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

**Practice program**

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|---|---|
| **course:** | Project Session/Проектная сессия |
| **major:** | Biotechnology |
| **specialization:** | Biomedical Engineering/Биомедицинская инженерия |
| | Физтех-школа Биологической и Медицинской Физики |
| | Phystech School of Biological and Medical Physics |
| **term:** | 2 |
| **qualification:** | Bachelor |
| **type of practice:** | training |
| **practice method:** | |

Semester, form of interim assessment: 4 (spring) - Pass/fail exam

Author of the program:     A.Y. Kuksin, candidate of physics and mathematical sciences

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

**Annotation**

The practice of obtaining primary professional skills and abilities is an integral part of the educational process, designed to ensure a close connection between scientific-theoretical and practical training, to give students an initial experience of practical activity in accordance with the profile of the program.

## 1. General characteristics of practice

### Purpose of the course

- obtaining primary professional skills and professional experience. The practice is carried out with the aim of practical training of students and is aimed at acquainting students with modern trends in the development of biology (mathematics, computer science) and its applications in various fields, acquisition of new knowledge and primary skills, practical skills and competencies for future professional research activities in the profile of the educational program, consolidation and deepening of the theoretical training of students. This goal is realized through acquaintance with the topics and methods of theoretical and experimental research in biology in the basic organizations of the institute.

### Purpose of practice

– Acquaintance of students with the structure, scientific directions of the organization, the unit that is the place of internship;

– acquaintance with the forms of scientific activity of the organization, division, the study of methods of research work;

– acquaintance with the peculiarities of collective work in the field of scientific activity;

– selection of the direction of research work.

**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 |
|---|---|
| UC-2 Determine the range of tasks for the set goal and choose the best way(s) to solve them, based on current legal regulations, available resources, and constraints | UC-2.1 Determine a set of interrelated tasks required to achieve the current objective, define the expected results of these tasks |
| | UC-2.2 Work out a solution to a specific task within a project, selecting the best way(s) to solve it, based on current legal regulations, available resources, and constraints |
| Pro.C-1 Plan and conduct scientific experiments (in a selected subject area) and/or theoretical (analytical and simulation) research | Pro.C-1.1 Understand the fundamental concepts, laws, and theories of modern physics and biology |
| | Pro.C-1.2 Gain in-depth knowledge and understanding of mathematical disciplines |
| | Pro.C-1.3 Proficiency in methods of observation, description, identiflcation and scientific classification of biological objects |
| | Pro.C-1.4 Set scientific objectives and build models of biotechnological objects and systems |
| | Pro.C-1.5 Build mathematical models used to describe and research various processes and phenomena in relevant scientific fields |
| | Pro.C-1.6 Safely use modern scientific tools and other experimental equipment |
| | Pro.C-1.7 Follow the basic rules of conduct in a modern scientific laboratory |
| | Pro.C-1.8 Estimate the time and resources required to conduct a scientific experiment |
| | Pro.C-1.9 Use modern programming languages and software packages for scientific calculations |

| | Pro.C-1.10 Apply knowledge of leading scientific journals to select relevant publications in professional settings |
|---|---|
| | Pro.C-1.11 Conducts experimental research with cells and cell cultures, conduct physical and chemical study of macromolecules, analyze and study life systems, apply mathematical methods to process biological research outcomes, understand and apply the basic concepts of bioengineering |
| Pro.C-2 Analyze research data and make scientific conclusions | Pro.C-2.1 Adopt methods of statistical process and scientific data analysis |
| | Pro.C-2.2 Define key parameters of the studied phenomenon and make relevant numerical estimates |
| | Pro.C-2.3 Make scientific claims with supporting evidence for a professional audience in verbal and written form, state scientific problems and propose solutions |
| Pro.C-3 Select the necessary devices, tools, and research methods for problem-solving in a selected subject area | Pro.C-3.1 Apply functional principles and operating ranges of scientific equipment |
| | Pro.C-3.2 Apply theory to evaluate the accuracy of analytical calculations |
| | Pro.C-3.3 Estimate the accuracy of numerical methods used on a computer, learn the computational complexity of the applied algorithms and the number of required computing resources |

## 3. List of the planned results of the practice

As a result of studying the course the student should:

know:

- To have an idea of the content of scientific activity, of modern research in the field corresponding to the profile of the educational program;
- Peculiarities of theoretical and experimental methods of scientific research in the field corresponding to the profile of the educational program;
- Principles of organizing experiments and tests;
- The principles of formalizing the results of research work.

be able to:

- Apply modern methods of data collection and processing;
- conduct a review of the available material to solve the problem;
- to build activities on the basis of meeting technological requirements and standards, to adhere to legal and ethical standards adopted in professional activities;
- to draw up and present the results of the work performed.

master:

– the skills of searching and analyzing scientific and technical information in the field corresponding to the profile of the educational program.

## 4. Practice content
### 4.1. Main stages of practice

| № | Practice stage content | Labor intensity (hours), including independent work |
|---|---|---|
| | 4 semester | |
| 1 | Preparatory stage | 120 |
| 2 | Exploratory and search stage | 120 |
| 3 | The final stage | 120 |
| Total AH in 4 semester | | 360 |
| AH in total | | 360 |

### 4.2. Work content

Semester: 4 (Spring)

1. Preparatory stage

Conducting safety briefing, familiarizing students with internal regulations. Drawing up an internship plan.

2. Exploratory and search stage

Acquaintance with the structure of the organization, the unit - the place of internship, scientific directions, laboratory equipment, methods of organizing work in a research team (including when performing joint scientific work), applied research methods, justifications for choosing a research method (including economic ones). Study of scientific, periodical (including foreign) literature, electronic databases on the selected research. Preparation of an analytical review.

3. The final stage

Preparation of a report on practice based on the results obtained, presentation at a scientific seminar / meeting of the department.

## 4.3. Practice supervision

The practice is managed by an appointed student leader, whose responsibilities include:
– Scientific and educational-methodical guidance of the student's work during the period of practice;
– Provision of assistance to students in the development and implementation of an internship plan;
– Conducting consultations;
– Control over the implementation of the plan for passing the internship;
– Checking the reporting documentation on the implementation of the internship program.
Based on the results of the internship, the leader gives the student a grade.
Discussion of the results of the practice is carried out at the department that prepares students.

## 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.

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

Main literature
Provided at the base department:
1. Flint V. E. Birds of European Russia. Field guide; M .: "Algorithm", 2000
2. Avilova K.V., Zubakin V.A., Mosalov Birds of the Moscow Region: a field guide. M .: Kolos, 2009
3. Kruskop S.V. Mammals of the Moscow Region M .: MGSYUN, 2000.
4. Chertoprud M.V., Chertoprud E.S. A Brief Key to Invertebrate Fresh Waters of the Center of European Russia M .: KMK Scientific Publishing Association, 2005
5. Kiseleva K.V., Mayorov S.R., Novikov V.S., Ed. prof. V. S. Novikova Flora of Central Russia: Atlas-Identifier: M., JSC "Fiton +" 2010

Additional literature
Provided at the base department:
1. Guidelines for the summer educational practice of biology students at the Zvenigorod biological station named after S.N. Skadovsky, Moscow: Publishing house of Moscow State University, 2004
2. MV Kozlov, Planning of Environmental Research: Theory and Practical Recommendations, Moscow: KMK, 2015

## 7. List of curricular resources for independent work on practice

Electronic library: https://zoomet.ru

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

Software: MS Office MSWindows XP.
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 head, 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 analysis and systematization of scientific and technical information. When completing an assignment in practice, the student must combine practical work in the unit at the place of internship 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. The result of the work should be a motivated choice of the direction of further research work. The internship ends with writing a report in accordance with Appendix 1 and passing the intermediate certification.

**Assessment funds for practice**

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| **Author:** | A.Y. Kuksin, candidate of physics and mathematical sciences |

# 1. Competencies formed during the process of studying the practice

| Code and the name of the competence | Competency indicators |
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| UC-2 Determine the range of tasks for the set goal and choose the best way(s) to solve them, based on current legal regulations, available resources, and constraints | UC-2.1 Determine a set of interrelated tasks required to achieve the current objective, define the expected results of these tasks |
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| | Pro.C-2.3 Make scientific claims with supporting evidence for a professional audience in verbal and written form, state scientific problems and propose solutions |
| Pro.C-3 Select the necessary devices, tools, and research methods for problem-solving in a selected subject area | Pro.C-3.1 Apply functional principles and operating ranges of scientific equipment |
| | Pro.C-3.2 Apply theory to evaluate the accuracy of analytical calculations |
| | Pro.C-3.3 Estimate the accuracy of numerical methods used on a computer, learn the computational complexity of the applied algorithms and the number of required computing resources |

# 2. Competency assessment indicators

As a result of studying the course the student should:

**know:**

- To have an idea of the content of scientific activity, of modern research in the field corresponding to the profile of the educational program;
- Peculiarities of theoretical and experimental methods of scientific research in the field corresponding to the profile of the educational program;
- Principles of organizing experiments and tests;
- The principles of formalizing the results of research work.

**be able to:**
- Apply modern methods of data collection and processing;
- conduct a review of the available material to solve the problem;
- to build activities on the basis of meeting technological requirements and standards, to adhere to legal and ethical standards adopted in professional activities;
- to draw up and present the results of the work performed.

**master:**
– the skills of searching and analyzing scientific and technical information in the field corresponding to the profile of the educational program.

## 3. Student practice reporting

During the period of internship, the student is obliged to:
- Completely complete the internship program, submit a report on the internship;
- follow the instructions of the head of the practice;
- be responsible for the work performed and its results.

The practice report is drawn up at the final stage of the practice. The report must reflect all the activities that were performed by the student. The report should contain information about the specific work performed, the conclusions obtained during the internship.

The mark for the internship (passed / not credited) is given to the student by the head of the internship based on the results of the test carried out in the form of an interview and the student's report on the results of the internship.

Evaluation criteria:

"Passed" is given to the student if the report on the practice is prepared on time, it contains a fairly complete description of the content of the work performed in practice; on the basis of the report, it can be concluded that the internship program has been completed in full; the report is executed competently and neatly.

"Not passed" is given to the student if the report on the practice was prepared out of time, with a delay, it contains incomplete information about the work performed in practice; the report does not correspond to the work plan in practice; the report is executed illiterately, inaccurately.