12. Pharmacogenomics. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Section 6. Practical Applications of Epigenetics and Pluripotent Stem Cells in Medicine

Practical Exercise 13. Diseases caused by mutations in genes localized in sex chromosomes. Diseases with non-traditional inheritance. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Practical Exercise 14. Known from the medical literature are cases of patient therapy using cell technologies based on genetically modified biological material. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Section 7. Transplantation of genetically engineered tissues and organs into humans

Practical Exercise 15. Synthetic Biology and Genome Editing. (2 hours)

1. Problem statement.
2. Definition of the goal.
3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Practical Exercise 16. Epigenetic modulation of gene expression and selected cases of its application in medicine (2 hours).

1. Problem statement.

2. Definition of the goal.

3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Section 8. Prospects for Genomic Medicine

Practical Exercise 17. Methods of risk prediction in oncology and methods of early diagnosis of oncological diseases. (2 hours)

1. Problem statement.

2. Definition of the goal.

3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Practical Exercise 18. The use of immunotherapy in the treatment of oncological diseases. (2hrs)

1. Problem statement.

2. Definition of the goal.

3. Technology of task execution, solution of situational problems and interpretation of the results obtained.

Self-study (90 hours)

Independent work includes:

1) library or homework with educational literature and lecture notes;

2) preparation for practical exercises;

3) work with microslides in the laboratory;

4) preparation for testing and control interviews;

The order of independent work by students is determined by the schedule of independent work in the discipline (see below)

Control of the results of independent work is carried out in the course of laboratory classes, oral surveys, interviews and tests, including by testing

Control questions and tasks for current control and intermediate certification based on the results of mastering the discipline follow from the thematic content of the discipline.

Students' independent work consists of preparing for practical classes, working on recommended literature, writing reports on the topic of the seminar, and preparing presentations.

The teacher offers each student individual and differentiated assignments. Some of them can be carried out in a group (for example, the preparation of a report and a presentation on the same topic can be done by several students with a division

of their responsibilities - one prepares the scientific and theoretical part, and the second analyzes the practice).

Independent work can be carried out individually or by groups of students, depending on the purpose, volume, specific topic of independent work, level of complexity and level of skills of students.

Control of the results of students' independent work should be carried out within the time allotted for compulsory classes and extracurricular independent work of students in the discipline, can take place in written, oral or mixed form.

Self-paced tasks

1. Writing an essay on a topic proposed by the teacher or independently chosen by the student and agreed with the teacher.
2. Preparation of presentations using multimedia equipment.

Topics of abstracts and presentations

1. The History of Genomic Medicine – The Most Significant Experiments to Date.
2. Structure of the human genome.
3. Genomics, Human Genome Project.
4. Methods of molecular genetics related to restriction
5. Methods of molecular genetics related to hybridization
6. Genome analysis by Southern blotting.
7. Methods of molecular genetics related to PCR.
8. DNA sequencing and its role for medicine.
9. Whole genome sequencing.
10. Types of genetic diseases and possible approaches to their therapy at the present time, as well as current trends in the development of these approaches.
11. Transcriptomics and its role in medicine.
12. Epigenetics, epigenetic modifications, and epigenetics-related diseases.
13. Methods of medical genetics.
14. General characteristics of congenital and hereditary diseases.
15. Analysis of the genome of parents as a method of predicting the health of the future child.
16. Chromosomal diseases.
17. Autosomal dominant diseases.
18. Autosomal recessive diseases.
19. Genomic diagnostics.
20. Genomic diagnostics of infectious diseases.
21. Prenatal genomic diagnostics.

22. Diseases caused by mutations in genes localized in sex chromosomes.

23. Diseases with non-traditional inheritance.

24. Фармакогеномика.

25. Cases of therapy of patients with the use of cell technologies based on genetically modified biological material known from the medical literature.

26. Synthetic Biology and Methods for Creating Extended Genomic Fragments.

27. Genetic vectors based on viruses and viral particles.

28. Genome editing.

29. CRISPR-Cas system and their prospects in genomic medicine.

30. Use of immunotherapy in the treatment of oncological diseases.

31. Epigenetic modulation of gene expression and selected cases of its application in medicine.

32. Stem cell therapy. Cases known to medicine.

33. Methods of Risk Prediction in Oncology and Methods of Early Diagnosis of Oncological Diseases.

34. Use of genetically modified tissues and their transplantation with well-known examples from the practice of treatment.

35. New methods of anti-cancer immunotherapy.

36. Технология CAR-T.

37. Prospects for the use of genetic engineering in medicine.

38. Legal Aspects in Genomics and Genomic Medicine.

39. Ethical Aspects in Genomics and Genomic Medicine.

40. The Future of Genomic Medicine: Directions for the Development of Today's Trends and Possible Breakthroughs of the 21st Century.

VI. EDUCATIONAL AND METHODOLOGICAL SUPPORT OF STUDENTS' INDEPENDENT WORK

Independent work is defined as individual or collective learning activities carried out without the direct supervision of the teacher, but according to his tasks and under his supervision. Independent work is a cognitive learning activity, when the sequence of the student's thinking, his mental and practical operations and actions depends and is determined by the student himself.

Independent work of students contributes to the development of independence, responsibility and organization, a creative approach to solving problems at the educational and professional levels, which ultimately leads to the development of the skill of independent planning and implementation of activities.

The purpose of students' independent work is to acquire the necessary competencies in their field of training, experience in creative and research activities.

Forms of independent work of students:

- work with basic and additional literature, Internet resources;
- independent acquaintance with the lecture material presented on electronic media, in the library of an educational institution;
- preparation of abstract reviews of periodical press sources, reference notes, predetermined by the teacher;
- search for information on the topic with its subsequent presentation in the audience in the form of a report, presentations;
- preparation for classroom tests;
- Performing home tests;
- Performance of test tasks, problem solving;
- compilation of crosswords, schemes;
- preparation of reports for presentation at a seminar, conference;
- filling in the workbook;
- writing essays, term papers;
- preparation for business and role-playing games;
- Writing a resume;
- preparation for tests and exams;
- other types of activities organized and carried out by the educational institution and student self-government bodies.

Guidelines for writing and formatting an abstract

An essay is a creative activity of a student, which reproduces in its structure research activities to solve theoretical and applied problems in a certain branch of scientific knowledge. For this reason, coursework is the most important component of the educational process in higher education.

An essay, being a model of scientific research, is an independent work in which the student solves a problem of a theoretical or practical nature, applying scientific principles and methods of this branch of scientific knowledge. The result of this scientific research can have not only subjective, but also objective scientific novelty, and therefore can be presented for discussion by the scientific community in the form of a scientific report or a report at a scientific and practical conference, as well as in the form of a scientific article.

The abstract involves the acquisition of skills for building business cooperation based on ethical standards of scientific activity. Purposefulness, initiative, disinterested cognitive interest, responsibility for the results of one's actions, conscientiousness, competence are the personal qualities that characterize

the subject of research activities that correspond to the ideals and norms of modern science.

An essay is an independent educational and research activity of a student. The instructor provides advice and evaluates the process and results. He provides an approximate topic of abstracts, clarifies the problem and topic of research together with students, helps to plan and organize research activities, appoints a time and a minimum number of consultations.

The teacher accepts the text of the essay for review at least ten days before the defense.

Traditionally, there is a certain structure of the abstract, the main elements of which, in the order of their arrangement, are the following:

1. Title page.
2. Task.
3. Table of Contents.
4. List of symbols, symbols and terms (if necessary).
5. Introduction.
6. Main part.
7. Conclusion.
8. References.
9. Applications.

The title page indicates: educational institution, graduating department, author, teacher, research topic, place and year of the abstract.

The title of the abstract should be as brief as possible and fully correspond to its content.

The table of contents (contents) reflects the names of the structural parts of the abstract and the pages on which they are located. It is advisable to place the table of contents at the beginning of the work on one page.

The presence of a detailed introduction is a mandatory requirement for the abstract. Despite the small volume of this structural part, its writing causes significant difficulties. However, it is the high-quality introduction that is the key to understanding the entire work, testifying to the professionalism of the author.

Thus, the introduction is a very important part of the abstract. The introduction should begin with a justification of the relevance of the chosen topic. When applied to an abstract, the concept of "relevance" has one peculiarity. The author's ability to choose a topic and how correctly he understands and evaluates this topic from the point of view of modernity and social significance characterizes his scientific maturity and professional preparedness.

In addition, in the introduction, it is necessary to identify the methodological base of the abstract, to name the authors whose works formed the theoretical basis

of the study. A review of the literature on the topic should show the author's thorough familiarity with specialized literature, his ability to systematize sources, critically consider them, highlight the essential, and determine the main thing in the current state of study of the topic.

The introduction reflects the significance and relevance of the chosen topic, defines the object and subject, the purpose and objectives, and the chronological framework of the study.

The introduction concludes with a statement of general conclusions about the scientific and practical significance of the topic, the degree of its study and provision with sources, and the formulation of a hypothesis.

In the main part, the essence of the problem is stated, the topic is revealed, the author's position is determined, factual material is provided as an argument and to illustrate the proposed provisions. The author needs to demonstrate the ability to consistently present the material while simultaneously analyzing it. Preference is given to the main facts rather than small details.

The abstract ends with the final part, which is called the "conclusion". Like any conclusion, this part of the abstract plays the role of a conclusion conditioned by the logic of the research, which is in the form of a synthesis of the scientific information accumulated in the main part. This synthesis is a consistent, logically harmonious presentation of the results obtained and their correlation with the general goal and specific tasks set and formulated in the introduction. It is here that the so-called "inferential" knowledge is contained, which is new in relation to the original knowledge. The conclusion may include suggestions of a practical nature, thereby increasing the value of the theoretical materials.

So, the conclusion of the abstract should include: a) the conclusions of the study; b) theoretical and practical significance, novelty of the abstract; c) the possibility of applying the results of the study is indicated.

After the conclusion, it is customary to place a bibliographic list of the references. This list is one of the essential parts of the abstract and reflects the independent creative work of the author of the abstract.

A list of the sources used is placed at the end of the work. It is formatted either in alphabetical order (by the author's surname or the title of the book), or in the order in which references appear in the text of the written work. In all cases, the full title of the work, the surnames of the authors or the editor of the publication, if a team of authors participated in the writing of the book, data on the number of volumes, the name of the city and publishing house in which the work was published, the year of publication, the number of pages are indicated.

Guidelines for Preparing Presentations

To prepare a presentation, it is recommended to use: PowerPoint, MS Word, Acrobat Reader, LaTeX beamer package. The easiest program to create presentations is Microsoft PowerPoint. To prepare a presentation, it is necessary to process the information collected when writing the abstract.

Sequence of presentation preparation:

1. Clearly state the purpose of the presentation.

2. Determine what the format of the presentation will be: live performance (how long it will be) or e-mailing (what will be the context of the presentation).

3. Select all the content for the presentation and build a logical chain of presentation.

4. Identify the key points in the content of the text and highlight them.

5. Determine the types of visualization (pictures) to be displayed on slides in accordance with the logic, purpose and specifics of the material.

6. Choose the design and format of the slides (the number of pictures and text, their location, color and size).

7. Check the visual perception of the presentation.

Types of visualization include illustrations, images, diagrams, tables. An illustration is a representation of a real-life visual series. Images, as opposed to illustrations, are metaphors. Their purpose is to evoke an emotion and create an attitude towards it, to influence the audience. With the help of well-thought-out and presented images, information can remain in a person's memory for a long time. A diagram is a visualization of quantitative and qualitative relationships. They are used for convincing demonstration of data, for spatial thinking in addition to logical thinking. A table is a concrete, visual and accurate display of data. Its main purpose is to structure information, which sometimes makes it easier for the audience to perceive the data.

Practical tips for preparing a presentation

– printed text + slides + handouts are prepared separately;

– slides – visual presentation of information, which should contain a minimum of text, a maximum of images that carry a semantic load, look clear and simple;

– Textual content of the presentation – oral speech or reading, which should include arguments, facts, evidence and emotions;

– Recommended number of slides 17-22

– mandatory information for the presentation: topic, surname and initials of the speaker; Communication plan brief conclusions from all that has been said; list of references;

– Handouts – should provide the same depth and reach as a live performance: people trust more what they can take with them than disappearing images, words

and slides are forgotten, and the handout remains a constant tangible reminder; It is important to hand out handouts at the end of the presentation; Handouts should be different from slides, they should be more informative.

Criteria for evaluating the abstract.

The stated understanding of the abstract as an integral author's text determines the criteria for its evaluation: novelty of the text; the reasonableness of the choice of source; the degree of disclosure of the essence of the issue; compliance with the design requirements.

Novelty of the text: a) relevance of the research topic; b) novelty and independence in the formulation of the problem, formulation of a new aspect of the known problem in the establishment of new connections (interdisciplinary, intra-subject, integration); c) ability to work with research, critical literature, systematize and structure material; d) the manifestation of the author's position, the independence of assessments and judgments; e) stylistic unity of the text, unity of genre features.

Degree of disclosure of the essence of the issue: a) correspondence of the plan to the topic of the abstract; b) correspondence of the content to the topic and outline of the abstract; c) completeness and depth of knowledge on the topic; d) the validity of the ways and methods of working with the material; f) the ability to generalize, draw conclusions, compare different points of view on one issue (problem).

Validity of the choice of sources: a) assessment of the literature used: whether the most well-known works on the topic of research are involved (including journal publications of recent years, the latest statistical data, summaries, references, etc.).

Compliance with formatting requirements: a) how correctly the references to the literature used, the list of references; b) assessment of literacy and culture of presentation (including spelling, punctuation, stylistic culture), knowledge of terminology; c) compliance with the requirements for the length of the abstract.

The reviewer should clearly formulate a comment and questions, preferably with references to the work (it is possible to specific pages of the work), to research and factual data that the author did not take into account.

The reviewer can also indicate: whether the student has addressed the topic before (essays, written works, creative works, Olympiad works, etc.) and whether there are any preliminary results; how the graduate conducted the work (plan, intermediate stages, consultation, revision and revision of the written or lack of a clear plan, rejection of the recommendations of the supervisor).

The student submits an abstract for review no later than one week before the defense. The reviewer is the teacher. Experience shows that it is advisable to

familiarize the student with the review a few days before the defense. Opponents are appointed by a teacher from among the students. For an oral presentation, 10-20 minutes is enough for a student (this is approximately the time he answers on the exam tickets).

Grade 5 is given if all the requirements for writing and defending an abstract are met: the problem is identified and its relevance is justified, a brief analysis of various points of view on the problem under consideration is made and one's own position is logically stated, conclusions are formulated, the topic is fully disclosed, the volume is maintained, the requirements for external design are met, and correct answers to additional questions are given.

Grade 4 – the main requirements for the abstract and its defense have been met, but at the same time there are shortcomings. In particular, there are inaccuracies in the presentation of the material; there is no logical consistency in judgments; the length of the abstract is not maintained; there are omissions in the design; Incomplete answers were given to additional questions during the defense.

Grade 3 – there are significant deviations from the abstract requirements. In particular, the topic is covered only partially; factual errors were made in the content of the abstract or in answering additional questions; There is no conclusion during the defense.

Grade 2 – the topic of the abstract is not disclosed, a significant misunderstanding of the problem is revealed.

Grade 1 – the abstract is not submitted by the student.

VII. MONITORING THE ACHIEVEMENT OF THE COURSE OBJECTIVES

No. p/p	Supervised sections/topics of the discipline	Codes and Stages of Competency Formation		Evaluation Tools	
				Current control	Intermediate Attestation
1	Section 1. Modern Molecular Genetics and Genomics, Their Place in Medicine	PC-4.1 Analyzes biochemical and molecular-biological mechanisms of development of pathological processes in cells and tissues of the human body and applies the principles of cellular organization of biological objects	Knows biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body. Can apply the principles of cellular organization of biological objects. Owns skills in determining the biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body.	Oral Questioning	Exam Questions
2	Section 2. Genetic diseases			Test	Exam Questions
3	Section 3. Genomic Therapy – The Use of Genetically Engineered DNA and Cells in Modern Medicine			Oral Questioning	Exam Questions
4	Section 4. Public health and the environment	PC-4.2 Understands the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body	Knows biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body. Can to apply biochemical and molecular-biological	Oral Questioning	Exam Questions

5	Section 5. Radiation Hygiene		mechanisms of the development of pathological processes in the cells and tissues of the human body. Owns skills in the use of biochemical and molecular-biological mechanisms of the development of pathological processes in the cells and tissues of the human body	Test	Exam Questions
6	Section 6. Practical Applications of Epigenetics and Pluripotent Stem Cells in Medicine	PC-4.3 Understands and investigates the physical processes underlying the functioning of the body in normal and pathological conditions, understands the influence of physical factors on the functioning of biological systems, is able to study the physical structure of biologically important molecules in order to identify the relationship between the structure of substances and their biological activity	Knows the physical structure of biologically important molecules and the physical processes underlying their functioning. Can determine the relationship between the physical structure and properties and the functions that perform them in the body. Owns skills to study the physical structure of biologically important molecules and the physical processes underlying their functioning	Test	Exam Questions
7	Section 7. Transplantation of genetically engineered tissues and organs into humans	PC-4.4 Able to develop and apply health-saving technologies	Knows technologies aimed at preserving the health of the population. Can apply health-saving technologies. Owns ability to develop health-saving technologies	Oral Questioning	Exam Questions
8	Section 8. Prospects for Genomic Medicine			Abstract	Exam Questions

VIII. LIST OF REFERENCES AND INFORMATIONAL AND METHODOLOGICAL SUPPORT OF THE DISCIPLINE

Reference citations

1. Nakhaeva, V. I. General genetics. Practical course: textbook for higher education institutions / V. I. Nakhaeva. — 2nd ed., revised and supplemented — Moscow: Yurayt Publishing House, 2023. — 276 p. — (Higher education). — ISBN 978-5-534-06631-9. — Text : electronic // Educational platform Urait [site]. — URL: https://urait.ru/bcode/516004

2. Andrianov, A.M. Conformational analysis of proteins [Elektronnyi resurs]: teoriya i primeniya [Electronic resource]: theory and applications.M. Andrianov. "Electron. textual data. – Minsk: BelOrusskaya Nauka, 2013. – 531 p. – Mode of access: http://www.iprbookshop.ru/29465.html

3. Katmakov P. S., Gavrilenko V. P., Bushov A. V., Anisimova E. I.; edited by P. S. Katmakov. - Moscow: Yurayt Publishing House, 2023. — 278 p. — (Higher education). — ISBN 978-5-534-14484-0. — Text : electronic // Educational platform Urait [site]. — URL: https://urait.ru/bcode/519244

4. Borisova, T. N. Human Genetics with the Basics of Medical Genetics: Textbook for Secondary Professional Education / T. N. Borisova, G. I. Chuvakov. - 2nd ed., ispr. i dop. — Moscow: Yurayt Publishing House, 2023. — 159 p. — (Professional education). — ISBN 978-5-534-08537-2. — Text : electronic // Educational platform Urait [site]. — URL: https://urait.ru/bcode/512989

5. Pukhal'skii V. A. Vvedenie v genetiku: uchebnoe posobie [Introduction to genetics: textbook]. — 2nd ed., rev. and add. — Moscow: INFRA-M, 2023. — 273 p. — (Higher education: Bachelor's degree). — DOI 10.12737/1019851. - ISBN 978-5-16-015633-0. - Text : electronic. - URL: https://znanium.com/catalog/product/1915360

6. Schelkunov S.N. Geneticheskaya inzheneriya [Genetic Engineering]: Educational and Reference Manual. –Electron. Text data. Novosibirsk: Siberian University Publishing House, 2017. – 514 c. http://www.iprbookshop.ru/65273.html

7. Borisova, T. N. Medical Genetics: Textbook for Higher Educational Institutions / T. N. Borisova, G. I. Chuvakov. - 2nd ed., ispr. i dop. — Moscow: Yurayt Publishing House, 2023. — 159 p. — (Higher education). — ISBN 978-5-534-07338-6. — Text : electronic // Educational platform Urait [site]. — URL: https://urait.ru/bcode/512854

8. Ivanishchev V. V. Osnovy genetiki: uchebnik [Fundamentals of genetics: textbook]. — Moscow : RIOR : INFRA-M, 2023. — 207 p. — (Higher education: Bachelor's degree). — DOI: https://doi.org/10.12737/17443. - ISBN 978-5-369-01640-4. - Text : electronic. - URL: https://znanium.com/catalog/product/1905743

Further reading

1. Online Resourse Centre: Lesk: Introduction to Bioinformatics (страница вспомогательных ресурсов к книге Артура Леска «Введение в биоинформатику») // Internet: http://global.oup.com/uk/orc/biosciences/bioinf/leskbioinf3e/

2. Bionics. Biocybernetics. Bioengineering. T.2. Fundamentals of the Theory of Excitable Environments / Ed. by A.A.Nichiporovich. – M.VINITI Publ., 1977. – 106 c. http://lib.dvfu.ru:8080/lib/item?id=chamo:118494&theme=FEFU

3. Ignasimutu S. Osnovy bioinformatiki [Fundamentals of bioinformatics] / Ignasimutu S. – Electronic text data. Moscow, Izhevsk: Regular and Chaotic Dynamics, Izhevsk Institute for Computer Research, 2007. – 324 c. – Mode of access: http://www.iprbookshop.ru/16582.html. – EBS "IPRbooks"

4. Karetin, Y.A. Synergetics. Course of lectures for biologists / Y.A. Karetin. –Vladivostok. Far Eastern University Publ., 2008. 259 p. (in Russian). Available at: http://lib.dvfu.ru:8080/lib/item?id=chamo:262992&theme=FEFU

5. Kartavtsev, Y.F. Molecular Evolution and Population Genetics: Textbook for Higher Educational Institutions. Vladivostok: Far Eastern University Publ., 2009. 277 p. (in Russian). Mode of access: http://ini-fb.dvgu.ru/scripts/refget.php?ref=/ukazatel/kartavtsev/kartavtsev54.pdf

6. Lesk, A. Introduction to Bioinformatics, 2nd edition. Moscow: BINOM. Laboratory of Knowledge. 2015. – 318 p. Mode of access: http://lib.dvfu.ru:8080/lib/item?id=chamo:797691&theme=FEFU

7. Lukashov, V.V. Molecular Evolution and Phylogenetic Analysis. Tutorial. Moscow, Binom Publ., 2009. 256 p. Available at: http://lib.dvfu.ru:8080/lib/item?id=chamo:299205&theme=FEFU

8. Fundamentals of Biochemical Engineering in 2 Hours: Part 1 / J. Bailey, D. Ollis; transl. by A. A. Kiryushkin. Moscow: Mir, 1989. – 692 c. http://lib.dvfu.ru:8080/lib/item?id=chamo:26812&theme=FEFU

9. Fundamentals of Biochemical Engineering in 2 Hours: Part 2 / D. Ollis, transl. by A.A. Kiryushkina. Moscow: Mir, 1989. – 590 c. http://lib.dvfu.ru:8080/lib/item?id=chamo:26813&theme=FEFU

10. Spirin, A.S. Molecularnaya biologiya [Molecular biology]. Ribosomes and protein biosynthesis. Textbook for Higher Educational Institutions in Biological Specialties. Moscow: Akademiya, 2011. 498 p. (in Russian). Mode of access: http://lib.dvfu.ru:8080/lib/item?id=chamo:669007&theme=FEFU

11. Wilson, K. Principles and Methods of Biochemistry and Molecular Biology.Wilson, J Walker; transl. from Eng. T.P. Mosolova, E.Y. Bozelek-

Reshetnyak. Moscow, Binom Publ., 2012. 848 p. (in Russian). Available at: http://lib.dvfu.ru:8080/lib/item?id=chamo:705602&theme=FEFU

12. Haubold, B. Introduction to Computational Biology: An Evolutionary Approach. Haubold, T. Vie; transl. by S.V. Chudov. Moscow: Institute of Computer Research "Regular and Chaotic Dynamics" Publ., 2011. 455 p. (in Russian). Mode of access: http://lib.dvfu.ru:8080/lib/item?id=chamo:673149&theme=FEFU

13. Tsarik, G.N. Informatics and Medical Statistics / V.M. Ivoylov, I.A. Polyanskaya. – Moscow: GEOTAR-Media, 2017. 302 p. (in Russian). Mode of access: http://lib.dvfu.ru:8080/lib/item?id=chamo:842407&theme=FEFU

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/ - ЭБС "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.
11. http://rosalind.info/problems/locations/- resource for self-study of bioinformatics Rosalind.
12. http://www.ncbi.nlm.nih.gov/ website of the- National Center for Biotechnology Information (NCBI).
13. http://www.mendeley.com/- *Mendeley*: Free reference manager and PDF organizer; программа-библитекарь.
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

1. Microsoft Office Professional Plus 2013 is an office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.);
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. AutoCAD Electrical 2015 - three-dimensional computer-aided design and drafting system;
5. ESET Endpoint Security 5 is a comprehensive protection solution for Windows-based workstations. Virtualization support + new technologies;
6. WinDjView 2.0.2 is a program for recognizing and viewing files with the DJV and DjVu formats of the same name; 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
7. Compass-3D LT V12 - Three-Dimensional Simulation System
8. 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 "Genetic Engineering", 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 the 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 in the course of 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 the laboratory lesson, students perform one or more laboratory works (tasks) under the guidance of the 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, 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 they are carried out, 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.

A detailed conversation involves the preparation of students for 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 tasks – situations (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 competencies aimed at solving various life and industrial 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.

X. LOGISTICAL SUPPORT OF DISCIPLINE

Training sessions on the discipline are held in rooms equipped with appropriate equipment and software.

The list of logistical and software of the discipline is given in the table.

Logistical and software of the discipline

Name of special rooms and rooms for independent work	Equipment special rooms and rooms for self-study	List of licensed software. Details of the supporting document
690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 605	Multimedia audience: Экран с электроприводом 236*147 см Trim Screen Line; Проектор DLP, 3000 ANSI Lm, WXGA 1280x800, 2000:1 EW330U Mitsubishi; Подсистема специализированных креплений оборудования CORSA-2007 Tuarex; Подсистема видеокоммутации: матричный коммутатор DVI DXP 44 DVI Pro Extron; удлинитель DVI по витой паре DVI 201 Tx/Rx Extron; Подсистема аудиокоммутации и	-

	звукоусиления; акустическая система для потолочного монтажа SI 3CT LP Extron; цифровой аудиопроцессор DMP 44 LC Extron; расширение для контроллера управления IPL T CR48; беспроводные ЛВС для обучающихся обеспечены системой на базе точек доступа 802.11a/b/g/n 2x2 MIMO(2SS). Моноблок HP ProOne 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	
690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 422	Multimedia audience: HP ProOne 400 G1 AiO 19.5" Intel Core i3-4130T 4GB DDR3-1600 SODIMM (1x4GB)500GB All-in-One PC; Projection screen Projecta Elpro Electrol, 300x173 cm; Multimedia projector, Mitsubishi FD630U, 4000 ANSI Lumen, 1920x1080; Mortise interface with TLS TAM 201 Stan automatic cable retraction; Avervision CP355AF visualizer; Sennheiser EW 122 G3 UHF lavalier radio system consisting of a wireless microphone and receiver; LifeSizeExpress 220-Codeconly- Non-AES video conferencing codec; Multipix MP-HD718 Network Video Camera; Two 47" LCD panels, Full HD, LG M4716CCBA; Audio switching and sound amplification subsystem; Centralized, uninterrupted power supply	-
690922, Primorsky Krai, Vladivostok, Russky Island, Saperny Peninsula, Ajax village, 10, aud. M 627	Light microscope Carl Zeiss GmbH Primo Star 3144014501 (13 pcs.); Light microscope with digital camera Altami	-

	BIO8 (2 pcs).	
Computer class of the School of Biomedicine aud. M723, 15 workplaces	Motorized 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 (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	-