Federal State Autonomous Educational Institution of Higher Education "Moscow Institute of Physics and Technology (National Research University)"

APPROVED
Head of the Phystech School of Biological and Medical Physics
D.V. Kuzmin

Practice program

course:	Personal Research Project/Научно-исследовательская работа
major:	Biotechnology
specialization:	Medical Biotechnology/Медицинская биотехнология Физтех-школа Биологической и Медицинской Физики Phystech School of Biological and Medical Physics
term:	1
qualification:	Master
type of practice:	industrial
practice method:	

Semesters, forms of interim assessment:

2 (spring) - Grading test
3 (fall) - Grading test
4 (spring) - Grading test

Authors of the program:

A.S. Dukh, teacher
D.V. Kuzmin, candidate of biological sciences
O.Y. Belogurova-Ovchinnikova, phd (candidate of biological sciences)

The program was discussed at the Phystech School of Biological and Medical Physics 04.06.2020

Annotation

Industrial practice - research work - is an integral part of the educational process, designed to ensure a close connection between scientific and theoretical and practical training, to give students practical experience in accordance with the profile of the program.

The purpose of the practice is to acquire professional skills and professional experience. The practice provides practical training for students and is aimed at the formation, consolidation, development of practical skills and competencies in the profile of the educational program.

The practice is carried out in the scientific laboratories of the basic and faculty departments of the Physics and Technology School.

1. General characteristics of practice

Purpose of the course

The purpose of the practice is to obtain professional skills and professional experience in the field of biotechnology and biological physics. The practice provides practical training for students and is aimed at the formation, consolidation, development of practical skills and competencies in the profile of the educational program.

Purpose of practice

The objectives of the practice are:

– development of professional research thinking of students, the formation of a clear understanding of the main professional tasks and ways to solve them;

– formation of the ability to independently perform laboratory, computational research with professional research using modern methods of researching the tasks of modern apparatus and computing facilities;

– formation of the ability to competently use modern technologies for collecting information, processing and interpreting the obtained experimental data.

During the period of practice, the student must:

explore:

– information sources on the topic being developed for the purpose of their use in the performance of the final qualifying work;

– methods of analysis and processing of statistical data;

– information technologies used in scientific research, software products related to the professional sphere;

– requirements for the design of scientific and technical documentation;

execute:

– analysis, systematization and generalization of information on the topic of research, including bibliographic work on a given topic using modern information technologies;

– comparison of the research results of the object of development with domestic and foreign analogues;

– analysis of the scientific and practical significance of the research;

– a report on the work done.

Forms of practice: dispersed

2. List of the planned results of the practice

Mastering the discipline is aimed at the formation of the following competencies:

Code and the name of the competence	Competency indicators
	Gen.Pro.C-1.1 Apply fundamental scientific knowledge in the field of biological, physical, mathematical sciences
	Gen.Pro.C-1.2 Consolidate and critically assess professional experience and research findings

Gen.Pro.C-1 Gain fundamental scientific knowledge in the field of biological, physical, mathematical sciences	Gen.Pro.C-1.3 Understand interdisciplinary relations in applied biological, physical, mathematical sciences and apply them in professional tasks
	Gen.Pro.C-1.4 Able to plan, organise and carry out research work in biotechnology, correctly process the results of experiments and draw valid opinions and conclusions
Gen.Pro.C-2 Acquire an understanding of current scientific and technological challenges in professional settings, and scientifically formulate professional objectives	Gen.Pro.C-2.1 Assess the current state of mathematical research within professional settings
	Gen.Pro.C-2.2 Assess the relevance and practical importance of research in professional settings
	Gen.Pro.C-2.3 Understand professional terminology used in modern scientific and technical literature and present scientific results in oral and written form within professional communication
Gen.Pro.C-3 Select and/or develop approaches to professional problem-solving with consideration to the limitations and specifics of different solution methods	Gen.Pro.C-3.1 Analyze problems, plan research strategy to achieve solution(s), propose, and combine solution approaches
	Gen.Pro.C-3.2 Employ research methods to solve new problems and apply knowledge from various fields of science (technology)
	Gen.Pro.C-3.3 Gain knowledge of analytical and computational methods of problem-solving, understand the limitations for applying the obtained solutions in practice
	Gen.Pro.C-3.4 Professionally operate and upgrade modern bioinstrumentation
	Gen.Pro.C-3.5 Has the skills to design new bioinformatics solutions for the scientific, technical, biotechnological task at hand
Gen.Pro.C-4 Successfully perform a task, analyze the results, and present conclusions, apply knowledge and skills in the field of physical and mathematical sciences and ICTs	Gen.Pro.C-4.1 Apply ICT knowledge and skills to search for and study scientific literature, using software products
	Gen.Pro.C-4.2 Apply knowledge in the field of physical and mathematical sciences to solve problems, make conclusions, and evaluate the obtained results
	Gen.Pro.C-4.3 Justify the chosen method of scientific research
	Gen.Pro.C-4.4 Evaluate, analyze, and interpret the results of biotechnological processes
	Gen.Pro.C-4.5 Set scientific and technical objectives, using biotechnological processes and the proper equipment
Gen.Pro.C-5 Undertake professional training, achieve professional growth, and become a team leader in a professional sphere, tolerant of social, ethnic, religious, and cultural differences	Gen.Pro.C-5.1 Tolerate social, ethnic, religious, and cultural differences in teamwork
	Gen.Pro.C-5.2 Manage a small professional team
	Gen.Pro.C-5.3 Apply new knowledge and achieve personal and professional growth
Pro.C-1 Assign, formalize, and solve tasks, develop and research mathematical models of the studied phenomena and processes, systematically analyze scientific problems and obtain new scientific results	Pro.C-1.1 Locate, analyze, and summarize information on current research findings within a selected subject area
	Pro.C-1.2 Apply fundamental knowledge of mathematics, physics, chemistry, and biology in professional settings
	Pro.C-1.3 Make hypotheses, build mathematical models of the studied phenomena and processes, evaluate the quality of the developed model
	Pro.C-1.4 Apply theoretical and/or experimental research methods to a specific scientific task and interpret the obtained results
	Pro.C-1.5 Has the ability to create software tools and databases used in bioengineering and bioinformatics

Pro.C-2 Organize and conduct scientific research and testing independently or as a member (leader) of a small research team	Pro.C-2.1 Plan and conduct scientific research independently or as part of a research team
	Pro.C-2.2 Conduct tests of research results through scientific publications and participation in conferences
Pro.C-3 Use research and testing equipment (devices and installations, specialized software) in a selected subject field	Pro.C-3.1 Understand the operating principles of the equipment and specialized software
	Pro.C-3.2 Conduct an experiment (simulation), using research equipment (software)
	Pro.C-3.3 Evaluate the accuracy of experimental (numerical) results
	Pro.C-3.4 Apply new bioengineering and bioinformatics resources and software
	Pro.C-3.5 Apply bioengineering and bioinformatics methods to create biological objects with altered properties

3. List of the planned results of the practice

As a result of studying the course the student should:

know:

– approaches to the organization of independent and collective research work;
– principles of organizing experiments and tests;
– principles of formalizing the results of research work;
– to have an idea of the economic component of scientific research.

be able to:

– to carry out search, processing, analysis and systematization of scientific and technical information, to select methods and means of solving problems set by the research program;
– perform processing and analysis of the results of experiments and tests;
– analyze the difficulties arising in research activities and contribute to their resolution;
– to design a solution to a research problem, based on current legal regulations and available resources and restrictions;
– to formalize and present the results of research work.

master:

– the skills of preparing plans and programs for conducting scientific research, technical developments, assignments for performers.

4. Practice content

4.1. Main stages of practice

№	Practice stage content	Labor intensity (hours), including independent work
2 semester		
1	Formulation of the problem	40
2	Collection, processing, analysis and systematization of scientific and technical information on the research topic	55
3	Preparation for scientific research	100
4	Conducting part of the research	100
5	Checking the results, reading articles	200
Total AH in 2 semester		495
3 semester		
6	Conducting the second part of the tests	500
7	Analytical part	535
Total AH in 3 semester		1 035
4 semester		
8	Final part	350
9	Systematization of statistical and analytical material for writing a research report	820
Total AH in 4 semester		1 170

AH in total	2 700

4.2. Work content

Semester: 2 (Spring)

1. Formulation of the problem

Conducting a safety briefing, familiarizing students with the internal regulations. Setting a research task, drawing up a plan of practice, developing a research program.

2. Collection, processing, analysis and systematization of scientific and technical information on the research topic

Study of scientific, periodical (including foreign) literature on the research topic. Selection and justification of the accepted direction of research. Preparation of an analytical review. Formulation of the goals and objectives of the study. Planning experimental research.

3. Preparation for scientific research

Selection of the necessary materials for the FQP Conducting independent research in accordance with the developed program.

4. Conducting part of the research

Test setting, according to the drawn up plan.

5. Checking the results, reading articles

Reading articles, drawing up a preliminary report.

Semester: 3 (Fall)

6. Conducting the second part of the tests

Conducting the second part of the tests after checking the literature, articles.

7. Analytical part

Analysis of the research results obtained. Conclusions and recommendations based on the results of the study.

Semester: 4 (Spring)

8. Final part

Registration of research results (presentation of the FQP project to the scientific advisor). Preparation of abstracts at a conference or preparation of research materials for publication in scientific periodicals. Preparation of a report on practice based on the results obtained, presentation at a scientific seminar / meeting of the department.

9. Systematization of statistical and analytical material for writing a research report

4.3. Practice supervision

The practice is managed by the student's appointed scientific advisor, whose duties include:

– scientific and educational-methodical management of research work;
– development of individual tasks for students, performed during the practice period;
– provision of assistance to students in the development of a plan for conducting research;
– conducting consultations (research seminar, lectures) on conducting research;
– control over the implementation of the research plan;
– verification of the reporting documentation on the implementation of research work.

Discussion of the plan and intermediate results of research is carried out at the department that prepares students, as well as within the framework of the scientific seminar of the department and organizations with which cooperation is conducted and on the basis of which research can be carried out.
The results of research work should be drawn up in the form of a report and submitted for consideration and approval to the supervisor. Attached to the report (if available) is a list of articles and abstracts of the student's reports published on the research topic, as well as a list of reports and speeches of the student at scientific conferences and seminars. Lists of published works and speeches are accompanied by supporting documents (reprints of articles, photocopies of abstracts, as well as certificates of participation in conferences or the conference program).
Based on the results of the research work, the supervisor gives the student an assessment.

5. Description of the material and technical facilities that are necessary for the implementation of the educational process of the course (training module)

To carry out the practice, you need: a workplace in an educational or scientific unit, which is a place of practice, a workplace for independent work, containing a personal computer, with access to the Internet and the MIPT electronic educational environment.
Place of the practice: scientific laboratories of the basic and faculty departments of the Physics and Technology School.

6. List of the main and additional literature, that is necessary for the course (training module) mastering

Main literature

1. Подготовка и защита бакалаврской работы, магистерской диссертации, дипломного проекта [Электронный ресурс], учеб. пособие / Ю. Н. Новиков. — СПб., Лань, 2019.— URL: https://e.lanbook.com/book/122187 (дата обращения: 29.01.2021). - Полный текст (Режим доступа : из сети МФТИ / Удаленный доступ)

Additional literature

1. Искусство писать научные статьи, научно-практическое руководство / Е. З. Мейлихов. — Долгопрудный, Интеллект, 2020.— URL: http://books.mipt.ru/book/301312 (дата обращения: 18.12.2020). - Полный текст (Режим доступа : из сети МФТИ / Удаленный доступ)

7. List of curricular resources for independent work on practice

Not used

8. List of web resources that are necessary for the practice mastering

Database:
–Referential-bibliographic and scientometric (bibliometric) database Web of Science Core Collection;
–Abstract and scientometric database (citation index) Scopus.
Electronic libraries:
–RFBR electronic library - https://www.rfbr.ru/rffi/ru/library;
–Scientific electronic library - https://elibrary.ru.

9. Guidelines for students to master the cource

The assignment for practice is determined by the supervisor, taking into account the specifics of the research work of the department or the base enterprise. The basis of the content of the student's independent work in the implementation of the practice program is the development of methods, techniques, technologies for analyzing and systematizing scientific and technical information, developing plans and programs for conducting scientific research and acquiring practical skills for carrying out research activities, taking into account the interests and capabilities of the department or the base enterprise, where it is held. When completing an individual assignment, the student must combine practical work on the subject of the assignment with a theoretical study of the issue using the recommended information resources. When working with literary sources, it is recommended to draw up a short synopsis with the obligatory fixation of the bibliographic data of the source. Research work ends with writing a report.

SUPPLEMENT

Assessment funds for practice

major:	Biotechnology
specialization:	Medical Biotechnology/Медицинская биотехнология Физтех-школа Биологической и Медицинской Физики Phystech School of Biological and Medical Physics
term:	1
qualification:	Master

Semesters, forms of interim assessment:

2 (spring) - Grading test
3 (fall) - Grading test
4 (spring) - Grading test

Authors:

A.S. Dukh, teacher
D.V. Kuzmin, candidate of biological sciences
O.Y. Belogurova-Ovchinnikova, phd (candidate of biological sciences)

1. Competencies formed during the process of studying the practice

Code and the name of the competence	Competency indicators
Gen.Pro.C-1 Gain fundamental scientific knowledge in the field of biological, physical, mathematical sciences	Gen.Pro.C-1.1 Apply fundamental scientific knowledge in the field of biological, physical, mathematical sciences
	Gen.Pro.C-1.2 Consolidate and critically assess professional experience and research findings
	Gen.Pro.C-1.3 Understand interdisciplinary relations in applied biological, physical, mathematical sciences and apply them in professional tasks
	Gen.Pro.C-1.4 Able to plan, organise and carry out research work in biotechnology, correctly process the results of experiments and draw valid opinions and conclusions
Gen.Pro.C-2 Acquire an understanding of current scientific and technological challenges in professional settings, and scientifically formulate professional objectives	Gen.Pro.C-2.1 Assess the current state of mathematical research within professional settings
	Gen.Pro.C-2.2 Assess the relevance and practical importance of research in professional settings
	Gen.Pro.C-2.3 Understand professional terminology used in modern scientific and technical literature and present scientific results in oral and written form within professional communication
Gen.Pro.C-3 Select and/or develop approaches to professional problem-solving with consideration to the limitations and specifics of different solution methods	Gen.Pro.C-3.1 Analyze problems, plan research strategy to achieve solution(s), propose, and combine solution approaches
	Gen.Pro.C-3.2 Employ research methods to solve new problems and apply knowledge from various fields of science (technology)
	Gen.Pro.C-3.3 Gain knowledge of analytical and computational methods of problem-solving, understand the limitations for applying the obtained solutions in practice
	Gen.Pro.C-3.4 Professionally operate and upgrade modern bioinstrumentation
	Gen.Pro.C-3.5 Has the skills to design new bioinformatics solutions for the scientific, technical, biotechnological task at hand
Gen.Pro.C-4 Successfully perform a task, analyze the results, and present conclusions, apply knowledge and skills in the field of physical and mathematical sciences and ICTs	Gen.Pro.C-4.1 Apply ICT knowledge and skills to search for and study scientific literature, using software products
	Gen.Pro.C-4.2 Apply knowledge in the field of physical and mathematical sciences to solve problems, make conclusions, and evaluate the obtained results
	Gen.Pro.C-4.3 Justify the chosen method of scientific research
	Gen.Pro.C-4.4 Evaluate, analyze, and interpret the results of biotechnological processes
	Gen.Pro.C-4.5 Set scientific and technical objectives, using biotechnological processes and the proper equipment
Gen.Pro.C-5 Undertake professional training, achieve professional growth, and become a team leader in a professional sphere, tolerant of social, ethnic, religious, and cultural differences	Gen.Pro.C-5.1 Tolerate social, ethnic, religious, and cultural differences in teamwork
	Gen.Pro.C-5.2 Manage a small professional team
	Gen.Pro.C-5.3 Apply new knowledge and achieve personal and professional growth
Pro.C-1 Acquire, formalize, and solve tasks	Pro.C-1.1 Locate, analyze, and summarize information on current research findings within a selected subject area
	Pro.C-1.2 Apply fundamental knowledge of mathematics, physics, chemistry, and biology in professional settings

Pro.C-1 Assign, formalize, and solve tasks, develop and research mathematical models of the studied phenomena and processes, systematically analyze scientific problems and obtain new scientific results	Pro.C-1.3 Make hypotheses, build mathematical models of the studied phenomena and processes, evaluate the quality of the developed model
	Pro.C-1.4 Apply theoretical and/or experimental research methods to a specific scientific task and interpret the obtained results
	Pro.C-1.5 Has the ability to create software tools and databases used in bioengineering and bioinformatics
Pro.C-2 Organize and conduct scientific research and testing independently or as a member (leader) of a small research team	Pro.C-2.1 Plan and conduct scientific research independently or as part of a research team
	Pro.C-2.2 Conduct tests of research results through scientific publications and participation in conferences
Pro.C-3 Use research and testing equipment (devices and installations, specialized software) in a selected subject field	Pro.C-3.1 Understand the operating principles of the equipment and specialized software
	Pro.C-3.2 Conduct an experiment (simulation), using research equipment (software)
	Pro.C-3.3 Evaluate the accuracy of experimental (numerical) results
	Pro.C-3.4 Apply new bioengineering and bioinformatics resources and software
	Pro.C-3.5 Apply bioengineering and bioinformatics methods to create biological objects with altered properties

2. Competency assessment indicators

As a result of studying the course the student should:

know:

– approaches to the organization of independent and collective research work;
– principles of organizing experiments and tests;
– principles of formalizing the results of research work;
– to have an idea of the economic component of scientific research.

be able to:

– to carry out search, processing, analysis and systematization of scientific and technical information, to select methods and means of solving problems set by the research program;
– perform processing and analysis of the results of experiments and tests;
– analyze the difficulties arising in research activities and contribute to their resolution;
– to design a solution to a research problem, based on current legal regulations and available resources and restrictions;
– to formalize and present the results of research work.

master:

– the skills of preparing plans and programs for conducting scientific research, technical developments, assignments for performers.

3. Student practice reporting

Interim certification in practice is carried out in the form of a differentiated offset.

During the period of practice, the student is obliged:

- Completely fulfill the research plan;
- follow the instructions of the head of research work;
- be responsible for the work performed and its results.

Assessment for industrial practice - research work - is given to the student by the scientific supervisor based on the results of the defense of his work. The defense of research work is carried out in the form of a scientific seminar of the department. When evaluating research work, the following is taken into account:

- implementation of the research plan;
- presentation of research results;
- R&D report of the established form (Appendix 1).

The mark "excellent" (8-10 points) is given if the individual task is completed in full, the student has shown a high level of independence and a creative approach to its implementation.

The mark "good" (5-7 points) is given if the individual task is completed in full, there are some shortcomings in the design of the presented material.

The mark "satisfactory" (3-4 points) is given if the task as a whole is completed, but there are shortcomings in the implementation of individual sections (parts) of the task during practice, there are comments on the design of the collected material.

The mark "unsatisfactory" (1-2 points) is given if the task is completed only partially, there are numerous comments on the design of the collected material.

Форма отчета о прохождении практики

ОТЧЕТ **о прохождении производственной практики– научно-исследовательской работы** **_____семестр, ____/____ учебный год**	
ФИО обучающегося	
Физтех-школа, группа	
Место прохождения практики	
Задание на практику	
Отчет (проделанная работа и полученные результаты)	
Отзыв руководителя о работе обучающегося	
Оценка руководителя за работу обучающегося	

Обучающийся _____ дата составления отчета _____

Контактный телефон: 8-9__-___-__-__

Научный руководитель _____ /_____/

Контактный телефон: 8-9__-___-__-__ e-mail:

Зав. кафедрой _____ /_____/