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:	Research Practice/Научно-исследовательская практика
major:	Biotechnology
specialization:	Biomedical Engineering/Биомедицинская инженерия Физтех-школа Биологической и Медицинской Физики Phystech School of Biological and Medical Physics
term:	1
qualification:	Bachelor
type of practice:	training
practice method:	

Semester, form of interim assessment: 2 (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 provide a close connection between scientific and theoretical and practical training, to give students an initial practical experience 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
Gen.Pro.C-1 Apply knowledge of mathematical, physical, chemical, biological laws, patterns, and interrelation to study, analyze, and utilize biological objects and processes	Gen.Pro.C-1.1 Analyze the task in hand, outline the ways to complete it
	Gen.Pro.C-1.2 Build mathematical models, make quantitative measurements and estimates
	Gen.Pro.C-1.3 Determine the applicability limits of the obtained results
Gen.Pro.C-2 Use modern IT and software tools to perform professional tasks in compliance with information security requirements	Gen.Pro.C-2.1 Apply modern computing tools and Internet services in professional settings
	Gen.Pro.C-2.2 Apply numerical mathematical methods and use software applications for scientific problem-solving in professional settings
	Gen.Pro.C-2.3 Fulfill basic information security requirements
Gen.Pro.C-3 Write scientific and/or technical (technological, innovative) reports (publications, projects)	Gen.Pro.C-3.1 Adopt the general criteria for submission of manuscripts, scientific and technical documentation, using relevant software applications
	Gen.Pro.C-3.2 Employ practical methodologies for preparing scientific and technical reports (projects)
	Gen.Pro.C-3.3 Visually and graphically present scientific (scientific and technical, innovative technological) outcomes in the form of reports, scientific publications
Gen.Pro.C-4 Collect and process scientific and technical and/or technological data for fundamental and applied problem-solving	Gen.Pro.C-4.1 Apply scientific research and intellectual analysis methods for professional problem-solving
	Gen.Pro.C-4.2 Search for primary sources of scientific and technical and/or technological information in professional settings
	Gen.Pro.C-4.3 Prepare abstracts, reports, bibliographies, and reviews of information in professional settings

	Gen.Pro.C-4.4 Use computer and network skills to obtain, store, and process scientific (technical, technological) information
Gen.Pro.C-5 Participate in fundamental and applied research and development activities; independently develop new theoretical research methods (including mathematical research methods)	Gen.Pro.C-5.1 Perform tasks in the field of theoretical and experimental research and development activities
	Gen.Pro.C-5.2 Apply new knowledge through the study of literature, scientific articles, and other sources
Gen.Pro.C-6 Operate technological equipment, manage biotechnological processes, design technical and technological systems, technical facilities, biotechnological production processes by applying basic engineering and technological knowledge	Gen.Pro.C-6.1 Professionally operate modern experimental scientific research (measuring and analytical, technological) equipment in biotechnological research
	Gen.Pro.C-6.2 Evaluate, analyze, and interpret biotechnological data
	Gen.Pro.C-6.3 Possession of the skills to design new technological solutions for the scientific, technical, biotechnological task at hand
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, identifIcation 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

Pro.C-4 Critically assess the applicability of applied methods and techniques	Pro.C-4.1 Apply the numerical order of values in respective professional settings
	Pro.C-4.2 Understand the causes of measurement errors and inaccuracies, estimate them, verify the validity of experimental results
	Pro.C-4.3 Provide evidence to support the cause-effect relationship of applied concepts and models

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;
– principles of formalizing the results of research work;
– to have an idea of the economic component of scientific research.

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, 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
2 semester		
1	Preparatory stage	135
2	Exploratory and search stage	135
3	The final stage	135
Total AH in 2 semester		405
AH in total		405

4.2. Work content

Semester: 2 (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

1. Novikov, YN Preparation and defense of bachelor's work, master's thesis, diploma project [Electronic resource]: textbook. allowance / Yu. N. Novikov. - 4th ed., Stereotype. - SPb .: Lan, 2019.

Additional literature

1. Meilikhov, EZ The art of writing scientific articles [Electronic resource]: scientific-practical. leadership / EZ Meilikhov. - Dolgoprudny: Intellect, 2018

7. List of curricular resources for independent work on practice

1. Questel Orbit https://www.orbit.com/ - unites about 100 databases intended for specialists in the field of patent science and a wide range of researchers. FamPat's main patent database contains data from 95 patent offices from all regions of the world; patents are grouped thematically into families.
2. Inspec Analytics - analytical module of the Inspec database https://inspec-analytics-app.theiet.org/. Inspec Analytics allows you to visualize search results, compare the results obtained at the level of institutions, authors, topics by the number of publications.
3. Sage journals - More than 100 journals are available in full text mode in the natural sciences, engineering and medicine.
https://journals.sagepub.com/action/doSearch?filterOption=allJournal&AllField=research&content=journalTitle&target=titleSearch&pageSize=100&startPage=0
4. Taylor & Francis journals - over 2000 journals in all areas of expertise. The journals are divided into collections in STM Sciences (Science, Technology & Medicine) and HSS (Humanities & Social Sciences), as well as narrower, specific areas of expertise.
https://www.tandfonline.com/action/doSearch?AllField=research&startPage=&target=titleSearch&content=title
5. Wiley online library - the largest library of electronic resources in various fields. The Wiley Journal Foundation contains over 4 million articles from 1,500 journals, covering the full spectrum of life sciences, life sciences, social sciences and humanities, including many cutting-edge research in their respective fields.
https://onlinelibrary.wiley.com/action/doSearch?AllField=science+research&startPage=&PubType=journal

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.

SUPPLEMENT

Assessment funds for practice

major:	Biotechnology
specialization:	Biomedical Engineering/Биомедицинская инженерия Физтех-школа Биологической и Медицинской Физики Phystech School of Biological and Medical Physics
term:	1
qualification:	Bachelor

Semester, form of interim assessment: 2 (spring) - Pass/fail exam

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
Gen.Pro.C-1 Apply knowledge of mathematical, physical, chemical, biological laws, patterns, and interrelation to study, analyze, and utilize biological objects and processes	Gen.Pro.C-1.1 Analyze the task in hand, outline the ways to complete it
	Gen.Pro.C-1.2 Build mathematical models, make quantitative measurements and estimates
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	Gen.Pro.C-6.2 Evaluate, analyze, and interpret biotechnological data
	Gen.Pro.C-6.3 Possession of the skills to design new technological solutions for the scientific, technical, biotechnological task at hand
	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, identifIcation 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

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	Pro.C-4.2 Understand the causes of measurement errors and inaccuracies, estimate them, verify the validity of experimental results
	Pro.C-4.3 Provide evidence to support the cause-effect relationship of applied concepts and models

2. Competency assessment indicators

As a result of studying the course the student should:

know:

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– 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;
– principles of formalizing the results of research work;
– to have an idea of the economic component of scientific research.

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, 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.

Приложение 1

Форма отчета о прохождении практики

ОТЧЕТ **о прохождении учебной практики – практика по получению первичных профессиональных умений и навыков** **7 семестр, ____/____ учебный год**	
ФИО обучающегося	
Физтех-школа, группа	
Место прохождения практики	
Задание на практику	Ознакомиться со структурой, научными направлениями организации, подразделения, являющихся местом прохождения практики. Ознакомиться с формами научной деятельности организации, подразделения, изучение методик научно-исследовательской работы. Ознакомиться с особенностями коллективного труда в сфере научной деятельности (на примере организации, подразделения, являющихся местом прохождения практики). Осуществить выбор направления научно-исследовательской работы.
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 _____ /_____/