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
Virology
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

Back 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 " _____ *202 g №*

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Abstract of the discipline

Virology

The total labor intensity of the discipline is 2 credit units a / 72 academic hours a. It is a discipline of the compulsory part of the EP, studied in the 4th year and ends *with a test.* The curriculum provides for lectures in the amount of 1 8 hours, practical classes of 18 hours, laboratory work of *18* hours , and 1 *8 hours* of independent work for the student.

Language: Russian.

Objective: to form deep basic theoretical and practical knowledge in the field of virology in biology students from the point of view of modern ideas about the diversity of the world of microorganisms as part of the biosphere, and the role of viruses in its sustainable development.

Tasks:

- to form students' knowledge about the features of the structure of phages and viruses of plants, humans and animals, the classification of viruses, the mechanism of interaction of viruses with the cell;
- to develop the ability to use knowledge about viruses in biotechnological and biomedical industries, genetic engineering, nanobiotechnology, molecular modeling;
- to promote the mastery of standard methods of working with viruses for their use in biomedical production and genetic engineering;
- to develop students' skills in the use of modern apparatus and equipment for biological work;
- to develop students' skills in working with educational and scientific literature.

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;
-comprehends the principles of structural and functional organization of biological systems;
- and uses physiological, cytological, histological, biochemical, biophysical methods of analysis to assess the state of living objects and monitor their habitat.

Competencies are obtained as a result of studying the disciplines of *general biology, biochemistry, microbiology.*

General professional competence ofstudents, indicators of their achievement and learning outcomes in the discipline

Competency code and name (result of mastering)		Code and name of the competency indicator
OPK-1 Able to apply knowledge of biological diversity and use methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems		OPK-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
OPK-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology	Knows Theoretical Foundations of Molecular and Cellular Biology, Microbiology and Virology. Can apply the theoretical foundations of molecular and cellular biology, microbiology and virology in professional activities. Owns skills in using the fundamentals of molecular and cellular biology, microbiology and virology in professional activities.

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

Competency code and name (result of mastering)	Code and name of the competency indicator
PC-7 Able to conduct microbiological, virological and epidemiological studies to solve professional problems in the field of biomedicine	PC-7.1 Possesses fundamental knowledge of the structure, vital activity, classification of microorganisms
	PC-7.2 Applies methods of virological, microbiological and epidemiological analysis
	PC-7.3 Understands the molecular features of the structure of microorganisms, the mechanisms of their interaction with cells and their role in pathological processes

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
PC-7.1 Possesses fundamental knowledge of the structure, vital activity, classification of microorganisms	Knows basic concepts and principles of structure, vital activity, classification of microorganisms. Can use knowledge about the structure, vital activity, and classification of microorganisms. Owns basic fundamental knowledge of the structure, vital activity, and classification of microorganisms.
PC-7.2 Applies methods of virological, microbiological and epidemiological analysis	Knows methods of virological, microbiological and epidemiological analysis. Can apply methods of virological, microbiological and epidemiological analysis. Owns skills in the use of virological, microbiological and epidemiological analysis methods in professional activities.
PC-7.3 Understands the molecular features of the structure of microorganisms, the mechanisms of their interaction with cells and their role in pathological processes	Knows molecular features of the structure of microorganisms, mechanisms of their interaction with cells and role in pathological processes. Can apply knowledge about the structure, mechanisms of interaction with cells and role in pathological processes. Owns skills of using knowledge of the structure, mechanisms of interaction with cells and the role in pathological processes in professional activity.

To form the above competencies within the framework of the discipline "Virology", 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 form deep basic theoretical and practical knowledge in the field of virology in biology students from the point of view of modern ideas about the diversity of the world of microorganisms as part of the biosphere, and the role of viruses in its sustainable development.

Tasks:

- to form students' knowledge about the features of the structure of phages and viruses of plants, humans and animals, the classification of viruses, the mechanism of interaction of viruses with the cell;

- to develop the ability to use knowledge about viruses in biotechnological and biomedical industries, genetic engineering, nanobiotechnology, molecular modeling;

- to promote the mastery of standard methods of working with viruses for their use in biomedical production and genetic engineering;

- to develop students' skills in the use of modern apparatus and equipment for biological work;

- to develop students' skills in working with educational and scientific literature.

General professional competence ofstudents, indicators of their achievement and learning outcomes in the discipline

Competency code and name (result of mastering)	Code and name of the competency indicator
OPK-1 Able to apply knowledge of biological diversity and use methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems	OPK-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology

Code and name of the competency indicator	Name of the assessment indicator (the result of learning in the discipline)
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Professional Competencies of Students, Indicators of Their Achievement and Results of Achievement and Learning Outcomes in the Discipline

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PC-7.3 Understands the molecular features of the structure of microorganisms, the mechanisms of their interaction with cells and their role in pathological processes	Knows molecular features of the structure of microorganisms, mechanisms of their interaction with cells and role in pathological processes. Can apply knowledge about the structure, mechanisms of interaction with cells and role in pathological processes. Owns skills of using knowledge of the structure, mechanisms of interaction with cells and the role in pathological processes in professional activity.

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

The total labor intensity of the discipline is 2 credits (72 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. History of Virology. Concepts.	7	2	2	2	-	18	-	Questions for the test
2	Section 2. Structure of the virion. Basics of Virus Classification.		2	2	2				Questions for the test
3	Section 3. Cultivation of viruses. Mechanism of interaction between the virus and the cell.		3	3	3				Questions for the test
4	Section 4. Genetics of viruses: features of the viral genome and genetic interactions between viruses.		3	3	3				Questions for the test
5	Section 5. The main groups of DNA- and RNA-containing viruses that cause diseases in humans and animals.		3	3	3				Questions for the test
6	Section 6. Bacteriophages, their meaning and use.		3	3	3				Questions for the test
7	Section 7. The role of viruses in plant and insect pathology.		2	2	2				Questions for the test
	Total:	7	18	18	18	-	18	-	Credit

IV. CONTENT OF THE THEORETICAL PART OF THE COURSE

Lecture

Section 1. History of Virology. Concepts.

History of the Doctrine of Viruses. The discovery of viruses, the main stages in the study of the biology of viruses. Viruses: definition, signs of living and non-living. Theories of the origin of viruses. Viruses play a role in the biosphere. Prions, their features, possible method of reproduction.

Section 2. Structure of the virion. Basics of Virus Classification.

The structure of the virion, the differences between simple and complex viruses. Morphological diversity of viruses. Sizes and types of symmetry of viral particles. Structural organization and chemical composition of viruses. Resistance to external influences and the spread of viruses. Features used to categorize known viruses. The main groups into which the diversity of viruses can be divided depending on the type of nucleic acid, the number of strands, the presence or absence of the outer envelope, and the method of replication. Principles of classification and taxonomy of viruses. Nomenclature of viruses.

Section 3. Cultivation of viruses. Mechanism of interaction between the virus and the cell.

Methods of cultivating human viruses. Growing viruses in chicken embryos and tissue cultures. Cell cultures for virus culture. Types of interaction between viruses and the host cell. Phases of development and reproduction of viruses: attachment, penetration, "undressing". Viral NK replication, maturation, release (release) of viruses from a sensitive cell. Methods of detecting and identifying viruses.

Section 4. Genetics of viruses: features of the viral genome and genetic interactions between viruses.

Peculiarities of virus genetics. Features of replication of DNA and RNA viral genomes. Features of replication of genomes represented by positive and negative single-stranded RNA. Genome replication in retroviruses. Typical viral enzymes for NK replication. Types of mutation in viruses. Shift and genetic drift of viruses. Genetic recombinations and their role in the evolution of viruses.

Section 5. The main groups of DNA- and **RNA-containing viruses that cause diseases in humans and animals.**

The Importance of Viruses in Human and Animal Pathology. Main groups and families of human and animal viruses. Influenza viruses: discovery, structure, chemical composition, antigenic characteristics. Diversity of hepatitis viruses. HIV: history of discovery, peculiarities of structure and chemical composition. Viruses that cause SARS. Diversity of enteroviruses. Herpesvirus infections and their features.

Section 6. Bacteriophages, their meaning and use.

Discovery, Nature, and Origin of Bacteriophages. Morphology of coliphages, particle structure, chemical composition. Classification of coliphages, their use in various industries. The Importance of Bacteriophages in Nature, Theories of Their Origin. Phases of phage development and reproduction: attachment, penetration, "undressing", genome replication, maturation, exit (release) of viruses from the bacterial cell. Virulent and temperate phages, productive developmental cycle, lysogenization.

Section 7. The role of viruses in plant and insect pathology.

Plant viruses, structure, morphological diversity. Chemical and biological characteristics of plant viruses, methods of plant protection from viral diseases). Ways in which viruses enter a plant cell. The Importance of Viruses in Phytopathology. Insect viruses, peculiarities of biology, main groups. Ways in which viruses enter the insect's body. The Importance of Insect Viruses and Their Use for Plant Protection.

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

Practical exercises

Topic 1. The nature of viruses and their basic properties.

Rules for working with viruses and safety precautions. Structure of viruses

Topic 2. Acquisition and processing of pathological material.

General rules for taking material during the life and after the death of the animal. Preservation and transportation of material to the laboratory. Stages of laboratory diagnostics, indication of viruses by detection of elementary corpuscles and corpuscles of inclusions.

Topic 3. Cultivation of viruses in the laboratory.

Laboratory animals, their species, methods of infection, sensitivity to various viruses. Techniques of contamination, dissection, material selection. Naturally

susceptible animals, their use in the laboratory, methods of infection, advantages and disadvantages.

Topic 4. Chicken embryos and their use in virology.

Structure of chicken embryos of 5-11 days of age (CE). Methods of infection with FE during virus isolation, indication of viruses in FE. Accumulation of virus-containing material, methods of virus attenuation.

Topic 5. Cell culture, its use in virology.

Primary trypsinized, transplantable and semi-transplanted cells, methods of production. Culture media and saline solutions for cell culture. Preparation of primary cell culture, the principle of obtaining a transplantable cell culture, their preservation.

Topic 6. Titration of viruses by infectious effect.

The concept of the virus titer, the unit of the amount of virus, the titration method, the calculation of the titer according to the CPD, the plaque method in cell culture, titration in chicken embryos, the Reed-Mench method.

Topic 7. Method of indication and principle of diagnosis of viral diseases.

Types of CPD, hemadsorption, color assay. Titration by hemagglutinating action, method of setting the RHA, determination of 1 and 4 GAE. Titration of antibodies in RTGA.

Topic 8. Serological Reactions and Their Use in Virology

Essence of neutralization reaction, immunofluorescence reaction, indirect hemagglutination reaction, RSC, enzyme-linked immunosorbent assay. PCR is the principle of staging, the value for diagnosis.

Labs

Topic 1. Cultivation of human and animal viruses in chicken embryos.

Topic 2. Use of cell cultures to grow viruses.

Topic 3. Methods for detecting viruses in cell culture.

Topic 4. Methods of virus identification.

Topic 5. Phagotyping of bacterial cultures.

Topic 6. Methods for determining the number of bacteriophages

Topic 7. Methods for the study of plant and insect viruses.

Self-paced work

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. Ecology of viruses. Environmental factors that determine the patterns of virus circulation in nature.

2. Characteristic types of virus-host interaction at the cell level. Host response to viruses. Types of viral infections: alternative, latent, oncogenic slow (example).

3. Biocenoses of animal viruses: viruses and arthropods, protozoa, cold-blooded, birds, mammals. Features of the infectious process.

4. Peculiarities of relationships on the example of a virus host

5. Sanitary Virology. The principle of indicating viruses in environmental objects.

6. Sanitary Virology of Water, Soil, Air and Sewage Sludge. Principle of definition.

7. Sanitary indicators of viral water contamination (coli-phages). Stages of sanitary and virological research.

8. Sanitary Virology of Food Products. Principle of material selection, method of isolation, epidemiological significance.

9. Characterization of viruses isolated from household items and their sanitary assessment. Principle of material selection, method of isolation, epidemiological significance.

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. How the author of the essay is able 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 training.

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 drawn up 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 names 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 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 stay in a person's memory for a long time. Diagram – 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 what they can take with them more than disappearing images, words and slides are forgotten, and the handout remains a constant tangible reminder; Handouts should be given out at the end of the presentation, handouts should be different from slides, 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).

Reasonableness 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 a 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. 10-20 minutes is enough for a student to make an oral presentation (this is about the time it takes to answer 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, 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 volume 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

Item No.	Supervised sections/topics of the discipline	Codes and Stages of Competency Formation		Evaluation Tools	
				Current control	Intermediate Attestation
1	Section 1. History of Virology. Concepts.	OPK-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology	Knows Theoretical Foundations of Molecular and Cellular Biology, Microbiology and Virology. Can apply the theoretical foundations of molecular and cellular biology, microbiology and virology in professional activities. Owns skills in using the fundamentals of molecular and cellular biology, microbiology and virology in professional activities.	test	Questions for the test
2	Section 2. Structure of the virion. Basics of Virus Classification.			colloquium	Questions for the test
3	Section 3. Cultivation of viruses. Mechanism of interaction between the virus and the cell.	PC-7.1 Possesses fundamental knowledge of the structure, vital activity, classification of microorganisms	Knows basic concepts and principles of structure, vital activity, classification of microorganisms. Can use knowledge about the structure, vital activity, and classification of microorganisms.	test	Questions for the test

4	Section 4. Genetics of viruses: features of the viral genome and genetic interactions between viruses.		Owns basic fundamental knowledge of the structure, vital activity, and classification of microorganisms.	colloquium	Questions for the test
5	Section 5. The main groups of DNA- and RNA-containing viruses that cause diseases in humans and animals.	PC-7.2 Applies methods of virological, microbiological and epidemiological analysis	Knows methods of virological, microbiological and epidemiological analysis. Can apply methods of virological, microbiological and epidemiological analysis. Owns skills in the use of virological, microbiological and epidemiological analysis methods in professional activities.	test	Questions for the test
6	Section 6. Bacteriophages, their meaning and use.			colloquium	Questions for the test

7	Section 7. The role of viruses in plant and insect pathology.	PC-7.3 Understands the molecular features of the structure of microorganisms, the mechanisms of their interaction with cells and their role in pathological processes	Knows molecular features of the structure of microorganisms, mechanisms of their interaction with cells and role in pathological processes. Can apply knowledge about the structure, mechanisms of interaction with cells and role in pathological processes. Owns skills of using knowledge of the structure, mechanisms of interaction with cells and the role in pathological processes in professional activity.		Questions for the test

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

Reference citations

1. Pinevich A. V., Sirotkin A. K., Gavrilova O. V., Potekhin A. A.; ed. by A. V. Pinevich. - 2nd ed., add. - St. Petersburg: St. Petersburg State University, 2020. - 442 p. - ISBN 978-5-288-06011-3. - Text : electronic. - URL: https://znanium.com/catalog/product/1244714

2. Firsov G. M. Virology, immunology and biotechnology: textbook. - Volgograd: Volgograd State Agrarian University, 2021. - 164 p. - Text : electronic. - URL: https://znanium.com/catalog/product/1911476

3. Firsov G.M., Akimova S.A., - 2nd ed., supplemented - Volgograd: Volgograd GAU, 2015. - 232 p. - Text : electronic. - URL: https://znanium.com/catalog/product/615175

4. Pavlovich S. A. Microbiology with Virology and Immunology: Textbook. - Minsk: Vysheishaya shkola, 2013. — 800 c. — ISBN 978-985-06-2237-2. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: https://www.iprbookshop.ru/24067.html

Further reading

1. Medical Microbiology, Virology and Immunology [Text] : textbook : in 2 vols. Vol. 1 / ed. by V. V. Zverev, M. N. Boychenko. - Moscow: GEOTAR-Media, 2014. - 447 p. - ISBN 9785970429143. - ISBN 9785970429136 : 669.57.

2. Medical Microbiology, Virology and Immunology [Text] : textbook : in 2 vols. Vol. 2 / ed. by V. V. Zverev, M. N. Boychenko. - Moscow: GEOTAR-Media, 2014. - 477 p. : ill. + 1 electron. wholesale. DISK (CD-ROM). - ISBN 9785970429150. - ISBN 9785970429136 : 669.57.

3. Gosmanov R.G., Kolychev N.M., Pleshakova V.I. Veterinary Virology: Textbook. - 5th ed., ster. — St. Petersburg: Lan, 2018. — 500 p. — ISBN 978-5-8114-1073-6. — Text: electronic // Lan: electronic library system. — URL: https://e.lanbook.com/book/105990

4. Baryshnikov P.I., Razumovskaya V.V. Laboratornaya diagnostika virnykh boleznykh zhivotnykh [Laboratory diagnostics of viral diseases of animals: textbook]. - 2nd ed., ispr. - St. Petersburg: Lan, 2015. — 672 p. — ISBN 978-5-8114-1882-4.

5. Chastnaya veterinary-sanitary microbiology and virology: textbook / R.G. Gosmanov, R.Kh. Ravilov, A.K. Galiullin [i dr.]. — St. Petersburg: Lan, 2019. — 316 p. — ISBN 978-5-8114-3593-7. — Text: electronic // Lan: electronic library system. — URL: https://e.lanbook.com/book/116373

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.
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; Librarian Program.
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 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
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 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.

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: 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 2x 2 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	
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 microphone 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	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. Monoblock HP RgoOpe 400 All-in-One 19.5 (1600x900), Core and3-4150T, 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	