

Abstract
of Bachelor's Degree Program
in Field of Education 19.03.01 Biotechnology,
Discipline (Specialization) "Biotechnology"
(Internal Study Mode)

Terms, Workload of the Degree Program and Qualification of Graduates

Name	Qualification	Term of education including the holidays provided after the completion of the State Final Certification	Workload (in credits)
Bachelor's degree program	Bachelor	4 years	240

Purpose (Mission) of the Degree Program

The mission of the bachelor's degree program in "Biotechnology" is comprehensive and qualitative training of competitive and high-skilled specialists capable for creative solving of theoretical and practical tasks of the professional activity in current conditions based on the development of knowledge, abilities and skills necessary for a future specialist in the field of biotechnology when combined with the requirements of advanced innovative technologies, as well as demands of Russian and regional labor markets promoting social mobility of the graduate. The admission to the bachelor's degree program "Biotechnology" promotes the participation of students in scientific projects of the university, disclosure of creative abilities, formation of an educated and harmoniously developed personality, modeling of current conditions for the training of high-skilled specialists who are able to effectively, using fundamental sciences, applied knowledge, innovative and IT solutions, carry out professional activities in the field of biotechnology and technology for obtaining products using microbiological synthesis, biocatalysis, genetic engineering and nanobiotechnology, and provides a high level of employment of graduates.

The degree program is aimed at the implementation of the following principles, namely: application of the education results in professional practices; professional activities based on the continuous development of biotechnologies; independent execution of tasks related to the development, production, quality control of biotechnology products, including medicinal products.

Demand for Graduates

Graduates of the bachelor's degree program "Biotechnology" are in demand with biotechnological and immunobiological enterprises, quality control departments of pharmaceutical enterprises, scientific laboratories of development of biopharmaceutical medicinal products, microbiological laboratories of analysis of biologically active supplements, cosmetics, foodstuffs and other laboratories carrying out microbiologic and biochemical analysis.

Requirements for Enrollment in the Degree Program

The persons with at least general secondary education who have passed entrance examinations in accordance with the Regulations for Admission to Higher Education Programs, namely bachelor's degree programs, specialist's and master's degree programs, are allowed for enrollment.

Graduate's Qualification Characteristic
Areas of Professional Activity

The area of the professional activity of graduates who have completed the bachelor's degree program includes:

- generation, research and application of ferments, viruses, microorganisms, animal and plant cell cultures, products of their biosynthesis and biotransformation;
- technologies for producing products with the use of microbiological synthesis, biocatalysis, genetic engineering and nanobiotechnologies;
- operation and quality management of biotechnological production units in compliance with the local and international regulatory acts;
- arrangement and performance of quality control of raw materials, intermediate products and finished products.

According to the register of professional standards (the list of types of professional activity approved by Order No. 667n of the Ministry of Labor of Russia dated 29.09.2014), the areas of professional activity and fields of professional activity which the graduates who have completed the bachelor's degree program (hereinafter referred to as graduates) can be engaged in include:

02 Healthcare (in the field of production of medicinal products, study of new medicinal products, validation of pharmaceutical manufacturing, quality control of raw materials and finished products of the pharmaceutical industry, pharmaceutical quality assurance);

26 Chemical, chemical engineering productions (in the field of quality control of raw materials, semi-finished and finished products, organization of biochemical production);

40 Cross-cutting types of professional activity in industry (in the field of quality management of production processes, products quality control).

Graduates can be engaged in professional activity in other areas and (or) fields of professional activity if their education level and acquired competences correspond to the employee's qualification.

Objects of Professional Activity

In accordance with the types of professional activity, the objects of professional activity of graduates of the bachelor's degree program "Biotechnology", are:

- microorganisms, animal and plant cell cultures, viruses, ferments, biologically active chemical substances;
- instruments and equipment for studying of properties of used microorganisms, cell cultures and substances obtained due to their use in laboratory and industrial conditions;
- installations and equipment for biotechnological processes;
- means of quality control of raw materials, semi-finished and finished products;
- means of condition assessment of the environment and its protection against the industrial production impact.

Types of Professional Activity

Types of professional activity which the graduates who have completed the bachelor's degree program are prepared for:

- scientific research;
- engineering and manufacturing;
- organization and management;
- project.

Tasks of Professional Activity

The graduate who has completed the bachelor's degree program according to the types of professional activity which the bachelor's degree program is aimed at, is ready to solve the following job tasks:

scientific research activities:

- study of scientific and technical information, literature and patent search according to the area of research;
- mathematical modeling of processes and objects based on standard computer-aided design packages;
- carrying out of experimental researches and tests according to a given methodology, mathematical processing of experimental data;
- participation in the implementation of results of researches and developments;
- data preparation for drawing up of reports, reviews, scientific publications;
- involvement in activities on intellectual property object protection;

engineering and manufacturing activities:

- management of individual stages of existing biotechnological production processes;
- arrangement of workplaces, their equipment, layout of the process equipment;
- control of compliance with process discipline;
- arrangement and carrying out of incoming control of raw materials and other materials;

- use of type methods of quality control of manufactured products;
- identification of causes of defects in production and development of measures to prevent and eliminate them;
- involvement in works on improving and completing the engineering processes in the course of preparation for production of new products;
- involvement in works on alignment, adjustment and experimental testing of equipment and software;
- check of the technical condition and residual life of the equipment, organization of preventive examinations and current repairs, drawing up of requests for equipment and spare parts, preparation of technical documentation for carrying out repair works;

organizational and managerial activities:

- development of operational work plans of primary production units;
- arrangement of performers' work;
- involvement in drawing up of technical documentation (work schedules, process instructions, safety instructions, requests for materials and equipment, business correspondence documents);
- acquisition and preparation of initial data for making and justifying the scientific and technical and organizational decisions based on the economic analysis;
- preparation of documentation and involvement in the implementation of the enterprise's quality management system;
- performance of works related to certification of technical means, systems, processes, equipment and materials;
- organization and implementation of measures to prevent work-related injuries, occupational diseases and environmental disruption;

project activities:

- acquisition of initial data for designing of engineering processes and process units;
- calculation and designing of separate stages of an engineering process using standard design automation facilities;
- participation in the development of project and operating technical documentation.

List of Professional Standards Corresponding to the Professional Activity of Graduates Who Have Completed the Degree Program

Item No.	Code of professional standard	Name of professional standard
02 Healthcare		
1	02.010	Specialist in industrial pharmacy in the field of research of medicinal products
2	02.011	Specialist in validation (qualification) of pharmaceutical manufacturing
3	02.013	Specialist in industrial pharmacy in the field of quality control of medicinal products
4	02.014	Specialist in industrial pharmacy in the field of quality assurance of medicinal products
5	02.016	Specialist in industrial pharmacy in the field of production of medicinal products
26 Chemical, chemical engineering productions		
6	26.009	Technology specialist for production of washing and cleaning products using the biotechnological method
7	26.013	Specialist in quality control of biotechnological production of agents for plant industry
40 Cross-cutting types of professional activity in industry		
8	40.010	Products quality control specialist

9	40.011	Specialist in research and technological development
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General Characteristic of the Degree Program

Planned results of completing of the degree program (competences) and indicators of their achievement

In accordance with the aims of the degree program and types of tasks of the professional activity, the graduate of the bachelor's degree program "Biotechnology" shall have the following competences characterized by the indicators of their achievement

Codes	Competences, indicators of competence achievement
GCC-1	Ability to use the basics of philosophy in order to form the world view
GCC-1.1	Builds their own world view in respect of socio-humanitarian problems and makes their own value choice based on the comprehension of philosophical and scientific world view.
GCC-1.2	Uses positions and categories of philosophy to assess and analyze various social trends, facts and phenomena; builds and reasonably maintains their own position to various problems in terms of philosophy.
GCC-2	Ability to analyze main phases and regularities of historical development of the society in order to form the civic position
GCC-2.1	Interprets history of Russia in the context of world historical development
GCC-2.2	Applies knowledge on main phases and regularities of historical development of the society in order to form the civic position
GCC-3	Ability to use basics of economic knowledge in various fields of activities
GCC-3.1	Makes decisions on personal financial management based on knowledge of basic categories and concepts of market economy, regularities of behavior of different economic entities in the context of limited resources
GCC-3.2	Participates in the implementation of economic activities of the unit, considering the theoretical basis of business activities based on knowledge of economic patterns and relations
GCC-4	Ability to use basics of legal knowledge in various fields of activities
GCC-4.1	Able to be involved in social interaction with due regard to knowledge of their rights and obligations and regulatory legal acts regulating the relations between individuals
GCC-4.2	Able to be involved in professional interaction with due regard to knowledge of their rights and obligations and regulatory legal acts regulating the relations between individuals and legal entities
GCC-5	Ability to communicate in oral and written form in Russian and in a foreign language to solve tasks of interpersonal and inter-cultural collaboration
GCC-5.1	Chooses the style of communicating in Russian depending on the goal and conditions of partnership; adapts speech and communication style to the situations of interaction
GCC-5.2	Maintains business correspondence in Russian, given the stylistics features of formal and informal letters;
GCC-5.3	Translates official and professional texts from a foreign language into Russian and from Russian into a foreign language for personal advantage;
GCC-5.4	Makes a public appearance with a speech of results of their activities in Russian and (or) in a foreign language, builds their speech so as to meet the audience and the purpose of communication, can support the conversation during the discussion of the results.
GCC-6	Ability to work in a team, perceive social and cultural differences in a non-judgmental manner
GCC-6.1	When playing their role in social interaction and teamwork, takes into account the particularities of behavior and interests of other members

GCC-6.2	Overcomes communication barriers in inter-cultural collaboration
GCC-6.3	Analyzes possible consequences of personal actions in social interaction and teamwork and makes productive interaction
GCC-7	Ability to self-organization and self-education
GCC-7.1	Uses time management tools and techniques when performing specific tasks, implementing specific projects, and achieving set goals
GCC-7.2	Sets the priorities of their activities, personal development and professional growth
GCC-7.3	Evaluates the labor market requirements and the educational service offering to build a professional growth path of their own
GCC-8	Ability to use methods and means of physical culture to provide full social and professional activities
GCC-8.1	Chooses health-saving technologies to ensure wellness management, given the physiological make-up and the conditions for implementation of professional activities
GCC-8.2	Schedules their work and free time for an optimal combination of physical load and mental burden as well as performance assurance
GCC-8.3	Follows healthy lifestyle standards in various life situations and professional activities
GCC-9	Readiness to use main methods of protection of production personnel and population against possible consequences of accidents, catastrophes, natural disasters
GCC-9.1	Explains the rules of conduct in case of natural and man-made emergencies
GCC-9.2	Administers first aid, describes the ways of being engaged in rehabilitation measures
GCC-9.3	Analyzes factors of harmful effect of parts of the environment (facilities, engineering processes, materials, buildings and structures, natural and social phenomena)
GPC-1	Ability to search, store, interpret and analyze information from various sources and databases, present it in a required format with the use of information, computer and networking technologies
GPC-1.1	Applies knowledge in the field of selection of main sources of information, ways of structuring information in the network, main methods of analysis and consolidation of information for solving set tasks
GPC-1.2	Searches the specified information through key words using networks and automated databases, and critically analyzes the obtained information
GPC-1.3	Presents obtained information in a form of summary reports and presentations
GPC-2	Ability and readiness to use main laws of sciences in the professional activity, apply methods of mathematical analysis and modeling, theoretic and experimental research
GPC-2.1	Uses main biological and biochemical regularities for solving job tasks
GPC-2.2	Handles experimental data using common techniques of numerical characteristics approximation
GPC-2.3	Uses basic knowledge in the field of mathematics, physics, chemistry in planning biology-oriented activities, including activities in biotechnology
GPC-2.4	Applies methods of mathematical analysis and modeling in the professional activity
GPC-3	ability to use knowledge of the modern physical world, spatial and temporal patterns, constitution of substances in order to comprehend the environment and natural phenomena
GPC-3.1	Uses knowledge of the modern physical world in order to comprehend the environment and natural phenomena

GPC-3.2	Interprets spatial and temporal patterns to determine the constitution of a substance
GPC-3.3	Applies knowledge of physical and chemical laws to describe the scientific world view
GPC-4	Ability to understand the meaning of information in the development of today's information society, awareness of danger and threat arising therein, ability to observe main requirements of information security, including official secrets protection
GPC-4.1	Understands the meaning of information in the development of today's information society
GPC-4.2	Works with common information media, makes an assessment of the software and perspectives of its use considering solvable job tasks
GPC-4.3	Meets information security standards in the professional activity
GPC-5	Knowledge of main methods, techniques and means of obtaining, storing and processing of information, PC skills as a means of information control
GPC-5.1	Uses main methods, techniques and means of obtaining, storing and processing of information
GPC-5.2	Carries out primary processing of scientific and scientific technical information in the field of professional direction using common data-processing methods
GPC-6	Knowledge of main methods of protection of production personnel and population against possible consequences of accidents, catastrophes, natural disasters
GPC-6.1	Identifies hazardous and harmful factors within the activity undertaken in laboratory and process conditions
GPC-6.2	Identifies problems related to the safety violations at the workplace in laboratory and process conditions, and suggests ways for their prevention and solution
PC-1	Ability to implement the engineering process according to the regulations and to use technical means for measuring main parameters of biotechnological processes, properties of raw materials and products
PC-1.1	Ready to implement the engineering process according to the regulations
PC-1.2	Uses technical means to measure main parameters of the engineering process
PC-1.3	Uses technical means and instruments to determine properties of raw materials, other materials, and products
PC-1.4	Performs material calculations in the course of engineering process
PC-1.5	Reasonably selects the instruments and equipment for measuring main parameters of the biotechnological process
PC-2	Ability to implement and manage biotechnological processes
PC-2.1	Reasonably selects equipment for implementation of the biotechnological process
PC-2.2	Able to take decisions on the implementation of the biotechnological process management system
PC-2.3	Implements biotechnological process according to the project and regulatory documentation
PC-3	Readiness to assess technical means and technologies taking into account the environmental consequences of their application
PC-3.1	Selects technical means and technologies taking into account the environmental consequences of their application
PC-3.2	Assesses process engineering solutions in terms of environmental safety
PC-4	Ability to ensure the observation of health and safety, industrial sanitation and fire safety regulations
PC-4.1	Applies health and safety, industrial sanitation and fire safety regulations in the production area
PC-4.2	Uses labor protection standards and parameters of production microclimate, level of dust and gas concentration, noise, and vibration, illumination of workplaces

PC-4.3	Follows requirements of production sanitary and biological safety for personnel training and preparation of production premises in accordance with the job tasks
PC-5	Ability to arrange the performers' work, find and make managerial decisions in the field of organization and rate setting of labor
PC-5.1	Has skills of collecting information on engineering process as the object of management
PC-5.2	Able to develop organizational chart of production as the object of management
PC-5.3	Ready to arrange work of the personnel of production units taking into account the particularities of interpersonal relations
PC-5.4	Takes managerial decisions in the field of organization and rate setting of labor
PC-6	Readiness to implement quality management systems of biotechnological products in accordance with the requirements of Russian and international quality standards
PC-6.1	Applies knowledge of main international and Russian regulatory documents to solve tasks in the field of quality management
PC-6.2	Implements the measures to improve quality of biotechnological medicinal products according to the requirements of quality standards
PC-6.3	Participates in the development of operating documentation in accordance with the requirements of Russian and international quality standards
PC-6.4	Ready to be involved in validation of the engineering process, qualification of the equipment and technical systems
PC-6.5	Ready to be involved in the organization of preparation of production premises and equipment, including personnel training according to the requirements of good manufacturing practice
PC-7	Ability to systematize and summarize information on the enterprise resources use
PC-7.1	Systematizes and summarizes information on the enterprise resources use
PC-7.2	Determines the valuation of main production resources
PC-7.3	Performs works on planning the provision of the enterprise with resources
PC-7.4	Put proposals on implementation of resource-saving technologies
PC-8	Ability to operate with scientific and technical information, to use Russian and international experience in the professional activities
PC-8.1	Knows methodology how to search scientific and technical information, knows principles of its systematization and analysis
PC-8.2	Analyzes and summarizes the obtained scientific and technical information, implements the results of Russian and international scientific researches into the practice of the production process
PC-8.3	Applies achievements of new technologies for solving job tasks
PC-9	Ability to conduct standard and certification tests of raw materials, finished products and engineering processes
PC-9.1	Uses knowledge of physical and chemical, biochemical and biological properties of raw materials, other materials, semi-finished and finished products to perform tests
PC-9.2	Carries out tests of raw materials, semi-finished and finished products for compliance with the requirements of the regulatory documentation
PC-9.3	Controls the conduct of engineering processes according to the regulatory documentation
PC-10	Knowledge of the experiment planning, processing and presentation of obtained results
PC-10.1	Plans the experimental research, sets goals and chooses the ways of their achievement
PC-10.2	Able to apply up-to-date mathematical tools to process research results in their professional field
PC-11	Readiness to use state-of-the-art IT solutions in their professional field, including databases and application program packages
PC-11.1	Applies knowledge of state-of-the-art IT solutions, software, including databases and application program packages, main methods of analysis of output data and optimization of software use to solve tasks of the professional activity

PC-11.2	Uses today's software, as well as databases and application program packages when solving engineering problems
PC-12	Ability to participate in the development of engineering projects within the authoring team
PC-12.1	Performs development of engineering projects using knowledge in the field of definitions, concepts, principles, phases and methodology of the development of modern engineering projects in biotechnological production.
PC-12.2	Able to reasonably select the method for production of biotechnological products, to draw up the process flow diagram within the authoring team
PC-12.3	Selects the main and auxiliary equipment to implement the engineering process based on the made material calculations
PC-12.4	Develops projects of layout arrangements of production areas considering the GMP, fire and biological safety requirements
PC-13	Readiness to use modern computer-aided design systems
PC-13.1	Selects computer-aided design programs based on knowledge on existing type programs, principles of applying standard programs, and main phases of computer-aided design
PC-13.2	Ready to use programs required for computer-aided design
PC-14	Ability to design engineering processes using automated systems of production planning within the authoring team
PC-14.1	Determines their role in the authoring team based on understanding of principles and design phases of engineering processes using automated systems of production planning
PC-14.2	Participates in designing of engineering processes using automated systems of production planning within the authoring team

Curriculum of Bachelor's Degree Program in "Biotechnology"
Mandatory part (name, workload, final discipline assessment)

1. Foreign Language – 6 credits (216 hours), in-class work – 70 hours, examination, pass-fail test
2. History – 3 credits (108 hours), in-class work – 38 hours, examination
3. Philosophy – 3 credits (108 hours), in-class work – 46 hours, examination
4. Economics – 3 credits (108 hours), in-class work – 42 hours, pass-fail test
5. Ecology – 3 credits (108 hours), in-class work – 42 hours, pass-fail test
6. Health and Wellness – 3 credits (108 hours), in-class work – 46 hours, examination
7. Mathematics – 8 credits (288 hours), in-class work – 108 hours, examination, pass-fail test
8. Basics of Probability Theory and Mathematical Statistics – 4 credits (144 hours), in-class work – 54 hours, graded test
9. Computer Science – 4 credits (144 hours), in-class work – 54 hours, examination
10. Physics – 9 credits (324 hours), in-class work – 124 hours, examination, pass-fail test
11. General and Inorganic Chemistry – 8 credits (288 hours), in-class work – 110 hours, examination, pass-fail test
12. Organic Chemistry – 9 credits (324 hours), in-class work – 124 hours, examination, pass-fail test
13. Physical Chemistry – 9 credits (324 hours), in-class work – 124 hours, examination, pass-fail test
14. Colloid Chemistry – 3 credits (108 hours), in-class work – 40 hours, examination, pass-fail test
15. Microbiology – 9 credits (324 hours), in-class work – 132 hours, examination, pass-fail test
16. Basics of Biochemistry and Molecular Biology – 9 credits (324 hours), in-class work – 131 hours, examination, pass-fail test
17. Applied Mechanics – 4 credits (144 hours), in-class work – 50 hours, examination
18. Processes and Apparatus of Biotechnology – 4 credits (144 hours), in-class work – 74 hours, examination
19. Physical Training and Sports – 2 credits (72 hours), in-class work – 26 hours, pass-fail test
20. Culture of Spoken Russian – 3 credits (108 hours), in-class work – 40 hours, pass-fail test

21. Culture Studies – 3 credits (108 hours), in-class work – 42 hours, pass-fail test
22. Conflict Resolution Studies – 3 credits (108 hours), in-class work – 42 hours, pass-fail test
23. Legal Studies – 2 credits (72 hours), in-class work – 26 hours, pass-fail test
24. Introduction to a Profession – 2 credits (72 hours), in-class work – 28 hours, pass-fail test
25. General Biology – 3 credits (108 hours), in-class work – 38 hours, examination
26. Basics of Genetics and Microbial Selection – 2 credits (72 hours), in-class work – 34 hours, pass-fail test
27. Professional Safety – 2 credits (72 hours), in-class work – 26 hours, pass-fail test

The part formed by participants of educational relations (name, workload, final discipline assessment)

28. Analytical Chemistry – 4 credits (144 hours), in-class work – 60 hours, examination
29. Machine Elements – 4 credits (144 hours), in-class work – 52 hours, examination
30. Basics of Biotechnology – 3 credits (108 hours), in-class work – 54 hours, pass-fail test
31. Mass Exchange Processes and Apparatus of Biotechnology – 5 credits (180 hours), in-class work – 88 hours, examination, course project
32. Physical and Chemical Methods of Analysis – 4 credits (144 hours), in-class work – 74 hours, examination
33. Electronics and Electrical Engineering – 3 credits (108 hours), in-class work – 40 hours, pass-fail test
34. Basics of Economics and Management of Biotechnological Pharmaceutical Enterprise – 4 credits (144 hours), in-class work – 52 hours, examination, course work
35. Technology of Cultivation of Producers of Biologically Active Substances – 3 credits (108 hours), in-class work – 52 hours, graded test
36. Equipment and Basics of Design of Biotechnological Production Units – 5 credits (180 hours), in-class work – 89 hours, examination, pass-fail test
37. Organization of Production According to GMP – 3 credits (108 hours), in-class work – 52 hours, pass-fail test
38. Bioengineering – 6 credits (216 hours), in-class work – 82 hours, examination
39. Basics of Industrial Aseptics – 3 credits (108 hours), in-class work – 54 hours, pass-fail test
40. Technology of Downstream of Biologically Active Substances – 7 credits (252 hours), in-class work – 124 hours, examination, pass-fail test, course project
41. Metrological Support of Biotechnological Production Units – 2 credits (72 hours), in-class work – 26 hours, pass-fail test
42. Biotechnological Process Management System – 3 credits (108 hours), in-class work – 40 hours, pass-fail test
43. Engineering Drawing – 3 credits (108 hours), in-class work – 40 hours, graded test
44. Basics of Computer-Aided Design of Equipment Parts – 2 credits (72 hours), in-class work – 26 hours, pass-fail test

Elective disciplines in physical training and sports (name, workload, final discipline assessment)

45. Elective Physical Training and Sports: General Physical Preparedness – 0 credits (328 hours), in-class work – 132 hours, pass-fail test
46. Elective Physical Training and Sports: Health-Improving Physical Activities – 0 credits (328 hours), in-class work – 132 hours, pass-fail test

Elective disciplines (name, workload, final discipline assessment)

47. Latin Language – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
48. Biochemical Basics of Immunity – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
49. 3D graphics in “COMPASS-GRAPHICS” system – 2 credits (72 hours), in-class work – 20 hours, pass-fail test
50. Numerical Methods – 2 credits (72 hours), in-class work – 20 hours, pass-fail test
51. Equipment for Mechanical Processes on Pharmaceutical Manufacturing – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
52. Dimensionless Parameters in Chemical Technologies – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
53. Modeling of Biotechnological Processes – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
54. Digital Devices for Measuring, Control and Management – 3 credits (108 hours), in-class work – 30 hours, pass-fail test

55. Basics of Mycology – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
56. Chemistry of Biologically Active Substances – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
57. Application of Capillary Electrophoresis and Chromatographic Procedures in Biotechnology – 2 credits (72 hours), in-class work – 20 hours, pass-fail test
58. Optical Methods in Physical Chemistry – 2 credits (72 hours), in-class work – 20 hours, pass-fail test
59. Basics of Pharmaceutical Marketing – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
60. Communication Psychology – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
61. Introduction to Pharmacology – 2 credits (72 hours), in-class work – 20 hours, pass-fail test
62. Viruses in Biotechnology and Medicine – 2 credits (72 hours), in-class work – 20 hours, pass-fail test
63. Nanomaterials in Biotechnology – 2 credits (72 hours), in-class work – 20 hours, pass-fail test
64. Engineering Enzymology – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
65. Biotechnology of Plant Cell Culture – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
66. Recombinant Protein Technology – 2 credits (72 hours), in-class work – 20 hours, pass-fail test
67. Biotransformation of Medicinal Substances – 2 credits (72 hours), in-class work – 20 hours, pass-fail test
68. Basics of Finished Medicinal Product Technology – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
69. Basics of Obtaining of Plant Cell Strain – 3 credits (108 hours), in-class work – 30 hours, pass-fail test

Optional subjects (name, workload, final discipline assessment)

70. Complex Loading Cases – 3 credits (108 hours), in-class work – 30 hours, pass-fail test
71. Basics of Industrial Safety in Pharmaceutical Production Units – 3 credits (108 hours), in-class work – 46 hours, pass-fail test

Practices (name, workload, final assessment)

72. Academic Practical Training, Practice in Obtaining Primary Professional Abilities and Skills, Including Primary Abilities and Skills of Research Activities – 3 credits (108 hours), in-class work – 48 hours, pass-fail test
73. Manufacturing Practice, Practice in Obtaining Professional Abilities and Experience of Professional Activities – 6 credits (216 hours), in-class work – 16 hours, graded test
74. Manufacturing Practice, Scientific Research Work – 3 credits (108 hours), in-class work – 8 hours, graded test
75. Pre-graduation Practice – 3 credits (108 hours), in-class work – 8 hours, graded test

State final certification

76. Presentation of Graduate Qualification Work – 9 credits (324 hours), in-class work – 4 hours, GQW presentation.

Resources Provision of the Degree Program

The bachelor's degree program in "Biotechnology" is provided with learning and teaching documentation, as well as materials in all disciplines (modules) and practices, including electronic educational-methodical complexes posted in electronic information and educational environment of the University.

The University has facilities and resources that are in compliance with applicable fire safety rules and regulations and ensure all types of the disciplinary and interdisciplinary preparation, practical and scientific research works of students, provided for by the curriculum.

The list of facilities and resources, learning and teaching support, required for implementation of the degree program, includes the following: special rooms in the form of classrooms for conducting lecture-type activities, seminar-type activities, course work development (course work execution), group and individual tutorials, current control and midterm assessment. There are also rooms for independent work and rooms for storage and preventative maintenance of training equipment. Special rooms are equipped with designated furniture and teaching aids intended for presentation of teaching information to a large audience. Laboratories are equipped with laboratory equipment depending on the degree of complexity. Sets of demonstration equipment and illustrative study guides providing for topic-based illustrations and corresponding to discipline (module) programs, working educational programs of disciplines (modules), are offered for lecture-type activities.

Rooms for students' independent work are equipped with computer hardware with the possibility of connecting to the Internet network and access to electronic information and educational environment of the organization. Furthermore, students' independent work is arranged with the use of electronic resources of the University.

The library fund is provided with the required number of printed publications, moreover, there is an access to electronic library systems.

The University has the necessary licensed software package the composition of which is given in working programs of disciplines (modules) and is subject to annual update.

The students are provided with an access (remote access), including in the event of doing electronic learning, applying distance learning technology, to today's professional databases and inquiry and communications systems the composition of which is determined in working programs of disciplines (modules) and is subject to annual update.

During the whole period of studying every student and a teacher are provided for with an unlimited access (including the remote one) to electronic library systems and to electronic information and educational environment of the University from any place with the available Internet connection.

Electronic information and educational environment of the University provides for:

- the access to curricula, working programs of disciplines (modules), practices, editions of electronic library systems and electronic learning resources specified in working programs;
- recording of progress of the educational process, results of midterm assessment and results of the degree program completion;
- the formation of electronic portfolio of the student, including the preservation of student's works and grades for these works by any participants of the educational process;
- interaction between participants of the educational process, as well as synchronous and (or) asynchronous communication via Internet.

Functioning of electronic information and educational environment complies with the requirements of the legislation of the Russian Federation in the field of education and is provided for with the relevant means of information and communication technologies and qualification of the University employees who use and maintain it.

Staffing of the Degree Program

Implementation of the bachelor's degree program is ensured by the University teaching staff, as well as by persons engaged in the implementation of the bachelor's degree program under the terms of the civil contract.

Qualification of the teaching staff meets the qualification requirements specified in qualification reference books and professional standards. At least 60 percent of the teaching staff who take part in the implementation of the bachelor's degree program and of persons engaged in the implementation of the bachelor's degree program carry out scientific, teaching and learning, and (or) practical work corresponding to the profile of disciplines (modules) being taught.

At least 5 percent of the University teaching staff, taking part in the implementation of the bachelor's degree program and of persons engaged in the implementation of the bachelor's degree program, are managers and (or) employees of other organizations who carry out labor activities in the professional sphere corresponding to the professional activities the graduates prepare for and who have work experience in this professional sphere of at least 3 years.

At least 60 percent of the teaching staff of the University, and of persons engaged in the implementation of the bachelor's degree program, have an academic degree and (or) rank.

Uniqueness and Competitive Advantages of the Degree Program

The distinctive feature of the degree program is forming of competences in the process of degree program mastering. These competences allow carrying out professional activities in the field of technology for obtaining biotechnological and immunobiotechnological medicinal products using microbiological synthesis, cellular and genetic engineering, biocatalysis, nanobiotechnologies. In the Russian pharmaceutical industry, there is an active process of technical and engineering re-equipment of production, as well as the creation of new production capacities for release of high-tech biotechnological medicinal products. Modern production base for release of medicinal products is being created, new and modernized enterprises are being equipped with innovative equipment for implementing biotechnological processes. Educational trajectories allowing for operative considering the modern requirements in the field of obtaining innovative biopharmaceutical medicinal products are formed in the bachelor's degree program. High priority is given to the comprehensive training of graduates in the field of biochemistry, microbiology, biotechnology and engineering disciplines, such as processes and apparatus of biotechnology, bioengineering, equipment and basics of design of biotechnological production units.

The degree program has been created in cooperation with employers – modern biopharmaceutical companies “Biocad”, “Geropharm” and others. The degree program disciplines being implemented take into account current scientific trends: development of a biomedical cell product scheme; development of plasmid designs; study of the techniques for assessment of the specific activity of a biotherapeutic medicinal product; implementation of the QbD concept in the development of biomedical products; ways to modify medicinal products using nanocarriers for possible use in medicine, cosmetology, pharmacy and other fields; methods for obtaining nanoclusters and nanostructures; obtaining medicinal products from various biological objects by purposefully adding additional information to their genetic material; disposable systems for up-stream processes in the production of recombinant therapeutic proteins; industrial production of virus vaccines using animal cell culture; biotechnology of hyperimmune serums and immunoglobulins; theory and practice of using membrane technologies for fractionation and concentration of biologically active substances, including immunobiopreparations and recombinant therapeutic proteins.

The content of the program represents the needs of today's labor market: graduates of the degree program in 19.03.01 “Biotechnology” are in demand with biotechnological and immunobiological enterprises, quality control departments of pharmaceutical enterprises, scientific laboratories of development of biopharmaceutical medicinal products, microbiological laboratories of analysis of biologically active supplements, cosmetics, foodstuffs and other laboratories carrying out microbiologic and biochemical analysis.

Active career guidance counseling involving employers is carried out with students within the educational process, this allows graduates to get involved in the work processes of organizations more quickly. As part of the discipline “Introduction to a Profession”, mandatory meetings with graduates who have successfully built their careers are held for first-year students in face-to-face or online formats. During the whole term of education, regular meetings with representatives of various biotechnological companies are held. Students in field of education 19.03.01 “Biotechnology” have the opportunity to become grant-aided students from “R-Pharm”, as well as undergo internship in the development departments of “Biocad”, “Geropharm”, FSUE Saint Petersburg Scientific Research Institute of Vaccines and Serums.