Approved by the decision
of the MIPT Academic Council
dated May 26, 2022
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**Federal State Autonomous Educational Institution of Higher Education "Moscow Institute of Physics and Technology
(National Research University)"**

**THE MAIN EDUCATIONAL PROGRAM
OF HIGHER EDUCATION**

**Level of higher education
MASTER**

**Domain of study
19.04.01 BIOTECHNOLOGY**

**Orientation (specialty)
MEDICAL BIOTECHNOLOGY/МЕДИЦИНСКАЯ
БИОТЕХНОЛОГИЯ**

**Starting year of the educational program
2022 y.**

The main educational program of higher education in the field domain of study 19.04.01 Biotechnology, orientation (specialty) Medical Biotechnology/Медицинская биотехнология, implemented at MIPT, is a set of basic characteristics of education (volume, content, planned results), organizational and pedagogical conditions, forms of certification, which is presented as a general characteristic of the educational program, curriculum, academic calendar schedule, work programs of disciplines (modules), training programs, evaluation and methodological materials. The main educational program of higher education has been created on the basis of the educational standard domain of study 19.04.01 Biotechnology, independently developed and approved by MIPT.

1. General characteristics of the educational program
Qualifications awarded to graduate: master.
Form of education: full-time
Education period: 2 years.
The educational program consists of 120 credits and includes all types of student's classroom and independent work, training, time, allotted for quality control of the mastering of the educational program by the student.
The contact work of students with teachers consists of, at least, 1 227 hours.
Program implementation language: english.
Using a network form of educational program implementation: no.
Program goal:

The program is developed for training specialists who are ready to carry out research and project activities in the field of biomedicine and biophysics, molecular and cell biomedical technologies. Students receive results in the following fields of expertise: research, production and use of enzymes, viruses, diseases, animal and cell cultures, products of their biosynthesis and genetic engineering.

2. Characteristics of the professional activity of graduates:
Fields of professional activity and areas of professional activity,
in which graduates, who have mastered the master's program, can carry out professional activities:

40 Cross-cutting types of professional activity in manufacturing (in the field of fundamental and applied research, innovation and experimental design, as well as in the development and implementation of new technological processes for the production of promising biomaterials).

Graduates can carry out professional activities in other fields of professional activity and (or) areas of professional activity, provided that their level of education and acquired competencies meet the requirements of the employee's qualification.

Types of tasks of professional activity of graduates:
research.

Tasks of professional activity of graduates:
analysis of biotechnological process indicators in conformity with scientific developments and development of research programs, evaluation and analysis of the results obtained;

consolidation of the obtained data, independent formation of conclusions and preparation of scientific and analytical reports, publications and presentations of the results of scientific and analytical research, qualified transfer of the results of scientific and analytical research to related subject areas;

planning and conducting scientific work and analytical research in accordance with the approved direction of research in the subject area of specialization;

planning and development of new algorithms and computer programs for research and applied purposes;

planning and development of new methods and technical means for fundamental research and innovative developments;

selection, processing and analysis of scientific, technical and patent information on the subject of research using specialized databases with information technology;

search and development of new effective ways to obtain biotechnological products, creation of modern biotechnologies, including nanobiotechnologies, genetic technologies, cell technologies;

creation of new methods (genetic, cellular, biotechnological), technical means, algorithms and computer programs for research and applied purposes;

experimental study of biological and physico-chemical kinetics at all stages of the technological process and their mathematical description.

Objects of professional activity of graduates, mastered the program Master's:

biomass, installations and equipment for biotechnological processes;

microorganisms, cell cultures of animals and plants, viruses, enzymes, biologically active chemicals;

models, methods and means of fundamental and applied research and development in the field of mathematics, biotechnologies, biophysics and other natural and social sciences according to the training profile in science, engineering, technology, as well as in the areas of knowledge-based industries, management and business;

objects of biotechnological production;

devices and equipment for studying the properties of used microorganisms, cell cultures obtained in laboratory and industrial conditions.

 3. List of professional standard, corresponding to the professional
activities of graduates:

40.011 Research and Development Specialist.

Code and name of the professional standard	Generalized labor functions			Labor functions		
	code	name	level of qualification	name	code	level of qualification
40.011 Professional standard "Research and Development Specialist"	B	Conducting research and development in the study of independent topics	6	Leading a group of workers in the study of independent topics	B/03.6	6
				Conducting work on the processing and analysis of scientific and technical information and research results	B/02.6	6
	D	Implementation of scientific leadership in the relevant field of knowledge	7	Formation of new areas of R&D work	D/01.7	7
				Defining the scope of application of the results of R&D work	D/04.7	7

4. Requirements for the results of mastering the educational program

As a result of mastering the main educational program, the graduate should form universal, general professional and professional competencies.

Universal competencies of graduates and indicators of their achievement:

Code and name of competence	Code and name of the indicator of competence achievement
UC-1 Use a systematic approach to critically analyze a problem and develop an action plan	UC-1.1 Systematically analyze the problem situation, identify its components and the relations between them UC-1.2 Search for solutions by using available sources UC-1.3 Develop a step-by-step strategy for achieving a goal, foresee the result of each step, evaluate the overall impact on the planned activity and its participants
UC-2 Manage all stages of a research project	UC-2.1 Set an objective within a defined scientific problem; formulate the agenda, relevance, significance (scientific, practical, methodological, or other, depending on the project type), forecast the expected results and possible areas of their application UC-2.2 Forecast the project outcomes, plan necessary steps to achieve the outcomes, chart the project schedule and monitoring plan UC-2.3 Organize and coordinate the work of project stakeholders, provide the team with necessary resources UC-2.4 Publicly present the project results (or results of its stages) via reports, articles, presentations at scientific conferences, seminars, and similar events
UC-3 Organize and manage a team, and develop the team strategy to achieve the objectives	UC-3.1 Organize and coordinate the work of the project stakeholders and help resolve disputes and conflicts UC-3.2 Consider the interests, specific behavior, and diversity of opinions of team members/colleagues/counterparties UC-3.3 Foresee the results (consequences) of both individual and collective actions UC-3.4 Plan teamwork, distribute tasks to team members, hold discussions of different ideas and opinions

UC-4 Use modern communication tools in the academic and professional fields, including those in a foreign language	UC-4.1 Exchange business information in oral and written forms in Russian and at least one foreign language UC-4.2 Use the acquired skills to write, translate, and edit various academic texts (abstracts, essays, reviews, articles, etc.) UC-4.3 Present the results of academic and professional activities in various academic events, including international conferences UC-4.4 Use modern ICT tools for academic and professional collaboration
UC-5 Analyze and consider cultural diversity in intercultural interactions	UC-5.1 Identify specific philosophical and scientific traditions in major world cultures UC-5.2 Define the theoretical and practical significance of cultural and linguistic factors within various interrelated philosophical and scientific traditions
UC-6 Determine priorities and ways to improve performance through self-assessment	UC-6.2 Evaluate performance results in correlation with the set objectives and applied methods

General professional competencies of graduates and indicators of their achievement:

Code and name of competence	Code and name of the indicator of competence achievement
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 | |

Professional competencies of graduates and indicators of their achievement:

Code and name of competence	Code and name of the indicator of competence achievement	Basis (professional standarts, analysis of other requirements for graduates)
type of professional activity tasks: research		
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-1.1 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-1.2 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-1.3 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-1.4 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-1.5 Has the ability to create software tools and databases used in bioengineering and bioinformatics	Research and Development Specialist
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	Research and Development Specialist
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	Research and Development Specialist

5. Curriculum

The curriculum (Appendix 1) determines the list, labor input, sequence and distribution by periods of study of academic disciplines (modules), trainings, other types of educational activities, forms of intermediate and final certification of students. The labor input of the educational program is set in credit units.

The volume of compulsory part, excluding the volume of the state final attestation, is 51,67 persents percent of the total volume of the program.

The matrix of compliance of competencies with the disciplines of the curriculum is given in Appendix 2.

6. Academic calendar schedule

Academic calendar schedule (Appendix 3) shows the distribution of types of educational activities, periods of attestation of students and vacations by year of study (courses) and within each academic year. The academic calendar schedule of the educational program of higher education includes 92 4/6 weeks, of which there are 58 5/6 weeks of theoretical and practical training, 15 3/6 weeks of the credit-examination period, 3 1/6weeks of the state final certification and 15 1/6 weeks of holidays.

7. Work programs of disciplines (modules)

Work programs of disciplines (modules), including evaluation materials for ongoing monitoring of progress and intermediate certification, are presented in Appendix 4.

8. Practice programs

The educational program provides for the following trainings:

Personal Research Project/Научно-исследовательская работа: practical training.

Work programs of trainings, including assessment materials for ongoing monitoring of progress and intermediate certification are presented in Appendix 5.

9. Program of the state final certification

As part of the state final certification, the following are provided:

Performance of and Defence of Graduation Thesis/Выполнение и защита выпускной квалификационной работы.

The program of the state final certification (Appendix 6) includes requirements for final qualifying works (volume, structure, design, presentation), the procedure for their implementation, the procedure for defending the final qualifying work, criteria for evaluating the results.

10. Material and technical, educational and methodological support of the educational program

Work programs of disciplines (modules), trainings determine the material and technical, educational and methodological support of the educational program, including a list of licensed and freely distributed software, a list of electronic educational publications and (or) printed publications, electronic educational resources, a list and composition of modern professional databases and information reference systems.

Classrooms for conducting learning sessions provided for by the educational program feature equipment and technical teaching aids, the composition of which is determined in the work programs of disciplines (modules) and trainings.

Premises for independent work of students are equipped with computers with Internet connection and are provided with access to the electronic information and educational environment of MIPT.

The MIPT electronic information and educational environment provides access to:

- Electronic library system (hereinafter – ELS):

Golden Fund of Scientific Classics ELS

University Online Library;

Book on Lime of University's Book House publishing house;

Doe publishing house ELS;
Urait publishing house ELS;
IBooks.ru publishing house ELS;
Information system "National Electronic Library" (NEL);
LLC Publishing House Fizmatkniga;
Znanium ELS;
books.mipt.ru ELS;
Litsenziat ELS;
Knowledge Lab ELS;
- international scientific journals and electronic databases:
ELS Doe Database
SPIE journals;
The Cambridge Crystallographic Data Centre Database;
Elsevier database;
Web of Science database;
abstract and scientometric database (citation index) Scopus;
American Chemical Society journals;
American Institute of Physics journals;
Optical Society of America database;
The Royal Society of Chemistry journals;
Sage Publications journals;
Taylor & Francis Group journals;
WILEY journals;
American Physical Society journals;
Cambridge University Press publishing house journals;
Institute of Electrical and Electronics Engineers database;
Institute of Physics journals;
MathSciNet abstract database;
Oxford University Press journals;
American Association for the Advancement of Science — AAAS journal;
Springer Nature E-Books database;
Questel patents database;
Annual Reviews journals.

When teaching the disciplines of the base departments, as well as having all types of practices, students use the material and technical support and literature of the base organizations, which consist of base departments involved in the educational process within the framework of this educational program.

11. Features of the educational program implementation for the disabled and persons with special needs

If there are persons with disabilities or persons with special needs among students, the educational program is adapted taking into account the special educational needs of such students.
When teaching according to an individual curriculum for people with disabilities, the period for mastering the educational program can be extended at their request by no more than one year compared to the period for obtaining education for the corresponding form of education.

12. Staff conditions for the implementation of the educational program

The teaching staff providing training in the major disciplines of the educational program are highly qualified specialists in the field of biophysics, molecular biology and biotechnology, practicing their professional activities at the Institute of general genetics of RAS, Federal scientific and clinical center, Institute of molecular biology of RAS, Institute of bioorganic chemistry of RAS.

The share of scientific and pedagogical staff (in teaching loads reduced to integer values) with an education corresponding to the profile of the discipline (module) being taught, in the total number of scientific and pedagogical staff implementing the Master's program is more than 70 persents.

The share of scientific and pedagogical staff (in teaching loads reduced to integer values) who have an academic degree (including an academic degree awarded abroad and recognized in the Russian Federation) and (or) an academic title (including an academic title obtained abroad and recognized in the Russian Federation), in the total number of scientific and pedagogical staff implementing the Master's program, is more than 60 persents.

The share of scientific and pedagogical staff (in teaching loads reduced to integer values) from the number of managers and employees whose activities are related to the orientation (specialty) of the ongoing Master's program (having work experience in this professional field for more than 3 years) in the total number of employees implementing the master's program is more than 5 persents.

The general management of the scientific content of the master's program is carried out by the Doctor of Biological Sciences, Full Professor, Kuprash Dmitriy Vladimirovich, who carries out independent research projects and participates in the implementation of such projects in the field of study, who has annual publications based on the results of this research activity in leading Russian and international peer-reviewed scientific journals and publications, as well as carrying out annual approbation of the results of this research activity at national and international conferences.

Kuprash's scientific achievements are recognized by a scholarship for young scientists of the European Academy, a scholarship for young scientists of the Russian Biochemical Society, international scholarships International Cancer Research Technology Transfer Award (ICRETT) and American Cancer Society International Fellowship for Beginning Investigators (ACSBI) from the International Union Against Cancer (UICC). He worked on UICC projects in the USA while also working on immunology projects supported by internal NIH grants. While working in the US, he led a research group for the development of mouse models with targeted modifications of cytokine genes. The two mouse models developed by the group have been deposited with the Jakson Laboratories Resource Center: https://www.jax.org/search?q=kuprash. In 2016 he was awarded the title of Professor of the Russian Academy of Sciences and Corresponding Member of the Russian Academy of Sciences.

13. Information about the departments involved in the implementation of the educational program

Center for educational programs in bioinformatics: analyst, Golenkova Anna Nikolaevna, analyst. The Center for Educational Programs has brought together a set of various programs and areas, teachers have different competencies, disciplines are taught by practitioners in various fields, and student enrollment is increasing every year. Students learn to process and analyze large amounts of information about biological objects, both currently available and that which will become available in the near future, taking into account the tendency for the exponential growth of this data. They will also study how molecular diagnostic methods are developed and new drug targets are selected.