



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

AGREED  
Head of OP

(Signed) (Full name)



CLAIM  
Director of the Department of Medical Biology and  
Biotechnology

(Signed) (Acting Name)  
December 30, 2021

WORK PROGRAM OF THE DISCIPLINE  
Scientific-research seminar "Modern problems of molecular and cell biology"  
Direction of training 06.04.01 Biology  
(Molecular and Cell Biology)  
Form of training: full-time

Course 1 semester 2  
lectures    hour.  
practical exercises 18 hours.  
laboratory work - hour.  
total hours of classroom load 18 hours.  
independent work 90 hours.  
test with grade 2 semester  
exam is not provided

The work program is drawn up in accordance with the requirements of the Federal State Educational Standard in the direction of training 19.03.01 Biotechnology, approved by the order of the Ministry of Education and Science of Russia dated 10.08.2021 No.736.

The work program was discussed at the meeting of the Department of Medical Biology and Biotechnology protocol of "28" January 2021 No. 5

Director of the Department of Implementing Structural Unit of the Cand. Biol. Ph.D., Associate Professor V.V. Kumeiko

Compiled by: Candidate of Biological Sciences, Associate Professor V.V. Kumeiko

Vladivostok  
2021

Reverse side of the RPD cover page

1. The work program was revised at the meeting of the Department / department / department (implementing the discipline) and approved at the meeting of the Department / department / department (issuing structural unit), the protocol from " \_\_\_\_\_ № \_\_\_\_\_

2. The work program was revised at the meeting of the Department / department / department (implementing the discipline) and approved at the meeting of the Department / department / department (issuing structural unit), the protocol from " \_\_\_\_\_ № \_\_\_\_\_

3. The work program was revised at the meeting of the Department / Department / Department (implementing the discipline) and approved at the meeting of the Department / Department / Department (issuing structural unit), the protocol from " \_\_\_\_\_ № \_\_\_\_\_

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1. Goals and objectives of mastering the discipline:

Purpose: formation of students of the necessary skills and competencies that allow them to conduct research work both individually and collectively.

Tasks:

1. Conducting career guidance work among students, allowing them to choose the direction and topic of research.
2. Teaching students the skills of academic work, including the preparation and conduct of research, writing scientific papers.
3. Discussion of projects and ready-made research works of students.
4. Development of students' skills of scientific discussion and presentation of research results in the field of molecular and cell biology.

Professional competencies of graduates and indicators of their achievement:

| Task type | Code and name of professional competence (the result of mastery)  | Code and name of the competency achievement indicator   |
|-----------|---|---|
| research  | PC-1 Is able to creatively use in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines (modules) that determine the scope of molecular and cell biology. | PC-1.1 Works with scientific and technical information and special literature, studies the achievements of domestic and foreign science in the field of molecular and cell biology using new technologies and electronic databases. |
|           |   | PC-1.2 Comprehends and formulates diagnostic solutions to the problems of molecular and cellular biology by integrating fundamental biological concepts and specialized knowledge in the field of professional activity             |
|           |   | PC-1.3 Uses in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology   |
| research  | PC-2 is able to apply the methodological foundations of design, perform laboratory biological, environmental research, use modern equipment and computing   | PC-2.1 Develops rules and algorithms for the design, implementation of laboratory biological and environmental research.  |
|           |   | PC-2.2 Performs laboratory biological, environmental research using the scientific methodological foundations of fundamental research.  |

|          |   |  |
|----------|---|--|
|          | complexes in molecular and cell biology.  | PK-2.3 Applies the methodological foundations of design, laboratory biological, environmental research, uses modern equipment and computing complexes in molecular and cellular biology.   |
| research | PC-4 is capable of conducting scientific research in molecular and cellular biology in order to develop the scientific potential of the Russian Far East and the development of the resources of the World Ocean. | <p>PP-4.1 Conducts substantiation of scientific research in molecular and cellular biology in order to develop the scientific potential of the Russian Far East and the development of the resources of the World Ocean.</p> <p>PP-4.2 Performs applied and exploratory research and development in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean.</p> <p>PP-4.3 Interprets the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean.</p> |

| Code and name of the competency achievement indicator   | Name of the assessment indicator (the result of training in the discipline)   |
|---|---|
| PC-1.1 Works with scientific and technical information and special literature, studies the achievements of domestic and foreign science in the field of molecular and cell biology using new technologies and electronic databases. | Knows standards adopted in health care, technical regulations, standards, recommendations, terminology, current classifications for the qualitative maintenance of specialized documentation        |
|   | Can conduct a statistical assessment of its work and the activities of the organization using accounting and reporting specialized documentation  |
|   | Owns skills in maintaining specialized documentation at all stages of professional activity   |
| PC-1.2 Comprehends and formulates diagnostic solutions to the problems of molecular and cellular biology by integrating fundamental biological concepts and specialized knowledge in the field of professional activity             | Knows diagnostic solutions to problems of molecular and cell biology  |
|   | Can formulate diagnostic solutions to problems in molecular and cell biology by integrating fundamental biological concepts   |
|   | Owns skills in making diagnostic solutions to problems of molecular and cell biology by integrating fundamental biological concepts and specialized knowledge in the field of professional activity |
|   | Knows   |

|  |  |
|--|--|
| PC-1.3 Uses in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology    | He knows about the features of scientific and production-technological activity knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology  |
|  | Can<br>Able to use in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology   |
|  | Owns<br>Possesses the skills of applying the acquired knowledge of immunology in scientific and production-technological activities and the study of related disciplines   |
| PC-2.1 Develops rules and algorithms for the design, implementation of laboratory biological and environmental research.   | Knows<br>methodological foundations of design, implementation of field and laboratory biological, environmental studies  |
|  | Can<br>develop rules and algorithms for designing, performing laboratory biological and environmental studies  |
|  | Owns<br>skills in developing and improving new rules and algorithms for designing, performing laboratory biological and environmental research   |
| PC-2.2 Performs laboratory biological, environmental research using the scientific methodological foundations of fundamental research.   | Knows<br>– modern classification of methods of scientific research, specifics and boundaries of their applicability;<br>– the specifics of research characteristic of various environmental disciplines, the main classes of models that are a reflection of real systems - objects of environmental research;<br>– the main methods of statistical analysis: correlation, regression and variance |
|  | Can<br>use methods of statistical analysis to assess the reliability of data, compare empirical and theoretical systems, find the relationship between the variables that characterize the state of the system   |
|  | Owns<br>the ability to independently analyze the available information, identify fundamental problems, set the task  |
| PK-2.3 Applies the methodological foundations of design, laboratory biological, environmental research, uses modern equipment and computing complexes in molecular and cellular biology. | Knows<br>basic modern field and laboratory methods of biology and ecology research   |
|  | Can<br>work on modern analytical equipment of a modern biological laboratory   |
|  | Owns<br>modern methods of research in ecology and biology  |
| PP-4.1 Conducts substantiation of scientific research in molecular and cellular biology in order to develop  | Knows<br>the current situation of development of the scientific potential of the Russian Far East and the development of the resources of the World Ocean  |

|  |  |
|--|--|
| the scientific potential of the Russian Far East and the development of the resources of the World Ocean.  | Can<br>to characterize the achievements of modern science in the field of molecular and cell biology in order to develop the scientific potential of the Russian Far East and the development of the resources of the World Ocean            |
|  | Owns<br>the ability to substantiate scientific research in molecular and cell biology  |
| PP-4.2 Performs applied and exploratory research and development in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean. | Knows<br>fundamental scientific research and development in the field of molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean         |
|  | Can<br>perform applied and exploratory research and development in molecular and cellular biology  |
|  | Owns<br>skills in the use of applied and exploratory research and development in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean |
| PP-4.3 Interprets the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean.             | Knows<br>scientific research in molecular and cell biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean  |
|  | Can<br>to interpret the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean                        |
|  | Owns<br>skills in analyzing the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean                |

### 1. Labor intensity of discipline and types of training sessions in the discipline

The total labor intensity of the discipline is 3 credited units (108 academic hours), (1 credit unit corresponds to 36 academic hours).

Types of training sessions and work of the student in the discipline are:

| Designation | Types of training sessions and work of the student                        |
|-------------|---|
| Ave         | Practical exercises   |
| Pr electr.  | Hands-on labs in an interactive way                                       |
| WED:        | Independent work of the student during the period of theoretical training |
|             | And other types of work   |

## Structure of the discipline:

The form of training is full-time.

| №      | Name of the section<br>Discipline   | S<br>e<br>m<br>e<br>s<br>t<br>e<br>r | Number of hours by types of training<br>sessions and work of the student |     |     |    |         | Contr<br>ol | Intermediate<br>attestation forms   |
|--------|---|--------------------------------------|--|-----|-----|----|---------|-------------|-------------------------------------|
|        |   |                                      | Lek  | Lab | Ave | OK | WE<br>D |             |                                     |
| 1      | Section 1. Modern<br>problems of molecular<br>and cell biology                  | 2                                    | -  | -   | 6   | -  | 90      | -           | Questions for test<br>No. 1-11      |
| 2      | Section 2. Modern<br>problems of genetics,<br>physiology and medical<br>biology |                                      | -  | -   | 6   | -  |         | -           | Questions for the<br>test No. 12-22 |
| 3      | Section 3. Applied aspects<br>of biology and<br>biotechnology                   |                                      | -  | -   | 6   | -  |         | -           | Questions for test<br>No. 23-33     |
| Total: |   | 2                                    | -  | -   | 18  | -  | 90      | -           | Credit                              |

## IV. STRUCTURE AND CONTENT OF THE PRACTICAL PART OF THE COURSE AND INDEPENDENT WORK

### Practical exercises (18 hours)

#### **Section 1.** Modern problems of molecular and cell biology .

Topic 1. Mechanisms of control over the development of a multicellular organism: regulation of differential activity of genes in time and space.

Topic 2: Principles and methods of proteome analysis.

Topic 3: Modern methods of DNA sequencing (modifications of the Sanger method for automatic sequencing, pyrosequencing).

Topic 4: Principles and methods of genomic mapping.

Topic 5: Functional genomics and proteomics.

#### **Section 2.** Modern problems of genetics, physiology and medical biology.

Topic 1. Human genome. RNCinterference: theoretical and practical aspects.

Topic 2. Modern problems of neurobiology and neuroimmunology

#### **Section 3.** Applied aspects of biology and biotechnology.

Topic 1. The use of microorganisms and microbial biological products to combat diseases and pests of agricultural plants.

Topic 2. The main tasks and prospects for the development of molecular and cell biology.

Topic 3. The use of bacteria in the processes of biotransformation of organic compounds.

Topic 4. General principles of construction of analytical biosensor devices.

Topic 5. Modern trends in the creation of genetically modified plants

### **Independent work (90 hours)**

#### **Topics of reports**

1. Regulation of differential activity of genes in time and space.
2. Regional division of the early embryo into cellular domains.
3. The concept of morphogens and gradients of their concentrations.
4. Study of intercellular interactions in the early development of amphibians.
5. Problems of search and identification of free radical reactions in cells.
6. Bioradicals and their biochemical functions.
7. Antioxidants and pro-oxidants. Their role in the regulation of free radical reactions.
8. Structural and functional aspects of the design of protein molecules.
9. Problems and prospects of applied areas of protein engineering.
10. Principles and methods of proteome analysis.
11. Genomic revolution of the late XX century: technological innovations and their results.
12. Computational and experimental approaches to the identification of genes in genomic sequences and the determination of their functions.
13. Molecular databases.
14. Application of DNA microarrays in genomic research.
15. Study of plant resistance to infectious diseases.
16. Two-level (interspecific and racial-varietal) alien recognition system in plants, innate immunity.
17. Probable ontogenetic functions of R-genes.

## **V. EDUCATIONAL AND METHODOLOGICAL SUPPORT OF INDEPENDENT WORK OF STUDENTS**

Educational and methodological support for the independent work of students in the discipline Research seminar "Modern problems of molecular and cell biology" includes:



- characteristics of tasks for independent work of students and methodological recommendations for their implementation;
- requirements for the presentation and design of the results of independent work;
- criteria for evaluating the performance of independent work.

## VI. MONITORING THE ACHIEVEMENT OF COURSE OBJECTIVES

| No p/n | Supervised sections / topics of the discipline                            | Achievement indicator code and name   | Learning outcomes   | Assessment tools |                                     |
|--------|---|---|---|------------------|-------------------------------------|
|        |   |   |   | current control  | Intermediate-accurate certification |
| 1      | Section 1.<br>Modern problems of molecular and cell biology               | PC-1.1 Works with scientific and technical information and special literature, studies the achievements of domestic and foreign science in the field of molecular and cell biology using new technologies and electronic databases. | Knows standards adopted in health care, technical regulations, standards, recommendations, terminology, current classifications for the qualitative maintenance of specialized documentation<br>Can conduct a statistical assessment of its work and the activities of the organization using accounting and reporting specialized documentation<br>Owns skills in maintaining specialized documentation at all stages of professional activity | Report           | Questions for credit                |
|        | Section 2.<br>Modern problems of genetics, physiology and medical biology |   |   |                  |                                     |
|        | Section 3.<br>Applied aspects of biology and biotechnology                | PC-1.2 Comprehends and formulates diagnostic solutions to the problems of molecular and cellular biology by integrating fundamental biological concepts and specialized knowledge in the field of professional activity             | Knows diagnostic solutions to problems of molecular and cell biology<br>Can formulate diagnostic solutions to problems in molecular and cell biology by integrating fundamental biological concepts<br>Owns skills in making diagnostic solutions to problems of molecular and cell biology by integrating fundamental biological concepts and specialized knowledge in the field of professional activity                                      | Colloquium       | Questions for credit                |

|  |  |  |  |                   |                             |
|--|--|--|--|-------------------|-----------------------------|
|  |  | <p>PC-1.3 Uses in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology</p> | <p>Knows<br/>He knows about the features of scientific and production-technological activity knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology</p> <p>Can<br/>Able to use in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology</p> <p>Owns<br/>Possesses the skills of applying the acquired knowledge of immunology in scientific and production-technological activities and the study of related disciplines</p> | <p>Colloquium</p> | <p>Questions for credit</p> |
|  |  | <p>PC-2.1 Develops rules and algorithms for the design, implementation of laboratory biological and environmental research.</p>  | <p>Knows<br/>methodological foundations of design, implementation of field and laboratory biological, environmental studies</p> <p>Can<br/>develop rules and algorithms for designing, performing laboratory biological and environmental studies</p> <p>Owns<br/>skills in developing and improving new rules and algorithms for designing, performing laboratory biological and environmental research</p>   | <p>Colloquium</p> | <p>Questions for credit</p> |

|  |  |  |   |               |                             |
|--|--|--|---|---------------|-----------------------------|
|  |  | <p>PC-2.2 Performs laboratory biological, environmental research using the scientific methodological foundations of fundamental research</p> | <p>Knows</p> <ul style="list-style-type: none"> <li>– modern classification of methods of scientific research, specifics and boundaries of their applicability;</li> <li>– the specifics of research characteristic of various environmental disciplines, the main classes of models that are a reflection of real systems - objects of environmental research;</li> <li>– the main methods of statistical analysis: correlation, regression and variance</li> </ul> <p>Can</p> <p>use methods of statistical analysis to assess the reliability of data, compare empirical and theoretical systems, find the relationship between the variables that characterize the state of the system</p> <p>Owns</p> <p>the ability to independently analyze the available information, identify fundamental problems, set the task</p> | <p>Report</p> | <p>Questions for credit</p> |
|--|--|--|---|---------------|-----------------------------|

|  |  |  |   |            |                      |
|--|--|--|---|------------|----------------------|
|  |  | <p>PK-2.3 Applies the methodological foundations of design, laboratory biological, environmental research, uses modern equipment and computing complexes in molecular and cellular biology.</p>                              | <p>Knows<br/>basic modern field and laboratory methods of biology and ecology research<br/>Can<br/>work on modern analytical equipment of a modern biological laboratory<br/>Owns<br/>modern methods of research in ecology and biology</p>   | Colloquium | Questions for credit |
|  |  | <p>PP-4.1 Conducts substantiation of scientific research in molecular and cellular biology in order to develop the scientific potential of the Russian Far East and the development of the resources of the World Ocean.</p> | <p>Knows<br/>the current situation of development of the scientific potential of the Russian Far East and the development of the resources of the World Ocean<br/>Can<br/>to characterize the achievements of modern science in the field of molecular and cell biology in order to develop the scientific potential of the Russian Far East and the development of the resources of the World Ocean<br/>Owns<br/>the ability to substantiate scientific research in molecular and cell biology</p> |            |                      |
|  |  | <p>PP-4.2 Performs applied and exploratory research and development in molecular and</p>   | <p>Knows<br/>fundamental scientific research and development in the field of molecular and cellular biology</p>   | Colloquium | Questions for credit |

|  |  |  |        |                      |
|--|--|--|--------|----------------------|
|  | cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean.   | aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean<br>Can perform applied and exploratory research and development in molecular and cellular biology<br>Owns skills in the use of applied and exploratory research and development in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean  |        |                      |
|  | PP-4.3 Interprets the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean. | Knows scientific research in molecular and cell biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean<br>Can to interpret the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean<br>Owns skills in analyzing the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean | Report | Questions for credit |

## VII. LIST OF REFERENCES AND INFORMATION AND METHODOLOGICAL SUPPORT OF THE DISCIPLINE

### Main literature

1. Ivanova, T. V. Methodology of Scientific Research : textbook / T. V. Ivanova, A. A. Kozlov, E. A. Zhuravleva. — Moscow : Russian University of Friendship of Peoples, 2012. — 80 c. — ISBN 978-5-209-03657-9. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/11580.html>
2. Skvortsova, L. M. Methodology of scientific research : uchebnoe posobie / L. M. Skvortsova. — Moscow : Moskovskii gosudarstvennyi stroitel'nyi universiteta, Ai Pi Er Media, EBS ASP, 2014. — 79 p. — ISBN 978-5-7264-0938-2. — Text : elektronnyi // Filial'nyi obrazovatel'nyi resurs IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/27036.html>
3. Kentbaeva, B. A. Methodology of scientific research : textbook / B. A. Kentbaeva. — Almaty : Nur-Print, 2014. — 209 p. — ISBN 978-601-241-535-3. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/69140.html>
4. Kravtsova, E. D. Logica i komodosiya nauchnykh issledovaniya : uchebnoe posobie / E. D. Kravtsova, A. N. Gorodishcheva. — Krasnoyarsk : Sibirskii federal'nyi universiteta, 2014. — 168 p. — ISBN 978-5-7638-2946-4. — Text : elektronnyi // Fillektsionnyi obrazovatel'skii IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/84369.html>
5. Kitsenko, T. P. Methodology, planning and processing of the results of the experiment in scientific research : educational and methodical manual / T. P. Kitsenko, S. V. Lakhtarina, E. V. Egorova. — Makeevka : Donbass national academy of construction and architecture, EBS ASV, 2020. — 70 p. — Text : electronic // Digital educational resource IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/93862.html>
6. Afanasyev, V. N. Statistical methodology in scientific research : uchebnoe posobie dlya postgraduate / V. N. Afanasyev, N. S. Eremeeva, T. V. Lebedeva. — Orenburg : Orenburgskii gosudarstvennyi universiteta, EBS ASP, 2017. — 246 p. — ISBN 978-5-7410-1703-6. — Text : elektronnyi // Fillektsionnoi obrazovatel'skii ipr SMART : [site]. — URL: <https://www.iprbookshop.ru/78841.html>
7. Li, R. I. Osnovy nauchnykh issledovaniya : uchebnoe posobie / R. I. Li. — Lipetskii gosudarstvennyi tekhnicheskii universiteta, EBS ASP, 2013. — 190 p. — ISBN 978-5-88247-600-6. — Text : elektronnyi // Fillektsionnoi obrazovatel'nyi resurs IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/22903.html>

8. Shutov, A. I. Osnovy nauchnykh issledovaniya : uchebnoe posobie / A. I. Shutov, Y. V. Semikopenko, E. A. Novopisnyi. — Belgorod : Belgorodskii gosudarstvennyi tekhnologicheskii universiteta imeni V.G. Shukhova, EBS ASP, 2013. — 101 s. — Text : elektronnyi // Fillektsionnogo obrazovatel'noi IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/28378.html>

9. Biological methods of scientific research (selected lectures) : uchebnoe posobie / compiled by L. G. Kharitonova, I. N. Kalinina. — Omsk : Sibirskii gosudarstvennyi universiteta physical kul'tury i sportu, 2014. — 76 p. — Text : elektronnyi // Uchificheskii obrazovatel'nyi resurs IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/64973.html>

10. Computer technologies in scientific research : uchebnoe posobie / E. N. Kosova, K. A. Katkov, O. V. Velts [i dr.]. — Stavropol : Severo-Kavkazskii federal'nyi universiteta, 2015. — 241 p. — Text : elektronnyi // Uchificheskii obrazovatel'nyi resurs IPR SMART : [site]. — URL: <https://www.iprbookshop.ru/63098.html>

#### Further reading

1. Scientific and methodical activity: educational and methodical manual / compilers S. Y. Makhov. — Eagle: Interregional Academy of Security and Survival (MABIV), 2020. — 123 p. — Text: electronic // Digital educational resource IPR SMART: [site]. — URL: <https://www.iprbookshop.ru/95405.html>

2. Demina L.A. Logic, methodology, argumentation in scientific research : textbook for postgraduate students / L. A. Demina, V. I. Przhilensky. — Moscow : Prospekt, 2018. — 159 p.  
<https://lib.dvfu.ru/lib/item?id=chamo:865081&theme=FEFU>

3. Sosnin, E. A. Methodology of experimentation : uchebnoe posobie / E. A. Sosnin, B. N. Poizner. — Moscow : Infra-M, 2017. — 161 p.  
<https://lib.dvfu.ru/lib/item?id=chamo:841841&theme=FEFU>

4. Demina L.A. Logic, methodology, argumentation in scientific research: a textbook for postgraduate students / L. A. Demina, V. I. Przhilensky. — Moscow: Prospekt, 2018. — 159 p.  
<https://lib.dvfu.ru/lib/item?id=chamo:865081&theme=FEFU>

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

1. <http://elibrary.ru/> - scientific electronic library
2. <http://molbiol.ru/> is an information resource on molecular biology
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 information and cognitive resource dedicated to the natural sciences.
6. <http://www.iprbookshop.ru/> is an electronic library system IPRbooks.
7. <http://znanium.com/> - EBS "Znanium".
8. <https://nplus1.ru/> - N+1, a popular science online publication on science, engineering and technology
9. <http://antropogenez.ru/> - 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; bibliothecar program.
14. [http:// www.ebi.ac.uk](http://www.ebi.ac.uk/)- website of the European Bioinformatics Institute
15. [http:// www.scopus.com](http://www.scopus.com) – Bibliographic database and Scopus citation index
16. <http://thomsonreuters.com/thomson-reuters-web-of-science/> bibliographic database and Web of Science 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 a high degree of data compression;
3. Adobe Acrobat XI Pro – 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 for Windows-based workstations. Virtualization support + new technologies;
6. WinDjView 2.0.2 - a software to recognize and view files with the same format DJV and DjVu; SolidWorks 2016 - CAD software package for automation of industrial enterprise operations at the stages of design and technological preparation of production

7. Compass-3D LT V12 - three-dimensional modeling system
8. Notepad++ 6.68 – text editor

## **VIII.METHODICAL INSTRUCTIONS FOR MASTERING THE DISCIPLINE**

### **Colloquia**

Colloquium is a collective form of consideration and consolidation of educational material. Colloquia are one of the types of practical classes designed for in-depth study of the discipline, conducted in an interactive mode. At the classes on the topic of the colloquium, questions are analyzed, and then, together with the teacher, their discussion is held, which is aimed at consolidating the material, forming the skills to conduct polemics, 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 colloquia, the following are used: a detailed conversation, a debate, a press conference.

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

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

**Press conference.** The teacher instructs several students to prepare brief (thesis) messages. After the reports, students ask questions that 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-situation analysis based on learning by solving specific problems - situations (solving cases). The method of specific situations (case study method) refers to non-game imitative active learning 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 number 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 should analyze the situation, understand the essence of the problems, offer possible solutions and choose the best of them. Thanks to the knowledge gained at the lecture, it is easy for the student to correlate the theoretical baggage of knowledge obtained with the real practical situation. Being an interactive method of teaching, it wins a positive attitude from students, who see in it an opportunity to show initiative, feel independent in mastering

theoretical positions 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 teacher.

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

- identification, selection and problem solving;
- work with information – comprehension of the meaning of the details described in the situation;
- analysis and synthesis of information and arguments;
- work with assumptions and conclusions;
- evaluation of alternatives;
- decision-making;
- listening and understanding other people are group work skills. 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 alone with real situations.

*The* case study is designed to improve 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 resolving various life and production situations (the use of the case involves individual and group work of students).

Brainstorming (brainstorming) is a widely used way of producing new ideas to solve scientific and practical problems. Its purpose is to organize collective mental activity to find non-traditional ways to solve problems.

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

- creative assimilation of educational material by students;
- the relationship of theoretical knowledge with practice;
- activation of educational and cognitive activity of trainees;
- formation of the ability to concentrate attention and mental efforts on solving an urgent problem;
- formation of experience of collective mental activity.

The problem formulated in the brainstorming session should have theoretical or practical relevance and arouse the active interest of students. A common

requirement to consider when choosing a problem for brainstorming is the possibility of many ambiguous options for solving a problem that is put forward to students as a learning task.

### **Tests and testing**

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

From the assessments of laboratory, colloquiums, tests and testing, an assessment of this discipline is mainly formed.

## **IX. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE**

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

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

### **Logistics and Software Discipline**

| Name of special premises and premises for independent work  | Equipment special premises and rooms for independent work   | 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: Screen with electric drive 236 * 147 cm Trim Screen Line; Projector DLP, 3000 ANSI Lm, WXGA 1280x800, 2000:1 EW330U Mitsubishi; Subsystem of specialized fasteners of equipment CORSA-2007 Tuarex; Video switching subsystem: DVI DXP 44 DVI Pro Extron matrix switch; DVI twisted pair extender DVI 201 Tx/Rx Extron; Subsystem of audio switching and sound amplification; acoustic system for ceiling mounting SI 3CT LP Extron; digital audio processor DMP 44 LC Extron; extension for IPL T CR48 management controller; Wireless LANs for trainees are provided with a system based on 802.11a/b/g/n 2x2 | -   |

|   |   |   |
|---|---|---|
|   | MIMO(2SS) access points.<br>HP All-in-One 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW, GigEth, Wi-Fi, WT, 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:<br>Monoblock HP ProOne 400 G1 AiO 19.5" Intel Core i3-4130T 4GB DDR3-1600 SODIMM (1x4GB)500GB;<br>Projection screen Projecta Elpro Electrol, 300x173 cm;<br>Multimedia projector, Mitsubishi FD630U, 4000 ANSI Lumen, 1920x1080;<br>Mortise interface with TLS TAM 201 Stan automatic cable retraction system;<br>Avervision CP355AF Visualizer; Microphone cordless radio system UHF band Sennheiser EW 122 G3 consisting of a wireless microphone and receiver;<br>LifeSizeExpress 220-Codeonly- Non-AES video conferencing codec; Network video camera Multipix MP-HD718; Two 47" LCD panels, Full HD, LG M4716CCBA; Subsystem of audio switching and sound amplification; 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                                | Screen with electric drive 236 * 147 cm Trim Screen Line; Projector DLP, 3000 ANSI Lm, WXGA 1280x800, 2000:1 EW330U Mitsubishi; Subsystem of specialized fasteners of equipment CORSA-2007  | - |

|  |   |  |
|--|---|--|
|  | <p>Tuarex; Video switching subsystem: DVI DXP 44 DVI Pro Extron matrix switch; DVI twisted pair extender DVI 201 Tx/Rx Extron; Subsystem of audio switching and sound amplification; acoustic system for ceiling mounting SI 3CT LP Extron; digital audio processor DMP 44 LC Extron; extension for IPL T CR48 management controller; Wireless LANs for trainees are provided with a system based on 802.11a/b/g/n 2x2 MIMO(2SS) access points.</p> <p>HP All-in-One 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW, GigEth, Wi-Fi, WT, usb kbd/mse, Win7Pro (64-bit)+Win8.1Pro(64-bit), 1-1-1 Wty</p> |  |
|--|---|--|

## X. VALUATION FUNDS

| Code and name of the competency achievement indicator   | Name of the assessment indicator<br>(the result of training in the discipline)   |
|---|--|
| PC-1.1 Works with scientific and technical information and special literature, studies the achievements of domestic and foreign science in the field of molecular and cell biology using new technologies and electronic databases. | Knows<br>standards adopted in health care, technical regulations, standards, recommendations, terminology, current classifications for the qualitative maintenance of specialized documentation              |
|   | Can<br>conduct a statistical assessment of its work and the activities of the organization using accounting and reporting specialized documentation  |
|   | Owns<br>skills in maintaining specialized documentation at all stages of professional activity   |
| PC-1.2 Comprehends and formulates diagnostic solutions to the problems of molecular and cellular biology by integrating fundamental biological concepts and specialized knowledge in the field of professional activity             | Knows<br>diagnostic solutions to problems of molecular and cell biology  |
|   | Can<br>formulate diagnostic solutions to problems in molecular and cell biology by integrating fundamental biological concepts   |
|   | Owns<br>skills in making diagnostic solutions to problems of molecular and cell biology by integrating fundamental biological concepts and specialized knowledge in the field of professional activity       |
| PC-1.3 Uses in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology   | Knows<br>He knows about the features of scientific and production-technological activity knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology |
|   | Can<br>Able to use in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology                 |
|   | Owns<br>Possesses the skills of applying the acquired knowledge of immunology in scientific and production-technological activities and the study of related disciplines                                     |
|   | Knows  |

|   |  |
|---|--|
| PC-2.1 Develops rules and algorithms for the design, implementation of laboratory biological and environmental research.  | methodological foundations of design, implementation of field and laboratory biological, environmental studies   |
|   | Can<br>develop rules and algorithms for designing, performing laboratory biological and environmental studies  |
|   | Owns<br>skills in developing and improving new rules and algorithms for designing, performing laboratory biological and environmental research   |
| PC-2.2 Performs laboratory biological, environmental research using the scientific methodological foundations of fundamental research.  | Knows<br>– modern classification of methods of scientific research, specifics and boundaries of their applicability;<br>– the specifics of research characteristic of various environmental disciplines, the main classes of models that are a reflection of real systems - objects of environmental research;<br>– the main methods of statistical analysis: correlation, regression and variance |
|   | Can<br>use methods of statistical analysis to assess the reliability of data, compare empirical and theoretical systems, find the relationship between the variables that characterize the state of the system   |
|   | Owns<br>the ability to independently analyze the available information, identify fundamental problems, set the task  |
| PK-2.3 Applies the methodological foundations of design, laboratory biological, environmental research, uses modern equipment and computing complexes in molecular and cellular biology.                              | Knows<br>basic modern field and laboratory methods of biology and ecology research   |
|   | Can<br>work on modern analytical equipment of a modern biological laboratory   |
|   | Owns<br>modern methods of research in ecology and biology  |
| PP-4.1 Conducts substantiation of scientific research in molecular and cellular biology in order to develop the scientific potential of the Russian Far East and the development of the resources of the World Ocean. | Knows<br>the current situation of development of the scientific potential of the Russian Far East and the development of the resources of the World Ocean  |
|   | Can<br>to characterize the achievements of modern science in the field of molecular and cell biology in order to develop the scientific potential of the Russian Far East and the development of the resources of the World Ocean  |
|   | Owns<br>the ability to substantiate scientific research in molecular and cell biology  |



|  |  |
|--|--|
| PP-4.2 Performs applied and exploratory research and development in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean. | Knows<br>fundamental scientific research and development in the field of molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean         |
|  | Can<br>perform applied and exploratory research and development in molecular and cellular biology  |
|  | Owns<br>skills in the use of applied and exploratory research and development in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean |
| PP-4.3 Interprets the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean.             | Knows<br>scientific research in molecular and cell biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean  |
|  | Can<br>to interpret the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean                        |
|  | Owns<br>skills in analyzing the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean                |

| No p/n | Supervised sections / topics of the discipline           | Achievement indicator code and name  | Learning outcomes  | Assessment tools |                                     |
|--------|--|--|--|------------------|-------------------------------------|
|        |  |  |  | current control  | Intermediate-accurate certification |
| 1      | Section 1. Modern problems of molecular and cell biology | PC-1.1 Works with scientific and technical information and special literature, studies the achievements of domestic and foreign science in the field of molecular and cell biology using | Knows<br>standards adopted in health care, technical regulations, standards, recommendations, terminology, current classifications for the qualitative maintenance of specialized documentation<br>Can | Report           | Questions for credit                |

|  |  |   |  |            |                      |
|--|--|---|--|------------|----------------------|
|  | Section 2. Modern problems of genetics, physiology and medical biology | new technologies and electronic databases.  | conduct a statistical assessment of its work and the activities of the organization using accounting and reporting specialized documentation<br>Owns skills in maintaining specialized documentation at all stages of professional activity  |            |                      |
|  | Section 3. Applied aspects of biology and biotechnology                | PC-1.2 Comprehends and formulates diagnostic solutions to the problems of molecular and cellular biology by integrating fundamental biological concepts and specialized knowledge in the field of professional activity | Knows diagnostic solutions to problems of molecular and cell biology<br>Can formulate diagnostic solutions to problems in molecular and cell biology by integrating fundamental biological concepts<br>Owns skills in making diagnostic solutions to problems of molecular and cell biology by integrating fundamental biological concepts and specialized knowledge in the field of professional activity   | Colloquium | Questions for credit |
|  |  | PC-1.3 Uses in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology                                   | Knows He knows about the features of scientific and production-technological activity knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology<br>Can Able to use in scientific and production-technological activities knowledge of fundamental and applied sections of disciplines that determine the scope of molecular and cell biology<br>Owns Possesses the skills of applying the acquired knowledge of immunology in scientific and | Colloquium | Questions for credit |

|  |  |   |   |            |                      |
|--|--|---|---|------------|----------------------|
|  |  |   | production-technological activities and the study of related disciplines  |            |                      |
|  |  | PC-2.1 Develops rules and algorithms for the design, implementation of laboratory biological and environmental research.              | <p>Knows<br/>methodological foundations of design, implementation of field and laboratory biological, environmental studies</p> <p>Can<br/>develop rules and algorithms for designing, performing laboratory biological and environmental studies</p> <p>Owns<br/>skills in developing and improving new rules and algorithms for designing, performing laboratory biological and environmental research</p>  | Colloquium | Questions for credit |
|  |  | PC-2.2 Performs laboratory biological, environmental research using the scientific methodological foundations of fundamental research | <p>Knows</p> <ul style="list-style-type: none"> <li>– modern classification of methods of scientific research, specifics and boundaries of their applicability;</li> <li>– the specifics of research characteristic of various environmental disciplines, the main classes of models that are a reflection of real systems - objects of environmental research;</li> <li>– the main methods of statistical analysis: correlation, regression and variance</li> </ul> <p>Can<br/>use methods of statistical analysis to assess the reliability of data, compare empirical and theoretical systems, find the relationship between</p> | Report     | Questions for credit |

|  |  |   |   |            |                      |
|--|--|---|---|------------|----------------------|
|  |  |   | <p>the variables that characterize the state of the system</p> <p>Owns the ability to independently analyze the available information, identify fundamental problems, set the task</p>  |            |                      |
|  |  | <p>PK-2.3 Applies the methodological foundations of design, laboratory biological, environmental research, uses modern equipment and computing complexes in molecular and cellular biology.</p> | <p>Knows basic modern field and laboratory methods of biology and ecology research</p> <p>Can work on modern analytical equipment of a modern biological laboratory</p> <p>Owns modern methods of research in ecology and biology</p> | Colloquium | Questions for credit |

|  |  |   |   |                   |                             |
|--|--|---|---|-------------------|-----------------------------|
|  |  | <p>PP-4.1 Conducts substantiation of scientific research in molecular and cellular biology in order to develop the scientific potential of the Russian Far East and the development of the resources of the World Ocean.</p>            | <p>Knows<br/>the current situation of development of the scientific potential of the Russian Far East and the development of the resources of the World Ocean<br/>Can<br/>to characterize the achievements of modern science in the field of molecular and cell biology in order to develop the scientific potential of the Russian Far East and the development of the resources of the World Ocean<br/>Owns<br/>the ability to substantiate scientific research in molecular and cell biology</p>   |                   |                             |
|  |  | <p>PP-4.2 Performs applied and exploratory research and development in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean.</p> | <p>Knows<br/>fundamental scientific research and development in the field of molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean<br/>Can<br/>perform applied and exploratory research and development in molecular and cellular biology<br/>Owns<br/>skills in the use of applied and exploratory research and development in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean</p> | <p>Colloquium</p> | <p>Questions for credit</p> |

|  |  |   |  |               |                             |
|--|--|---|--|---------------|-----------------------------|
|  |  | <p>PP-4.3 Interprets the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean.</p> | <p>Knows<br/>scientific research in molecular and cell biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean</p> <p>Can<br/>to interpret the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean</p> <p>Owens<br/>skills in analyzing the results of scientific research in molecular and cellular biology aimed at developing the scientific potential of the Russian Far East and the development of the resources of the World Ocean</p> | <p>Report</p> | <p>Questions for credit</p> |
|--|--|---|--|---------------|-----------------------------|

## **Examples of current control jobs**

### **Sample topics for the colloquium**

COLLOQUIUM 1. Topic: Modern problems of genetics, molecular biology, biochemistry.

Questions for written answer:

1. Regulation of differential activity of genes in time and space.
2. The concept of morphogens and gradients of their concentrations.
3. Modern methods of DNA sequencing.
4. Principles and methods of genomic mapping.
5. Human Genome Project
6. Mitochondrial genes and genetic code.
7. Principles of molecular diagnostics of hereditary and non-hereditary human diseases at different stages of ontogenesis.
8. Gene and cell therapy of monogenic and multifactorial diseases.
9. Structural and functional organization of microRNAs, short interfering RNAs and other small RNAs.
10. Functional role of RNA interference.
11. The use of the phenomenon of RNA interference and small RNA in functional genomics and experimental gene therapy.
12. New viruses: HIV, hepatitis C, hepatitis GB, herpesviruses, SARS, their characteristics and the diseases they cause.
13. Patterns of differentiation of somatic cells.
14. Stem cells of embryo and adult organism. Differentiation.
15. The importance of the microenvironment for the self-maintenance of the stem cell population.

COLLOQUIUM 2. Theme: Evolution and diversity of the organic world.

Questions for written answer:

1. Genome structure and non-canonical forms of variability, their role in the evolution of living organisms.
2. The influence of genomics achievements on the development of key areas of evolutionary biology.
3. Molecular phylogeny (molecular clock).
4. The role of horizontal (lateral) gene transfers in the evolution of living organisms.
5. Evolutions of cellular organelles and the origin of eukaryotes from the standpoint of genomics.
6. Reconstruction of the phylogeny of taxa of different ranks.
7. The problem of similarity, reflecting the commonality of origin.

8. New methods of systematics: karyosystematics, chemosystematics, genosystematics.

9. Modern directions of classification: phenetics, cladism, philistics.

10. Problems of phylogeny and megasystematics of fungi and plants.

11. Aboriginal and adventive forms, introduction and naturalization. The introduction of invasive species in the community, its consequences.

12. Adventive fraction of the retent fauna and forecast of its replenishment in the modern period.

13. Alpha, beta and gamma diversity.

14. Status and prospects of studying the biodiversity of animals, plants and fungi; its importance for maintaining the stability of natural and artificial ecosystems.

15. Modern approaches to biodiversity conservation.

COLLOQUIUM 3. Theme: Applied aspects of biology and biotechnology.

Questions for written answer:

1. The use of microorganisms and microbial biological products to combat diseases and pests of agricultural plants.

2. Microbial soil-fertilizer biological preparations and their use in agriculture.

3. Phytostimulants.

4. Use of microorganisms in animal husbandry.

5. Obtaining feed protein products, medical, enzyme, veterinary preparations, bacterial fertilizers and metabolites of bacteria of the first and second phase of growth.

6. The use of certain groups of microorganisms in the production of lactic acid products, bakery, meat and fish industries, etc. The use of bacteria in the processes of biotransformation of organic compounds

7. Modern ideas about the pathogenicity factors of pathogenic bacteria.

8. Mechanisms of action of bacterial toxins at the cellular and molecular levels.

9. Systems of secretion of pathogenicity factors by bacterial cells.

10. General principles of construction of analytical biosensor devices.

11. Use of biosensors in scientific research, medicine, environmental assessment and production.

12. Vector systems for introducing genetic information into plant cells.

13. Modern trends in the creation of genetically modified plants.

14. Socio-economic aspects of the introduction of transgenic organisms into practice.

15. Criteria and methods for assessing the safety of genetically modified organisms



## Criteria for evaluating the colloquium

|            |                                  |                                |                        |                              |
|------------|----------------------------------|--------------------------------|------------------------|------------------------------|
| evaluation | 50-60 points<br>(unsatisfactory) | 61-75 points<br>(satisfactory) | 76-85 points<br>(good) | 86-100 points<br>(excellent) |
|------------|----------------------------------|--------------------------------|------------------------|------------------------------|

### Examples of intermediate control jobs

#### List of questions to the test

1. Problems of search and identification of free radical reactions in cells.
2. Bioradicals: structural and functional bases of reactivity.
3. Biochemical functions of bioradicals.
4. Antioxidants and pro-oxidants: the relationship between structure and function in the regulation of free radical reactions.
5. Regulation of differential activity of genes in time and space.
6. The concept of morphogens and gradients of their concentrations.
7. Modern methods of DNA sequencing.
8. Principles and methods of genomic mapping.
9. Human Genome Project
10. Mitochondrial genes and genetic code.
11. Principles of molecular diagnostics of hereditary and non-hereditary human diseases at different stages of ontogenesis.
12. Gene and cell therapy of monogenic and multifactorial diseases.
13. Structural and functional organization of microRNAs, short interfering RNAs and other small RNAs.
14. Functional role of RNA interference.
15. Use of the phenomenon of RNA interference and small RNAs in functional genomics and experimental gene therapy.
16. New viruses: HIV, hepatitis C, hepatitis GB, herpesviruses, ATYPICAL pneumonia, their characteristics and diseases caused by them.
17. Regularities of differentiation of somatic cells.
18. Stem cells of embryo and adult organism. Differon.
19. The importance of the microenvironment for the self-maintenance of the stem cell population.
20. Reconstruction of the phylogeny of taxa of various ranks.
21. New methods of systematics: karyosystematics, chemosystematics, genosystematics.
22. Modern directions of classification: phenetics, cladism, philistics.
23. The role of cognition of little-studied taxa for the construction of the phylogenetic system of the animal kingdom.
24. Problems of phylogeny and megasystematics of fungi and plants.

25. Introduction of invasive species in the community, its consequences.  
Applied aspects of the problem.
26. Diversity of the organic world. Alpha, beta and gamma diversity.
27. The importance of biodiversity in the conservation and use of biosphere resources.
28. Modern approaches to biodiversity conservation.
29. Phytopathogenic microorganisms.
30. The use of microorganisms and microbial biological products to combat diseases and pests of agricultural plants.
31. The main tasks and prospects for the development of industrial microbiology.
32. The use of bacteria in the processes of biotransformation of organic compounds.
33. Modern ideas about the pathogenicity factors of pathogenic bacteria

**Criteria for assessing students on the test  
by discipline**

**Research Seminar "Modern Problems of Molecular and Cell Biology"**

| Points<br>(rating) | Score of the<br>test/exam<br>(standard) | Requirements for the formed competencies   |
|--------------------|---|--|
| 100-85<br>points   | <i>"excellent" / offset</i>             | The grade "test / excellent" is given to the student if he has deeply and firmly mastered the program material, exhaustively, consistently, clearly and logically coherently presents it, is able to closely link the theory with practice, freely copes with tasks, questions and other types of application of knowledge, and does not find it difficult to answer when modifying tasks, uses in the answer the material of monographic literature, correctly justifies the decision made, has versatile skills and techniques for performing practical tasks. |
| 85-76 points       | <i>"good" / offset</i>                  | The grade "test / good" is given to the student if he firmly knows the material, correctly and substantively presents it, not allowing significant inaccuracies in the answer to the question, correctly applies theoretical provisions when solving practical questions and problems, owns the necessary skills and techniques for their implementation.  |
| 75-61 points       | <i>"satisfactory" / offset</i>          | The grade "offset / satisfactory" is given to the student if he has knowledge of only the basic material, but has not mastered its details, admits inaccuracies, insufficiently correct wording, violations of the logical sequence in the presentation of the program material, has difficulties in performing practical work.  |
| 60-50 points       | <i>"unsatisfactory" / offset</i>        | The grade "non-credit / unsatisfactory" is given to a student who does not know a significant part of the program material, makes significant mistakes, is uncertain, with great difficulty performs practical work. As a rule, the "unsatisfactory" grade is given to students who cannot continue their studies without additional classes in the relevant discipline.   |