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)

# COLLECTION OF WORK PROGRAMS PRACTICES
## Direction of training 06.03.01 Biology
## Bachelor's program "Biomedicine (in English)"

Graduate qualification - Bachelor

Full-time form of education
The standard period for completing the program is 4 years
Starting year of preparation 2023

The collection of practical work programs has been compiled in accordance with the requirements of the Federal State Educational Standard in the field of study 03/06/01 Biology, approved by Order of the Ministry of Education and Science of Russia dated 08/07/2020 No. 920.
*A collection of work programs for practices was discussed at a meeting of the Department of Medical Biology and Biotechnology (minutes dated April 12, 2023 No. 3)*
*Director of the Department of the Implementing Structural Unit, Ph.D., Kumeiko V.V.*
*Compiled by: Kumeiko V.V.*

Vladivostok
2023

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# WORK PROGRAM OF TRAINING PRACTICE

Educational practice. Introductory practice (Training practice. Introductory practice)

for the direction of training

**06.03.01 Biology**

**Name of the educational program "Biomedicine (in English)"**

Vladivostok
2023

## 1. OBJECTIVES OF MASTERING EDUCATIONAL PRACTICE

The goals of the educational (Training practice. Introductory practice) practice are to consolidate the theoretical knowledge acquired in the study of basic and professional disciplines; acquisition of initial professional skills for future professional activities; formation of competencies that meet the requirements of the main professional educational program of the undergraduate program “Biomedicine (in English)” 03/06/01 Biology.

## 2. OBJECTIVES OF EDUCATIONAL PRACTICE

The objectives of educational practice are:

- preparation of objects and mastering research methods;
- obtaining biological material for laboratory research;
- participation in laboratory and biological research using a given methodology;
- selection of technical means and methods of work, work on experimental installations, preparation of equipment;
- analysis of obtained laboratory biological information using modern computer technology.

## 3. PLACE OF TRAINING PRACTICE IN THE STRUCTURE OF EP

Block B2.O.01 “Training practice” of the Federal state educational standard in the field of study 03/06/01 Biology, approved by order of the Ministry of Science and Higher Education of the Russian Federation dated 08/07/2020 No. 920, is mandatory and represents a type of training sessions, directly focused on professional and practical training of students.

Educational practice is the first stage of practical training at the bachelor's level of higher education and is aimed at students obtaining initial skills in research activities. Training practice is carried out only in a basic, stationary organization, structural unit, which has the necessary personnel, scientific, technical and material potential (stationary).

Educational practice is based on the theoretical mastery of such disciplines as: “Fundamentals of project activity”, “Fundamentals of digital literacy”, “General biology”, “General and inorganic chemistry”, “Higher mathematics”, etc.

Students undergoing practical training is an integral part of the educational process and is necessary for subsequent study of the professional modules “Chemistry Module”, “FEFU Digital Core”, “Module of Physical and Mathematical Sciences”, “General Professional Module”, “Module of Biology and Fundamental Medicine” and etc., as well as during other types of practice: “Training practice. Research work (Obtaining primary skills in research work)", "Industrial practice. Medicine development practice", "Industrial practice. Research work", "Industrial practice. Pre-graduation practice, including research work.”

## 4. TYPES, METHODS, PLACE AND TIMES OF TRAINING PRACTICE

| | |
|---|---|
| Type of practice | Educational practice |
| Type of practice | Educational practice. Introductory practice |
| Method of implementation | Stationary/traveling |
| Form(s) of conduct | Concentrated |
| Volume of practice in credit units; duration of practice; course, semester | 1st year, 2nd semester: 3 credits, 2 weeks, 108 academic units. hour. |
| Practice bases | 1) Center for Genomic and Regenerative Medicine of the ShBM FEFU, laboratory of biomedical cell technologies;<br>2) Federal Scientific Center for Biodiversity of Terrestrial Biota of East Asia FEB RAS (FSC Biodiversity FEB RAS), laboratory of biotechnology; bioengineering laboratory;<br>3) Federal State Budgetary Institution of Science "National Scientific Center for Marine Biology named after. A.V. Zhirmunsky" Far Eastern Branch of the Russian Academy of Sciences, Laboratory of Cell Technologies |

## 5. STUDENT COMPETENCIES FORMED AS A RESULT OF TRAINING PRACTICE

General professional competencies of graduates and indicators of their achievement

| **Code and name of general professional competencies** | **Code and name of the general professional achievement indicator competencies** |
|---|---|
| OPK-1. Able to apply knowledge of biological diversity and use techniques observation, identification, classification, reproduction and cultivation of living objects for solving professional problems | GPC-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology |
| | GPC-1.2 Uses the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation; |
| | OPK-1.3 Applies methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems |
| OPK-2. Able to apply the principles of structural and functional organization, use physiological, cytological, biochemical, biophysical methods of analysis to assess and correct the condition of living objects and monitor their habitat; | GPC-2.1 Understands the principles of structural and functional organization of biological systems |
| | OPK-2.2 Uses physiological, cytological, histological, biochemical, biophysical methods of analysis to assess the condition of living objects and monitor their habitat; |
| | OPK-2.3 Analyzes the pharmacokinetics and pharmacodynamics of the studied objects based on knowledge of morphofunctional characteristics, physiological states and pathological processes in |

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| | the body |
| OPK-3. Able to apply knowledge of the basics of evolutionary theory, use modern ideas about the structural and functional organization of the genetic program<br>living objects and methods of molecular biology, genetics and developmental biology for<br>research into the mechanisms of ontogenesis and phylogenesis in professional activities; | GPC-3.1 Applies knowledge of the basics of evolutionary theory and analyzes modern directions of evolutionary processes; |
| | GPC-3.2 Applies knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics |
| | GPC-3.3 Uses modern ideas about the structural and functional organization of the genetic program of living objects; |
| OPK-4. Capable of implementing measures for protection, use, monitoring and<br>restoration of biological resources, using knowledge of the laws and methods of general and applied<br>ecology; | GPC-4.1 Applies knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole |
| | OPK-4.2 Implements measures for the protection, use, monitoring and restoration of biological resources; |
| | OPK-4.3 Uses knowledge of the laws and methods of general and applied ecology |
| OPK-5. Able to apply modern concepts in professional activities<br>about the basics of biotechnological and biomedical production, genetic engineering,<br>nanobiotechnology, molecular modeling; | GPC-5.1 Uses the principles of modern biotechnology, genetic engineering techniques, the basics of nanobiotechnology, molecular modeling in professional activities; |
| | OPK-5.2 Evaluates and predicts the prospects of the objects of his professional activity for biotechnological production; |
| | GPC-5.3 Applies in professional activities modern ideas about the fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling |
| OPK-6. Able to use the basic laws of physics in professional activities,<br>chemistry, earth sciences and biology, apply methods of mathematical analysis and modeling,<br>theoretical and experimental research, acquire new mathematical and<br>natural science knowledge using modern educational and information technologies; | GPC-6.1 Uses the basic laws of physics, chemistry, earth sciences and biology in professional activities |
| | OPK-6.2 Applies methods of mathematical analysis and modeling, theoretical and experimental research |
| | GPC-6.3 Acquires new mathematical and natural science knowledge using modern educational and information technologies |
| OPK-7. Able to understand the principles of operation of modern information technologies and<br>use them to solve problems of professional activity; | OPK-7.1 Uses modern IT technologies in collecting, analyzing, processing and presenting natural science information |
| | GPC-7.2 Complies with information security standards in professional activities; |
| | OPK-7.3 Creates and studies models of real-life natural scientific objects, processes or phenomena |

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| OPK-8. Able to use methods of collecting, processing, organizing and presenting<br>field and laboratory information, apply skills in working with modern equipment,<br>analyze the results obtained. | OPK-8.1 Formulates conclusions and conclusions based on the results of the analysis of literary data, own experimental and theoretical work in natural sciences |
| | OPK-8.2 Offers interpretation of the results of one's own experiments and theoretical calculations using the theoretical foundations of natural sciences |
| | OPK-8.3 Systematizes and analyzes the results of experiments, observations, measurements and theoretical calculations |

| Code and name of the competency achievement indicator | Name of the assessment indicator<br>(result of training by practice) |
|---|---|
| GPC-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology | Knows<br>theoretical foundations of molecular and cellular biology, microbiology and virology.<br>Can<br>apply the theoretical foundations of molecular and cellular biology, microbiology and virology.<br>Owns<br>skills in using the theoretical foundations of molecular and cellular biology, microbiology and virology. |
| GPC-1.2 Uses the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation | Knows<br>theoretical foundations of molecular and cellular biology.<br>Can<br>apply the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation.<br>Owns<br>skills in using the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation. |
| OPK-1.3 Applies methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems | Knows<br>methods of observation, identification, classification, reproduction and cultivation of living objects.<br>Can<br>applymethods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems.<br>Owns<br>methods of observation, identification, classification, reproduction and cultivation of living objects in professional activities. |
| GPC-2.1 Understands the principles of structural and functional organization of biological systems | Knows<br>principles of structural and functional organization of biological systems.<br>Can<br>apply the principles of structural and functional organization of biological systems.<br>Owns<br>skills in using the principles of structural and functional organization |

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| | of biological systems. |
| OPK-2.2 Uses physiological, cytological, histological, biochemical, biophysical methods of analysis to assess the condition of living objects and monitor their habitat | Knows<br>physiological, cytological, histological, biochemical, biophysical methods of analysis.<br>Can<br>apply physiological, cytological, histological, biochemical, biophysical methods of analysis in professional activities.<br>Owns<br>physiological, cytological, histological, biochemical, biophysical methods of analysis to assess the condition of living objects and monitor their habitat. |
| OPK-2.3 Analyzes the pharmacokinetics and pharmacodynamics of the studied objects based on knowledge of morphofunctional characteristics, physiological states and pathological processes in the body | Knows<br>pharmacokinetics and pharmacodynamics of the studied objects.<br>Can<br>analyze the pharmacokinetics and pharmacodynamics of the studied objects.<br>Owns<br>the ability to analyze the pharmacokinetics and pharmacodynamics of the studied objects based on knowledge of morphofunctional characteristics, physiological states and pathological processes in the body. |
| GPC-3.1 Applies knowledge of the basics of evolutionary theory and analyzes modern directions of evolutionary processes | Knows<br>foundations of evolutionary theory and modern directions of evolutionary processes.<br>Can<br>apply knowledge of the basics of evolution.<br>Owns<br>knowledge of the basics of evolutionary theory and modern directions of evolutionary processes. |
| GPC-3.2 Applies knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics | Knows<br>history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics.<br>Can<br>apply knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics.<br>Owns<br>skills in using knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics. |
| OPK-3.3 Uses modern ideas about the structural and functional organization of the genetic program of living objects | Knows<br>structural and functional organization of the genetic program of living objects.<br>Can<br>apply modern ideas about the structural and functional organization of the genetic program of living objects.<br>Owns<br>modern ideas about the structural and functional organization of the genetic program of living objects. |
| GPC-4.1 Applies knowledge of the | Knows<br>the basics of the interaction of organisms with their environment, |

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| basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole | environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole.<br>Can<br>apply knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole.<br>Owns<br>skills in using knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole. |
| OPK-4.2 Implements measures for the protection, use, monitoring and restoration of biological resources | Knows<br>measures for the protection, use, monitoring and restoration of biological resources.<br>Can<br>carry out measures for the protection, use, monitoring and restoration of biological resources.<br>Owns<br>skills in carrying out activities for the protection, use, monitoring and restoration of biological resources. |
| OPK-4.3 Uses knowledge of the laws and methods of general and applied ecology | Knows<br>patterns and methodsgeneral and applied ecology.<br>Can<br>use knowledge of the laws and methods of general and applied ecology.<br>Owns<br>knowledge of patterns and methods of general and applied ecology. |
| GPC-5.1 Uses the principles of modern biotechnology, genetic engineering techniques, the basics of nanobiotechnology, molecular modeling in professional activities | Knows<br>principles of modern biotechnology, techniques of genetic engineering, fundamentals of nanobiotechnology, molecular modeling.<br>Can<br>apply the principles of modern biotechnology, genetic engineering techniques, fundamentals of nanobiotechnology, molecular modeling in professional activities.<br>Owns<br>principles of modern biotechnology, genetic engineering techniques, fundamentals of nanobiotechnology, molecular modeling. |
| OPK-5.2 Evaluates and predicts the prospects of the objects of his professional activity for biotechnological production | Knows<br>prospects for direction and useobjects of their professional activities in biotechnological production.<br>Can<br>predict the prospects of the objects of their professional activity for biotechnological production.<br>Owns<br>skills in assessing and forecasting the prospects of objects of their professional activity for biotechnological production. |

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| GPC-5.3 Applies in professional activities modern ideas about the fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling | Knows<br>fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling.<br>Can<br>apply ideas about the basics of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling in professional activities.<br>Owns<br>skills to use in professional activities modern ideas about the fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, and molecular modeling. |
| GPC-6.1 Uses the basic laws of physics, chemistry, earth sciences and biology in professional activities | Knows<br>basic laws of physics, chemistry, earth sciences and biology.<br>Can<br>apply the basic laws of physics, chemistry, earth sciences and biology in professional activities.<br>Owns<br>skills of using the basic laws of physics, chemistry, earth sciences and biology in professional activities. |
| OPK-6.2 Applies methods of mathematical analysis and modeling, theoretical and experimental research | Knows<br>methodsmathematical analysis and modeling, theoretical and experimental research.<br>Can<br>apply methods of mathematical analysis and modeling, theoretical and experimental research.<br>Owns<br>skills in using methods of mathematical analysis and modeling, theoretical and experimental research. |
| GPC-6.3 Acquires new mathematical and natural science knowledge using modern educational and information technologies | Knows<br>modern educational and information technologies.<br>Can<br>use modern educational and information technologies.<br>Owns<br>modern educational and information technologies. |
| OPK-7.1 Uses modern IT technologies in collecting, analyzing, processing and presenting natural science information | Knows<br>modern IT technologies.<br>Can<br>apply modern IT technologies in collecting, analyzing, processing and presenting natural science information.<br>Owns<br>modern IT technologies in the collection, analysis, processing and presentation of natural science information. |
| GPC-7.2 Complies with information security standards in professional activities | Knows<br>information security standards.<br>Can<br>comply with information security standards.<br>Owns<br>skills to comply with information security standards in professional activities. |
| OPK-7.3 Creates and studies models of real- | Knows<br>models of real-life natural scientific objects, processes or |

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| life natural scientific objects, processes or phenomena | phenomena.<br>Can<br>study models of real-life natural scientific objects, processes or phenomena.<br>Owns<br>the ability to create models of natural scientific objects, processes or phenomena. |
| OPK-8.1 Formulates conclusions and conclusions based on the results of the analysis of literary data, own experimental and theoretical work in natural sciences | Knows<br>how to interpret the results obtained during scientific research.<br>Can<br>formulateconclusions and conclusions based on the results of analysis of literature data, own experimental and theoretical calculations.<br>Owns<br>skills in interpreting the obtained literature data, own experimental and computational-theoretical works in natural sciences, on the basis of which he formulates conclusions and conclusions. |
| OPK-8.2 Offers interpretation of the results of one's own experiments and theoretical calculations using the theoretical foundations of natural sciences | Knows<br>theoretical foundations of natural sciences.<br>Can<br>interpret the resultsown experiments and theoretical calculations.<br>Owns<br>skillsinterpretation of the results of our own experiments and theoretical calculations using the theoretical foundations of natural sciences. |
| OPK-8.3 Systematizes and analyzes the results of experiments, observations, measurements and theoretical calculations | Knows<br>theoretical foundations of natural sciences.<br>Can<br>systematize and analyzeresults of experiments, observations, measurements and theoretical calculations.<br>Owns<br>the ability to systematize and analyze the results of experiments, observations, measurements and theoretical calculations. |

## 6. STRUCTURE AND CONTENT OF PRACTICE, INCLUDING PRACTICAL TRAINING

The content of practice is determined by its type and type.

The total labor intensity of industrial practice is 2 weeks / 3 credit units, 108 hours.

| **Practice stage** | **Types of work in practice, including independent work student** | **Labor intensity** | **Forms of current control** |
|---|---|---|---|
| Preparatory (organizational) stage:<br>– obtaining documents for practice (direction, diary, individual assignment);<br>– arriving at the place of practice and undergoing introductory, initial and on-the-job training;<br>– organization of the workplace and getting to know the team. | – introductory lecture;<br>– safety briefing. | 2 hours<br>2 hours | diary entry; answers on questions |

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| Main stage:<br>– familiarization with basic working methods in biochemical and culture laboratories, as well as safety precautions when working in the laboratory;<br>– selection of technical means and methods of work, work on experimental installations, preparation of equipment;<br>– preparation of objects and mastering research methods;<br>– acquisition of practical skills in preparing solutions for biochemical methods and cell culture methods;<br>– acquiring skills in working with laboratory animals and isolating biomaterial;<br>– mastering the method of isolation and fractionation of high molecular weight protein compounds;<br>– acquiring skills in working with cell culture in a laminar flow hood: thawing, transplanting, changing the medium and freezing. | – safety briefing in the laboratory;<br>– performing practice tasks in accordance with<br>– with a program and individual assignment;<br>– studying materials and documents at the place of internship;<br>– processing and analysis of received practice materials. | 16 hours<br><br>18:00<br><br><br>16h.<br><br><br>16h. | diary entry; answers to questions |
| Final stage:<br>– processing and systematization of the received material;<br>– preparation of a report on practical training;<br>– defense of the report on industrial practice. | – systematization of material;<br>– preparation of an individual assignment;<br>– report writing;<br>– preparing a presentation;<br>– report protection. | 10 o'clock<br><br>10 o'clock<br><br>10 o'clock<br>6 hours<br>2 hours | test with grade |

## 7. EDUCATIONAL AND METHODOLOGICAL SUPPORT OF INDEPENDENT WORK OF STUDENTS IN THE TRAINING PRACTICE

The educational practice is aimed at familiarizing students with the material and technical support of the cell technology laboratory, software and modern methods of laboratory research and testing.

During training practice, regardless of where it takes place, students should pay special attention to issues related to life safety and labor protection. To do this, it is necessary to consider the principles of state and public control of compliance with labor legislation, the organization of the life safety service and its tasks.

Educational practice" begins with drawing up a general description of the laboratory, its functions, a description of the structure of the laboratory, a program of research activities, and a study of development directions.

The acquisition of primary skills and abilities, consolidation of theoretical

knowledge for research activities under the “Biomedicine (in English)” program must be carried out through the following types of work:

1) selection of technical means and methods of work, work on experimental installations, preparation of equipment;

2) mastery of the method of isolation and fractionation of high-molecular protein compounds.

3) preparation of objects and mastering research methods;

4) obtaining biological material for laboratory research;

5) acquiring skills in working with cell culture in a laminar flow hood: thawing, transplanting, changing the medium and freezing.

6) acquiring skills in working with laboratory animals and isolating biomaterial.

7) acquisition of practical skills in preparing solutions for biochemical methods and cell culture methods.

An individual assignment (Appendix 1) is issued to the student at the university by the internship supervisor before the internship begins. It should be aimed at collecting and analyzing scientific and technical information concerning methods of molecular and cellular biology, molecular biotechnology.

8. CERTIFICATION FORMS (BASED ON PRACTICE),including a list of assessment forms used at various stages of developing competencies during practice assignments

| No. | Controlled sections of educational (industrial) practice | Code and name of the achievement indicator | Learning outcomes | Evaluation tools * | |
|---|---|---|---|---|---|
| | | | | current control | intermediate certification |
| 1 | Individual assignment for educational (industrial) practice | GPC-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology | Knows<br>theoretical foundations of molecular and cellular biology, microbiology and virology.<br>Can<br>apply the theoretical foundations of molecular and cellular biology, microbiology and virology.<br>Owns<br>skills in using the theoretical foundations of molecular and cellular biology, microbiology and virology. | PR-9 | - |
| | | GPC-1.2 Uses the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation; | Knows<br>theoretical foundations of molecular and cellular biology.<br>Can<br>apply the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation.<br>Owns<br>skills in using the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation. | PR-14 | - |
| | | OPK-1.3 Applies methods of observation, identification, classification, reproduction and cultivation of living objects to | Knows<br>methods of observation, identification, classification, reproduction and cultivation of living objects.<br>Can | PR-14 | - |

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| | | solve professional problems | applymethods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems.<br>Owns<br>methods of observation, identification, classification, reproduction and cultivation of living objects in professional activities. | | |
| | | GPC-2.1 Understands the principles of structural and functional organization of biological systems | Knows<br>principles of structural and functional organization of biological systems.<br>Can<br>apply the principles of structural and functional organization of biological systems.<br>Owns<br>skills in using the principles of structural and functional organization of biological systems. | PR-14 | - |
| | | OPK-2.2 Uses physiological, cytological, histological, biochemical, biophysical methods of analysis to assess the condition of living objects and monitor their habitat | Knows<br>physiological, cytological, histological, biochemical, biophysical methods of analysis.<br>Can<br>apply physiological, cytological, histological, biochemical, biophysical methods of analysis in professional activities.<br>Owns<br>physiological, cytological, histological, biochemical, biophysical methods of analysis to assess the condition of living objects and monitor their habitat. | PR-14 | - |
| | | OPK-2.3 Analyzes the pharmacokinetics and pharmacodynamics of the studied objects based on knowledge of morphofunctional | Knows<br>pharmacokinetics and pharmacodynamics of the studied objects.<br>Can<br>analyze the pharmacokinetics and pharmacodynamics of the studied objects. | PR-14 | - |

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| | | characteristics, physiological states and pathological processes in the body | Owns<br>the ability to analyze the pharmacokinetics and pharmacodynamics of the studied objects based on knowledge of morphofunctional characteristics, physiological states and pathological processes in the body. | | |
| | | GPC-3.1 Applies knowledge of the basics of evolutionary theory and analyzes modern directions of evolutionary processes | Knows<br>foundations of evolutionary theory and modern directions of evolutionary processes.<br>Can<br>apply knowledge of the basics of evolution.<br>Owns<br>knowledge of the basics of evolutionary theory and modern directions of evolutionary processes. | PR-14 | - |
| | | GPC-3.2 Applies knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics | Knows<br>history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics.<br>Can<br>apply knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics.<br>Owns<br>skills in using knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics. | PR-14 | - |
| 2 | Completing a report on educational (industrial) practice | OPK-3.3 Uses modern ideas about the structural and functional organization of the genetic program of living objects | Knows<br>structural and functional organization of the genetic program of living objects.<br>Can<br>apply modern ideas about the structural and functional | PR-16 | - |

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| | | | organization of the genetic program of living objects.<br>Owns<br>modern ideas about the structural and functional organization of the genetic program of living objects. | | |
| | | GPC-4.1 Applies knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole | Knows<br>the basics of the interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole.<br>Can<br>apply knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole.<br>Owns<br>skills in using knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole. | PR-16 | - |
| | | OPK-4.2 Implements measures for the protection, use, monitoring and restoration of biological resources | Knows<br>measures for the protection, use, monitoring and restoration of biological resources.<br>Can<br>carry out measures for the protection, use, monitoring and restoration of biological resources.<br>Owns<br>skills in carrying out activities for the protection, use, | PR-16 | - |

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| | | | monitoring and restoration of biological resources. | | |
| | | OPK-4.3 Uses knowledge of the laws and methods of general and applied ecology | Knows<br>patterns and methodsgeneral and applied ecology.<br>Can<br>use knowledge of the laws and methods of general and applied ecology.<br>Owns<br>knowledge of patterns and methods of general and applied ecology. | PR-16 | - |
| | | GPC-5.1 Uses the principles of modern biotechnology, genetic engineering techniques, the basics of nanobiotechnology, molecular modeling in professional activities | Knows<br>principles of modern biotechnology, techniques of genetic engineering, fundamentals of nanobiotechnology, molecular modeling.<br>Can<br>apply the principles of modern biotechnology, genetic engineering techniques, fundamentals of nanobiotechnology, molecular modeling in professional activities.<br>Owns<br>principles of modern biotechnology, genetic engineering techniques, fundamentals of nanobiotechnology, molecular modeling. | PR-16 | - |
| | | OPK-5.2 Evaluates and predicts the prospects of the objects of his professional activity for biotechnological production | Knows<br>prospects for direction and useobjects of their professional activities in biotechnological production.<br>Can<br>predict the prospects of the objects of their professional activity for biotechnological production.<br>Owns<br>skills in assessing and forecasting the prospects of objects of their professional activity for biotechnological production. | PR-16 | - |

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| | | GPC-5.3 Applies in professional activities modern ideas about the fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling | Knows<br>fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling.<br>Can<br>apply ideas about the basics of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling in professional activities.<br>Owns<br>skills to use in professional activities modern ideas about the fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, and molecular modeling. | PR-16 | - |
| | | GPC-6.1 Uses the basic laws of physics, chemistry, earth sciences and biology in professional activities | Knows<br>basic laws of physics, chemistry, earth sciences and biology.<br>Can<br>apply the basic laws of physics, chemistry, earth sciences and biology in professional activities.<br>Owns<br>skills of using the basic laws of physics, chemistry, earth sciences and biology in professional activities. | PR-16 | - |
| | | OPK-6.2 Applies methods of mathematical analysis and modeling, theoretical and experimental research | Knows<br>methodsmathematical analysis and modeling, theoretical and experimental research.<br>Can<br>apply methods of mathematical analysis and modeling, theoretical and experimental research.<br>Owns<br>skills in using methods of mathematical analysis and modeling, theoretical and experimental research. | PR-16 | - |

| | | | | | |
|---|---|---|---|---|---|
| 3 | Defense of the practice report | GPC-6.3 Acquires new mathematical and natural science knowledge using modern educational and information technologies | Knows<br>modern educational and information technologies.<br>Can<br>use modern educational and information technologies.<br>Owns<br>modern educational and information technologies. | - | UO-1 |
| | | OPK-7.1 Uses modern IT technologies in collecting, analyzing, processing and presenting natural science information | Knows<br>modern IT technologies.<br>Can<br>apply modern IT technologies in collecting, analyzing, processing and presenting natural science information.<br>Owns<br>modern IT technologies in the collection, analysis, processing and presentation of natural science information. | - | UO-1 |
| | | GPC-7.2 Complies with information security standards in professional activities | Knows<br>information security standards.<br>Can<br>comply with information security standards.<br>Owns<br>skills to comply with information security standards in professional activities. | - | UO-1 |
| | | OPK-7.3 Creates and studies models of real-life natural scientific objects, processes or phenomena | Knows<br>models of real-life natural scientific objects, processes or phenomena.<br>Can<br>study models of real-life natural scientific objects, processes or phenomena.<br>Owns<br>the ability to create models of natural scientific objects, processes or phenomena. | - | UO-1 |
| | | OPK-8.1 Formulates conclusions and conclusions | Knows<br>how to interpret the results obtained during scientific | - | UO-1 |

| | | | | | |
|---|---|---|---|---|---|
| | | based on the results of the analysis of literary data, own experimental and theoretical work in natural sciences | research.<br>Can<br>formulateconclusions and conclusions based on the results of analysis of literature data, own experimental and theoretical calculations.<br>Owns<br>skills in interpreting the obtained literature data, own experimental and computational-theoretical works in natural sciences, on the basis of which he formulates conclusions and conclusions. | | |
| | | OPK-8.2 Offers interpretation of the results of one's own experiments and theoretical calculations using the theoretical foundations of natural sciences | Knows<br>theoretical foundations of natural sciences.<br>Can<br>interpret the resultsown experiments and theoretical calculations.<br>Owns<br>skillsinterpretation of the results of our own experiments and theoretical calculations using the theoretical foundations of natural sciences. | - | UO-1 |
| | | OPK-8.3 Systematizes and analyzes the results of experiments, observations, measurements and theoretical calculations | Knows<br>theoretical foundations of natural sciences.<br>Can<br>systematize and analyzeresults of experiments, observations, measurements and theoretical calculations.<br>Owns<br>the ability to systematize and analyze the results of experiments, observations, measurements and theoretical calculations. | - | UO-1 |

* Recommended forms of assessment tools:
1. interview (UO-1), colloquium (UO-2); report, message (UO-3); round table, discussion, controversy, dispute, debate (UO-4); etc.
2. tests (PR-1); tests (PR-2), essays (PR-3), abstracts (PR-4), term papers (PR-5); laboratory work (PR-6); abstract (PR-7); portfolio (PR-8); project (PR-9); business and/or role-playing game (PR-10); case task (PR-11); workbook (PR-12); multi-level tasks and assignments (PR-13); calculation - graphic work (PR-14); creative task (PR-15), practice report (PR-16), etc.

3. simulator (TS-1), etc.

Criteria for evaluating the collected texts, requirements for the content of the report, criteria for evaluating the report on practice.

Before undergoing practical training, the student receives an individual assignment from the university internship supervisor, the content and scope of which are discussed with the internship supervisor. Based on the results of the practice, the student draws up a report on the completion of the practice, participates in the final conference with a presentation of the results of the practice, after which he receives a test with a grade.

The practice report must contain the following elements:

− title page (Appendix 3);

− assignment and calendar plan of practice (Appendix 1);

− document confirming the fact of internship;

− a description drawn up by the head of practice from an organization or structural unit if the practice is conducted on the basis of FEFU;

− content;

− introduction;

− the main part about the activities during the internship;

− completed individual task;

− conclusion;

− sources of information;

The report is prepared in accordance with the "Requirements for the preparation of written work performed by FEFU students."

Approximate structure of the main part of the report:

1. General information about the laboratory and its brief description (history, list of structural divisions indicating their purpose; description of the functions of the laboratory, research programs, description of development directions).

2. Description of technical means and methods of work, work on experimental installations, preparation of equipment and research objects.

3. Description of methods for the isolation and fractionation of high molecular weight protein compounds.

4. Description of biological material for laboratory research.

5. Description of obtaining biological material.

6. Description of the process technology for working with cell culture in a laminar flow hood: defrosting, transplanting, changing the medium and freezing.

In agreement with the internship supervisor from the university and depending on the location of this type of internship, the structure of the report or its individual parts may change.

After completing the internship and completing the report in accordance with

the requirements, the student submits his report for defense to the supervisor from the university. Based on the results of the defense, a test is given with a grade (excellent, good, satisfactory, unsatisfactory):

“Excellent” – the necessary practical skills and professional competencies provided for by the educational practice program are fully formed, the tasks are completed, the quality of their implementation is assessed with a number of points close to the maximum.

“Good” – the necessary practical work skills and professional competencies provided for by the educational practice program are fully formed, the tasks are completed, the quality of none of them is assessed with a minimum number of points, some types of tasks are completed with errors or not thoroughly enough.

“Satisfactory” – the necessary practical skills and professional competencies are basically formed, the gaps are not significant, some of the completed tasks contain errors.

“Unsatisfactory” - the necessary practical skills and professional competencies provided for by the educational practice program have not been developed, all completed educational assignments contain gross errors, additional independent work on the report materials will not lead to any significant improvement in the quality of assignments.

## 9. EDUCATIONAL-METHODOLOGICAL AND INFORMATION SUPPORT OF EDUCATIONAL PRACTICE (including basic and additional literature)

1. Biotechnology: textbook and workshop for universities / edited by N.V. Zagoskina, L.V. Nazarenko. — 4th ed., rev. and additional - Moscow: Yurayt Publishing House, 2023. - 384 p. - (Higher education). — ISBN 978-5-534-16026-0. — Text: electronic // Educational platform Urayt [website]. — URL:https://urait.ru/bcode/530288

2. Zagoskina, N.V. Genetic engineering: textbook and workshop for universities / N.V. Zagoskina, L.V. Nazarenko. - Moscow: Yurayt Publishing House, 2023. - 118 p. - (Higher education). — ISBN 978-5-534-16029-1. — Text: electronic // Educational platform Urayt [website]. — URL:https://urait.ru/bcode/530292

3. Konichev, A. S. Molecular biology: a textbook for universities / A. S. Konichev, G. A. Sevastyanova, I. L. Tsvetkov. — 5th ed. - Moscow: Yurayt Publishing House, 2023. - 422 p. - (Higher education). — ISBN 978-5-534-13468-1. — Text: electronic // Educational platform Urayt [website]. — URL:https://urait.ru/bcode/517095

## 10. MATERIAL AND TECHNICAL SUPPORT OF TRAINING

PRACTICE

Educational and scientific laboratories equipped with the following equipment:

1) Centrifuge 5804 R, Eppendorf; Microscope IX-73, Olympus,. CO2 incubator Galaxy 48R, Eppendorf 14. System for continuous monitoring of living cells in real time Cell-IQ. Applied Biosystems amplifier; Biorad amplifier, Spectrophotometer, GNOM thermostat, Termite thermostat, Biorad chambers for electrophoresis of proteins and nucleic acids 2 pcs., Power supplies for phoresis chamber 2 pcs. Biorad, Zeiss inverted microscope 2 pcs.

2) Deep optical imaging system for biomaterials FluoView FV1200MPE, Freezing microtome CM 1950, Leica, Microtome RM2265, Leica, Robotic system for automated cell cultivation CompacT SelecT, Laboratory cryogenic storage 24K, Taylor Wharton, High-speed cell sorter MoFlo Astrios EQ, Beckman Coulter, CO2 incubator Galaxy 130R, Eppendorf, Sample preparation system for whole genome sequencing Ion Chef™ Instrument, Thermo Fisher Scientific, DNA sequence analysis system Ion S5™ XL System, Thermo Fisher Scientific, Applied Biosystems 3500 genetic analyzer, Thermo Fisher Scientific, Biacore X100 System automated system for the analysis of intermolecular interactions, System for analyzing the rheological properties of biomaterials HAAKE MARS III, Thermo Fisher Scientific, Atomic force microscope (probe) BioScope Resolve, Bruker

For persons with disabilities and people with disabilities, the choice of places of practice is consistent with the requirement of their accessibility for these students and the practice is carried out taking into account the characteristics of their psychophysical development, individual capabilities and health status.

Head of OP V.V. Kumeiko

ANNEX 1

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)**

**I CONFIRM:**
Head of OP
_____FULL NAME.

"____" _____20__

**INDIVIDUAL TASK**

By _____
(type of practice)

student _____groups _____
(student's name)

Educational program 06.03.01 Biology, profile “Biomedicine (in English)”_____
_____

Base (place, organization) of practice_____
_____

Duration of practice from _____20___ to _____ 20___

| | |
|---|---|
| Generalized formulation of the task | |

Task schedule

| Name of tasks (activities) that make up the task | Date of completion of the task (activity) |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| | |

Head of practice _____ _____
*signature full name, position*

APPENDIX 2

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)**

**DEPARTMENT** _____

**DIARY**

according to _____
practice
student _____
group_____
program_____
Place of practice_____
Duration of internship:_____weeks_____

Head of practice from FEFU
_____
Head of practice from a specialized organization
_____

1. Student work schedule

| No. | Name of works | Calendar dates | | Last name of practice manager |
|---|---|---|---|---|
| | | Start | ending | |
| | | | | |
| | | | | |
| | | | | |

2. Student's work diary

| date | Summary of the trainee's work | Signature head |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

3. Report protection results

The report is protected by "____" _____ 20___

With a rating of _____

Department Director _____ AND ABOUT. Surname

APPENDIX 3

**Internship report cover page form**

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)**

**DEPARTMENT** _____

The report is protected with a rating
_____
"_____"_____20__ g

Supervisor
educational program
_____Last name I.O.

.

# REPORT

**about completing educational practice "Training practice. Introductory practice"**
(full name of the profile organization)

Student _____group _____ (_____)
*Signature Full name*
Head of Practice
from a specialized organization_____ (_____)
*Signature Full name*

Head of Practice
from FEFU_____ (_____)
*Signature Full name*

APPENDIX 4

**Referral form for educational practice**

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)**
**DEPARTMENT** _____

**DIRECTION**
**for practice**_____
_____

student of __bachelor's course
Full Namegroups _____
(Full Name)
sent to _____
name of the base organization
address _____

Order on assignment to practice dated No._____
for internship
in the field of study 06.03.01 Biology
for the period from _____ 20 to _____ 20 (continuous/discrete)

Head of Practice

M.P. _____ _____ _____
(position, academic title) (signature) (I.O.F)

**Notes on completion and dates of practice**

| Business name | Arrival and departure notes | Signature, decryption of signature, seal |
|---|---|---|
| Name of the enterprise, organization in accordance with the agreement | Arrived __.__.20__ | |
| | Dropped out on __.__.20__ | |

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)

# WORK PROGRAM OF TRAINING PRACTICE

Educational practice. Research work (Obtaining primary skills of research work)
(Training practice. Research work (Obtaining primary skills of research work))
for the direction of training
06.03.01 Biology
Name of the educational program “Biomedicine (in English)”

Vladivostok
2023

## 1. OBJECTIVES OF MASTERING EDUCATIONAL PRACTICE

The goals of educational practice “Educational practice. Research work (Obtaining primary skills in research work)" is the consolidation of theoretical knowledge acquired in the study of basic and professional disciplines; acquisition of initial professional skills for future professional activities; formation of competencies that meet the requirements of the main professional educational program of the undergraduate program “Biomedicine (in English)” 03/06/01 Biology.

## 2. OBJECTIVES OF EDUCATIONAL PRACTICE

The objectives of educational practice are:

– preparation of objects and mastering methods of research, analysis and processing of experimental data obtained during research;

– mastering modern information technologies and software products used for scientific research in the field of biotechnology;

– obtaining biological material for laboratory research;

– participation in laboratory and biomedical research using a given methodology;

– carrying out analysis, systematization and generalization of scientific and technical information on the research topic;

– selection of technical means and methods of work, work on experimental installations, preparation of equipment;

– analysis of obtained laboratory biological information using modern computer technology;

– assessment of the scientific and practical significance of the ongoing research and the reliability of the research results obtained;

– developing skills in preparing the results of scientific research (drawing a report, writing scientific articles, abstracts of reports).

## 3. PLACE OF TRAINING PRACTICE IN THE STRUCTURE OF EP

Block B2.O.01 “Educational Practice” of the Federal State Educational Standard in the field of study 03/06/01 Biology, approved by order of the Ministry of Science and Higher Education of the Russian Federation dated 08/07/2020. No. 920 is mandatory and is a type of training sessions directly focused on the professional and practical training of students.

Educational practice is the first stage of practical training at the bachelor's level of higher education and is aimed at students obtaining initial skills in research activities. Training practice is carried out only in a basic, stationary organization,

structural unit, which has the necessary personnel, scientific, technical and material potential (stationary).

Educational practice is based on the theoretical mastery of such disciplines as: “Fundamentals of project activity”, “Fundamentals of digital literacy”, “General biology”, “General and inorganic chemistry”, “Higher mathematics”, “Digital technologies in professional activities”, “Organic chemistry”, “General physics”, “Biophysics”, “General biology”, “Developmental biology”, “Medical parasitology”, “Histology”, “Molecular and cellular biology”, “Genetics”, “Biochemistry”, etc.

Students undergoing practical training is an integral part of the educational process and is necessary for subsequent study of the professional modules “Chemistry Module”, “FEFU Digital Core”, “Module of Physical and Mathematical Sciences”, “General Professional Module”, “Module of Biology and Fundamental Medicine” and etc., as well as during other types of internship: “Industrial practice. Medicine development practice", "Industrial practice. Research work", "Industrial practice. Pre-graduation practice, including research work.”

## 4. TYPES, METHODS, PLACE AND TIMES OF TRAINING PRACTICE

| | |
|---|---|
| Type of practice | Educational practice |
| Type of practice | Educational practice. Research work (Obtaining primary skills in research work) |
| Method of implementation | Stationary / traveling |
| Form(s) of conduct | Concentrated |
| Volume of practice in credit units; duration of practice; course, semester | 2nd year, 4th semester: 3 credits, 2 weeks, 108 academic units. hour. |
| Practice bases | 1) Center for Genomic and Regenerative Medicine of the ShBM FEFU, laboratory of biomedical cell technologies;<br>2) Federal Scientific Center for Biodiversity of Terrestrial Biota of East Asia FEB RAS (FSC Biodiversity FEB RAS), laboratory of biotechnology; bioengineering laboratory;<br>3) Federal State Budgetary Institution of Science “National Scientific Center for Marine Biology named after. A.V. Zhirmunsky" Far Eastern Branch of the Russian Academy of Sciences, Laboratory of Cell Technologies |

## 5. STUDENT COMPETENCIES FORMED AS A RESULT OF TRAINING PRACTICE

General professional competencies of graduates and indicators of their achievement

| Code and name of general professional competencies | Code and name of the general professional achievement indicator competencies |
|---|---|
| OPK-1. Able to apply knowledge of biological diversity and use techniques observation, identification, classification, reproduction and cultivation of living objects for solving professional problems | GPC-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology |
| | GPC-1.2 Uses the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation; |
| | OPK-1.3 Applies methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems |
| OPK-2. Able to apply the principles of structural and functional organization, use physiological, cytological, biochemical, biophysical methods of analysis to assess and correct the condition of living objects and monitor their habitat; | GPC-2.1 Understands the principles of structural and functional organization of biological systems |
| | OPK-2.2 Uses physiological, cytological, histological, biochemical, biophysical methods of analysis to assess the condition of living objects and monitor their habitat; |
| | OPK-2.3 Analyzes the pharmacokinetics and pharmacodynamics of the studied objects based on knowledge of morphofunctional characteristics, physiological states and pathological processes in the body |
| OPK-3. Able to apply knowledge of the basics of evolutionary theory, use modern ideas about the structural and functional organization of the genetic program living objects and methods of molecular biology, genetics and developmental biology for research into the mechanisms of ontogenesis and phylogenesis in professional activities; | GPC-3.1 Applies knowledge of the basics of evolutionary theory and analyzes modern directions of evolutionary processes; |
| | GPC-3.2 Applies knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics |
| | GPC-3.3 Uses modern ideas about the structural and functional organization of the genetic program of living objects; |
| OPK-4. Capable of implementing measures for protection, use, monitoring and restoration of biological resources, using knowledge of the laws and methods of general and applied ecology; | GPC-4.1 Applies knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole |
| | OPK-4.2 Implements measures for the protection, use, monitoring and restoration of biological resources; |
| | OPK-4.3 Uses knowledge of the laws and methods of general and applied ecology |
| OPK-5. Able to apply modern concepts in professional activities about the basics of biotechnological and | GPC-5.1 Uses the principles of modern biotechnology, genetic engineering techniques, the basics of nanobiotechnology, molecular modeling |

| | |
|---|---|
| biomedical production, genetic engineering,<br>nanobiotechnology, molecular modeling; | in professional activities; |
| | OPK-5.2 Evaluates and predicts the prospects of the objects of his professional activity for biotechnological production; |
| | GPC-5.3 Applies in professional activities modern ideas about the fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling |
| OPK-6. Able to use the basic laws of physics in professional activities,<br>chemistry, earth sciences and biology,<br>apply methods of mathematical analysis and modeling,<br>theoretical and experimental research,<br>acquire new mathematical and<br>natural science knowledge using modern educational and information technologies; | GPC-6.1 Uses the basic laws of physics, chemistry, earth sciences and biology in professional activities |
| | OPK-6.2 Applies methods of mathematical analysis and modeling, theoretical and experimental research |
| | GPC-6.3 Acquires new mathematical and natural science knowledge using modern educational and information technologies |
| OPK-7. Able to understand the principles of operation of modern information technologies and<br>use them to solve problems of professional activity; | OPK-7.1 Uses modern IT technologies in collecting, analyzing, processing and presenting natural science information |
| | GPC-7.2 Complies with information security standards in professional activities; |
| | OPK-7.3 Creates and studies models of real-life natural scientific objects, processes or phenomena |
| OPK-8. Able to use methods of collecting, processing, organizing and presenting<br>field and laboratory information, apply skills in working with modern equipment,<br>analyze the results obtained. | OPK-8.1 Formulates conclusions and conclusions based on the results of the analysis of literary data, own experimental and theoretical work in natural sciences |
| | OPK-8.2 Offers interpretation of the results of one's own experiments and theoretical calculations using the theoretical foundations of natural sciences |
| | OPK-8.3 Systematizes and analyzes the results of experiments, observations, measurements and theoretical calculations |

| Code and name of the competency achievement indicator | Name of the assessment indicator<br>(result of training by practice) |
|---|---|
| GPC-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology | Knows<br>theoretical foundations of molecular and cellular biology, microbiology and virology.<br>Can<br>apply the theoretical foundations of molecular and cellular biology, microbiology and virology.<br>Owns<br>skills in using the theoretical foundations of molecular and cellular biology, microbiology and virology. |
| GPC-1.2 Uses the theoretical foundations of | Knows<br>theoretical foundations of molecular and cellular biology. |

| | |
|---|---|
| molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation | Can<br>apply the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation.<br>Owns<br>skills in using the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation. |
| OPK-1.3 Applies methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems | Knows<br>methods of observation, identification, classification, reproduction and cultivation of living objects.<br>Can<br>applymethods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems.<br>Owns<br>methods of observation, identification, classification, reproduction and cultivation of living objects in professional activities. |
| GPC-2.1 Understands the principles of structural and functional organization of biological systems | Knows<br>principles of structural and functional organization of biological systems.<br>Can<br>apply the principles of structural and functional organization of biological systems.<br>Owns<br>skills in using the principles of structural and functional organization of biological systems. |
| OPK-2.2 Uses physiological, cytological, histological, biochemical, biophysical methods of analysis to assess the condition of living objects and monitor their habitat | Knows<br>physiological, cytological, histological, biochemical, biophysical methods of analysis.<br>Can<br>apply physiological, cytological, histological, biochemical, biophysical methods of analysis in professional activities.<br>Owns<br>physiological, cytological, histological, biochemical, biophysical methods of analysis to assess the condition of living objects and monitor their habitat. |
| OPK-2.3 Analyzes the pharmacokinetics and pharmacodynamics of the studied objects based on knowledge of morphofunctional characteristics, physiological states and pathological processes in the body | Knows<br>pharmacokinetics and pharmacodynamics of the studied objects.<br>Can<br>analyze the pharmacokinetics and pharmacodynamics of the studied objects.<br>Owns<br>the ability to analyze the pharmacokinetics and pharmacodynamics of the studied objects based on knowledge of morphofunctional characteristics, physiological states and pathological processes in the body. |
| GPC-3.1 Applies knowledge of the basics of evolutionary theory and analyzes modern | Knows<br>foundations of evolutionary theory and modern directions of evolutionary processes.<br>Can<br>apply knowledge of the basics of evolution. |

| | |
|---|---|
| directions of evolutionary processes | Owns<br>knowledge of the basics of evolutionary theory and modern directions of evolutionary processes. |
| GPC-3.2 Applies knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics | Knows<br>history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics.<br>Can<br>apply knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics.<br>Owns<br>skills in using knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics. |
| OPK-3.3 Uses modern ideas about the structural and functional organization of the genetic program of living objects | Knows<br>structural and functional organization of the genetic program of living objects.<br>Can<br>apply modern ideas about the structural and functional organization of the genetic program of living objects.<br>Owns<br>modern ideas about the structural and functional organization of the genetic program of living objects. |
| GPC-4.1 Applies knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole | Knows<br>the basics of the interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole.<br>Can<br>apply knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole.<br>Owns<br>skills in using knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole. |
| OPK-4.2 Implements measures for the protection, use, monitoring and restoration of biological resources | Knows<br>measures for the protection, use, monitoring and restoration of biological resources.<br>Can<br>carry out measures for the protection, use, monitoring and restoration of biological resources.<br>Owns<br>skills in carrying out activities for the protection, use, monitoring and restoration of biological resources. |
| OPK-4.3 Uses | Knows |

| | |
|---|---|
| knowledge of the laws and methods of general and applied ecology | patterns and methodsgeneral and applied ecology.<br>Can<br>use knowledge of the laws and methods of general and applied ecology.<br>Owns<br>knowledge of patterns and methods of general and applied ecology. |
| GPC-5.1 Uses the principles of modern biotechnology, genetic engineering techniques, the basics of nanobiotechnology, molecular modeling in professional activities | Knows<br>principles of modern biotechnology, techniques of genetic engineering, fundamentals of nanobiotechnology, molecular modeling.<br>Can<br>apply the principles of modern biotechnology, genetic engineering techniques, fundamentals of nanobiotechnology, molecular modeling in professional activities.<br>Owns<br>principles of modern biotechnology, genetic engineering techniques, fundamentals of nanobiotechnology, molecular modeling. |
| OPK-5.2 Evaluates and predicts the prospects of the objects of his professional activity for biotechnological production | Knows<br>prospects for direction and useobjects of their professional activities in biotechnological production.<br>Can<br>predict the prospects of the objects of their professional activity for biotechnological production.<br>Owns<br>skills in assessing and forecasting the prospects of objects of their professional activity for biotechnological production. |
| GPC-5.3 Applies in professional activities modern ideas about the fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling | Knows<br>fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling.<br>Can<br>apply ideas about the basics of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling in professional activities.<br>Owns<br>skills to use in professional activities modern ideas about the fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, and molecular modeling. |
| GPC-6.1 Uses the basic laws of physics, chemistry, earth sciences and biology in professional activities | Knows<br>basic laws of physics, chemistry, earth sciences and biology.<br>Can<br>apply the basic laws of physics, chemistry, earth sciences and biology in professional activities.<br>Owns<br>skills of using the basic laws of physics, chemistry, earth sciences and biology in professional activities. |
| OPK-6.2 Applies methods of mathematical analysis and modeling, theoretical and experimental research | Knows<br>methodsmathematical analysis and modeling, theoretical and experimental research.<br>Can<br>apply methods of mathematical analysis and modeling, theoretical and experimental research.<br>Owns |

| | |
|---|---|
| | skills in using methods of mathematical analysis and modeling, theoretical and experimental research. |
| GPC-6.3 Acquires new mathematical and natural science knowledge using modern educational and information technologies | Knows<br>modern educational and information technologies.<br>Can<br>use modern educational and information technologies.<br>Owns<br>modern educational and information technologies. |
| OPK-7.1 Uses modern IT technologies in collecting, analyzing, processing and presenting natural science information | Knows<br>modern IT technologies.<br>Can<br>apply modern IT technologies in collecting, analyzing, processing and presenting natural science information.<br>Owns<br>modern IT technologies in the collection, analysis, processing and presentation of natural science information. |
| GPC-7.2 Complies with information security standards in professional activities | Knows<br>information security standards.<br>Can<br>comply with information security standards.<br>Owns<br>skills to comply with information security standards in professional activities. |
| OPK-7.3 Creates and studies models of real-life natural scientific objects, processes or phenomena | Knows<br>models of real-life natural scientific objects, processes or phenomena.<br>Can<br>study models of real-life natural scientific objects, processes or phenomena.<br>Owns<br>the ability to create models of natural scientific objects, processes or phenomena. |
| OPK-8.1 Formulates conclusions and conclusions based on the results of the analysis of literary data, own experimental and theoretical work in natural sciences | Knows<br>how to interpret the results obtained during scientific research.<br>Can<br>formulateconclusions and conclusions based on the results of analysis of literature data, own experimental and theoretical calculations.<br>Owns<br>skills in interpreting the obtained literature data, own experimental and computational-theoretical works in natural sciences, on the basis of which he formulates conclusions and conclusions. |
| OPK-8.2 Offers interpretation of the results of one's own experiments and theoretical calculations using the theoretical foundations of natural sciences | Knows<br>theoretical foundations of natural sciences.<br>Can<br>interpret the resultsown experiments and theoretical calculations.<br>Owns<br>skillsinterpretation of the results of our own experiments and theoretical calculations using the theoretical foundations of natural sciences. |
| OPK-8.3 Systematizes | Knows |

| | |
|---|---|
| and analyzes the results of experiments, observations, measurements and theoretical calculations | theoretical foundations of natural sciences.<br>Can<br>systematize and analyzeresults of experiments, observations, measurements and theoretical calculations.<br>Owns<br>the ability to systematize and analyze the results of experiments, observations, measurements and theoretical calculations. |

6. STRUCTURE AND CONTENT OF PRACTICE, INCLUDING PRACTICAL TRAINING

The content of practice is determined by its type and type.

The total labor intensity of educational practice “Training practice. Research work (Obtaining primary skills in research work" is 2 weeks / 3 credit units, 108 hours.

| **Practice stage** | **Types of work in practice, including independent work student** | **Labor intensity** | **Shapes of the current** |
|---|---|---|---|
| Preparatory (organizational) stage:<br>– obtaining documents for practice (direction, diary, individual assignment);<br>– arriving at the place of practice and undergoing introductory, initial and on-the-job training;<br>– organization of the workplace and getting to know the team. | – introductory lecture;<br>– safety briefing. | 2 hours<br><br>2 hours | diary entry; answers on questions |
| Main stage:<br>– familiarization with basic working methods in biochemical and culture laboratories, as well as safety precautions when working in the laboratory;<br>– selection of technical means and methods of work, work on experimental installations, preparation of equipment;<br>– preparation of objects and mastering research methods;<br>– acquisition of practical skills in preparing solutions for biochemical methods and cell culture methods;<br>– acquiring skills in working with laboratory animals and isolating biomaterial;<br>– mastering the method of isolation and fractionation of high molecular weight protein compounds;<br>– acquiring skills in working with cell culture in a laminar flow hood: thawing, transplanting, changing the medium and freezing. | – safety briefing in the laboratory;<br>– completing practice assignments in accordance with the program and individual assignments;<br>– studying materials and documents at the place of internship;<br>– processing and analysis of received practice materials. | 16 hours<br><br>18 h<br><br>16 hours<br><br>16 hours | diary entry; answers on questions |
| Final stage: | | | |

| | | | |
|---|---|---|---|
| – processing and systematization of the received material;<br>– preparation of a report on practical training;<br>– defense of the report on industrial practice. | – systematization of material;<br>– preparation of an individual assignment;<br>– report writing;<br>– preparing a presentation;<br>– report protection. | 10 o'clock<br><br>10 o'clock<br><br>10 o'clock<br>6 hours<br>2 hours | test with grade |

## 7. EDUCATIONAL AND METHODOLOGICAL SUPPORT OF INDEPENDENT WORK OF STUDENTS IN THE TRAINING PRACTICE

The educational practice is aimed at familiarizing students with the material and technical support of the cell technology laboratory, software and modern methods of laboratory research and testing.

During practice to obtain primary professional skills, including primary skills in research activities, regardless of the place where it takes place, students should pay special attention to issues related to life safety and labor protection. To do this, it is necessary to consider the principles of state and public control of compliance with labor legislation, the organization of the life safety service and its tasks.

Educational practice begins with drawing up a general description of the laboratory, its functions, a description of the structure of the laboratory, a program of research activities, and studying directions of development.

The acquisition of primary skills and abilities, consolidation of theoretical knowledge for research activities under the “Biomedicine (in English)” program must be carried out through the following types of work:

1) selection of technical means and methods of work, work on experimental installations, preparation of equipment;

2) mastery of the method of isolation and fractionation of high-molecular protein compounds.

3) preparation of objects and mastering research methods;

4) obtaining biological material for laboratory research;

5) acquiring skills in working with cell culture in a laminar flow hood: thawing, transplanting, changing the medium and freezing.

6) acquiring skills in working with laboratory animals and isolating biomaterial.

7) acquisition of practical skills in preparing solutions for biochemical methods and cell culture methods.

Individual task(Appendix 1) is issued to the student at the University by the internship supervisor before the internship begins. It should be aimed at collecting and analyzing scientific and technical information concerning methods of molecular and cellular biology, molecular biotechnology.

8. CERTIFICATION FORMS (BASED ON PRACTICE),including a list of assessment forms used at various stages of developing competencies during practice assignments

| No. | Controlled sections of educational (industrial) practice | Code and name of the achievement indicator | Learning outcomes | Evaluation tools * | |
|---|---|---|---|---|---|
| | | | | current control | intermediate certification |
| 1 | Individual assignment for educational (industrial) practice | GPC-1.1 Applies the theoretical foundations of molecular and cellular biology, microbiology and virology | Knows<br>theoretical foundations of molecular and cellular biology, microbiology and virology.<br>Can<br>apply the theoretical foundations of molecular and cellular biology, microbiology and virology.<br>Owns<br>skills in using the theoretical foundations of molecular and cellular biology, microbiology and virology. | PR-9 | - |
| | | GPC-1.2 Uses the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation; | Knows<br>theoretical foundations of molecular and cellular biology.<br>Can<br>apply the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation.<br>Owns<br>skills in using the theoretical foundations of molecular and cellular biology to study the properties of living objects, their identification, reproduction and cultivation. | PR-14 | - |
| | | OPK-1.3 Applies methods of observation, identification, classification, reproduction and cultivation of living objects to solve professional problems | Knows<br>methods of observation, identification, classification, reproduction and cultivation of living objects.<br>Can<br>applymethods of observation, identification, | PR-14 | - |

| | | | | | |
|---|---|---|---|---|---|
| | | | classification, reproduction and cultivation of living objects to solve professional problems.<br>Owns<br>methods of observation, identification, classification, reproduction and cultivation of living objects in professional activities. | | |
| | | GPC-2.1 Understands the principles of structural and functional organization of biological systems | Knows<br>principles of structural and functional organization of biological systems.<br>Can<br>apply the principles of structural and functional organization of biological systems.<br>Owns<br>skills in using the principles of structural and functional organization of biological systems. | PR-14 | - |
| | | OPK-2.2 Uses physiological, cytological, histological, biochemical, biophysical methods of analysis to assess the condition of living objects and monitor their habitat | Knows<br>physiological, cytological, histological, biochemical, biophysical methods of analysis.<br>Can<br>apply physiological, cytological, histological, biochemical, biophysical methods of analysis in professional activities.<br>Owns<br>physiological, cytological, histological, biochemical, biophysical methods of analysis to assess the condition of living objects and monitor their habitat. | PR-14 | - |
| | | OPK-2.3 Analyzes the pharmacokinetics and pharmacodynamics of the studied objects based on knowledge of morphofunctional characteristics, physiological | Knows<br>pharmacokinetics and pharmacodynamics of the studied objects.<br>Can<br>analyze the pharmacokinetics and pharmacodynamics of the studied objects.<br>Owns | PR-14 | - |

| | | | | | |
|---|---|---|---|---|---|
| | | states and pathological processes in the body | the ability to analyze the pharmacokinetics and pharmacodynamics of the studied objects based on knowledge of morphofunctional characteristics, physiological states and pathological processes in the body. | | |
| | | GPC-3.1 Applies knowledge of the basics of evolutionary theory and analyzes modern directions of evolutionary processes | Knows<br>foundations of evolutionary theory and modern directions of evolutionary processes.<br>Can<br>apply knowledge of the basics of evolution.<br>Owns<br>knowledge of the basics of evolutionary theory and modern directions of evolutionary processes. | PR-14 | - |
| | | GPC-3.2 Applies knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics | Knows<br>history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics.<br>Can<br>apply knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics.<br>Owns<br>skills in using knowledge of the history of development, principles and methodological approaches of general genetics, molecular genetics, population genetics, epigenetics. | PR-14 | - |
| 2 | Completing a report on educational (industrial) practice | OPK-3.3 Uses modern ideas about the structural and functional organization of the genetic program of living objects | Knows<br>structural and functional organization of the genetic program of living objects.<br>Can<br>apply modern ideas about the structural and functional organization of the genetic program of living objects. | PR-16 | - |

| | | | | | |
|---|---|---|---|---|---|
| | | | Owns<br>modern ideas about the structural and functional organization of the genetic program of living objects. | | |
| | | GPC-4.1 Applies knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole | Knows<br>the basics of the interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole.<br>Can<br>apply knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole.<br>Owns<br>skills in using knowledge of the basics of interaction of organisms with their environment, environmental factors and response mechanisms of organisms, principles of population ecology, community ecology; fundamentals of organization and sustainability of ecosystems and the biosphere as a whole. | PR-16 | - |
| | | OPK-4.2 Implements measures for the protection, use, monitoring and restoration of biological resources | Knows<br>measures for the protection, use, monitoring and restoration of biological resources.<br>Can<br>carry out measures for the protection, use, monitoring and restoration of biological resources.<br>Owns<br>skills in carrying out activities for the protection, use, monitoring and restoration of biological resources. | PR-16 | - |

| | | | | | |
|---|---|---|---|---|---|
| | | OPK-4.3 Uses knowledge of the laws and methods of general and applied ecology | Knows<br>patterns and methodsgeneral and applied ecology.<br>Can<br>use knowledge of the laws and methods of general and applied ecology.<br>Owns<br>knowledge of patterns and methods of general and applied ecology. | PR-16 | - |
| | | GPC-5.1 Uses the principles of modern biotechnology, genetic engineering techniques, the basics of nanobiotechnology, molecular modeling in professional activities | Knows<br>principles of modern biotechnology, techniques of genetic engineering, fundamentals of nanobiotechnology, molecular modeling.<br>Can<br>apply the principles of modern biotechnology, genetic engineering techniques, fundamentals of nanobiotechnology, molecular modeling in professional activities.<br>Owns<br>principles of modern biotechnology, genetic engineering techniques, fundamentals of nanobiotechnology, molecular modeling. | PR-16 | - |
| | | OPK-5.2 Evaluates and predicts the prospects of the objects of his professional activity for biotechnological production | Knows<br>prospects for direction and useobjects of their professional activities in biotechnological production.<br>Can<br>predict the prospects of the objects of their professional activity for biotechnological production.<br>Owns<br>skills in assessing and forecasting the prospects of objects of their professional activity for biotechnological production. | PR-16 | - |
| | | GPC-5.3 Applies in professional activities modern | Knows<br>fundamentals of biotechnological and biomedical | PR-16 | - |

| | | | | | |
|---|---|---|---|---|---|
| | | ideas about the fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling | production, genetic engineering, nanobiotechnology, molecular modeling.<br>Can<br>apply ideas about the basics of biotechnological and biomedical production, genetic engineering, nanobiotechnology, molecular modeling in professional activities.<br>Owns<br>skills to use in professional activities modern ideas about the fundamentals of biotechnological and biomedical production, genetic engineering, nanobiotechnology, and molecular modeling. | | |
| | | GPC-6.1 Uses the basic laws of physics, chemistry, earth sciences and biology in professional activities | Knows<br>basic laws of physics, chemistry, earth sciences and biology.<br>Can<br>apply the basic laws of physics, chemistry, earth sciences and biology in professional activities.<br>Owns<br>skills of using the basic laws of physics, chemistry, earth sciences and biology in professional activities. | PR-16 | - |
| | | OPK-6.2 Applies methods of mathematical analysis and modeling, theoretical and experimental research | Knows<br>methodsmathematical analysis and modeling, theoretical and experimental research.<br>Can<br>apply methods of mathematical analysis and modeling, theoretical and experimental research.<br>Owns<br>skills in using methods of mathematical analysis and modeling, theoretical and experimental research. | PR-16 | - |
| 3 | Defense of the practice report | GPC-6.3 Acquires new mathematical and natural science knowledge using | Knows<br>modern educational and information technologies.<br>Can | - | UO-1 |

| | | | | | |
|---|---|---|---|---|---|
| | | modern educational and information technologies | use modern educational and information technologies.<br>Owns<br>modern educational and information technologies. | | |
| | | OPK-7.1 Uses modern IT technologies in collecting, analyzing, processing and presenting natural science information | Knows<br>modern IT technologies.<br>Can<br>apply modern IT technologies in collecting, analyzing, processing and presenting natural science information.<br>Owns<br>modern IT technologies in the collection, analysis, processing and presentation of natural science information. | - | UO-1 |
| | | GPC-7.2 Complies with information security standards in professional activities | Knows<br>information security standards.<br>Can<br>comply with information security standards.<br>Owns<br>skills to comply with information security standards in professional activities. | - | UO-1 |
| | | OPK-7.3 Creates and studies models of real-life natural scientific objects, processes or phenomena | Knows<br>models of real-life natural scientific objects, processes or phenomena.<br>Can<br>study models of real-life natural scientific objects, processes or phenomena.<br>Owns<br>the ability to create models of natural scientific objects, processes or phenomena. | - | UO-1 |
| | | OPK-8.1 Formulates conclusions and conclusions based on the results of the analysis of literary data, own experimental and theoretical | Knows<br>how to interpret the results obtained during scientific research.<br>Can<br>formulateconclusions and conclusions based on the | - | UO-1 |

| | | | | | |
|---|---|---|---|---|---|
| | | work in natural sciences | results of analysis of literature data, own experimental and theoretical calculations.<br>Owns<br>skills in interpreting the obtained literature data, own experimental and computational-theoretical works in natural sciences, on the basis of which he formulates conclusions and conclusions. | | |
| | | OPK-8.2 Offers interpretation of the results of one's own experiments and theoretical calculations using the theoretical foundations of natural sciences | Knows<br>theoretical foundations of natural sciences.<br>Can<br>interpret the resultsown experiments and theoretical calculations.<br>Owns<br>skillsinterpretation of the results of our own experiments and theoretical calculations using the theoretical foundations of natural sciences. | - | UO-1 |
| | | OPK-8.3 Systematizes and analyzes the results of experiments, observations, measurements and theoretical calculations | Knows<br>theoretical foundations of natural sciences.<br>Can<br>systematize and analyzeresults of experiments, observations, measurements and theoretical calculations.<br>Owns<br>the ability to systematize and analyze the results of experiments, observations, measurements and theoretical calculations. | - | UO-1 |

* Recommended forms of assessment tools:
1. interview (UO-1), colloquium (UO-2); report, message (UO-3); round table, discussion, controversy, dispute, debate (UO-4); etc.
2. tests (PR-1); tests (PR-2), essays (PR-3), abstracts (PR-4), term papers (PR-5); laboratory work (PR-6); abstract (PR-7); portfolio (PR-8); project (PR-9); business and/or role-playing game (PR-10); case task (PR-11); workbook (PR-12); multi-level tasks and assignments (PR-13); calculation - graphic work (PR-14); creative task (PR-15), practice report (PR-16), etc.
3. simulator (TS-1), etc.

Criteria for evaluating the collected texts, requirements for the content of the report, criteria for evaluating the report on practice.

Before undergoing an internship to obtain primary professional skills, including primary skills in research activities, the student receives an individual assignment from the University practice supervisor, the content and scope of which are discussed with the practice supervisor.

Based on the results of the practice, the student draws up a report on the completion of the practice, participates in the final conference with a presentation of the results of the practice, after which he receives a test with a grade.

The practice report must contain the following elements:

− title page (Appendix 3);

− assignment and calendar plan of practice (Appendix 1);

− document confirming the fact of internship;

− a description drawn up by the head of practice from an organization or structural unit if the practice is conducted on the basis of FEFU;

− content;

− introduction;

− the main part about the activities during the internship;

− completed individual task;

− conclusion;

− sources of information;

The report is prepared in accordance with the “Requirements for the preparation of written work performed by FEFU students.”

Approximate structure of the main part of the report:

1. General information about the laboratory and its brief description (history, list of structural divisions indicating their purpose; description of the functions of the laboratory, research programs, description of development directions).

2. Description of technical means and methods of work, work on experimental installations, preparation of equipment and research objects.

3. Planning an experiment and building a model using the example of growing microorganisms.

4. Description of methods and techniques of genetic engineering.

5. Description of methods for carrying out transformation of a biological object.

6. Technique for recording transformation, detection of integrated genes and their expression.

In agreement with the internship supervisor from the University and depending on the location of this type of internship, the structure of the report or its individual parts may change.

After completing the internship and completing the report in accordance with the requirements, the student submits his report for defense to the supervisor from the university. Based on the results of the defense, a test is given with a grade (excellent, good, satisfactory, unsatisfactory):

“Excellent” – the necessary practical skills and professional competencies provided for by the educational practice program are fully formed, the tasks are completed, the quality of their implementation is assessed with a number of points close to the maximum.

“Good” – the necessary practical work skills and professional competencies provided for by the educational practice program are fully formed, the tasks are completed, the quality of none of them is assessed with a minimum number of points, some types of tasks are completed with errors or not thoroughly enough.

“Satisfactory” – the necessary practical skills and professional competencies are basically formed, the gaps are not significant, some of the completed tasks contain errors.

“Unsatisfactory” - the necessary practical skills and professional competencies provided for by the educational practice program have not been developed, all completed educational assignments contain gross errors, additional independent work on the report materials will not lead to any significant improvement in the quality of assignments.

## 9. EDUCATIONAL-METHODOLOGICAL AND INFORMATION SUPPORT OF EDUCATIONAL PRACTICE (including basic and additional literature)

1. Equipment for biotechnological production: textbook for universities / I. A. Evdokimov [etc.]; edited by I. A. Evdokimov. - Moscow: Yurayt Publishing House, 2023. - 206 p. - (Higher education). — ISBN 978-5-534-12433-0. — Text: electronic // Educational platform Urayt [website]. — URL:https://urait.ru/bcode/518219

2. Aleshina, E.S. Cultivation of microorganisms as the basis of the biotechnological process [Electronic resource]: textbook / E.S. Aleshina, E.A. Drozdova, N.A. Romanenko – Electron. text data. – Orenburg: Orenburg State University, EBS ASV, 2017. – 192 p. - Access mode:http://www.iprbookshop.ru/71282.html

4. Genetic basis of plant breeding. Volume 4. Biotechnology in plant breeding. Genomics and genetic engineering [Electronic resource] / O.Yu. Urbanovich [and others]. - Electron. text data. – Minsk: Belarusian Science, 2014. – 654 p. - Access mode:http://www.iprbookshop.ru/29578.html

5. Dolgikh, S.G. Textbook on genetic engineering in plant biotechnology [Electronic resource]: textbook / Dolgikh S.G. - Electron. text data. – Almaty: Nur-Print, 2014. – 141 pp.— Access mode:http://www.iprbookshop.ru/67169.html

6. Ermishin, A.P. Genetically modified organisms and biosafety [Electronic resource]/ Ermishin A.P. - Electron. text data. - Minsk: Belarusian Science, 2013. - 172 p. - Access mode:http://www.iprbookshop.ru/29440.html

7. Sirotkin, A.S. Theoretical foundations of biotechnology [Electronic resource]: educational manual / A.S. Sirotkin, V.B. Zhukova. - Electron. text data. – Kazan: Kazan National Research Technological University, 2010. – 87 p. - Access mode:http://www.iprbookshop.ru/63475.html

## 10. MATERIAL AND TECHNICAL SUPPORT OF TRAINING PRACTICE

Educational and scientific laboratories equipped with the following equipment:

1) Centrifuge 5804 R, Eppendorf; Microscope IX-73, Olympus,. CO2 incubator Galaxy 48R, Eppendorf 14. System for continuous monitoring of living cells in real time Cell-IQ. Applied Biosystems amplifier; Biorad amplifier, Spectrophotometer, GNOM thermostat, Termite thermostat, Biorad chambers for electrophoresis of proteins and nucleic acids 2 pcs., Power supplies for phoresis chamber 2 pcs. Biorad, Zeiss inverted microscope 2 pcs.

2) Deep optical imaging system for biomaterials FluoView FV1200MPE, Freezing microtome CM 1950, Leica, Microtome RM2265, Leica, Robotic system for automated cell cultivation CompacT SelecT, Laboratory cryogenic storage 24K, Taylor Wharton, High-speed cell sorter MoFlo Astrios EQ, Beckman Coulter, CO2 incubator Galaxy 130R, Eppendorf, Sample preparation system for whole genome sequencing Ion Chef™ Instrument, Thermo Fisher Scientific, DNA sequence analysis system Ion S5™ XL System, Thermo Fisher Scientific, Applied Biosystems 3500 genetic analyzer, Thermo Fisher Scientific, Biacore X100 System automated system for the analysis of intermolecular interactions, System for analyzing the rheological properties of biomaterials HAAKE MARS III, Thermo Fisher Scientific, Atomic force microscope (probe) BioScope Resolve, Bruker

For persons with disabilities and people with disabilities, the choice of places of practice is consistent with the requirement of their accessibility for these students and the practice is carried out taking into account the characteristics of their psychophysical development, individual capabilities and health status.

Head of OP  V.V. Kumeiko

ANNEX 1

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)

**I CONFIRM:**
Head of OP
_____FULL NAME.
"____" _____20__

# INDIVIDUAL TASK

By _____
(type of practice)

student _____groups _____
(student's name)

Educational program 06.03.01 “Biology”, profile “Biomedicine (in English)”_____
_____

Base (place, organization) of practice_____
_____

Duration of practice from _____20___ to _____ 20___

| | |
|---|---|
| Generalized formulation of the task | |

Task schedule

| Name of tasks (activities) that make up the task | Date of completion of the task (activity) |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| | |

Head of practice _____ _____
*signature full name, position*

APPENDIX 2

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)**

**DEPARTMENT _____**

**DIARY**

according to _____
practice
student _____
group_____
program_____
Place of practice_____
Duration of internship:_____weeks_____

Head of practice from FEFU
_____
Head of practice from a specialized organization
_____

1. Student work schedule

| No. | Name of works | Calendar dates | | Last name of practice manager |
|---|---|---|---|---|
| | | Start | ending | |
| | | | | |
| | | | | |
| | | | | |

2. Student's work diary

| date | Summary of the trainee's work | Signature head |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

3. Report protection results

The report is protected by "____" _____ 20___

With a rating of _____

Department Director _____ AND ABOUT. Surname

APPENDIX 3

**Internship report cover page form**

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)**

**DEPARTMENT** _____

The report is protected with a rating
_____
"_____"_____20__G

Supervisor
educational program
_____Last name I.O.

.

**REPORT**

**about internship**_____
_____

_____
(full name of the profile organization)

Student _____group _____ (_____)
*Signature Full name*
Head of Practice
from a specialized organization_____ (_____)
*Signature Full name*

Head of Practice
from FEFU_____ (_____)
*Signature Full name*

APPENDIX 4

**Referral form for educational practice**

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)**

**DEPARTMENT** _____

**DIRECTION**

**for practice**_____

_____

student of __bachelor's course
Full Namegroups _____
(Full Name)
sent to _____
name of the base organization

address _____

Order on assignment to practice dated No._____
for internship
in the field of study 06.03.01 Biology
for the period from _____ 20 to _____ 20 (continuous/discrete)

Head of Practice

M.P. _____ (position, academic rank) _____ (signature) _____ (I.O.F)

**Notes on completion and dates of practice**

| Business name | Arrival and departure notes | Signature, decryption of signature, seal |
|---|---|---|
| Name of the enterprise, organization in accordance with the agreement | Arrived __.__.20__ | |
| | Dropped out on __.__.20__ | |

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)

# WORK PROGRAM FOR PRODUCTION PRACTICE

Internship. Pharmaceutical Development Practice (Industrial practice. Drug development practice)
for the direction of training
06.03.01 Biology
Name of the educational program “Biomedicine (in English)”

Vladivostok
2023

## 1. GOALS OF DEVELOPING PRODUCTION PRACTICES

The goals of the practice “Industrial practice. Practice in the development of medicines” are consolidation of theoretical knowledge acquired in the study of basic and professional disciplines; acquisition of professional skills in future professional activities; formation of competencies that meet the requirements of the main professional educational program of the undergraduate program “Biomedicine (in English)” 03/06/01 Biology.

## 2. OBJECTIVES OF PRODUCTION PRACTICE

The objectives of industrial practice are:

- training students in labor techniques and methods of performing labor processes necessary for mastering professional competencies;
- consolidation of theoretical knowledge about the manufacture of medicines;
- deepening students’ theoretical knowledge about the basic principles and rules for the manufacture of dosage forms;
- deepening students’ theoretical knowledge about the basic principles and rules for choosing excipients, packaging and closures;
- consolidation of skills in drawing up primary documentation necessary for the manufacture of medicines according to individual prescriptions of doctors and the requirements of medical organizations.

## 3. PLACE OF PRODUCTION PRACTICE IN THE STRUCTURE OF EP

Block B2.O.02.01(P) “Industrial practice. Practice in the development of medicines" of the educational standard in the field of training 06.03.01 Biology, approved by order of the Ministry of Science and Higher Education of the Russian Federation dated 07.08.2020 No. 920, is mandatory and is a type of training sessions directly focused on professional and practical training of students.

Industrial practice is the second stage of practical training at the level of higher education - bachelor's degree and is aimed at students obtaining professional skills and experience in professional activities.

Industrial practice is carried out both in third-party organizations that have the necessary personnel and scientific and technical potential (on-site), and on the basis of the Federal State Autonomous Educational Institution of Higher Education "Far Eastern Federal University" (stationary).

Industrial practice is based on theoretical mastery of such disciplines as: “Fundamentals of design activity”, “Fundamentals of digital literacy”, “General biology”, “General and inorganic chemistry”, “Higher mathematics”, “Digital technologies in professional activities”, “Organic chemistry”, “General physics”, “Biophysics”, “General biology”, “Developmental biology”, “Medical parasitology”, “Histology”, “Molecular and cellular biology”, “Genetics”, “Biochemistry”, “Microbiology”, “Molecular pharmacology”, “Immunology”, “Virology”, “Bioinformatics”, “Biostatistics”, “Drug development”, “Programming

in biomedicine", "Mechanisms of normal diseases", "Clinical diagnostic methods", "Molecular cell biology" , "Methods of molecular and cellular biology", etc.

Students undergoing practical training is an integral part of the educational process and is necessary for subsequent study of the professional modules "Chemistry Module", "FEFU Digital Core", "Module of Physical and Mathematical Sciences", "General Professional Module", "Module of Biology and Fundamental Medicine" and etc., as well as during other types of internship: "Industrial practice. Research work", "Industrial practice. Pre-graduation practice, including research work."

## 4. TYPES, METHODS, PLACE AND TIME OF PRODUCTION PRACTICE

| | |
|---|---|
| Type of practice | Internship |
| Type of practice | Internship. Drug development practice |
| Method of implementation | Stationary / Traveling |
| Form(s) of conduct | Concentrated |
| Volume of practice in credit units; duration of practice; course, semester | 3rd year, 6th semester: 6 credits, 4 weeks, 216 academic. hour. |
| Practice bases | Laboratories of the Department of Pharmacy and Pharmacology FEFU |

## 5. STUDENT COMPETENCIES FORMED AS A RESULT OF INDUSTRIAL PRACTICE

Professional competencies of graduates and indicators of their achievement:

| Task type | Code and name of professional competence (result of mastery) | Code and name of the competency achievement indicator |
|---|---|---|
| design | PC-1 Capable of carrying out fundamental and applied projects to study physiological processes and phenomena occurring at the molecular, cellular, organ and system levels in the human and animal body | PC-1.1 Explores the mechanisms of molecular interaction of cells, tissues and functional systems of organisms, studies the physiological processes occurring in them |
| | | PC-1.2 Uses methods of molecular genetic, cellular and physiological research to study physiological processes in the body |

| | | |
|---|---|---|
| | PC-2 Applies biotechnology and bioengineering methods for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | PC-2.1 Uses fundamental knowledge of molecular and cellular biology to implement genetic and cellular engineering technologies in practice |
| | | PC-2.2 Able to apply genetic and cellular engineering methods for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems |
| | | PC-2.3 Able to analyze the results of experiments in the field of biotechnology and bioengineering and carry out the development of medicines, medical devices, biomedical cell products and medical diagnostic systems |
| | | PC-2.4 Capable of transferring the results of research work in the field of biotechnology and bioengineering for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems |
| | PC-3 Capable of conducting experimental studies of biologically active substances and developing medicines and medical devices | PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances |
| | | PC-3.2 Able to apply molecular modeling methods for the development of medicines and medical devices |
| | | PC-3.3 Able to develop medicines and medical devices using methods of pharmacological research and pharmaceutical technologies |
| | | PC-3.4 Capable of developing nanosystems for creating medicines and medical devices |
| | | PC-3.5 Capable of conducting preclinical tests of medicines and medical devices |

| Code and name of the competency achievement indicator | Name of the assessment indicator (result of training by practice) |
|---|---|
| PC-1.1 Explores the mechanisms of molecular interaction of cells, tissues and functional systems of organisms, studies the physiological processes occurring in them | Knows<br>interactions of cells, tissues and functional systems of organisms.<br>Can<br>distinguish physiological processes occurring in cells and tissues.<br>Owns<br>skills in studying the mechanisms of molecular interaction of cells, tissues and functional systems of organisms. |
| PC-1.2 Uses methods of molecular | Knows |

| | |
|---|---|
| genetic, cellular and physiological research to study physiological processes in the body | methods of molecular genetic, cellular and physiological research.<br>Can<br>apply methods of molecular genetic, cellular and physiological research.<br>Owns<br>methods of molecular genetic, cellular and physiological research. |
| PC-2.1 Uses fundamental knowledge of molecular and cellular biology to implement genetic and cellular engineering technologies in practice | Knows<br>methods of biotechnology and bioengineering.<br>Can<br>apply methods of biotechnology and bioengineering.<br>Owns<br>skills in obtaining medicines, medical devices, biomedical cell products and medical diagnostic systems. |
| PC-2.2 Able to apply genetic and cellular engineering methods for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>methods of genetic and cellular engineering.<br>Can<br>apply genetic and cellular engineering methods.<br>Owns<br>ability to obtain medicines, medical devices, biomedical cell products and medical diagnostic systems. |
| PC-2.3 Able to analyze the results of experiments in the field of biotechnology and bioengineering and carry out the development of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>analyze the results of an experiment in the field of biotechnology and bioengineering<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. |
| PC-2.4 Capable of transferring the results of research work in the field of biotechnology and bioengineering for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>transfer the results of research work in the field of biotechnology and bioengineering.<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. |
| PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances | Knows<br>methods of physiology, biochemistry, molecular and cellular biology.<br>Can<br>use methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances.<br>Owns<br>skills of knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances. |
| PC-3.2 Able to apply molecular | Knows |

| | |
|---|---|
| modeling methods for the development of medicines and medical devices | molecular modeling methods.<br>Can<br>apply molecular modeling methods.<br>Owns<br>molecular modeling methods for the development of medicines and medical devices. |
| PC-3.3 Able to develop medicines and medical devices using methods of pharmacological research and pharmaceutical technologies | Knows<br>methods of pharmacological research and pharmaceutical technologies.<br>Can<br>apply methods of pharmacological research and pharmaceutical technologies.<br>Owns<br>ability to develop medicines and medical devices. |
| PC-3.4 Capable of developing nanosystems for creating medicines and medical devices | Knows<br>methods of pharmacological research and pharmaceutical technologies.<br>Can<br>apply development methods to create medicines and medical devices.<br>Owns<br>the ability to develop nanosystems for the creation of medicines and medical devices. |
| PC-3.5 Capable of conducting preclinical tests of medicines and medical devices | Knows<br>methods of preclinical testing of medicines and medical devices.<br>Can<br>conduct preclinical tests of medicines and medical devices.<br>Owns<br>skills in conducting preclinical testing of medicines and medical devices. |

## 6. STRUCTURE AND CONTENT OF PRACTICE, INCLUDING PRACTICAL TRAINING

The content of practice is determined by its type and type.

The total labor intensity of industrial practice is 4 weeks / 6 credit units, 216 hours.

| **No.** | **Sections (stages) of practice** | **Types of educational work in practice, including independent work of students** | **Labor intensity (in hours)** | **Forms current control** |
|---|---|---|---|---|
| 1 | Organizational stage | Safety briefing, receiving directions, individual assignments, programs and guidelines.<br>Introductory lectures. Acquaintance with the place of practice. | 12 | Interview |

| | | | | |
|---|---|---|---|---|
| 2 | Main stage | Studying the content of the work, types and specifics of the professional activity of the enterprise; Description of the assigned production tasks in the organization; Determining the specifics of the work; Description of the principles of organizing the work of the main areas of activity, the sequence of solving assigned production tasks; Characteristics of the content of the events carried out. | 60 | Individual task |
| 3 | Experimental stage | Production of extemporaneous medicines according to prescribed recipes. | 120 | Practice diary |
| 4 | The final stage | Completion of tasks; Description of completed production tasks; Drawing up and defending a report on practice. | 24 | Practice report |
| **TOTAL:** | | | **216** | |

## 7. EDUCATIONAL AND METHODOLOGICAL SUPPORT OF INDEPENDENT WORK OF STUDENTS IN PRODUCTION PRACTICE

Industrial practice is aimed at familiarizing students with the material and technical support of an enterprise/workshop/laboratory, software and modern research methods.

During practical training, regardless of its location, students should pay special attention to issues related to life safety, labor protection and industrial sanitation. To do this, it is necessary to consider the principles of state and public control of compliance with labor legislation, the organization of the life safety service and its tasks.

Production practice begins with drawing up a general description of the enterprise (organization, institution), which includes the history of its development, structure, program of production activities, analysis of the management scheme, and study of promising areas of development.

An individual assignment (Appendix 1) is issued to the student at the university by the internship supervisor before the internship begins. It should be aimed at collecting and analyzing medical-biological and scientific-technical information, as well as summarizing domestic and foreign experience in the field of biotechnical systems and technologies, analyzing patent literature, preparing source material for future coursework and projects, as well as final qualifying work .

8. CERTIFICATION FORMS (BASED ON PRACTICE),including a list of assessment forms used at various stages of developing competencies during practice assignments

| No. | Controlled sections of educational (industrial) practice | Code and name of the achievement indicator | Learning outcomes | Evaluation tools * | |
|---|---|---|---|---|---|
| | | | | current control | intermediate certification |
| 1 | Individual assignment for educational (industrial) practice | PC-1.1 Explores the mechanisms of molecular interaction of cells, tissues and functional systems of organisms, studies the physiological processes occurring in them | Knows<br>interactions of cells, tissues and functional systems of organisms.<br>Can<br>distinguish physiological processes occurring in cells and tissues.<br>Owns<br>skills in studying the mechanisms of molecular interaction of cells, tissues and functional systems of organisms. | PR-9 | - |
| | | PC-1.2 Uses methods of molecular genetic, cellular and physiological research to study physiological processes in the body | Knows<br>methods of molecular genetic, cellular and physiological research.<br>Can<br>apply methods of molecular genetic, cellular and physiological research.<br>Owns<br>methods of molecular genetic, cellular and physiological research. | PR-14 | - |
| | | PC-2.1 Uses fundamental knowledge of molecular and cellular biology to implement genetic and cellular engineering technologies in practice | Knows<br>methods of biotechnology and bioengineering.<br>Can<br>apply methods of biotechnology and bioengineering.<br>Owns<br>skills in obtaining medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-14 | - |

| | | | | | |
|---|---|---|---|---|---|
| | | PC-2.2 Able to apply genetic and cellular engineering methods for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>methods of genetic and cellular engineering.<br>Can<br>apply genetic and cellular engineering methods.<br>Owns<br>ability to obtain medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-14 | - |
| 2 | Completing a report on educational (industrial) practice | PC-2.3 Able to analyze the results of experiments in the field of biotechnology and bioengineering and carry out the development of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>analyze the results of an experiment in the field of biotechnology and bioengineering<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-16 | - |
| | | PC-2.4 Capable of transferring the results of research work in the field of biotechnology and bioengineering for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>transfer the results of research work in the field of biotechnology and bioengineering.<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-16 | - |
| | | PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular | Knows<br>methods of physiology, biochemistry, molecular and cellular biology.<br>Can | PR-16 | - |

| | | | | | |
|---|---|---|---|---|---|
| | | biology to study the properties of biologically active substances | use methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances.<br>Owns<br>skills of knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances. | | |
| | | PC-3.2 Able to apply molecular modeling methods for the development of medicines and medical devices | Knows<br>molecular modeling methods.<br>Can<br>apply molecular modeling methods.<br>Owns<br>molecular modeling methods for the development of medicines and medical devices. | PR-16 | - |
| | | PC-3.3 Able to develop medicines and medical devices using methods of pharmacological research and pharmaceutical technologies | Knows<br>methods of pharmacological research and pharmaceutical technologies.<br>Can<br>apply methods of pharmacological research and pharmaceutical technologies.<br>Owns<br>ability to develop medicines and medical devices. | PR-16 | - |
| 3 | Defense of the practice report | PC-3.4 Capable of developing nanosystems for creating medicines and medical devices | Knows<br>methods of pharmacological research and pharmaceutical technologies.<br>Can<br>apply development methods to create medicines and medical devices.<br>Owns<br>the ability to develop nanosystems for the creation of medicines and medical devices. | - | UO-1 |
| | | PC-3.5 Capable of conducting preclinical tests | Knows<br>methods of preclinical testing of medicines and medical | - | UO-1 |

| | | | | | |
|---|---|---|---|---|---|
| | | of medicines and medical devices | devices.<br>Can<br>conduct preclinical tests of medicines and medical devices.<br>Owns<br>skills in conducting preclinical testing of medicines and medical devices. | | |

* Recommended forms of assessment tools:
1. interview (UO-1), colloquium (UO-2); report, message (UO-3); round table, discussion, controversy, dispute, debate (UO-4); etc.
2. tests (PR-1); tests (PR-2), essays (PR-3), abstracts (PR-4), term papers (PR-5); laboratory work (PR-6); abstract (PR-7); portfolio (PR-8); project (PR-9); business and/or role-playing game (PR-10); case task (PR-11); workbook (PR-12); multi-level tasks and assignments (PR-13); calculation - graphic work (PR-14); creative task (PR-15), practice report (PR-16), etc.
3. simulator (TS-1), etc.

Before undergoing practical training, the student receives an individual assignment from the internship supervisor from the university, the content and scope of which are discussed with the internship supervisor.

Based on the results of the internship, the student draws up a report on the completion of the internship, participates in the final conference with a presentation of the results of the internship, after which he receives a test with a grade.

The practice report must contain the following elements:

− title page (Appendix 3);

− assignment and calendar plan of practice (Appendix 1);

− document confirming the fact of internship;

− a description drawn up by the head of practice from an organization or structural unit if the practice is conducted on the basis of FEFU;

− content;

− introduction;

− the main part about the activities during the internship;

− completed individual task;

− conclusion;

− sources of information;

The report is prepared in accordance with the "Requirements for the preparation of written work performed by FEFU students and listeners."

In agreement with the internship supervisor from the university and depending on the location of this type of internship, the structure of the report or its individual parts may change.

After completing the internship and completing the report in accordance with the requirements, the student submits his report for defense to the supervisor from the university. Based on the results of the defense, a test is given with a grade (excellent, good, satisfactory, unsatisfactory):

"Excellent" – the necessary practical skills and professional competencies provided for by the educational practice program are fully formed, the tasks are completed, the quality of their implementation is assessed with a number of points close to the maximum.

"Good" – the necessary practical work skills and professional competencies provided for by the educational practice program are fully formed, the tasks are completed, the quality of none of them is assessed with a minimum number of points, some types of tasks are completed with errors or not thoroughly enough.

"Satisfactory" – the necessary practical skills and professional competencies are basically formed, the gaps are not significant, some of the completed tasks contain errors.

“Unsatisfactory” - the necessary practical skills and professional competencies provided for by the educational practice program have not been developed, all completed educational assignments contain gross errors, additional independent work on the report materials will not lead to any significant improvement in the quality of assignments.

9. EDUCATIONAL, METHODOLOGICAL AND INFORMATION SUPPORT OF PRODUCTION PRACTICE (including basic and additional literature)

1. Aleshina, E.S. Cultivation of microorganisms as the basis of the biotechnological process [Electronic resource]: textbook / E.S. Aleshina, E.A. Drozdova, N.A. Romanenko – Electron. text data. – Orenburg: Orenburg State University, EBS ASV, 2017. – 192 p. - Access mode:http://www.iprbookshop.ru/71282.html

2. Bratus, A.S. Dynamic systems and models of biology / A.S. Bratus, A.S. Novozhilov, A.P. Platonov. – Moscow: FIZMATLIT, 2009. – 400 p.https://e.lanbook.com/book/2119

3. Ryabkova, G.V. Biotechnology (Biotechnology) [Electronic resource]: educational manual / G.V. Ryabkova – Electron. text data.http://www.iprbookshop.ru/61942.html

4. Sirotkin, A. S. Theoretical foundations of biotechnology: educational manual / A. S. Sirotkin, V. B. Zhukova. - Kazan: Kazan National Research Technological University, 2010. - 87 p. — ISBN 978-5-7882-0906-7. — Text: electronic // Digital educational resource IPR SMART: [website]. — URL:https://www.iprbookshop.ru/63475.html

**additional literature**

1. Pharmaceutical technology. Manufacturing of medicines [Electronic resource]: textbook. manual / Loyd W. Allen, A. S. Gavrilov - M.: GEOTAR-Media, 2014. -http://www.studentlibrary.ru/book/ISBN9785970427811.html

2. Pharmaceutical biotechnology [Electronic resource] / Orekhov S.N. - M.: GEOTAR-Media, 2013. - http://www.studentlibrary.ru/book/ISBN9785970424995.html

3. Pharmaceutical technology. Technology of dosage forms [Electronic resource] / Krasnyuk I.I., Mikhailova G.V., Muradova L.I. - M.: GEOTAR-Media, 2011. - 656 p.

- http://www.studentlibrary.ru/book/ISBN9785970418055.html

4. Pharmaceutical technology. Manufacturing of medicines [Electronic

resource] / Gavrilov A.S. - M.: GEOTAR-Media, 2010. - 624 p. - http://www.studentlibrary.ru/book/ISBN9785970414255.html

**Electronic resources and software**

1. State Pharmacopoeia XIV edition in three volumes, 2018 http://femb.ru/feml
2. Federal Electronic Medical Library http://feml.scsml.rssi.ru/feml/
3. Legal information systemhttp://www.consultant.ru/
4. Scientific electronic library eLIBRARY project RFBRwww.elibrary.ru
5. FEFU Scientific Library http://www.dvfu.ru/web/library/nb1
6. Electronic library system Znanium.com
7. List of information technologies and software
8. Microsoft Office Professional Plus 2010; an office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.);
9. 7Zip 9.20 - a free file archiver with a high degree of data compression;
10. ABBYY FineReader 11 - a program for optical character recognition;
11. Adobe Acrobat XI Pro – a software package for creating and viewing electronic publications in PDF format;
12. Adobe Photoshop CS6;
13. ESET Endpoint Security - comprehensive protection for Windows-based workstations. Virtualization support + new technologies;
14. Google Chrome;
15. LabSolutions LC/GC Workstation software, software for controlling the Shimadzu chromatographic system and processing the results obtained, including a software module for calculating the molecular weight characteristics of polymers;
16. Multifunctional UV Control Software, software for controlling the Shimadzu spectrophotometer and processing the results obtained;
17. LabSolutions IR software for controlling the Fourier transform infrared spectrometer and processing the results obtained, in addition to standard functions, allows for measurements in photometric and kinetic modes. Includes a unique algorithm for searching spectra, as well as a library containing about 12,000 spectra, which greatly facilitates the task of identifying substances.

## 10. LOGISTICAL AND TECHNICAL SUPPORT OF PRODUCTION PRACTICE

To conduct research related to the implementation of practical assignments, as well as to organize independent work, students have access to the following

laboratory equipment and specialized rooms that comply with current sanitary and fire safety standards, as well as safety requirements for scientific and production work:

| Name of equipped premises and premises for independent work | List of main equipment |
|---|---|
| Auditorium for conducting lectures and seminars<br>type and laboratory work<br><br>690922, Primorsky Territory, Vladivostok, Russky Island,<br>Saperny Peninsula, Ajax village, 10, Korpus 25.1, room.<br>**M403** | Sets of laboratory furniture (tables and chairs), student board. Multimedia complex: Monoblock Lenovo C360G-i34164G500UDK; Projection screen Projecta Elpro Electrol, 300x173 cm; Multimedia projector, Mitsubishi FD630U, 4000 ANSI Lumen, 1920x1080; Built-in interface with automatic cable retraction system TLS TAM 201 Stan; Document camera Avervision CP355AF; Microphone lavalier UHF radio system Sennheiser EW 122 G3 consisting of a wireless microphone and receiver; Video conferencing codec LifeSizeExpress 220-<br>Codeconly-Non-AES; Network video camera Multipix MP-HD718; Two 47" LCD panels, Full HD, LG M4716CCBA; Audio switching and sound amplification subsystem; centralized uninterrupted power supply. The auditorium is also equipped for an open-type pharmacy: counters, display cases (cabinets, racks with samples of pharmaceutical products), cash register<br>apparatus. |
| Auditorium for conducting lectures and seminars<br>type and laboratory work<br><br>690922, Primorsky Territory, Vladivostok, Russky Island,<br>Saperny Peninsula, Ajax village, 10, Korpus 25.1, room. M420 | Sets of educational furniture (tables and chairs), student board. Multimedia complex: Lenovo Monoblock C360G-i34164G500UDK; Projection screen Projecta Elpro Electrol, 300x173 cm; Multimedia projector, Mitsubishi FD630U, 4000 ANSI Lumen, 1920x1080; Built-in interface with automatic cable retraction system TLS TAM 201 Stan; Document camera Avervision CP355AF; Microphone lavalier UHF radio system Sennheiser EW 122 G3 included<br>wireless microphone and receiver; Video conferencing codec LifeSizeExpress 220-<br>Codeconly-Non-AES; Network video camera Multipix |

| | |
|---|---|
| | MP-HD718; Two 47" LCD panels, Full HD, LG M4716CCBA; Audio switching and sound amplification subsystem; centralized uninterruptible power supply.<br>Laboratory equipment: Aquadistiller PE-2205 (5l/h); analytical balances; laboratory scales Vibra SJ-6200CE (NPV=6200 g/0.1 g); moisture meter AGS100; two-beam spectrophotometer UV-1800manufactured by Shimadzu; magnetic stirrer PE-6100 (10 pcs); magnetic stirrer PE-6110 M with heating (5 pcs); electric heating plate; infrared spectrophotometer IRAffinity-1S with Fourier transform; liquid chromatograph LC-20 Prominence with spectrophotometric and refractometric detector; laboratory centrifuge PE-6926 with a 10×5 ml rotor; a set of automatic Ecochem dispensers, a water bath, a drying cabinet, a fume hood, a water purification system. Sets of chemical reagents and laboratory glassware. |
| Audiences for independent work of students<br><br>Reading rooms of the FEFU Scientific Library with open access to the collection (building A - level 10) | Educational furniture sets (tables and chairs)<br>Monoblock HP ProOpe 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW,GigEth,Wi-Fi,VT,usb kbd/mse,Win7Pro (64-bit)+Win8.1Pro(64-bit),1-1-1 Wty Internet access speed 500 Mbit/sec. Workplaces for people with disabilities are equipped with displays and Braille printers; equipped with: portable devices for reading flat-printed texts, scanning and reading machines, video enlargers with the ability to regulate color spectrums; magnifying electronic magnifiers and ultrasonic markers |
| Audience for independent work of students<br><br>690922, Primorsky Territory, Vladivostok, Russky Island,<br>Saperny Peninsula,<br>Ajax village, 10, Building 25.1, room. M621 | Kits educational furniture (tables Andchairs), student board. All-in-one Lenovo C360G-i34164G500UDK 19.5" Intel Core i3-4160T 4GB DDR3-1600 SODIMM (1x4GB)500GB Windows Seven Enterprise - 17 pieces; Wired LAN network – Cisco 800 series; wireless LANs are provided for students system based on access points 802.11a/b/g/n 2x2 MIMO(2SS). |

| | |
|---|---|
| Auditorium for conducting seminar-type classes and<br>laboratory work<br><br>690922, Primorsky Territory, Vladivostok, Russky Island,<br>Saperny Peninsula, Ajax village, 10, Korpus 25.1, room. M409 | Sets of laboratory furniture (tables, chairs, cabinets for storing equipment, reagents, pharmaceutical and laboratory glassware), student board.<br>Laboratory equipment: water distiller, water bath, laboratory scales, pharmaceutical turntables, dispenser sets, laboratory stirrers, pH meter, suppository form, filtration unit.<br>Sets of pharmaceutical substances, pharmaceutical and chemical glassware |
| Auditorium for conducting seminar-type classes and<br>laboratory work<br><br>690922, Primorsky Territory, Vladivostok, Russky Island,<br>Saperny Peninsula, Ajax village, 10, Building L,<br>room L406 | Sets of laboratory furniture (tables, chairs, cabinets for storing equipment, reagents, pharmaceutical and laboratory glassware), student board.<br>Laboratory equipment: water distiller, water bath, laboratory scales, pharmaceutical turntables, dispenser sets, laboratory stirrers, apparatus for producing pharmaceuticals UNIQ -2 with replaceable attachments: granulator, coating kettle, mixer; Laboratory scales AGN100; Magnetic stirrer PE-6100 (5 pcs); Magnetic stirrer PE-6110 M with heating (2 pcs); Electric heating plate; UNIQ-7 rotary tableting press for 7 punches; mold for forming suppositories with 100 cells; device for determining the disintegration of tablets. Sets of pharmaceutical substances, pharmaceutical and chemical glassware |

**Compiled by:**

Associate Professor, Candidate of Sciences biol. sciences,
head of the OP V.V. Kumeiko

ANNEX 1

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)**

**I CONFIRM:**
Head of OP
_____FULL NAME.
"____" _____20__

# INDIVIDUAL TASK

By _____
(type of practice)

student _____groups _____
(student's name)

Educational program 06.03.01 “Biology”, profile “Biomedicine (in English)”_____
_____

Base (place, organization) of practice_____
_____

Duration of practice from _____20___ to _____ 20___

| | |
|---|---|
| Generalized formulation of the task | |

Task schedule

| Name of tasks (activities) that make up the task | Date of completion of the task (activity) |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| | |

Head of practice _____ _____
*signature full name, position*

APPENDIX 2

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)**

**DEPARTMENT _____**

**DIARY**

according to _____
practice
student _____
group_____
program_____
Place of practice_____
Duration of internship:_____weeks_____

Head of practice from FEFU
_____
Head of practice from a specialized organization
_____

1. Student work schedule

| No. | Name of works | Calendar dates | | Last name of practice manager |
|---|---|---|---|---|
| | | Start | ending | |
| | | | | |
| | | | | |
| | | | | |

2. Student's work diary

| date | Summary of the trainee's work | Signature head |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

3. Report protection results

The report is protected by "____" _____ 20___

With a rating of _____

Department Director _____ AND ABOUT. Surname

APPENDIX 3

**Internship report cover page form**

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)**

**DEPARTMENT** _____

The report is protected with a rating
_____
"_____"_____20__ g

Supervisor
educational program
_____Last name I.O.

.

**REPORT**

**about passing**_____
_____

_____
(full name of the profile organization)

Student _____group _____ (_____)
*Signature Full name*
Head of Practice
from a specialized organization_____ (_____)
*Signature Full name*

Head of Practice
from FEFU_____ (_____)
*Signature Full name*

APPENDIX 4

**Referral form for educational practice**

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)**

**DEPARTMENT** _____

**DIRECTION**

**for practice**_____

_____

student of __bachelor's course
Full Namegroups _____
(Full Name)
sent to _____
name of the base organization

address _____

Order on assignment to practice dated No._____
for internship
in the field of study 06.03.01 Biology
for the period from _____ 20 to _____ 20 (continuous/discrete)

Head of Practice

M.P. _____ _____ _____
(position, academic title) (signature) (I.O.F)

**Notes on completion and dates of practice**

| Business name | Arrival and departure notes | Signature, decryption of signature, seal |
|---|---|---|
| *Name of the enterprise, organization in accordance with the agreement* | Arrived __.__.20__ | |
| | Dropped out on __.__.20__ | |

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)

# WORK PROGRAM FOR PRODUCTION PRACTICE

Internship. Research work (Industrial practice. Research work)
for the direction of training
06.03.01 Biology
Name of the educational program “Biomedicine (in English)”

Vladivostok
2023

1. GOALS OF DEVELOPING PRODUCTION PRACTICES

The purpose of industrial practice “Industrial practice. Research work” – to form students’ skills and develop competencies in research activities that allow them to solve professional problems.

2. OBJECTIVES OF PRODUCTION PRACTICE

– studying scientific and technical information, performing literary and patent searches on the topic of research;

– mathematical modeling of processes and objects based on standard computer-aided design packages;

– carrying out experimental studies and tests according to a given methodology, mathematical processing of experimental data;

– participation in the implementation of research and development results;

– preparation of data for the preparation of reports, reviews, scientific publications;

– participation in activities to protect intellectual property.

3. PLACE OF PRODUCTION PRACTICE IN THE STRUCTURE OF EP

Block B2.O.02.02(P) “Internship. Research work (Industrial practice. Research work)" of the educational standard in the field of training 03/06/01 Biology, approved by order of the Ministry of Science and Higher Education of the Russian Federation dated 08/07/2020 No. 920, is mandatory and is a type of training, directly focused on professional and practical training of students.

Industrial practice is the second stage of practical training at the level of higher education - bachelor's degree and is aimed at students obtaining professional skills and experience in professional activities.

Industrial practice is carried out both in third-party organizations that have the necessary personnel and scientific and technical potential (on-site), and on the basis of the Federal State Autonomous Educational Institution of Higher Education "Far Eastern Federal University" (stationary).

Industrial practice is based on theoretical mastery of such disciplines as: “Fundamentals of design activity”, “Fundamentals of digital literacy”, “General biology”, “General and inorganic chemistry”, “Higher mathematics”, “Digital technologies in professional activities”, “Organic chemistry”, “General physics”, “Biophysics”, “General biology”, “Developmental biology”, “Medical parasitology”, “Histology”, “Molecular and cellular biology”, “Genetics”, “Biochemistry”, “Microbiology”, “Molecular pharmacology”, “Immunology”, “Virology”, “Bioinformatics”, “Biostatistics”, “Drug development”, “Programming in biomedicine”, “Mechanisms of normal diseases”, “Clinical diagnostic methods”, “Molecular cell biology” , “Methods of molecular and cellular biology”,

“Biomedical cell technologies”, “Biomedical cell technologies”, “Bioengineering”, “Genetic engineering”, “Molecular modeling of biostructures”, “Structure and dynamics of biomolecules”, “Molecular genetics”, “Genetics” human”, “Molecular biotechnology”, “Medical biotechnology”, etc.

Students undergoing practical training is an integral part of the educational process and is necessary for subsequent study of the professional modules “General professional module”, “Module of biology and fundamental medicine”, etc., as well as when undergoing other types of practice: “Industrial practice. Pre-graduation practice, including research work.”

## 4. TYPES, METHODS, PLACE AND TIME OF PRODUCTION PRACTICE

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| Type of practice | Internship |
| Type of practice | Internship. Research work |
| Method of implementation | Stationary / Traveling |
| Form(s) of conduct | Concentrated |
| Volume of practice in credit units; duration of practice; course, semester | 4th year, 8th semester: 15 credits, 8 weeks, 540 academic. hour. |
| Practice bases | 1) Federal Scientific Center for Biodiversity of Terrestrial Biota of East Asia FEB RAS (FSC Biodiversity FEB RAS), laboratory of biotechnology; bioengineering laboratory;<br>2) Federal State Budgetary Institution of Science “National Scientific Center for Marine Biology named after. A.V. Zhirmunsky" Far Eastern Branch of the Russian Academy of Sciences, Laboratory of Cell Technologies<br>3) Center for Genomic and Regenerative Medicine of the ShBM FEFU, laboratory of biomedical cell technologies, etc.<br>4) Laboratories of the Department of Pharmacy and Pharmacology of the Institute of ZhBM FEFU |

## 5. STUDENT COMPETENCIES FORMED AS A RESULT OF INDUSTRIAL PRACTICE

Professional competencies of graduates and indicators of their achievement:

| Task type | Code and name of professional competence (result of mastery) | Code and name of the competency achievement indicator |
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| design | PC-1 Capable of carrying out fundamental and applied projects to study | PC-1.1 Explores the mechanisms of molecular interaction of cells, tissues and functional systems of organisms, studies |

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| | physiological processes and phenomena occurring at the molecular, cellular, organ and system levels in the human and animal body | the physiological processes occurring in them |
| | | PC-1.2 Uses methods of molecular genetic, cellular and physiological research to study physiological processes in the body |
| | PC-2 Applies biotechnology and bioengineering methods for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | PC-2.1 Uses fundamental knowledge of molecular and cellular biology to implement genetic and cellular engineering technologies in practice |
| | | PC-2.2 Able to apply genetic and cellular engineering methods for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems |
| | | PC-2.3 Able to analyze the results of experiments in the field of biotechnology and bioengineering and carry out the development of medicines, medical devices, biomedical cell products and medical diagnostic systems |
| | | PC-2.4 Capable of transferring the results of research work in the field of biotechnology and bioengineering for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems |
| | PC-3 Capable of conducting experimental studies of biologically active substances and developing medicines and medical devices | PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances |
| | | PC-3.2 Able to apply molecular modeling methods for the development of medicines and medical devices |
| | | PC-3.3 Able to develop medicines and medical devices using methods of pharmacological research and pharmaceutical technologies |
| | | PC-3.4 Capable of developing nanosystems for creating medicines and medical devices |
| | | PC-3.5 Capable of conducting preclinical tests of medicines and medical devices |
| research | PC-4 Able to understand, analyze, and apply the principles of cellular and tissue organization of | PC-4.1 Analyzes the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body and |

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| | biological objects, biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body to preserve the health of the population | applies the principles of cellular organization of biological objects |
| | | PC-4.2 Understands the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body |
| | | PC-4.3 Understands and explores the physical processes that underlie the functioning of the body in normal conditions and in pathology, understands the influence of physical factors on the functioning of biological systems, is able to study the physical structure of biologically important molecules in order to identify the relationship between the structure of substances and their biological activity |
| | | PC-4.4 Able to develop and apply health-saving technologies |
| | PC-5 Able to build mathematical models of physical, chemical and biological processes to solve biomedical problems, possess basic programming skills, use modern methods and resources of bioinformatics and biostatistics | PC-5.1 Able to build mathematical models of physical processes of living organisms, set parameters and simulate physical problems in common programming languages, including Python |
| | | PC-5.2 Able to build mathematical models of chemical processes to solve biomedical problems, set parameters and carry out modeling of chemical problems in common programming languages, including Python |
| | | PC-5.3 Able to build mathematical models of biological processes, set parameters and carry out modeling of biological problems in common programming languages, including Python |
| | | PC-5.4 Applies modern information technologies and software when solving professional problems |
| | | PC-5.5 Applies modern methods of processing and analysis of scientific and technical information, statistical analysis of biomedical data, including using the R language |
| | PC-6 Able to use modern knowledge and methods of genetics, molecular | PC-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems |

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| | and cellular biology to solve professional problems | PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes |
| | | PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology |
| | | PC-6.4 Able to perform research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies in order to identify the causes of the disease and make a diagnosis |
| | PC-7 Capable of conducting microbiological, virological and epidemiological studies to solve professional problems in the field of biomedicine | PC-7.1 Has fundamental knowledge of the structure, life 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 achievement indicator | Name of the assessment indicator (result of training by practice) |
|---|---|
| PC-1.1 Explores the mechanisms of molecular interaction of cells, tissues and functional systems of organisms, studies the physiological processes occurring in them | Knows<br>interactions of cells, tissues and functional systems of organisms.<br>Can<br>distinguish physiological processes occurring in cells and tissues.<br>Owns<br>skills in studying the mechanisms of molecular interaction of cells, tissues and functional systems of organisms. |
| PC-1.2 Uses methods of molecular genetic, cellular and physiological research to study physiological processes in the body | Knows<br>methods of molecular genetic, cellular and physiological research.<br>Can<br>apply methods of molecular genetic, cellular and physiological research.<br>Owns<br>methods of molecular genetic, cellular and physiological research. |
| PC-2.1 Uses fundamental knowledge of molecular and cellular biology to implement genetic and cellular engineering technologies in practice | Knows<br>methods of biotechnology and bioengineering.<br>Can<br>apply methods of biotechnology and bioengineering.<br>Owns<br>skills in obtaining medicines, medical devices, biomedical cell products and medical diagnostic systems. |
| PC-2.2 Able to apply genetic and | Knows |

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| cellular engineering methods for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | methods of genetic and cellular engineering.<br>Can<br>apply genetic and cellular engineering methods.<br>Owns<br>ability to obtain medicines, medical devices, biomedical cell products and medical diagnostic systems. |
| PC-2.3 Able to analyze the results of experiments in the field of biotechnology and bioengineering and carry out the development of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>analyze the results of an experiment in the field of biotechnology and bioengineering<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. |
| PC-2.4 Capable of transferring the results of research work in the field of biotechnology and bioengineering for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>transfer the results of research work in the field of biotechnology and bioengineering.<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. |
| PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances | Knows<br>methods of physiology, biochemistry, molecular and cellular biology.<br>Can<br>use methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances.<br>Owns<br>skills of knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances. |
| PC-3.2 Able to apply molecular modeling methods for the development of medicines and medical devices | Knows<br>molecular modeling methods.<br>Can<br>apply molecular modeling methods.<br>Owns<br>molecular modeling methods for the development of medicines and medical devices. |
| PC-3.3 Able to develop medicines and medical devices using methods of pharmacological research and pharmaceutical technologies | Knows<br>methods of pharmacological research and pharmaceutical technologies.<br>Can<br>apply methods of pharmacological research and pharmaceutical technologies.<br>Owns<br>ability to develop medicines and medical devices. |
| PC-3.4 Capable of developing nanosystems for creating | Knows<br>methods of pharmacological research and pharmaceutical |

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| medicines and medical devices | technologies.<br>Can<br>apply development methods to create medicines and medical devices.<br>Owns<br>the ability to develop nanosystems for the creation of medicines and medical devices. |
| PC-3.5 Capable of conducting preclinical tests of medicines and medical devices | Knows<br>methods of preclinical testing of medicines and medical devices.<br>Can<br>conduct preclinical tests of medicines and medical devices.<br>Owns<br>skills in conducting preclinical testing of medicines and medical devices. |
| PC-4.1 Analyzes the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body and applies the principles of cellular organization of biological objects | Knows<br>biochemical and molecular biological mechanisms of the development of pathological processes in cells and tissues of the human body.<br>Can<br>apply the principles of cellular organization of biological objects.<br>Owns<br>skills in determining the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body. |
| PC-4.2 Understands the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body | Knows<br>biochemical and molecular biological mechanisms of the development of pathological processes in cells and tissues of the human body.<br>Can<br>apply biochemical and molecular biological mechanisms for the development of pathological processes in the cells and tissues of the human body.<br>Owns<br>skills in using biochemical and molecular biological mechanisms for the development of pathological processes in the cells and tissues of the human body. |
| PC-4.3 Understands and explores the physical processes that underlie the functioning of the body in normal conditions and in pathology, understands the influence of physical factors on the functioning of biological systems, is able to study the physical structure of biologically important molecules in order to identify the relationship between the structure of substances and their biological activity | Knows<br>the physical structure of biologically important molecules and the physical processes underlying their functioning.<br>Can<br>determine the connection between physical structure and properties and the functions they perform in the body.<br>Owns<br>skills in studying the physical structure of biologically important molecules and the physical processes underlying their functioning. |

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| PC-4.4 Able to develop and apply health-saving technologies | Knows<br>technologies aimed at preserving public health.<br>Can<br>apply health-saving technologies.<br>Owns<br>ability to develop health-saving technologies. |
| PC-5.1 Able to build mathematical models of physical processes of living organisms, set parameters and simulate physical problems in common programming languages, including Python | Knows<br>mathematical models of physical processes of living organisms.<br>Can<br>build mathematical models of physical processes of living organisms, set parameters and carry out simulations.<br>Owns<br>skills in creating mathematical models of physical processes of living organisms, setting parameters and modeling physical problems in common programming languages, including Python |
| PC-5.2 Able to build mathematical models of chemical processes to solve biomedical problems, set parameters and carry out modeling of chemical problems in common programming languages, including Python | Knows<br>mathematical models of chemical processes for solving biomedical problems.<br>Can<br>build mathematical models of chemical processes to solve biomedical problems, set parameters and simulate chemical problems in common programming languages, including Python.<br>Owns<br>skills in constructing mathematical models of chemical processes to solve biomedical problems, setting parameters and performing simulations of chemical problems in common programming languages, including Python. |
| PC-5.3 Able to build mathematical models of biological processes, set parameters and carry out modeling of biological problems in common programming languages, including Python | Knows<br>mathematical models of biological processes.<br>Can<br>build mathematical models of biological processes, set parameters and perform simulations of biological problems in common programming languages, including Python.<br>Owns<br>skills in constructing mathematical models of biological processes, setting parameters and performing simulations of biological problems in common programming languages, including Python. |
| PC-5.4 Applies modern information technologies and software when solving professional problems | Knows<br>modern information technologies and software for solving professional problems.<br>Can<br>apply modern information technologies and software when solving professional problems.<br>Owns<br>skills in using modern information technologies and software in solving professional problems. |
| PC-5.5 Applies modern methods of processing and analysis of | Knows<br>modern methods of processing and analysis of scientific |

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| scientific and technical information, statistical analysis of biomedical data, including using the R language | and technical information, statistical analysis of biomedical data, including using the R language.<br>Can<br>apply methods of processing and analysis of scientific and technical information, statistical analysis of biomedical data, including using the R language.<br>Owns<br>skills in using modern methods of processing and analyzing scientific and technical information, statistical analysis of biomedical data, including using the R language. |
| PC-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems | Knows<br>modern methods of genetics and molecular and cellular biology for the study of living systems.<br>Can<br>conduct research in the fields of genetics and molecular and cellular biology to study living systems.<br>Owns<br>skills in using research methods in the field of genetics and molecular and cellular biology to study living systems. |
| PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes | Knows<br>methods for diagnosing pathological conditions.<br>Can<br>use fundamental knowledge and biophysical methods to diagnose pathological conditions.<br>Owns<br>skills in applying fundamental knowledge and biophysical methods to diagnose pathological conditions. |
| PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology | Knows<br>methods for diagnosing pathological conditions.<br>Can<br>use fundamental knowledge and biophysical methods to diagnose pathological conditions.<br>Owns<br>skills in applying fundamental knowledge and biophysical methods to diagnose pathological conditions. |
| PC-6.4 Able to perform research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies in order to identify the causes of the disease and make a diagnosis | Knows<br>research methods in the field of clinical laboratory diagnostics, molecular genetic and cytological research methods.<br>Can<br>carry out research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies.<br>Owns<br>ability to perform research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies in order to identify the causes of the disease and make a diagnosis. |
| PC-7.1 Has fundamental knowledge of the structure, life activity, classification of microorganisms | Knows<br>basic concepts and principles of structure, life activity, classification of microorganisms.<br>Can<br>use knowledge about the structure, life activity, |

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| | classification of microorganisms.<br>Owns<br>basic fundamental knowledge about the structure, life activity, classification of microorganisms. |
| PC-7.2 Applies methods of virological, microbiological and epidemiological analysis | Knows<br>methods of virological, microbiological and epidemiological analysis.<br>Can<br>apply methods of virological, microbiological and epidemiological analysis.<br>Owns<br>skills in using 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<br>molecular features of the structure of microorganisms, mechanisms of their interaction with cells and role in pathological processes.<br>Can<br>apply knowledge about the structure, mechanisms of interaction with cells and role in pathological processes.<br>Owns<br>skills in using knowledge about the structure, mechanisms of interaction with cells and the role in pathological processes in professional activities. |

## 6. STRUCTURE AND CONTENT OF PRACTICE, INCLUDING PRACTICAL TRAINING

The content of practice is determined by its type and type.

The total labor intensity of industrial practice is 10 weeks / 15 credit units, 540 hours.

| **Practice stage** | **Types of work in practice, including independent work student** | **Labor intensity** | **Shapes of the current** |
|---|---|---|---|
| Preparatory (organizational) stage:<br>– obtaining documents for practice (direction, diary, individual assignment);<br>– arriving at the place of practice and undergoing introductory, initial and on-the-job training;<br>– organization of the workplace and getting to know the team. | – introductory lecture;<br>– safety briefing. | 4 hours<br><br>4 hours | diary entry; answers on questions |
| Main stage:<br>– study of the organizational structure and economic processes of an enterprise (organization, institution);<br>– study of regulatory and technical documentation; | – safety training at the enterprise;<br>– completing practice assignments in accordance with the program and individual assignments; | 8 hours<br><br>180 h | diary entry; answers on questions |

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| – studying the algorithm for introducing development results into the production of biotechnological products;<br>– implementation of specific production tasks in the management of individual stages of existing biotechnological production;<br>– carrying out specific production tasks to monitor compliance<br>– technological discipline<br>– studying the organization of metrological support of production;<br>– participation in the collection of initial data for the design of technological processes and installations;<br>– participation in the implementation of the enterprise's quality management system;<br>– participation in monitoring compliance with environmental safety. | – studying materials and documents at the place of internship;<br>– processing and analysis of received practice materials | 180 h<br><br>120 h | |
| Final stage:<br>– processing and systematization of the received material;<br>– preparation of a report on practical training;<br>– defense of the report on industrial practice. | – systematization of material;<br>– preparation of an individual assignment;<br>– report writing;<br>– preparing a presentation;<br>– report protection. | 16 hours<br><br>12 h<br><br>14 h<br><br>2 hours | test with grade |

## 7. EDUCATIONAL AND METHODOLOGICAL SUPPORT OF INDEPENDENT WORK OF STUDENTS IN PRODUCTION PRACTICE

The following types and stages of performing and monitoring the student's research work are provided:

– planning research work, including familiarization with the topics of research work in this area and choosing a research topic;

– conducting research work;

– adjustment of the research plan;

– compiling a report on research work;

– public defense of the work performed.

The main form of planning and adjusting individual plans for students' research work is the substantiation of the topic, discussion of the plan and intermediate results of the research within the framework of the research seminar.

Based on the results of the research work, the student must:

Know:

– the history of the development of a specific scientific problem, its role and place in the scientific direction being studied;

– the degree of scientific development of the problem under study;
– specifics of technical presentation of scientific material;
– Own:
– modern problems of this branch of knowledge;
– the main methods of the research;
– scientific discussion skills;

Be able to:

– apply certain methods in scientific research;
– practically carry out scientific research, experimental work in one or another scientific field related to the completion of qualifying work / master's thesis;
– search for bibliographic sources;
– work with information software products and Internet resources, etc.

Research work should be carried out in the following forms:

– fulfillment of tasks of the scientific supervisor in accordance with the approved individual plan of research work;
– participation in scientific events of FEFU and the department;
– preparation of reports and speeches at scientific conferences, seminars, symposiums and other scientific events at the regional, national and international levels;
– preparation and publication of abstracts of reports, scientific articles;
– preparation and defense of course work in the direction of ongoing scientific research;
– participation in research projects carried out at the university as part of research programs;
– preparation and defense of final qualifying work.
– applicability within the chosen topic, as well as the author’s intended personal contribution to the development of the topic (the novelty of the research and the formulation of specific author’s proposals). Participation in the scientific and methodological seminar.

Setting goals and objectives of scientific research; definition of the object and subject of research; determination of the methodological apparatus that is supposed to be used, selection and study of the main bibliographic sources that will be used as the theoretical basis of the study; studying specialized literature and other scientific and technical information, achievements of domestic and foreign science and technology in the relevant field of professional activity.

Collection, processing, analysis and systematization of scientific and technical information on the topic of work, compilation of a literature review,

systematization of factual material for research. Participation in conducting experiments, developing measurement techniques (if any) and conducting scientific research on the topic of work.

## Experiment planning

Based on the analysis of literary data, the main, known technical and technological directions and solutions to the problem posed in the work are identified, its relevance is assessed, and the goal is clarified. As a first approximation, ways of its possible solution are outlined, i.e. a working hypothesis is formulated and specific research objectives are determined.

In the course of planning an experiment, a course of work is developed - a step-by-step (descriptive or graphic) structural diagram of the organization of the study, containing its main stages, objects and research methods, etc.

When starting to prepare an experimental design, you should understand the purpose and objectives of the research, understand the essence of the chosen approaches, the specifics of the objects and methods used. The methodology of work must be discussed with the supervisor. The design of the experiment must be specific, informative, and reflect the essence of the work, its main stages and their focus.

The correct choice of research objects largely determines the degree of reliability of experimental data. The object must be stable in composition and properties; When working, the rules for sampling and samples must be strictly observed.

The chosen methods and means of measurement must ensure the accuracy and objectivity of the experimental results.

It must be borne in mind that research is divided into direct and indirect, objective (individual, biological, biochemical, etc.) and subjective (organoleptic indicators). When planning an experiment, you should choose methods that have the smallest error and correlate with each other.

Preparatory work related to the allocation of a workplace, selection of equipment, materials and reagents, working documentation,

The installation of equipment that provides a given measurement accuracy must be planned in advance.

When conducting research work, the student must conduct a series of preliminary experiments to master the selected research methods, clarify their duration and identify emerging interference that affects the accuracy of the results obtained.

Taking into account the specific nature of the research work being carried out on the instructions of the supervisor, in order to study the mathematical model of the

process under study and use it to determine optimal conditions, it is recommended to carry out mathematical planning of the experiment.

## Conducting experimental studies

The main goal of the experiment is to verify the validity of the formulation of the working hypothesis and optimize the research results. The experimental part of the thesis research work, after undergoing safety instructions, is carried out by students independently with consultations and control certifications of the supervisor, provided for by the schedule and calendar plan.

Experimental records are kept in a workbook with numbered pages. The manager periodically checks the journal and adds his comments and recommendations to it. Each experiment must be described and recorded in detail.

In the general part of the experimental protocol, the name of the experiment and its number, the date of the experiment, characteristics of the research object, possible options for the research method, the specific plan of the experiment, the purpose of its implementation, and the parameters to be determined are recorded.

The data and observations obtained during the experiment are recorded in pre-prepared tables. If necessary, the student writes down special comments that arose during the experiment.

Scientific documentation is attached to the protocol: diagrams, graphs, diagrams, photographs, photocopies of documents (for example, tasting reports), chromatograms, aminograms, densitograms, etc.

Protocols and appendices to them are the only objective scientific documentation for writing a thesis.

As a rule, experimental studies are carried out in two stages: at the first stage, primary data are obtained on model systems (which allows for clarification or adjustment of the work program), at the second stage, basic results are obtained at basic objects.

Experimental data must be carried out in absolute or relative values, indicators of the same type must have the same degree of rounding. Quantities that have a physical meaning must have dimensions and designations in accordance with the international system of units (Si).

When performing experimental studies, it is necessary to pay attention to obtaining reliable results, which is achieved by conducting analysis through several parallel experiments (3-4), processing the results using statistical methods.

By systematizing and processing the data obtained in this way, we eliminate the possibility of erroneous conclusions and conclusions.

8. CERTIFICATION FORMS (BASED ON PRACTICE),including a list of assessment forms used at various stages of developing competencies during practice assignments

| No. | Controlled sections of educational (industrial) practice | Code and name of the achievement indicator | Learning outcomes | Evaluation tools * | |
|---|---|---|---|---|---|
| | | | | current control | intermediate certification |
| 1 | Individual assignment for educational (industrial) practice | PC-1.1 Explores the mechanisms of molecular interaction of cells, tissues and functional systems of organisms, studies the physiological processes occurring in them | Knows<br>interactions of cells, tissues and functional systems of organisms.<br>Can<br>distinguish physiological processes occurring in cells and tissues.<br>Owns<br>skills in studying the mechanisms of molecular interaction of cells, tissues and functional systems of organisms. | PR-9 | - |
| | | PC-1.2 Uses methods of molecular genetic, cellular and physiological research to study physiological processes in the body | Knows<br>methods of molecular genetic, cellular and physiological research.<br>Can<br>apply methods of molecular genetic, cellular and physiological research.<br>Owns<br>methods of molecular genetic, cellular and physiological research. | PR-14 | - |
| | | PC-2.1 Uses fundamental knowledge of molecular and cellular biology to implement genetic and cellular engineering technologies in practice | Knows<br>methods of biotechnology and bioengineering.<br>Can<br>apply methods of biotechnology and bioengineering.<br>Owns<br>skills in obtaining medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-14 | - |

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| | | PC-2.2 Able to apply genetic and cellular engineering methods for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>methods of genetic and cellular engineering.<br>Can<br>apply genetic and cellular engineering methods.<br>Owns<br>ability to obtain medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-14 | - |
| | | PC-2.3 Able to analyze the results of experiments in the field of biotechnology and bioengineering and carry out the development of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>analyze the results of an experiment in the field of biotechnology and bioengineering<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-14 | - |
| | | PC-2.4 Capable of transferring the results of research work in the field of biotechnology and bioengineering for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>transfer the results of research work in the field of biotechnology and bioengineering.<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-14 | - |
| | | PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances | Knows<br>methods of physiology, biochemistry, molecular and cellular biology.<br>Can<br>use methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances.<br>Owns | PR-14 | - |

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| | | | skills of knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances. | | |
| | | PC-3.2 Able to apply molecular modeling methods for the development of medicines and medical devices | Knows<br>molecular modeling methods.<br>Can<br>apply molecular modeling methods.<br>Owns<br>molecular modeling methods for the development of medicines and medical devices. | PR-14 | - |
| | | PC-3.3 Able to develop medicines and medical devices using methods of pharmacological research and pharmaceutical technologies | Knows<br>methods of pharmacological research and pharmaceutical technologies.<br>Can<br>apply methods of pharmacological research and pharmaceutical technologies.<br>Owns<br>ability to develop medicines and medical devices. | PR-14 | - |
| 2 | Completing a report on educational (industrial) practice | PC-3.4 Capable of developing nanosystems for creating medicines and medical devices | Knows<br>methods of pharmacological research and pharmaceutical technologies.<br>Can<br>apply development methods to create medicines and medical devices.<br>Owns<br>the ability to develop nanosystems for the creation of medicines and medical devices. | PR-16 | - |
| | | PC-3.5 Capable of conducting preclinical tests of medicines and medical devices | Knows<br>methods of preclinical testing of medicines and medical devices.<br>Can<br>conduct preclinical tests of medicines and medical devices.<br>Owns | PR-16 | - |

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| | | | skills in conducting preclinical testing of medicines and medical devices. | | |
| | | PC-4.1 Analyzes the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body and applies the principles of cellular organization of biological objects | Knows<br>biochemical and molecular biological mechanisms of the development of pathological processes in cells and tissues of the human body.<br>Can<br>apply the principles of cellular organization of biological objects.<br>Owns<br>skills in determining the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body. | PR-16 | - |
| | | PC-4.2 Understands the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body | Knows<br>biochemical and molecular biological mechanisms of the development of pathological processes in cells and tissues of the human body.<br>Can<br>apply biochemical and molecular biological mechanisms for the development of pathological processes in the cells and tissues of the human body.<br>Owns<br>skills in using biochemical and molecular biological mechanisms for the development of pathological processes in the cells and tissues of the human body. | PR-16 | - |
| | | PC-4.3 Understands and explores the physical processes that underlie the functioning of the body in normal conditions and in pathology, understands the influence of physical factors on the functioning of biological systems, is able to study the | Knows<br>the physical structure of biologically important molecules and the physical processes underlying their functioning.<br>Can<br>determine the connection between physical structure and properties and the functions they perform in the body.<br>Owns<br>skills in studying the physical structure of biologically | PR-16 | - |

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| | | physical structure of biologically important molecules in order to identify the relationship between the structure of substances and their biological activity | important molecules and the physical processes underlying their functioning. | | |
| | | PC-4.4 Able to develop and apply health-saving technologies | Knows<br>technologies aimed at preserving public health.<br>Can<br>apply health-saving technologies.<br>Owns<br>ability to develop health-saving technologies. | PR-16 | - |
| | | PC-5.1 Able to build mathematical models of physical processes of living organisms, set parameters and simulate physical problems in common programming languages, including Python | Knows<br>mathematical models of physical processes of living organisms.<br>Can<br>build mathematical models of physical processes of living organisms, set parameters and carry out simulations.<br>Owns<br>skills in creating mathematical models of physical processes of living organisms, setting parameters and modeling physical problems in common programming languages, including Python | PR-16 | - |
| | | PC-5.2 Able to build mathematical models of chemical processes to solve biomedical problems, set parameters and carry out modeling of chemical problems in common programming languages, including Python | Knows<br>mathematical models of chemical processes for solving biomedical problems.<br>Can<br>build mathematical models of chemical processes to solve biomedical problems, set parameters and simulate chemical problems in common programming languages, including Python.<br>Owns<br>skills in constructing mathematical models of chemical processes to solve biomedical problems, setting parameters | PR-16 | - |

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| | | | and performing simulations of chemical problems in common programming languages, including Python. | | |
| | | PC-5.3 Able to build mathematical models of biological processes, set parameters and carry out modeling of biological problems in common programming languages, including Python | Knows<br>mathematical models of biological processes.<br>Can<br>build mathematical models of biological processes, set parameters and perform simulations of biological problems in common programming languages, including Python.<br>Owns<br>skills in constructing mathematical models of biological processes, setting parameters and performing simulations of biological problems in common programming languages, including Python. | PR-16 | - |
| 3 | Defense of the practice report | PC-5.4 Applies modern information technologies and software when solving professional problems | Knows<br>modern information technologies and software for solving professional problems.<br>Can<br>apply modern information technologies and software when solving professional problems.<br>Owns<br>skills in using modern information technologies and software in solving professional problems. | - | UO-1 |
| | | PC-5.5 Applies modern methods of processing and analysis of scientific and technical information, statistical analysis of biomedical data, including using the R language | Knows<br>modern methods of processing and analysis of scientific and technical information, statistical analysis of biomedical data, including using the R language.<br>Can<br>apply methods of processing and analysis of scientific and technical information, statistical analysis of biomedical data, including using the R language.<br>Owns<br>skills in using modern methods of processing and analyzing scientific and technical information, statistical | - | UO-1 |

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| | | | analysis of biomedical data, including using the R language. | | |
| | | PC-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems | Knows<br>modern methods of genetics and molecular and cellular biology for the study of living systems.<br>Can<br>conduct research in the fields of genetics and molecular and cellular biology to study living systems.<br>Owns<br>skills in using research methods in the field of genetics and molecular and cellular biology to study living systems. | - | UO-1 |
| | | PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes | Knows<br>methods for diagnosing pathological conditions.<br>Can<br>use fundamental knowledge and biophysical methods to diagnose pathological conditions.<br>Owns<br>skills in applying fundamental knowledge and biophysical methods to diagnose pathological conditions. | - | UO-1 |
| | | PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology | Knows<br>methods for diagnosing pathological conditions.<br>Can<br>use fundamental knowledge and biophysical methods to diagnose pathological conditions.<br>Owns<br>skills in applying fundamental knowledge and biophysical methods to diagnose pathological conditions. | - | UO-1 |
| | | PC-6.4 Able to perform research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies in order to identify the causes of the disease and make a diagnosis | Knows<br>research methods in the field of clinical laboratory diagnostics, molecular genetic and cytological research methods.<br>Can<br>carry out research in the field of clinical laboratory | - | UO-1 |

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| | | | diagnostics, molecular genetic and cytological studies.<br>Owns<br>ability to perform research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies in order to identify the causes of the disease and make a diagnosis. | | |
| | | PC-7.1 Has fundamental knowledge of the structure, life activity, classification of microorganisms | Knows<br>basic concepts and principles of structure, life activity, classification of microorganisms.<br>Can<br>use knowledge about the structure, life activity, classification of microorganisms.<br>Owns<br>basic fundamental knowledge about the structure, life activity, classification of microorganisms. | - | UO-1 |
| | | PC-7.2 Applies methods of virological, microbiological and epidemiological analysis | Knows<br>methods of virological, microbiological and epidemiological analysis.<br>Can<br>apply methods of virological, microbiological and epidemiological analysis.<br>Owns<br>skills in using virological, microbiological and epidemiological analysis methods in professional activities. | - | UO-1 |
| | | 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<br>molecular features of the structure of microorganisms, mechanisms of their interaction with cells and role in pathological processes.<br>Can<br>apply knowledge about the structure, mechanisms of interaction with cells and role in pathological processes.<br>Owns<br>skills in using knowledge about the structure, mechanisms | - | UO-1 |

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| | | | of interaction with cells and the role in pathological processes in professional activities. | | |

* Recommended forms of assessment tools:

1. interview (UO-1), colloquium (UO-2); report, message (UO-3); round table, discussion, controversy, dispute, debate (UO-4); etc.

2. tests (PR-1); tests (PR-2), essays (PR-3), abstracts (PR-4), term papers (PR-5); laboratory work (PR-6); abstract (PR-7); portfolio (PR-8); project (PR-9); business and/or role-playing game (PR-10); case task (PR-11); workbook (PR-12); multi-level tasks and assignments (PR-13); calculation - graphic work (PR-14); creative task (PR-15), practice report (PR-16), etc.

3. simulator (TS-1), etc.

Before undergoing practical training, the student receives an individual assignment from the internship supervisor from the university, the content and scope of which are discussed with the internship supervisor.

Based on the results of the internship, the student draws up a report on the completion of the internship, participates in the final conference with a presentation of the results of the internship, after which he receives a test with a grade.

The practice report must contain the following elements:

− title page (Appendix 3);

− assignment and calendar plan of practice (Appendix 1);

− document confirming the fact of internship;

− a description drawn up by the head of practice from an organization or structural unit if the practice is conducted on the basis of FEFU;

− content;

− introduction;

− the main part about the activities during the internship;

− completed individual task;

− conclusion;

− sources of information;

The report is prepared in accordance with the "Requirements for the preparation of written work performed by FEFU students and listeners."

In agreement with the internship supervisor from the university and depending on the location of this type of internship, the structure of the report or its individual parts may change.

After completing the internship and completing the report in accordance with the requirements, the student submits his report for defense to the supervisor from the university. Based on the results of the defense, a test is given with a grade (excellent, good, satisfactory, unsatisfactory):

"Excellent" – the necessary practical skills and professional competencies provided for by the educational practice program are fully formed, the tasks are completed, the quality of their implementation is assessed with a number of points close to the maximum.

"Good" – the necessary practical work skills and professional competencies provided for by the educational practice program are fully formed, the tasks are completed, the quality of none of them is assessed with a minimum number of points, some types of tasks are completed with errors or not thoroughly enough.

"Satisfactory" – the necessary practical skills and professional competencies are basically formed, the gaps are not significant, some of the completed tasks contain errors.

“Unsatisfactory” - the necessary practical skills and professional competencies provided for by the educational practice program have not been developed, all completed educational assignments contain gross errors, additional independent work on the report materials will not lead to any significant improvement in the quality of assignments.

## 9. EDUCATIONAL, METHODOLOGICAL AND INFORMATION SUPPORT OF PRODUCTION PRACTICE (including basic and additional literature)

Main literature

*(electronic and printed publications)*


1. Aleshina, E.S. Cultivation of microorganisms as the basis of the biotechnological process [Electronic resource]: textbook / E.S. Aleshina, E.A. Drozdova, N.A. Romanenko – Electron. text data. – Orenburg: Orenburg State University, EBS ASV, 2017. – 192 p. - Access mode:http://www.iprbookshop.ru/71282.html

2. Anisimov, E.G. Organization and conduct of scientific research by graduate students [Electronic resource]: textbook / E.G. Anisimov, A.S. Grushko, N.P. Bagmet [and others]. - Electron. text data. – M.: Russian Customs Academy, 2014. – 278 p.http://www.iprbookshop.ru/69989.html

3. Lukanin, A.V. Engineering biotechnology: fundamentals of microbiological production technology: textbook. allowance / A.V. Lukanin. – M.: INFRA-M, 2018. – 304 p. Access mode:http://znanium.com/catalog/product/925281

4. Sidorenko, G.A. Research practice [Electronic resource]: textbook / G.A. Sidorenko, V.A. Fedotov, P.V. Medvedev. - Electron. text data. – Orenburg: Orenburg State University, EBS ASV, 2017. – 99 p. - Access mode:http://www.iprbookshop.ru/71292.html

5. Sosnin, E.A. Experimental methodology: textbook. allowance / E.A. Sosnin, B.N. Poizner. – M.: INFRA-M, 2017. – 162 p. + Add. materials [Electronic resource; Access mode http://www.znanium.com]. – www.dx.doi.org/10.12737/24370. - Access mode:http://znanium.com/catalog/product/774694

6. Shuvaeva, G.P. Microbiology with the basics of biotechnology (theory and practice) [Electronic resource]: textbook / G.P. Shuvaeva, T.V. Sviridova, O.S. Korneeva [and others]. - Electron. text data. – Voronezh: Voronezh State University of Engineering Technologies, 2017. – 316 p. - Access mode:http://www.iprbookshop.ru/70810.html

additional literature

*(printed and electronic publications)*

1. Stem Cell Therapy for Organ Failure [Electronic resource] / Indumathi Somasundaram; Publisher: Springer India; Year: 2014 http://link.springer.com/openurl?genre=book&isbn=978-81-322-2110-4

2. Abramenkov, D.E. Methodology of scientific research [Electronic resource]: textbook / D.E. Abramenkov, E.A. Abramenkov, V.A. Gvozdev, V.V. Georgian. - Electron. text data. – Novosibirsk: Novosibirsk State University of Architecture and Civil Engineering (Sibstrin), EBS ASV, 2015. – 317 p. http://www.iprbookshop.ru/68787.html

3. Averchenkov, V.I. Fundamentals of scientific creativity [Electronic resource]: textbook / V.I. Averchenkov, Yu.A. Malakhov. - Electron. text data. – Bryansk: Bryansk State Technical University, 2012. – 156 p. – Access mode: http://www.iprbookshop.ru/7004.html

4. Aleev, B.S. Introduction to technical microbiology / B.S. Aleev; edited by B.S. Aleeva, F.M. Chistyakova. – Moscow: Pishchepromizdat, 1943. – 220 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:327983&theme=FEFU

5. Alekseev, V.I. Applied molecular biology: textbook for universities / V.I. Alekseev, V.A. Kaminsky. – Vladivostok: Dalrybvtuz, 2011. – 238 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:425474&theme=FEFU

6. Atsyukovsky, V.A. Philosophy and methodology of modern natural science / V.A. Atsyukovsky. – M.: “Petit”, 2005. – 139 p. – Access mode: http://ivanik3.narod.ru/VAA/PhilosSociolog/Filmatest.pdf

7. Bakulev, V.A. Fundamentals of scientific research [Electronic resource]: textbook / V.A. Bakulev, N.P. Belskaya, V.S. Berseneva; edited by O.S. Eltsov. - Electron. text data. – Ekaterinburg: Ural Federal University, EBS ASV, 2014. – 64 pp.— Access mode: http://www.iprbookshop.ru/65958.html

8. Bezborodov, A. M. Microbiological synthesis / A. M. Bezborodov, G. I. Kvesitadze; [rep. ed. A. G. Lobanok]. – St. Petersburg: Prospekt Nauki, 2011. – 143 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:785480&theme=FEFU

9. Biology of stem cells and cell technologies: for medical universities in 2 volumes: t.1 / M.A. Paltsev, R.S. Akchurin, M.A. Alexandrova et al.]; edited by M.A. Paltseva. – Moscow: Medicine, Shiko, 2009. – 272 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:779352&theme=FEFU

10. Biology of stem cells and cell technologies: for medical universities in 2 volumes: vol. 2 / M.A. Paltsev, R.S. Akchurin, M.A. Alexandrova et al.]; edited by M.A. Paltseva. – Moscow: Medicine, Shiko, 2009. – 455 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:779355&theme=FEFU

11. Biology of stem cells and cell technologies: for medical universities in 2 volumes: t.1 / M.A. Paltsev, R.S. Akchurin, M.A. Alexandrova et al.]; edited by M.A. Paltseva. – Moscow: Medicine, Shiko, 2009. – 272 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:779352&theme=FEFU

12. Biology of stem cells and cell technologies: for medical universities in 2 volumes: vol. 2 / M.A. Paltsev, R.S. Akchurin, M.A. Alexandrova et al.]; edited by M. A. Paltseva. – Moscow: Medicine, Shiko, 2009. – 455 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:779355&theme=FEFU

13. Biotechnology: textbook for universities in 8 books. book 3. Cellular engineering / R.G. Butenko, M.V. Gusev, A.F. Kirkin [et al.]; edited by N.S. Egorova, V.D. Samuilova. – Moscow: Higher School, 1987. – 127 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:245775&theme=FEFU

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15. Genes and genomes in 2 volumes: volume 1 / M. Singer, P. Berg; edited by N.K. Yankovsky; lane from English T. S. Ilina, Yu. M. Romanova. – Moscow: Mir, 1998. – 373 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:23576&theme=FEFU

16. Histology, embryology, cytology: textbook for higher professional education / Yu.I. Afanasyev, N.A. Yurina, B.V. Aleshin et al.] ed. Yu.I. Afanasyeva, N.A. Yurina. – Moscow: GEOTAR-Media, 2013. – 798 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:695450&theme=FEFU

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58. Stepanov, V.M. Molecular biology. Structure and functions of proteins: Textbook. for biol. specialist. universities / Ed. A.S. Spirina. M.: Higher. School, 1996. – 335 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:20639&theme=FEFU

59. Stepanov, V.M. Molecular biology. Structure and function of proteins [Electronic resource]: textbook / Stepanov V.M. - Electron. text data. – M.: Moscow State University named after M.V. Lomonosova, 2005. – 336 p. – Access mode: http://www.iprbookshop.ru/13144.html. – EBS “IPRbooks”

60. Tarantula, V.Z. Gene-cell biotechnologies of the XXI century and people / V.Z. Tarantula // Russia and the modern world. – No. 1 – 2009. – P. 188-203. http://lib.dvfu.ru:8080/lib/item?id=chamo:641555&theme=FEFU

61. Way, T. Physical foundations of molecular biology: textbook / T. Way; lane from English edited by L. V. Yakovenko. – Dolgoprudny: Publishing house. House "Intelligence", 2010. – 368 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:663865&theme=FEFU

62. Chentsov, Yu.S. Introduction to cell biology: a textbook for universities in biological specialties / Yu.S. Chentsov. – ed. 4th, revised and additional, erased, reprinted with ed. 2005. – Moscow: Alliance, 2015. – 494 p. http://lib.dvfu.ru:8080/lib/item?id=chamo:776847&theme=FEFU

## 10. LOGISTICAL AND TECHNICAL SUPPORT OF PRODUCTION PRACTICE

Scientific laboratories of biomedical cell technologies, equipped with the following equipment:

– Robotic system for automated cell cultivation CompacT SelecT SC - workstation, with module for preparing plates for analysis, THE AUTOMATION PARTNERSHIP;

– System for continuous monitoring of living cells in culture, image formation and analysis Cell-IQ MLF, Chip Technologies, Czech Republic;

– System for deep optical imaging of biomaterials FluoView FV1200MPE (FV12M-5XX-3XX);

– Personal incubator CO2- with a system for monitoring and increasing the vitality of Galaxy cells (CO48R-230-1200);

– Spectrophotometer with accessories for sample processing BioSpectrometer-kinetic;

– Device for carrying out polymerase chain reaction with detection of amplification products in “real time” mode CFX96 Touch Real Time System;

– System for volumetric fixation and preparation of deposited biospecimens in the Volume Fixation System kit;

– Multimodule station for rotary sedimentation processing of samples Sediment Modules;

– Automated system Biacore X100 System for the analysis of intermolecular interactions with a set of additional parts and software;

– DNA sequence analysis system Ion S5™ XL System + Starter kit for testing the functionality and commissioning of the system;

– Applied Biosystems 3500 genetic analyzer + Starter kit for testing the functionality and commissioning of the system;

– High-speed cell sorter MoFlo Astrios EQ + Starter kit for testing the functionality and commissioning of the system;

– System for preparing samples for full genome sequencing Ion Chef™ Instrument + Starter kit for testing the functionality and commissioning of the system.

Reading rooms of the FEFU Scientific Library with open access to the collection (building A - level 10):

Monoblock HP ProOpe 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD+/-RW, GigEth, Wi-Fi, VT, usb kbd/ mse,Win7Pro (64-bit)+Win8.1Pro(64-bit),1-1-1 Wty Internet access speed 500 Mbit/sec. Workplaces for people with disabilities are equipped with displays and Braille printers; equipped with: portable devices for reading flat-printed texts, scanning and reading machines, video enlargers with the ability to regulate color spectrums; magnifying electronic magnifiers and ultrasonic markers.

For persons with disabilities and people with disabilities, the choice of places of practice is consistent with the requirement of their accessibility for these students and the practice is carried out taking into account the characteristics of their psychophysical development, individual capabilities and health status.

## LIST OF INFORMATION TECHNOLOGIES AND SOFTWARE

### Programs:

– Microsoft Office Professional Plus 2010 – an office suite that includes software for working with various types of documents (texts, spreadsheets, databases, etc.);

– 7Zip 9.20 – free file archiver with a high degree of data compression;

– ABBYY FineReader 11 – a program for optical character recognition;

– Adobe Acrobat XI Pro – a software package for creating and viewing electronic publications in PDF format;

– ESET Endpoint Security – comprehensive protection for Windows-based workstations. Virtualization support + new technologies;

– WinDjView 2.0.2 – a program for recognizing and viewing files with the same name DJV and DjVu format;

### Local network resources:

– Legal reference system Guarantor operating system – Microsoft Windows Linux (with WINE@Etersoft) iOS Android, etc.;

– Computer legal reference system ConsultantPlus – operating system Microsoft Windows, Linux (with WINE), Apple iOS Android, Windows Phone;

– Professional help system Techexpert – operating systems Microsoft Windows, Linux, FreeBSD.

### Educational software systems:

– 1C Enterprise 8.2, (educational version), version 8.2.13.205, training software package;

– Windows Seven Enterprise, version SP3x64, operating system

– Eset NOD32 Antivirus, version 4.2.76.1, malware detection tool;

– Microsoft Office 2010 Professional Plus, version 14.0.6029.1000, office suite;

– Microsoft Office Professional Plus 2013, version 15.0.4420.1017, office suite;

– Microsoft Visual Studio 2012 Professional, version 11.0.50727.26, educational software package;

– Microsoft Visual Studio 2013 Community, version 12.0.31101, educational software package;

– 7-Zip, version 9.20.00.0, educational software package;

– Abbyy FineReader 11, version 11.0.460, educational software package;

– Adobe Acrobat XI Pro, version 11.0.00, educational software package;

– Adobe Photoshop CS6, version 13.0, Educational software package;

– Autodesk 3DS Max Design 2013, version 15.0.0.347, educational software package;

– Autodesk 3DS Max Design 2015, version 17.1.149.0, educational software package;

– Autodesk Autocad 2012, version 18.2.51.0, educational software package;

– Autodesk Autocad 2013, version 19.0.55.0, educational software package;

– Autodesk Autocad 2013, version 19.0.59.0, educational software package;

– Autodesk Autocad 2015 version 20.0.51.0, educational software package;

– Autodesk Autocad Architecture 2013, version 7.0.50.0, educational software package;

– Autodesk Autocad Electrical 2016, version 20.0.46.0, educational software package;

– Autodesk Autocad Revit 2013, version 12.02.21203, educational software package;

– Autodesk DWG TrueView 2013, version 19.0.55.0, educational software package;

– Autodesk Invertor 2015, version 19.0.15900.0000, educational software package;

– Autodesk Revit 2015, version 15.0.207.0, educational software package;

– Coole Chrome, version 42.0.2311.90, browser for working in the WWW environment;

– CoreDraw Graphics Suite X3. version 13.0.0.739, educational software package;

– CoreDraw Graphics Suite X6, version 16.1.0.843, educational software package;

– Free Pascal, version 2.6.4, educational software package;

– Gimp 2.8.10, version Gimp 2.8.14, graphic package for teaching students;

– GNU Octave, version 3.8.2, educational software package;

– MySQL Community, version 5.6, database training package;

– MySQL Database, version 5.5.23, database training package.

# PROVIDING RESOURCES FOR THE ELECTRONIC LIBRARY SYSTEM AND ELECTRONIC INFORMATION AND EDUCATIONAL ENVIRONMENT

| Name of the document indicating details | Document validity period |
|---|---|
| Sublicense agreement Springer/34 dated 12/25/17 minEducation | 25.12.19-31.12.20 |
| Competition of the Ministry of Education and Science. Web of Science database by Clarivate Analytics (Scientific) LLC dated 04/01/17 | 01.04.19-31.03.20 |
| Agreement No. R-1370-16 dated January 09, 2017 EBS “Lan” “Engineering and technical sciences. Mathematics. Computer science. Physics. Theoretical mechanics. Chemistry" | 02/01/2019-01/31/2020 |
| Agreement No. R-61-17 dated January 25, 2017. EBS "Lan" "Psychology. Pedagogy", "Physical Education and Sports") | 01.03.2019-28.02.2020 |
| Agreement No. R-62-17 dated January 25, 2017. EBS “Student Consultant” “Medicine. Healthcare", "Architecture and Construction", "Mechanical Engineering" | Until 30.03.2020 |
| Agreement No. 12/IA/17 dated 03/09/2017 EB of the Grebennikov Publishing House | 05/01/2019-06/30/2020 |
| Agreement No. SIO-262/17 dated March 16, 2017 SCIENCE INDEX (NEB) | 12.04.2019-02.05 2020 |
| Agreement No. R-234-17 dated March 24, 2017 Ross Intellect Service LLC. Access to the electronic journal of the publishing house "Aktion MTsFER" "Glavbukh" | 01.05.2019-30.04.2020 |
| Agreement No. R-230-17 dated 04/03/2017. Scientific journals on the ELIBRARY platform (RUNEB) | 03.04.19-02.04.20 |
| Agreement No. R-288-17 dated 04/06/2017. EBS_URAYT | 02.05.19-01.05.20 |
| Agreement No. R-155-17 dated 05/02/2017 EBSCO | 02.05.19 – 01.05.20 |
| Agreement No. R-396-17 dated 05/03/2017. IVIS LLC Librarianship | 01.06.19-31.05.20 |
| Agreement R-472-17 dated 05.24.17. RUKONT electronic versions of educational and scientific publications in Russian | 06/05/2019-06/04/2020 |
| Agreement R-473-17 dated 05.24.17 Electronic library of dissertations of the RSL | 07/12/2019-07/11/2020 |
| Agreement R-470-17 dated 05.24.17 EBS “University Library Online” | 06.06.2019-05.06.2020 |
| Agreement R-505-17 dated 05.31.17 EBS Lan “Food production technology” | 01.07.2019-30.06.2020 |
| Agreement No. R-699-17 dated 08/01/2017 EBS INFRA-M (EBS ZNANIUM.COM) | 01.08.2019-31.07.2020 |
| Agreement No. R-595-17 dated 06/19/2017 LLC "IVIS" Questions of history" | 07/05/2019-07/06/2020 |
| Agreement No. R-596-17 dated 06/19/2017 LLC "IVIS" Literature issues" | 07/05/2019-07/06/2020 |
| Agreement N2931/17 (EU0181626) dated 07/03/17 IP Er Media LLC EBS IPRbooks (basic version) | 01.09.2019-31.08.2020 |
| Agreement No. R-889-17 dated 08.28.17 IVIS LLC “Publications on defense and security issues.” | 01.09.2019-31.08.2020 |

| | |
|---|---|
| Agreement No. R-880-17 dated 08/28/17 LLC "IVIS database of electronic periodicals of the East View company "Publications on social sciences and humanities" | 01.09.2019-31.08.2020 |
| Agreement No. R-882-17 dated 08.28.17 LLC "IVIS" database of electronic periodicals of the East View company "Statistical publications of Russia and the CIS countries" | 01.09.2019- 31.08.2020 |
| Agreement 1-12310992873 dated 06/01/2017 Publishing house Elsevier BV Integrated modular platform Sci Val: SciVal Collaboration; SciVal Trends; SciVal Overview; SciVal Benchmarking | 06/01/19 – 05/31/20 |
| Agreement (LICENSE AGREEMENT) R-672-17 dated 08/25/2017<br>Tongfang Knowledge Network Technology Co., Ltd., Beijing, China. | 08/25/19 – 08/25/20 |
| Sublicense agreement No. R-700-17 (EU0182507) dated August 3, 2017. Journal Citation Report database of Clarivate Analytics (US) LLC on the InCites platform | 03.08.17 – 02.08.20 |
| Agreement R-1377-17 dated December 27, 2017 Non-profit partnership "National Electronic Information Consortium" NP "NEICON". Databases and software products of Clarivate Analytics (US) LLC InCites Benchmarking & Analitics | 12/27/19 – 12/27/20 |
| Sublicense agreement No. Scopus/261 dated 09.01. 2018 Scopus | 09/01.2018 -31.12.2020 |
| Sublicense agreement No. IEEE/34 dated January 09, 2018. IEEE/IEL database (The Institute of Electrical and Electronics Engineers, Inc) | 01/09/18-06/30/20 |
| Sublicense agreement No. RSC/34 dated May 25, 2018 | 25.05.18-30.06.20 |
| Sublicense agreement No. Wiley/34 dated 01/09/18 Wiley Journals (Wiley Online Library of Wiley Subscription Services). Competition of the Ministry of Education and Science | 01/09/18-06/30/20 |
| Sublicense agreement No. SCI/34 dated 01/09/18 | 01/09/18-06/30/20 |
| Sublicense agreement No. Questel/34 dated 01/09/18 Patent base ORBIT Competition of the Ministry of Education and Science | 01/09/18-06/30/20 |
| Sublicense agreement No. ProQuest/34 dated January 09, 2018 | 01/09/18-06/30/20 |
| Sublicense agreement MathSciNet/ 34 dated January 01, 2018 MathSciNet database of the American Mathematical Society | 01/09/18-06/30/20 |
| Sublicense agreement No. INSPEC/34 dated 01/09/18 INSPEC database Competition of the Ministry of Education and Science | 01/09/18-06/30/20 |
| Sublicense agreement No. CUP/34 dated 01/09/18 Scientific journals published by Cambridge University Press. | 01/09/18-06/30/20 |
| Sublicense agreement No. CASC/34 dated January 9, 2018 Computer Applied Sciences Complete database by EBSCO Publishing | 01/09/18-06/30/20 |
| Sublicense agreement No. AIP/34 dated January 9, 2018. Scientific journals published by the American Institute of Physics. | 01/09/18-06/30/20 |
| Sublicense agreement No. APS/34 dated January 9, 2018 APS Online Journals database | 01/09/18-06/30/20 |
| Sublicense agreement No. IOP/34 dated 01/09/18 Scientific journals published by the Institute of Physics (UK) | 01/09/18-06/30/20 |
| Sublicense agreement No. T&F/34 01/09/18 Magazines published by Taylor & Francis Group “Social Sciences and Humanities” and “Natural Sciences and Technologies” Competition of the Ministry of Education and Science | 01/09/18-06/30/20 |

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|---|---|
| Agreement No. 1415-17 dated January 26, 2018. EBS "Lan" Engineering and technical sciences. Mathematics. Computer science. Physics. Theoretical mechanics. Chemistry | 01.02.2018-31.01.2020 |
| Agreement No. R-70-18 dated May 30, 2018 EBS “Lan” Psychology. Pedagogy, Physical education and sports | 01.07.2018-30.06.2020 |
| Agreement No. R-509-18 dated June 15, 2018. EBS “Student Consultant” “Medicine. Healthcare", "Architecture and Construction", "Mechanical Engineering", "Energy", Publishing House "Oriental Book", Publishing House "Flint" "Linguistics and Literary Studies" | 01.07.2019-30.06.2020 |
| Agreement No. 24/IA/18 dated June 15, 2018 EB of the Grebennikov Publishing House | 01.07.2019- 30.06.2020 |
| Agreement No. R-672-18 dated July 11, 2018 EBS_YURAYT | 09/17/2019 -09/16/2020 |
| Agreement No. RT-046/18 dated June 15, 2018 RUKONT electronic versions of educational and scientific publications in Russian | 01.03.2019-28.02.2020 |
| Agreement No. R-699-18 dated July 3, 2018 EBS "Lan" Food production technology | 01.08.2019-31.07.2020 |
| Agreement No. R-656-18 dated July 12, 2018 EBS INFRA-M (EBS ZNANIUM.COM) | 01.08.2019-31.07.2020 |
| Agreement No. P-803-18 dated 08/14/2018 IP Er Media LLC EBS IPRbooks (basic version) | 01.09.2019- 31.08.2020 |
| License agreement No. P-979-18_ with Tongfang Knowledge Network Technology Co., Ltd., Beijing China dated September 24, 2018 | 01.10.19 – 30.09.20 |

**Compiled by:**
Head of OP  V.V. Kumeiko

ANNEX 1

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)**

**I CONFIRM:**
Head of OP
_____FULL NAME.
"____" _____20__

# INDIVIDUAL TASK

By _____
(type of practice)

student _____groups _____
(student's name)

Educational program 06.03.01 “Biology”, profile “Biomedicine (in English)”_____
_____

Base (place, organization) of practice_____
_____

Duration of practice from _____20___ to _____ 20___

| | |
|---|---|
| Generalized formulation of the task | |

Task schedule

| Name of tasks (activities) that make up the task | Date of completion of the task (activity) |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| | |

Head of practice _____ _____
*signature full name, position*

APPENDIX 2

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)**

**DEPARTMENT _____**

**DIARY**

according to _____
practice
student _____
group_____
program_____
Place of practice_____
Duration of internship:_____weeks_____

Head of practice from FEFU
_____
Head of practice from a specialized organization
_____

1. Student work schedule

| No. | Name of works | Calendar dates | | Last name of practice manager |
|---|---|---|---|---|
| | | Start | ending | |
| | | | | |
| | | | | |
| | | | | |

2. Student's work diary

| date | Summary of the trainee's work | Signature head |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

3. Report protection results

The report is protected by "____" _____ 20___

With a rating of _____

Department Director _____ AND ABOUT. Surname

APPENDIX 3

**Internship report cover page form**

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)**

**DEPARTMENT** _____

The report is protected with a rating
_____
"_____"_____20__ g

Supervisor
educational program
_____Last name I.O.

.

**REPORT**

**about internship** _____

_____
(full name of the profile organization)

Student _____group _____ (_____)
*Signature Full name*
Head of Practice
from a specialized organization_____ (_____)
*Signature Full name*

Head of Practice
from FEFU_____ (_____)
*Signature Full name*

APPENDIX 4

**Referral form for educational practice**

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)**

**DEPARTMENT** _____

**DIRECTION**

**for practice**_____

_____

student of __bachelor's course
Full Namegroups _____
(Full Name)
sent to _____
name of the base organization

address _____

Order on assignment to practice dated No._____
for internship
in the field of study 06.03.01 Biology
for the period from _____ 20 to _____ 20 (continuous/discrete)

Head of Practice

M.P. _____ (position, academic rank) _____ (signature) _____ (I.O.F)

**Notes on completion and dates of practice**

| Business name | Arrival and departure notes | Signature, decryption of signature, seal |
|---|---|---|
| Name of the enterprise, organization in accordance with the agreement | Arrived __.__.20__ | |
| | Dropped out on __.__.20__ | |

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)

# WORK PROGRAM FOR PRODUCTION PRACTICE

Internship. Undergraduate practice, including research work (Industrial practice.
Pre-graduate practice, including research work)
for the direction of training06.03.01 Biology
Name of the educational program “Biomedicine (in English)”

Vladivostok
2023

## 1. GOALS OF DEVELOPING PRODUCTION PRACTICES

The goals of pre-graduation practice are to consolidate the theoretical knowledge acquired in the study of basic and professional disciplines; acquisition of professional skills in future professional activities; formation of competencies that meet the requirements of the main professional educational program of the undergraduate program “Biomedicine (in English)” 03/06/01 Biology.

## 2. OBJECTIVES OF PRODUCTION PRACTICE

The objectives of pre-graduate practice are:

– studying scientific and technical information, performing literary and patent searches on the topic of research;

– collection and analysis of medical-biological and scientific-technical information, as well as generalization of domestic and foreign experience in the field of biotechnology, analysis of patent literature;

– carrying out experimental studies and tests according to a given methodology, mathematical processing of experimental data;

– conducting computational experiments using standard software in order to obtain mathematical models of biological and biotechnical processes and objects;

– preparation of data, preparation of reports and scientific publications based on the results of the work performed, participation in the implementation of the results in medical and biological practice;

– organizing the protection of intellectual property and research and development results as a trade secret of the enterprise.

– preparation of data for the preparation of reports, reviews, scientific publications.

## 3. PLACE OF PRODUCTION PRACTICE IN THE STRUCTURE OF EP

Block B2.O.02.03(P) Industrial practice. Pre-graduation practice, including research work of the educational standard in the field of study 03/06/01 Biology, approved by order of the Ministry of Science and Higher Education of the Russian Federation dated 08/07/2020. No. 920 is mandatory and is a type of training sessions directly focused on the professional and practical training of students.

Pre-diploma practice is the final stage of practical training at the level of higher education - bachelor's degree and is aimed at students obtaining professional skills and experience in professional activities in the field of training.

Pre-graduation practice is carried out both in third-party organizations that have the necessary personnel and scientific and technical potential (on-site), and on the basis of the Federal State Autonomous Educational Institution of Higher Education "Far Eastern Federal University" (stationary).

Industrial practice is based on the theoretical mastery of such disciplines as: “Bioinformatics”, “Biostatistics”, “Drug development”, “Programming in biomedicine”, “Mechanisms of normal diseases”, “Clinical diagnostic methods”, “Molecular cell biology”, “ Methods of molecular and cellular biology", "Biomedical cell technologies", "Biomedical cell technologies", "Bioengineering", "Genetic engineering", "Molecular modeling of biostructures", "Structure and dynamics of biomolecules", "Molecular genetics", "Human genetics" , “Molecular biotechnology”, “Medical biotechnology”, etc.

## 4. TYPES, METHODS, PLACE AND TIME OF PRODUCTION PRACTICE

| | |
|---|---|
| Type of practice | Undergraduate practice |
| Type of practice | Internship. Pre-graduation practice, including research work |
| Method of implementation | Travel / stationary |
| Form(s) of conduct | Concentrated |
| Volume of practice in credit units; duration of practice; course, semester | 4th year, 8th semester: 6 credits, 4 weeks, 216 academic. hour. |
| Practice bases | 1) Center for Genomic Medicine of the ShBM FEFU, laboratory of biomedical cell technologies;<br>2) Federal State Budgetary Institution of Science “National Scientific Center for Marine Biology named after. A.V. Zhirmunsky" FEB RAS, Vladivostok;<br>3) Federal Scientific Center for Biodiversity, Far Eastern Branch of the Russian Academy of Sciences, Vladivostok;<br>4) Pacific Institute of Bioorganic Chemistry named after. G.B. Elyakova FEB RAS, Vladivostok;<br>5) Research Institute of Epidemiology and Microbiology named after G.P. Somova, Laboratory of Molecular Microbiology, Vladivostok<br>6) Laboratories of the Department of Pharmacy and Pharmacology FEFU |

## 5. STUDENT COMPETENCIES FORMED AS A RESULT OF INDUSTRIAL PRACTICE

Professional competencies of graduates and indicators of their achievement:

| Task type | Code and name of professional competence (result of mastery) | Code and name of the competency achievement indicator |
|---|---|---|
| design | PC-1 Capable of carrying out fundamental and applied projects to study physiological processes and phenomena occurring at the molecular, cellular, organ and system levels in the human and animal body | PC-1.1 Explores the mechanisms of molecular interaction of cells, tissues and functional systems of organisms, studies the physiological processes occurring in them |
| | | PC-1.2 Uses methods of molecular genetic, cellular and physiological research to study physiological processes in the body |

| | | |
|---|---|---|
| | PC-2 Applies biotechnology and bioengineering methods for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | PC-2.1 Uses fundamental knowledge of molecular and cellular biology to implement genetic and cellular engineering technologies in practice |
| | | PC-2.2 Able to apply genetic and cellular engineering methods for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems |
| | | PC-2.3 Able to analyze the results of experiments in the field of biotechnology and bioengineering and carry out the development of medicines, medical devices, biomedical cell products and medical diagnostic systems |
| | | PC-2.4 Capable of transferring the results of research work in the field of biotechnology and bioengineering for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems |
| | PC-3 Capable of conducting experimental studies of biologically active substances and developing medicines and medical devices | PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances |
| | | PC-3.2 Able to apply molecular modeling methods for the development of medicines and medical devices |
| | | PC-3.3 Able to develop medicines and medical devices using methods of pharmacological research and pharmaceutical technologies |
| | | PC-3.4 Capable of developing nanosystems for creating medicines and medical devices |
| | | PC-3.5 Capable of conducting preclinical tests of medicines and medical devices |
| research | PC-4 Able to understand, analyze, and apply the principles of cellular and tissue organization of biological objects, biochemical and molecular biological mechanisms of the development of pathological processes in | PC-4.1 Analyzes the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body and applies the principles of cellular organization of biological objects |
| | | PC-4.2 Understands the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body |

| | | |
|---|---|---|
| | the cells and tissues of the human body to preserve the health of the population | PC-4.3 Understands and explores the physical processes that underlie the functioning of the body in normal conditions and in pathology, understands the influence of physical factors on the functioning of biological systems, is able to study the physical structure of biologically important molecules in order to identify the relationship between the structure of substances and their biological activity |
| | | PC-4.4 Able to develop and apply health-saving technologies |
| | PC-5 Able to build mathematical models of physical, chemical and biological processes to solve biomedical problems, possess basic programming skills, use modern methods and resources of bioinformatics and biostatistics | PC-5.1 Able to build mathematical models of physical processes of living organisms, set parameters and simulate physical problems in common programming languages, including Python |
| | | PC-5.2 Able to build mathematical models of chemical processes to solve biomedical problems, set parameters and carry out modeling of chemical problems in common programming languages, including Python |
| | | PC-5.3 Able to build mathematical models of biological processes, set parameters and carry out modeling of biological problems in common programming languages, including Python |
| | | PC-5.4 Applies modern information technologies and software when solving professional problems |
| | | PC-5.5 Applies modern methods of processing and analysis of scientific and technical information, statistical analysis of biomedical data, including using the R language |
| | PC-6 Able to use modern knowledge and methods of genetics, molecular and cellular biology to solve professional problems | PC-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems |
| | | PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes |
| | | PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology |

| | | |
|---|---|---|
| | | PC-6.4 Able to perform research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies in order to identify the causes of the disease and make a diagnosis |
| | PC-7 Capable of conducting microbiological, virological and epidemiological studies to solve professional problems in the field of biomedicine | PC-7.1 Has fundamental knowledge of the structure, life 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 achievement indicator | Name of the assessment indicator (result of training by practice) |
|---|---|
| PC-1.1 Explores the mechanisms of molecular interaction of cells, tissues and functional systems of organisms, studies the physiological processes occurring in them | Knows<br>interactions of cells, tissues and functional systems of organisms.<br>Can<br>distinguish physiological processes occurring in cells and tissues.<br>Owns<br>skills in studying the mechanisms of molecular interaction of cells, tissues and functional systems of organisms. |
| PC-1.2 Uses methods of molecular genetic, cellular and physiological research to study physiological processes in the body | Knows<br>methods of molecular genetic, cellular and physiological research.<br>Can<br>apply methods of molecular genetic, cellular and physiological research.<br>Owns<br>methods of molecular genetic, cellular and physiological research. |
| PC-2.1 Uses fundamental knowledge of molecular and cellular biology to implement genetic and cellular engineering technologies in practice | Knows<br>methods of biotechnology and bioengineering.<br>Can<br>apply methods of biotechnology and bioengineering.<br>Owns<br>skills in obtaining medicines, medical devices, biomedical cell products and medical diagnostic systems. |
| PC-2.2 Able to apply genetic and cellular engineering methods for the development and production of medicines, medical devices, biomedical | Knows<br>methods of genetic and cellular engineering.<br>Can<br>apply genetic and cellular engineering methods.<br>Owns<br>ability to obtain medicines, medical devices, biomedical cell |

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| cell products and medical diagnostic systems | products and medical diagnostic systems. |
| PC-2.3 Able to analyze the results of experiments in the field of biotechnology and bioengineering and carry out the development of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>analyze the results of an experiment in the field of biotechnology and bioengineering<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. |
| PC-2.4 Capable of transferring the results of research work in the field of biotechnology and bioengineering for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>transfer the results of research work in the field of biotechnology and bioengineering.<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. |
| PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances | Knows<br>methods of physiology, biochemistry, molecular and cellular biology.<br>Can<br>use methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances.<br>Owns<br>skills of knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances. |
| PC-3.2 Able to apply molecular modeling methods for the development of medicines and medical devices | Knows<br>molecular modeling methods.<br>Can<br>apply molecular modeling methods.<br>Owns<br>molecular modeling methods for the development of medicines and medical devices. |
| PC-3.3 Able to develop medicines and medical devices using methods of pharmacological research and pharmaceutical technologies | Knows<br>methods of pharmacological research and pharmaceutical technologies.<br>Can<br>apply methods of pharmacological research and pharmaceutical technologies.<br>Owns<br>ability to develop medicines and medical devices. |
| PC-3.4 Capable of developing nanosystems for creating medicines and medical devices | Knows<br>methods of pharmacological research and pharmaceutical technologies.<br>Can |

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| | apply development methods to create medicines and medical devices.<br>Owns<br>the ability to develop nanosystems for the creation of medicines and medical devices. |
| PC-3.5 Capable of conducting preclinical tests of medicines and medical devices | Knows<br>methods of preclinical testing of medicines and medical devices.<br>Can<br>conduct preclinical tests of medicines and medical devices.<br>Owns<br>skills in conducting preclinical testing of medicines and medical devices. |
| PC-4.1 Analyzes the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body and applies the principles of cellular organization of biological objects | Knows<br>biochemical and molecular biological mechanisms of the development of pathological processes in cells and tissues of the human body.<br>Can<br>apply the principles of cellular organization of biological objects.<br>Owns<br>skills in determining the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body. |
| PC-4.2 Understands the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body | Knows<br>biochemical and molecular biological mechanisms of the development of pathological processes in cells and tissues of the human body.<br>Can<br>apply biochemical and molecular biological mechanisms for the development of pathological processes in the cells and tissues of the human body.<br>Owns<br>skills in using biochemical and molecular biological mechanisms for the development of pathological processes in the cells and tissues of the human body. |
| PC-4.3 Understands and explores the physical processes that underlie the functioning of the body in normal conditions and in pathology, understands the influence of physical factors on the functioning of biological systems, is able to study the physical structure of biologically important molecules in order to identify the relationship between the structure of substances and their biological activity | Knows<br>the physical structure of biologically important molecules and the physical processes underlying their functioning.<br>Can<br>determine the connection between physical structure and properties and the functions they perform in the body.<br>Owns<br>skills in studying the physical structure of biologically important molecules and the physical processes underlying their functioning. |
| PC-4.4 Able to develop and | Knows |

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| apply health-saving technologies | technologies aimed at preserving public health.<br>Can<br>apply health-saving technologies.<br>Owns<br>ability to develop health-saving technologies. |
| PC-5.1 Able to build mathematical models of physical processes of living organisms, set parameters and simulate physical problems in common programming languages, including Python | Knows<br>mathematical models of physical processes of living organisms.<br>Can<br>build mathematical models of physical processes of living organisms, set parameters and carry out simulations.<br>Owns<br>skills in creating mathematical models of physical processes of living organisms, setting parameters and modeling physical problems in common programming languages, including Python |
| PC-5.2 Able to build mathematical models of chemical processes to solve biomedical problems, set parameters and carry out modeling of chemical problems in common programming languages, including Python | Knows<br>mathematical models of chemical processes for solving biomedical problems.<br>Can<br>build mathematical models of chemical processes to solve biomedical problems, set parameters and simulate chemical problems in common programming languages, including Python.<br>Owns<br>skills in constructing mathematical models of chemical processes to solve biomedical problems, setting parameters and performing simulations of chemical problems in common programming languages, including Python. |
| PC-5.3 Able to build mathematical models of biological processes, set parameters and carry out modeling of biological problems in common programming languages, including Python | Knows<br>mathematical models of biological processes.<br>Can<br>build mathematical models of biological processes, set parameters and perform simulations of biological problems in common programming languages, including Python.<br>Owns<br>skills in constructing mathematical models of biological processes, setting parameters and performing simulations of biological problems in common programming languages, including Python. |
| PC-5.4 Applies modern information technologies and software when solving professional problems | Knows<br>modern information technologies and software for solving professional problems.<br>Can<br>apply modern information technologies and software when solving professional problems.<br>Owns<br>skills in using modern information technologies and software in solving professional problems. |
| PC-5.5 Applies modern methods of processing and analysis of scientific and | Knows<br>modern methods of processing and analysis of scientific and technical information, statistical analysis of biomedical data, |

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| technical information, statistical analysis of biomedical data, including using the R language | including using the R language.<br>Can<br>apply methods of processing and analysis of scientific and technical information, statistical analysis of biomedical data, including using the R language.<br>Owns<br>skills in using modern methods of processing and analyzing scientific and technical information, statistical analysis of biomedical data, including using the R language. |
| PC-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems | Knows<br>modern methods of genetics and molecular and cellular biology for the study of living systems.<br>Can<br>conduct research in the fields of genetics and molecular and cellular biology to study living systems.<br>Owns<br>skills in using research methods in the field of genetics and molecular and cellular biology to study living systems. |
| PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes | Knows<br>methods for diagnosing pathological conditions.<br>Can<br>use fundamental knowledge and biophysical methods to diagnose pathological conditions.<br>Owns<br>skills in applying fundamental knowledge and biophysical methods to diagnose pathological conditions. |
| PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology | Knows<br>methods for diagnosing pathological conditions.<br>Can<br>use fundamental knowledge and biophysical methods to diagnose pathological conditions.<br>Owns<br>skills in applying fundamental knowledge and biophysical methods to diagnose pathological conditions. |
| PC-6.4 Able to perform research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies in order to identify the causes of the disease and make a diagnosis | Knows<br>research methods in the field of clinical laboratory diagnostics, molecular genetic and cytological research methods.<br>Can<br>carry out research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies.<br>Owns<br>ability to perform research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies in order to identify the causes of the disease and make a diagnosis. |
| PC-7.1 Has fundamental knowledge of the structure, life activity, classification of microorganisms | Knows<br>basic concepts and principles of structure, life activity, classification of microorganisms.<br>Can<br>use knowledge about the structure, life activity, classification of microorganisms.<br>Owns<br>basic fundamental knowledge about the structure, life activity, |

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| | classification of microorganisms. |
| PC-7.2 Applies methods of virological, microbiological and epidemiological analysis | Knows<br>methods of virological, microbiological and epidemiological analysis.<br>Can<br>apply methods of virological, microbiological and epidemiological analysis.<br>Owns<br>skills in using 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<br>molecular features of the structure of microorganisms, mechanisms of their interaction with cells and role in pathological processes.<br>Can<br>apply knowledge about the structure, mechanisms of interaction with cells and role in pathological processes.<br>Owns<br>skills in using knowledge about the structure, mechanisms of interaction with cells and the role in pathological processes in professional activities. |

## 6. STRUCTURE AND CONTENT OF PRACTICE, INCLUDING PRACTICAL TRAINING

The content of practice is determined by its type and type.

The total labor intensity of industrial practice is 4 weeks / 6 credit units, 216 hours.

| **Practice stage** | **Types of work in practice, including independent work student** | **Labor intensity** | **Shapes of the current** |
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| Preparatory (organizational) stage:<br>– obtaining documents for practice (direction, diary, individual assignment);<br>– arriving at the place of practice and undergoing introductory, initial and on-the-job training;<br>– organization of the workplace and getting to know the team. | – orientation lecture;<br>– safety briefing. | 4 hours<br><br>4 hours | diary entry; answers on questions |
| Main stage:<br>– studying the organizational structure of the practice base;<br>– studying the management structure of an enterprise (organization, institution);<br>– familiarization with the scientific and production structure and program of the enterprise, prospects and plans for its development;<br>– familiarization with plans to expand the range and improve the quality of services provided by the enterprise; | – safety training at the enterprise;<br>– completing practice assignments in accordance with the program and individual assignments;<br>– studying materials and documents at the place of internship;<br>– processing and analysis of received practice materials. | 4h<br><br>80 h<br><br>40 h<br><br>40 h | diary entry; answers on questions |

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| – fulfillment of technical assignment for graduation design or diploma scientific work;<br>– conducting a patent search and literature review on the topic of certification work;<br>– selection and study of regulatory and technical documents and reference materials necessary for use when performing certification work;<br>– development of a program and methodology for experimental research;<br>– carrying out (if possible) experimental work on key issues of certification work;<br>– participation in solving individual production and scientific problems of an enterprise (organization, institution). | | | |
| – Final stage:<br>– processing and systematization of the received material;<br>– preparation of a report on<br>– undergoing pre-graduation practice;<br>– defense of the report on pre-graduate practice. | – systematization of material;<br>– decor<br>– individual task;<br>– report writing;<br>– preparing a presentation;<br>– report protection | 16 hours<br><br>12 h<br><br>12 h<br><br>4 hours | test with grade |

## 7. EDUCATIONAL AND METHODOLOGICAL SUPPORT OF INDEPENDENT WORK OF STUDENTS IN PRODUCTION PRACTICE

Pre-graduation practice is aimed at familiarizing students with the scientific and production structure and program of the enterprise, the prospects for its development, preparing the student to independently solve scientific and technological problems and to perform final certification work.

During pre-diploma internship, regardless of where it takes place, students should pay special attention to issues related to life safety, labor protection and industrial sanitation. To do this, it is necessary to consider the principles of state and public control over compliance with labor legislation, the organization of the life safety service and its tasks.

Pre-diploma practice begins with drawing up a general description of the enterprise (organization, institution), which includes the history of its development, structure, program of production activities, analysis of the management scheme, study of promising areas of development.

The acquisition of skills and experience in research activities in the field of biomedicine must be accomplished through the following types of work:

1) analysis of medical-biological and scientific-technical information in the field of molecular biotechnology;

2) conducting an analysis of patent literature;

3) participation in planning and conducting medical and biological experiments using a given methodology, processing the results using modern information technologies and technical means;

4) participation in conducting computational experiments using standard software tools in order to obtain

mathematical models of biological and biotechnical processes and objects;

5) preparation of data, preparation of reports and scientific publications based on the results of the work performed;

6) participation in the implementation of results in medical and biological practice;

7) participation in organizing the protection of intellectual property and research and development results as a trade secret of the enterprise.

An individual assignment (Appendix 1) is issued to the student at the university by the internship supervisor before the internship begins. It should be aimed at collecting and analyzing medical-biological and scientific-technical information, as well as summarizing domestic and foreign experience in the field of molecular biotechnologies, analyzing patent literature, and preparing source material for final qualifying work.

8. CERTIFICATION FORMS (BASED ON PRACTICE),including a list of assessment forms used at various stages of developing competencies during practice assignments

| No. | Controlled sections of educational (industrial) practice | Code and name of the achievement indicator | Learning outcomes | Evaluation tools * | |
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| | | | | current control | intermediate certification |
| 1 | Individual assignment for educational (industrial) practice | PC-1.1 Explores the mechanisms of molecular interaction of cells, tissues and functional systems of organisms, studies the physiological processes occurring in them | Knows<br>interactions of cells, tissues and functional systems of organisms.<br>Can<br>distinguish physiological processes occurring in cells and tissues.<br>Owns<br>skills in studying the mechanisms of molecular interaction of cells, tissues and functional systems of organisms. | PR-9 | - |
| | | PC-1.2 Uses methods of molecular genetic, cellular and physiological research to study physiological processes in the body | Knows<br>methods of molecular genetic, cellular and physiological research.<br>Can<br>apply methods of molecular genetic, cellular and physiological research.<br>Owns<br>methods of molecular genetic, cellular and physiological research. | PR-14 | - |
| | | PC-2.1 Uses fundamental knowledge of molecular and cellular biology to implement genetic and cellular engineering technologies in practice | Knows<br>methods of biotechnology and bioengineering.<br>Can<br>apply methods of biotechnology and bioengineering.<br>Owns<br>skills in obtaining medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-14 | - |

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| | | PC-2.2 Able to apply genetic and cellular engineering methods for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>methods of genetic and cellular engineering.<br>Can<br>apply genetic and cellular engineering methods.<br>Owns<br>ability to obtain medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-14 | - |
| | | PC-2.3 Able to analyze the results of experiments in the field of biotechnology and bioengineering and carry out the development of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>analyze the results of an experiment in the field of biotechnology and bioengineering<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-14 | - |
| | | PC-2.4 Capable of transferring the results of research work in the field of biotechnology and bioengineering for the development and production of medicines, medical devices, biomedical cell products and medical diagnostic systems | Knows<br>features of the development of medicines, medical devices, biomedical cell products and medical diagnostic systems.<br>Can<br>transfer the results of research work in the field of biotechnology and bioengineering.<br>Owns<br>skills in the development of medicines, medical devices, biomedical cell products and medical diagnostic systems. | PR-14 | - |
| | | PC-3.1 Uses knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances | Knows<br>methods of physiology, biochemistry, molecular and cellular biology.<br>Can<br>use methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances.<br>Owns | PR-14 | - |

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| | | | skills of knowledge and methods of physiology, biochemistry, molecular and cellular biology to study the properties of biologically active substances. | | |
| | | PC-3.2 Able to apply molecular modeling methods for the development of medicines and medical devices | Knows<br>molecular modeling methods.<br>Can<br>apply molecular modeling methods.<br>Owns<br>molecular modeling methods for the development of medicines and medical devices. | PR-14 | - |
| | | PC-3.3 Able to develop medicines and medical devices using methods of pharmacological research and pharmaceutical technologies | Knows<br>methods of pharmacological research and pharmaceutical technologies.<br>Can<br>apply methods of pharmacological research and pharmaceutical technologies.<br>Owns<br>ability to develop medicines and medical devices. | PR-14 | - |
| 2 | Completing a report on educational (industrial) practice | PC-3.4 Capable of developing nanosystems for creating medicines and medical devices | Knows<br>methods of pharmacological research and pharmaceutical technologies.<br>Can<br>apply development methods to create medicines and medical devices.<br>Owns<br>the ability to develop nanosystems for the creation of medicines and medical devices. | PR-16 | - |
| | | PC-3.5 Capable of conducting preclinical tests of medicines and medical devices | Knows<br>methods of preclinical testing of medicines and medical devices.<br>Can<br>conduct preclinical tests of medicines and medical devices.<br>Owns | PR-16 | - |

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| | | | skills in conducting preclinical testing of medicines and medical devices. | | |
| | | PC-4.1 Analyzes the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body and applies the principles of cellular organization of biological objects | Knows<br>biochemical and molecular biological mechanisms of the development of pathological processes in cells and tissues of the human body.<br>Can<br>apply the principles of cellular organization of biological objects.<br>Owns<br>skills in determining the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body. | PR-16 | - |
| | | PC-4.2 Understands the biochemical and molecular biological mechanisms of the development of pathological processes in the cells and tissues of the human body | Knows<br>biochemical and molecular biological mechanisms of the development of pathological processes in cells and tissues of the human body.<br>Can<br>apply biochemical and molecular biological mechanisms for the development of pathological processes in the cells and tissues of the human body.<br>Owns<br>skills in using biochemical and molecular biological mechanisms for the development of pathological processes in the cells and tissues of the human body. | PR-16 | - |
| | | PC-4.3 Understands and explores the physical processes that underlie the functioning of the body in normal conditions and in pathology, understands the influence of physical factors on the functioning of biological systems, is able to study the | Knows<br>the physical structure of biologically important molecules and the physical processes underlying their functioning.<br>Can<br>determine the connection between physical structure and properties and the functions they perform in the body.<br>Owns<br>skills in studying the physical structure of biologically | PR-16 | - |

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| | | physical structure of biologically important molecules in order to identify the relationship between the structure of substances and their biological activity | important molecules and the physical processes underlying their functioning. | | |
| | | PC-4.4 Able to develop and apply health-saving technologies | Knows<br>technologies aimed at preserving public health.<br>Can<br>apply health-saving technologies.<br>Owns<br>ability to develop health-saving technologies. | PR-16 | - |
| | | PC-5.1 Able to build mathematical models of physical processes of living organisms, set parameters and simulate physical problems in common programming languages, including Python | Knows<br>mathematical models of physical processes of living organisms.<br>Can<br>build mathematical models of physical processes of living organisms, set parameters and carry out simulations.<br>Owns<br>skills in creating mathematical models of physical processes of living organisms, setting parameters and modeling physical problems in common programming languages, including Python | PR-16 | - |
| | | PC-5.2 Able to build mathematical models of chemical processes to solve biomedical problems, set parameters and carry out modeling of chemical problems in common programming languages, including Python | Knows<br>mathematical models of chemical processes for solving biomedical problems.<br>Can<br>build mathematical models of chemical processes to solve biomedical problems, set parameters and simulate chemical problems in common programming languages, including Python.<br>Owns<br>skills in constructing mathematical models of chemical processes to solve biomedical problems, setting parameters | PR-16 | - |

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| | | | and performing simulations of chemical problems in common programming languages, including Python. | | |
| | | PC-5.3 Able to build mathematical models of biological processes, set parameters and carry out modeling of biological problems in common programming languages, including Python | Knows<br>mathematical models of biological processes.<br>Can<br>build mathematical models of biological processes, set parameters and perform simulations of biological problems in common programming languages, including Python.<br>Owns<br>skills in constructing mathematical models of biological processes, setting parameters and performing simulations of biological problems in common programming languages, including Python. | PR-16 | - |
| 3 | Defense of the practice report | PC-5.4 Applies modern information technologies and software when solving professional problems | Knows<br>modern information technologies and software for solving professional problems.<br>Can<br>apply modern information technologies and software when solving professional problems.<br>Owns<br>skills in using modern information technologies and software in solving professional problems. | - | UO-1 |
| | | PC-5.5 Applies modern methods of processing and analysis of scientific and technical information, statistical analysis of biomedical data, including using the R language | Knows<br>modern methods of processing and analysis of scientific and technical information, statistical analysis of biomedical data, including using the R language.<br>Can<br>apply methods of processing and analysis of scientific and technical information, statistical analysis of biomedical data, including using the R language.<br>Owns<br>skills in using modern methods of processing and analyzing scientific and technical information, statistical | - | UO-1 |

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| | | | analysis of biomedical data, including using the R language. | | |
| | | PC-6.1 Uses knowledge and methods of genetics, molecular and cellular biology to study living systems | Knows<br>modern methods of genetics and molecular and cellular biology for the study of living systems.<br>Can<br>conduct research in the fields of genetics and molecular and cellular biology to study living systems.<br>Owns<br>skills in using research methods in the field of genetics and molecular and cellular biology to study living systems. | - | UO-1 |
| | | PC-6.2 Applies methods of genetics, molecular and cellular biology to identify the mechanisms of pathological processes | Knows<br>methods for diagnosing pathological conditions.<br>Can<br>use fundamental knowledge and biophysical methods to diagnose pathological conditions.<br>Owns<br>skills in applying fundamental knowledge and biophysical methods to diagnose pathological conditions. | - | UO-1 |
| | | PC-6.3 Able to develop clinical diagnostic systems using knowledge and methods of genetics, molecular and cellular biology | Knows<br>methods for diagnosing pathological conditions.<br>Can<br>use fundamental knowledge and biophysical methods to diagnose pathological conditions.<br>Owns<br>skills in applying fundamental knowledge and biophysical methods to diagnose pathological conditions. | - | UO-1 |
| | | PC-6.4 Able to perform research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies in order to identify the causes of the disease and make a diagnosis | Knows<br>research methods in the field of clinical laboratory diagnostics, molecular genetic and cytological research methods.<br>Can<br>carry out research in the field of clinical laboratory | - | UO-1 |

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| | | | diagnostics, molecular genetic and cytological studies.<br>Owns<br>ability to perform research in the field of clinical laboratory diagnostics, molecular genetic and cytological studies in order to identify the causes of the disease and make a diagnosis. | | |
| | | PC-7.1 Has fundamental knowledge of the structure, life activity, classification of microorganisms | Knows<br>basic concepts and principles of structure, life activity, classification of microorganisms.<br>Can<br>use knowledge about the structure, life activity, classification of microorganisms.<br>Owns<br>basic fundamental knowledge about the structure, life activity, classification of microorganisms. | - | UO-1 |
| | | PC-7.2 Applies methods of virological, microbiological and epidemiological analysis | Knows<br>methods of virological, microbiological and epidemiological analysis.<br>Can<br>apply methods of virological, microbiological and epidemiological analysis.<br>Owns<br>skills in using virological, microbiological and epidemiological analysis methods in professional activities. | - | UO-1 |
| | | 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<br>molecular features of the structure of microorganisms, mechanisms of their interaction with cells and role in pathological processes.<br>Can<br>apply knowledge about the structure, mechanisms of interaction with cells and role in pathological processes.<br>Owns<br>skills in using knowledge about the structure, mechanisms | - | UO-1 |

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| | | | of interaction with cells and the role in pathological processes in professional activities. | | |

* Recommended forms of assessment tools:

1. interview (UO-1), colloquium (UO-2); report, message (UO-3); round table, discussion, controversy, dispute, debate (UO-4); etc.

2. tests (PR-1); tests (PR-2), essays (PR-3), abstracts (PR-4), term papers (PR-5); laboratory work (PR-6); abstract (PR-7); portfolio (PR-8); project (PR-9); business and/or role-playing game (PR-10); case task (PR-11); workbook (PR-12); multi-level tasks and assignments (PR-13); calculation - graphic work (PR-14); creative task (PR-15), practice report (PR-16), etc.

3. simulator (TS-1), etc.

Before undergoing pre-diploma internship, the student receives an individual assignment from the university internship supervisor, the content and scope of which are discussed with the internship supervisor.

Based on the results of the internship, the student draws up a report on the completion of the internship, participates in the final conference with a presentation of the results of the internship, after which he receives a test with a grade.

The practice report must contain the following elements:

− title page (Appendix 3);

− assignment and calendar plan of practice (Appendix 1);

− document confirming the fact of internship;

− a description drawn up by the head of the practice from the organization or structural unit, if the practice is carried out on the basis of FEFU;

− content;

− introduction;

− the main part about the activities during the internship (including the experimental part with methods and research results);

− completed individual task;

− conclusion;

− sources of information;

The report is prepared in accordance with the "Requirements for the preparation of written work performed by FEFU students and listeners."

## 10. EDUCATIONAL, METHODOLOGICAL AND INFORMATION SUPPORT OF PRE-DIGRADE PRACTICE

1. Basnakyan, I.A. Cultivation of microorganisms with specified properties / I.A. Basnakyan. – M.: Medicine, 1992. – 192 p.

2. Biotechnology. Principles and application / ed. I. Higgins, D. Best, J. Jones; lane from English – M.: Mir, 1988. – 480 p.

3. Biotechnology: Textbook for universities. In 8 books. / Ed. N.S. Egorova, V.D. Samuilova. – M.: Higher School, 1987

4. Biotechnology: Textbook for universities. In 8 books. Book 1: Problems and prospects / N.S. Egorov, A.V. Oleskin, V.D. Samuilov. – M.: Higher School, 1987. – 159 p.

5. Blazhevich, O.V. Cell cultivation: Course of lectures / O.V. Blazhevich - Mn.: BSU, 2004. - 78 p.

6. Genetic basis of plant breeding. Volume 3. Biotechnology in plant breeding. Cellular engineering [Electronic resource] / V.S. Anokhin [and others]. - Electron. text data.http://www.iprbookshop.ru/29441.html

7. Ermishin A.P. Biotechnology. Biosafety. Bioethics / A.P. Ermishin et al.; edited by A.L. Ermishina. – Mn.: Tekhnalogiya, 2005. – 430 p.

8. Microbial enzymes and biotechnology / Ed. M. W. Fogarty. – M.: Agropromizdat, 1986. – 318 p.

9. Pinaev, G.P. Cellular biotechnology: educational manual / G.P. Pinaev, M.I. Blinova, N.S. Nikolaenko, G.G. Polyanskaya, T.N. Efremova, N.S. Sharlaimova, N.A. Shubin. – St. Petersburg: Polytechnic University, 2011. – 224 p.

10. Practical chemistry of protein. / Per. from English / Ed. Darbre A. – M.: Mir, 1989. – 623 p.

11. Ryabkova, G.V. Biotechnology (Biotechnology) [Electronic resource]: educational manual / G.V. Ryabkova – Electron. text data.http://www.iprbookshop.ru/61942.html

12. Sirotkin A.S. Theoretical foundations of biotechnology [Electronic resource]: educational manual / Sirotkin A.S., Zhukova V.B. - Electron. text data.http://www.iprbookshop.ru/63475.html

## 11. MATERIAL AND TECHNICAL SUPPORT OF PRE-DIGRADE PRACTICE

Scientific laboratories of biomedical cell technologies, equipped with the following equipment:

– Robotic system for automated cell cultivation CompacT SelecT SC - workstation, with module for preparing plates for analysis, THE AUTOMATION PARTNERSHIP;

– System for continuous monitoring of living cells in culture, image formation and analysis Cell-IQ MLF, Chip Technologies, Czech Republic;

– System for deep optical imaging of biomaterials FluoView FV1200MPE (FV12M-5XX-3XX);

– Personal incubator CO2- with a system for monitoring and increasing the vitality of Galaxy cells (CO48R-230-1200);

– Spectrophotometer with accessories for sample processing BioSpectrometer-kinetic;

– Device for carrying out polymerase chain reaction with detection of amplification products in “real time” mode CFX96 Touch Real Time System;

– System for volumetric fixation and preparation of deposited biospecimens in the Volume Fixation System kit;

– Multimodule station for rotary sedimentation processing of samples Sediment Modules;

– Automated system Biacore X100 System for the analysis of intermolecular interactions with a set of additional parts and software;

– DNA sequence analysis system Ion S5™ XL System + Starter kit for testing the functionality and commissioning of the system;

– Applied Biosystems 3500 genetic analyzer + Starter kit for testing the functionality and commissioning of the system;

– High-speed cell sorter MoFlo Astrios EQ + Starter kit for testing the functionality and commissioning of the system;

– System for preparing samples for full genome sequencing Ion Chef™ Instrument + Starter kit for testing the functionality and commissioning of the system.

– For persons with disabilities and people with disabilities, the choice of places of practice is consistent with the requirement of their accessibility for these students and the practice is carried out taking into account the characteristics of their psychophysical development, individual capabilities and health status.

**Compiled by:**

Associate Professor, Candidate of Sciences biol. Sciences

V.V. Kumeiko

ANNEX 1

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)**

**I CONFIRM:**
Head of OP
_____FULL NAME.
"____" _____20__

# INDIVIDUAL TASK

By _____
(type of practice)

student _____groups _____
(student's name)

Educational program 06.03.01 “Biology”, profile “Biomedicine (in English)”_____
_____

Base (place, organization) of practice_____
_____

Duration of practice from _____20___ to _____ 20___

| | |
|---|---|
| Generalized formulation of the task | |

Task schedule

| Name of tasks (activities) that make up the task | Date of completion of the task (activity) |
|---|---|
| 1. | |
| 2. | |
| 3. | |
| | |

Head of practice _____ _____
*signature full name, position*

APPENDIX 2

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)**

**DEPARTMENT** _____

**DIARY**

according to _____
practice
student _____
group_____
program_____
Place of practice_____
Duration of internship:_____weeks_____

Head of practice from FEFU
_____
Head of practice from a specialized organization
_____

1. Student work schedule

| No. | Name of works | Calendar dates | | Last name of practice manager |
|---|---|---|---|---|
| | | Start | ending | |
| | | | | |
| | | | | |
| | | | | |

2. Student's work diary

| date | Summary of the trainee's work | Signature head |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

3. Report protection results

The report is protected by "____" _____ 20___

With a rating of _____

Department Director _____ AND ABOUT. Surname

APPENDIX 3

**Internship report cover page form**

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)**

**DEPARTMENT** _____

The report is protected with a rating
_____
"_____"_____20__ g

Supervisor
educational program
_____Last name I.O.

.

## REPORT

**about internship** _____

_____
(full name of the profile organization)

Student _____group _____ (_____)
*Signature Full name*
Head of Practice
from a specialized organization_____ (_____)
*Signature Full name*

Head of Practice
from FEFU_____ (_____)
*Signature Full name*

APPENDIX 4

**Referral form for educational practice**

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)

DEPARTMENT _____

**DIRECTION**

**for practice**_____

_____

student of __bachelor's course
Full Namegroups _____
(Full Name)
sent to _____
name of the base organization

address _____

Order on assignment to practice dated No._____
for internship
in the field of study 06.03.01 Biology
for the period from _____ 20 to _____ 20 (continuous/discrete)

Head of Practice

M.P. _____ (position, academic rank) _____ (signature) _____ (I.O.F)

**Notes on completion and dates of practice**

| Business name | Arrival and departure notes | Signature, decryption of signature, seal |
|---|---|---|
| Name of the enterprise, organization in accordance with the agreement | Arrived __.__.20__ | |
| | Dropped out on __.__.20__ | |