

Federal State Budgetary Educational Institution of Higher Education
"Privolzhsky Research Medical University"
Ministry of Health of the Russian Federation



APPROVED

Vice-Rector for Academic Affairs

E.S. Bogomolova

31 August 2021

WORKING PROGRAM

Name of the academic discipline: **BIOTECHNOLOGY**

Specialty: **33.05.01 PHARMACY**

Qualification: **PHARMACIST**

Department: **Pharmaceutical Chemistry and Pharmacognosy**

Mode of study: **full-time**

Labor intensity of the academic discipline: **144 academic hours**

Nizhny Novgorod
2021

The working program has been developed in accordance with the Federal State Educational Standard for the specialty 33.05.01 PHARMACY, approved by order of the Ministry of Science and Higher Education of the Russian Federation on March 27, 2018 N 219.

Developers of the working program:: V.K. Osmanov, Doctor of Chemistry, Associate Professor

The program was reviewed and approved at the department meeting (protocol No. 1 of 08/29/2021)

Head of the Department of Pharmaceutical Chemistry
and pharmacognosy, Ph.D.  / O.V. Zhukova /

29 August 2021

AGREED

Deputy Head of EMA ph.d. of biology  Lovtsova L.V.

29 August 2021

1.

1. GOALS AND OBJECTIVES OF THE DISCIPLINE

1.1 The purpose and objectives of mastering the academic discipline : participation forming the relevant competencies (UC-1, UC-2), general professional (GPC-1, GPC -3, GPC -6) and professional (PC-7) competencies; training of specialists with the necessary basic knowledge in the field of obtaining medicinal, preventive and diagnostic agents using biotechnology methods, as well as the formation of systemic knowledge among pharmacists on the circulation of biotechnological preparations.

1.2 Tasks of the disciplines - as a result of mastering the discipline, the student must:

Know:

- Basic terms and concepts of biotechnology.
- Modern biotechnological methods for obtaining drugs: genetic engineering, protein engineering, engineering enzymology.
- Production based on the vital activity of microorganisms and obtained as a result of biologically active substances.
- Technologies for the production of drugs based on the vital activity of microorganisms.
- The basic principles underlying modern methods for diagnosing diseases and analyzing drugs (enzymatic immunoassay, polymerase chain reaction, etc.).
- The device and principle of operation of modern laboratory and production biotechnological equipment.
- The main regulatory documents related to production, quality control, environmental safety, storage, international and domestic standards in relation to drugs obtained by biotechnological methods, as well as bio-objects - their producers.
- Major advances in modern biotechnology and bionanotechnology.
- Conditions for conducting a biotechnological process and its compliance with modern requirements for the organization of production.
- Methods for detection, selection, supporting selection and storage of industrial strains of biologically active substances producers.

Be able to:

- Calculate the required number of components for the preparation of nutrient media, select modes of sterilization of nutrient media and operation of equipment for continuous sterilization of nutrient media.
- Evaluate the parameters of biosynthesis in the fermenter (productivity, average rate of synthesis of the target product, yield of the target product from a given volume of culture liquid, etc.) and correct the process.
- Justify the choice of method and carry out the isolation of the target product from the culture fluid and biomass, carry out step-by-step control and

- standardization of the preparations obtained (for example, determining the activity of antibiotics, enzymatic activity, cell viability).
- Justify the need for and carry out immobilization of biological objects, evaluate the effectiveness of immobilization methods used in production.
 - Provide conditions for aseptic conduct of the biotechnological process and its compliance with modern requirements for the organization of production.
 - Substantiate the optimization of the biotechnological process.
 - Take into account the influence of biotechnological factors on the efficiency of the technological process and maintain optimal conditions for the biosynthesis of the target product.

Possess:

- Use the main ND (laboratory, pilot industrial regulations, etc.), scientific literature.
- Rules for calculating the optimal technological parameters of fermentation and their correction.
- The main methods and typical techniques for cultivating plant cells.
- Methods for the preparation and preparation of nutrient media for the cultivation of biological objects of bacterial, plant and animal nature.
- Methods of cultivation of biologically active substances producers on liquid, dense and loose nutrient media.
- The technique of carrying out all stages of immobilization and the use of immobilized biological objects.
- Methods of immune and genetic analysis, as well as determination of the biological activity of antibiotics, enzymes and immunobiological preparations.
- Participate in informing doctors of medical institutions about medical and diagnostic drugs and test systems.

2. Position of the academic discipline in the structure of the General Educational Program of Higher Education (GEP HE) of the organization.

2.1. The discipline ***Biotechnology*** refers to the core part (or the part formed by the participants of educational relations) of Block 1 of GEP HE (Academic discipline index). VIII semester.

The discipline is taught in 8 semester of study.

2.2. The following knowledge, skills and abilities formed by previous academic disciplines are required for mastering the discipline:

- *story*
- *history of pharmacy*
- *economic theory*
- *foreign language*
- *Latin language*
- *mathematics*
- *physics*
- *Informatics*

- *general and inorganic chemistry, physical and colloidal chemistry, analytical, biological, pharmaceutical, toxicological chemistry*
 - *biology*
 - *botany*
 - *physiology with the basics of anatomy*
 - *microbiology*
 - *physical Culture and sport*
 - *cultural studies*
 - *biophysics*
 - *bibliography*
 - *philosophy*
 - *life safety, emergency medicine*
 - *thermodynamics of chemical equilibrium of various systems*
 - *information technology in pharmacy*
 - *first aid*
 - *private anatomy of systems and organs*
 - *modern problems of medicinal chemistry*
 - *chemistry of surface phenomena*
 - *instrumental methods in analytical chemistry*
 - *jurisprudence*
 - *pathology*
 - *pharmacology*
 - *general hygiene*
 - *pharmacognosy*
 - *pharmaceutical technology*
 - *management and economics of pharmacy*
 - *bioethics*
 - *psychology and pedagogy*
 - *modern methods of pharmaceutical analysis*
 - *communication bases of pharmaceutical activity*
- Educational practices:
- *pharmaceutical propaedeutic*
 - *first aid practice*
 - *practice in pharmacognosy*
 - *practice in general pharmaceutical technology*

2.3. Mastering the discipline is required for forming the following knowledge, skills and abilities for subsequent academic disciplines:

- *fundamentals of ecology and nature conservation*
 - *pharmaceutical chemistry*
 - *toxicological chemistry*
 - *management and economics of pharmacy*
 - *pharmaceutical technology*
 - *clinical pharmacology*
 - *basics of marketing analysis of the pharmaceutical market*
 - *excipients in the production of medicines*
 - *clinical pharmacology with the basics of pharmacotherapy*
 - *legal basis for the activity of a pharmacist*
 - *biopharmacy*
 - *biotechnology*
 - *basics of pharmacoeconomics*
- Manufacturing practices:

- practice in pharmaceutical technology
- Practice for quality control of medicines
- practice in management and economics of pharmaceutical organizations
- pharmaceutical consulting and information practice

3. Deliverables of mastering the academic discipline and metrics of competence acquisition

Mastering the discipline aims at acquiring the following universal (UC) or/and general professional (GPC) or/and professional (PC) competencies

№	Competence code	The content of the competence (or its part)	Code and name of the competence acquisition metric	As a result of mastering the discipline, the students should:		
				know	be able to	possess
1.	UC-1.	Able to realize critical analysis of problem situations based on a systematic approach, develop strategy actions	<p>UC-1.1. Analyzes the problem situation as a system identifying its components and connections between them</p> <p>UC-1.2. Identifies gaps in the information needed to solve a problem situation, and designs processes for their elimination</p> <p>UC-1.3. Critically assesses reliability of information sources, works with conflicting information from different sources</p> <p>UC-1.4. Develops and meaningfully argues the strategy of solving the problem situations based on the system and interdisciplinary approaches</p> <p>UC-1.5. Uses logical and methodological tools for critical evaluation of modern concepts of philosophical and social na-</p>	<ul style="list-style-type: none"> • methodology of abstract thinking for systematization of processes and construction of cause-and-effect relationships; • modern theoretical and experimental methods for the implementation of own and borrowed results of scientific research into practice. 	<ul style="list-style-type: none"> • abstract, analyze and synthesize the information received; • highlight and to systematize the essential properties and connections of objects, to identify the main patterns of the objects under study; • search, select and analyze information obtained from various sources in order to make the best decision at the modern scientific level, in accordance with professional tasks and the requirements of legal documents. 	<ul style="list-style-type: none"> • methods of self-control, abstract and analytical thinking; • skills in analyzing methodological problems that arise in solving research and practical problems, including those in interdisciplinary areas; • skills of presenting an independent point of view

			ture in its subject areas			
2.	UC-2.	Able to manage the project at all stages of its life cycle	UC-2.1. Formulates a project task on the basis of the set problems and a method of its solutions through the implementation of the project management	principles for developing a project implementation plan in the field of professional activity at all stages of its life cycle	develop a project implementation plan in the field of professional activity at all stages of its life cycle, providing for problem situations and risks	methods of planning and executing projects under conditions of uncertainty, managing the project (supporting the implementation of the project)
			UC-2.2. Develops a project concept within the framework of the designated problem: formulates the purpose, tasks, justifies the relevance, significance, expected results and possible areas of their application			
			UC-2.3. Plans necessary resources, including taking into account their replaceability			
			UC-2.4. Develops a project implementation plan using planning tools			
			UC-2.5. Monitors the progress of the project, corrects deviations, makes additional changes to the project implementation plan, clarifies zones of responsibilities of project participants			
3.	GPC-1.	Able to use basic biological, physical-chemical, chemical, mathematical methods for the development, research and examination	GPC-1.1. Applies basic biological methods of analysis for the development, research and examination of pharmaceuticals and medicinal plant raw materials	modern biotechnological methods for obtaining drugs: genetic engineering, protein engineering, engineering enzymology, chromosome engineering, cell engineering; the most	ensure the conditions for the aseptic conduct of the biotechnological process and its compliance with modern requirements for the organization of production; ensure compliance	skills in compiling technological sections of industrial regulations for the production of finished dosage forms, including technological and instrumental
			GPC-1.2. Applies basic physical-			

		of medicines, the manufacture of medicinal products	chemical and chemical analysis methods for the development, research and examination of medicinal products and medicinal plant raw materials	important technological processes for the processing of plant and animal raw materials and the production of pharmaceutical products; technologies for the production of medicines based on the vital activity of microorganisms;	with the rules of industrial hygiene, environmental protection, labor, safety; take into account the influence of biotechnological factors on the efficiency of the technological process and maintain optimal conditions for the biosynthesis of the target product;	schemes for the production of finished dosage forms; the ability to draw up a material balance and carry out calculations, taking into account the consumption rates of all types of the technological process in the production of various drugs by stages; rules for calculating the optimal technological parameters of fermentation and their correction; technique for carrying out all stages of immobilization and the use of immobilized biological objects;
			GPC-1.3. Applies the basic methods of physical-chemical analysis in the manufacture of medicinal products			
			GPC-1.4. Applies mathematical methods and performs mathematical processing of data obtained during the development of medicines, as well as research and examination of medicines and medicinal plant raw materials			
4	GPC-3.	Able to carry out professional activities taking into account specific economic, environmental, social factors within the framework of the system of regulations of the medicine circulation sphere	GPC-3.1. Complies with norms and rules established by the authorized state authorities when solving the tasks of professional activity in the field of medicine circulation GPC-3.3. Performs labor actions taking into account their impact on the environment, preventing the occurrence of environmental hazards	<ul style="list-style-type: none"> • laws and legislative acts of the Russian Federation, normative and methodological materials of the Ministry of Health of Russia, regulating the procedure for conducting examinations provided for in the state registration of medicines; • general principles for the development, testing and registration of biotechnological medicines 	<ul style="list-style-type: none"> • put into practice the basic principles of the system of quality control and safety of biotechnological medicines in the conditions of pharmaceutical organizations; 	<ul style="list-style-type: none"> • Skills in carrying out preventive measures to ensure the quality of biotechnological medicinal products at the level of their production, transportation and storage.

5	GPC-6.	Able to understand the principles of modern information technologies and use them to solve the tasks of professional activity	GPC-6.2. Performs an effective search for information necessary to solve the tasks of professional activity using legal reference systems and professional pharmaceutical databases	modern means of computing technology	use modern computer technology and basic office applications And graphic packages; evaluate way of implementing information systems and devices for solving task	methods of practical use modern computers to search information processing and fundamentals numerical methods for solving applied tasks
			GPC-6.3. Uses specialized software for mathematical processing of observational and experimental data in solving problems of professional activity			
	PC-7.	Able to carry out operations related to the technological process in the production of medicines and their control	PC-7.5. Monitors the compliance of the raw materials and excipients used with the requirements of regulatory documentation	basic terms and concepts of biotechnology; theoretical foundations of biopharmaceuticals; device and principles of operation of modern laboratory and production equipment; main trends in the development of pharmaceutical technology, new directions in the creation of modern dosage forms and therapeutic systems	draw up a material balance for individual components of the technological process use educational, scientific, popular science literature for professional activities;	the ability to draw up a material balance and make calculations taking into account the consumption rates of all types of technological processes in the production of various drugs by stages

4. Sections of the academic discipline and competencies that are formed when mastering them

No. p / p	Competency code	Section name disciplines	Section content in didactic units
1.	UC-1, UC-2, GPC-1,		Introduction to biotechnology. History of development. The main achievements of the modern stage of development of biotechnology.

	GPC -3, GPC -6, PC-7	Theoretical foundations of biotechnological productions	Biomedical technologies. The main objects of biotechnology. Bioobjects as a means of production of medicinal, preventive and diagnostic agents. Metabolism. Basic processes of cellular metabolism. The concept of primary and secondary metabolites. Mechanisms of regulation of metabolic processes. Theoretical foundations for obtaining primary metabolites. Anaerobic processes (obtaining ethanol, lactic acid, glycerin). aerobic processes. Methods for the industrial production of Krebs cycle acids and their derivatives (citric, itaconic ketoglutaric, pyruvic acids). Theoretical foundations for obtaining secondary metabolites. Methods for regulating the biosynthesis of antibiotics and steroids. 6-apk. Semi-synthetic antibiotics. Production of amino acids, coenzymes and vitamins. Biotransformation of organic substances. Obtaining drugs in the processes of biotransformation. Biodegradation of xenobiotics. Biological methods of wastewater treatment and waste disposal.
2.	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7	Main processes and devices of biotechnological productions	Components of the biotechnological process. The structure of biotechnological production. The cultivation of producer cells is the central link in the biotechnological process. Surface and deep cultivation. Preparation of raw materials, air and seed. Sterilization and maintenance of aseptic conditions. Technological and instrumental design of the deep cultivation process (continuous and periodic, according to the scheme of ideal mixing or displacement, chemostatic and turbidostatic mode). Advantages and disadvantages of these schemes. The main technological equipment of biotechnological industries. Features of biotechnological productions, in comparison with similar chemical ones. Methods of aeration, mixing, heat removal and defoaming. Problems and methods of pre-sterilization of process equipment and maintenance of aseptic conditions during the process. Control and management of biotechnological processes. Methods for isolation and purification of biotechnological products. Exo- and endometabolites. Features and basic technological methods for the isolation, purification and drying of protein products.
3.	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7	Fundamentals of technology for cultivating cells and tissues of multicellular organisms. Cellular engineering.	Features of the technology of cultivation of cells and tissues of plants and animals. protoplasts and hybridomas. Fundamentals of cell engineering. Improvement of biological objects by methods of cell engineering.
4	UC-1, UC-2, GPC-1, GPC -3, GPC -6, PC-7	selection and mutagenesis. Fundamentals of genetic engineering. Genetically engineered drugs.	Mutagenesis. Improvement of biological objects by methods of mutagenesis and selection. Fundamentals of genetic engineering. Advantages and differences of genetic engineering methods for improving biological objects in comparison with classical methods of mutagenesis and selection. Creation of fundamentally new biological objects by genetic engineering methods (recombinant DNA technology). The sequence of operations carried out by a biotechnologist-genetic engineer. Control of recombinant gene expression. Problems and difficulties. Directed mutagenesis. Recombinant proteins and polypeptides (insulin, growth hormone, interferons). Traditional and genetic engineering methods of obtaining. Features of quality control. Methods of determination (in relation to insulin). Use of recombinant microorganisms to obtain commercial products (amino acids, vitamins, antibiotics, natural biopolymers). Potential hazards when working with recombinant and transgenic organisms. Control of research in the field of genetic engineering. Ethical and legal issues associated with the cloning of humans and human organs and tissues.
5.	UC-1, UC-2, GPC-1, GPC -3,	Medical and pharmaceutical	monoclonal antibodies. Receiving technology. The use of monoclonal antibodies in immune diagnostics (enzymatic immunosorbent assay) and as drugs and highly specific catalysts

GPC -6, PC-7	biotechnology.	(“catalytic antibodies”). Immunobiotechnology. Immune sera and vaccines. Recombinant vaccines (subunit, attenuated, "vector"). Probiotics and normoflora. Methods of DNA diagnostics. Molecular genetics of man. Gene therapy ex vivo and in vivo. Drugs based on “antisense oligonucleotides”. Ribozymes and small interfering RNAs as drugs. Biotechnology in the XXI century. Genomics, proteomics, bioinformatics and their importance for the search for new drugs. Human Genome Project. The main directions of development of medical biotechnology in the “postgenomic era”. Biotargets and basic approaches to their search. “ivet” genes, conserved peptides, kinases, signaling cascades as promising targets for the action of new generation drugs. Medical chemistry” - a symbiosis of chemistry and biotechnology in "postgenomic era". Rational drug design strategy. Finding leader compounds (hit- and lead-compounds). Combinatorial chemistry and HTS screening. Optimization of lead connections (docking, QSAR method). Methods for creating drugs based on compounds - leaders (prodrugs, bioisosteres, peptidomimetics, chiral and metabolic transition).
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5. Volume of the academic discipline and types of academic work

Type of educational work	Labor intensity (VIII semester)	
	volume in credit units (CU)	volume in academic hours (AH)
classroom work, including	2	66
Lectures (L)	0.6	14
Practicals (P)	1.4	52
Student’s individual work (SIW)	1	42
Mid-term assessment		
exam	1	36
TOTAL LABOR INTENSITY	4	144

6. Content of the academic discipline

6.1 Sections of the discipline and types of academic work

No. p / p	No. semester	Name section disciplines	Types of educational work (in ACH)							Evaluation tools	
			L	LP	P	S		SIW	Total		
1	VIII	Theoretical foundations of biotechnological productions	4		10				8	22	Individual survey, tests
2	VIII	Main processes and devices of biotechnological productions	2		10				6	18	Individual survey, tests
3	VIII	Fundamentals of technology for cultivating cells and tissues of multicellular organisms. Cellular engineering.	2		6				6	14	Individual survey, tests
4	VIII	selection and mutagenesis. Fundamentals of genetic engineering. Genetically engineered drugs	2		10				6	18	Individual survey, tests
5	VIII	Medical and	4		16				16	36	Individual survey, tests

	pharmaceutical biotechnology.								tests, course project
	TOTAL	14		52			42	108	

* - L – lectures; LP – laboratory practicum; P – practicals; S – seminars; SIW – student's individual work.

6.2. Thematic schedule of educational work types:

Thematic schedule of lectures

No. p/n	Name of lecture topics	Volume in AH
		8 semester
1.	Introduction to biotechnology. The main objects of biotechnology. Basic processes of cellular metabolism. Mechanisms of regulation of metabolic processes. Theoretical foundations for obtaining primary metabolites. anaerobic processes. aerobic processes.	2
2.	Theoretical foundations for obtaining secondary metabolites. Biotransformation of organic substances.	2
3.	Components of the biotechnological process. Surface and deep cultivation. Technological and instrumental design of the process of deep cultivation.	2
4.	The main technological equipment of biotechnological productions. Methods for isolation and purification of biotechnological products. Engineering enzymology and medical technologies.	2
5.	Mutagenesis and selection. Fundamentals of genetic engineering. The main genetically engineered products of protein and non-protein nature.	2
6.	monoclonal antibodies. Immunobiotechnology. recombinant vaccines. Methods of DNA diagnostics. Gene therapy ex vivo and in vivo. Medicines based on oligonucleotides.	2
7.	Biotechnology in the XXI century. Genomics, proteomics, bioinformatics. Human Genome Project. Biotargets and basic approaches to their search. "Medical chemistry" - a symbiosis of chemistry and biotechnology in "postgenomic era". The strategy is "From gene to drug".	2
	Total:	14

*(full-time form, with the use of EIOS and DOT)

6.4. Thematic plan of practicals

No. p / p	Name of the topics of practicals	Volume by semesters in ACH
		8 semester
1	Obtaining primary metabolites. Regulation of biologically active substances biosynthesis in production conditions. anaerobic processes. aerobic processes. Obtaining carboxylic acids.	5
2	Obtaining secondary metabolites. Theoretical foundations and basic techniques. Biosynthesis of antibiotics, vitamins and amino acids. Methods of biotransformation. Biotransformation in the production of medicinal substances. Bioutilization of waste and xenobiotics.	5
3	The main stages of biotechnological production. cultivation methods. Modes	5

	of operation of fermenters. Control and management of biotechnological productions.	
4	Main and auxiliary equipment. Methods for isolation and purification of biotechnological products. Immobilized enzymes and cells.	5
5	Fundamentals of technology for cultivating cells and tissues of multicellular organisms. Cellular engineering.	5
6	selection and mutagenesis. Basic methods and approaches. Fundamentals of genetic engineering.	5
7	Genetically engineered drugs.	5
8	Immunobiotechnology. Monoclonal antibodies in the diagnosis and treatment of diseases. hybrid technology. Methods of DNA diagnostics. Molecular genetics of man. Gene therapy ex vivo and in vivo. Medicines based on oligonucleotides. Genetically engineered vaccines.	5
9	Genomics, proteomics, bioinformatics. Medical biotechnology in the postgenomic era.	6
10	Medical chemistry. Rational drug design. Pharmacogenomics and Chemogenomics.	6
	Total: (Total AC)	52

*(full-time form, with the use of EIOS and DOT)

6.7. Types and topics of student's individual work (SIW)

/#	Types and topics of SIW	Volume in Ah 8 semester
1	work with literary and other sources of information on the studied section	28
2	coursework preparation	14
	TOTAL (total - ACH)	42

7. Types of assessment formats for ongoing monitoring and mid-term assessment

No. p / p	semester number	Types of control	Name of section of academic discipline	Competence codes	Assessment formats		
					types	number of test questions	number of test task options
1	2	3	4		5	6	7
1.	VIII	Current	Theoretical foundations of bio-technological productions		Tests, individual survey	26	5
2.	VIII	Current	Main processes and devices of biotechnological productions		Tests, individual survey	35	5
3.	VIII	Current	Fundamentals of technology for cultivating cells and tissues of multicellular		Tests, individual survey	15	5

			organisms. Cellular engineering.				
4.	VIII	Current	selection and mutagenesis. Fundamentals of genetic engineering. Genetically engineered drugs		Tests, individual survey	18	5
5.	VIII	Current	Medical and pharmaceutical biotechnology.		Tests, individual survey	15	5
—	VIII	final			Exam	2	24

8.8. Educational, methodological and informational support for mastering the academic discipline (printed, electronic publications, the Internet and other network resources)

8.1. Key literature references

No	Name according to bibliographic requirements	Number of copies	
		At the department	In the library
1.	Sazykin, Yu.O. Biotechnology: textbook. allowance for students of higher education. textbook institutions / Yu.O. Sazykin, S.N. Orekhov, I.I. Chakaleva; ed. A.V. Katlinsky. - M.: Publishing Center "Academy", 2006. - 256 p.	1	100
2.	Egorova T.A. Fundamentals of biotechnology / T.A. Egorova, S.M. Klunova, E.A. Zhivukhin. -M: Publishing Center "Academy", 2003.-208 p.	1	100
3.	Pharmaceutical microbiology // Pod. ed. V.A.Galynkina, V.I. Kocherovets. - M.: Arnebia, 2003.- 351s.	1	10

8.2. Further reading

No	Name according to bibliographic requirements	Number of copies	
		At the department	In the library
1.	Pharmaceutical biotechnology - a guide to practical classes: textbook. allowance / ed. V.A. Bykova, A.V. Katlinsky. - M.: Geotra-media, 2009. - 423 p.		1
2.	Glick B. Molecular biotechnology. Principles and application / B. Glick, J. Pasternak.-M. "Mir". 2002.-590 p.	1	10
3.	Biotechnology: textbook / I.V. Tikhonov [and others]; ed. acad. RAAS E.S. Voronina.- St. Petersburg: GIORN, 2005.- 792p.		1
4.	Zagoskina, N.V. Biotechnology: theory and practice: textbook. allowance for universities / N.V. Zagoskin [and others]; ed. N.V. Zagoskina, L.V. Nazarenko. - M .:		1

Publishing House Onyx, 2009. - 496 p.		
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8.4. Electronic educational resources for teaching academic subjects

8.4.1. Internal Electronic Library System of the University (IELSU)

Name of the electronic resource	Brief description (content)	Access conditions	Number of users
Internal electronic library system (VEBS)	Proceedings of the teaching staff of the department of UEF and FT: textbooks and teaching aids, monographs, collections of scientific papers, scientific articles, dissertations, abstracts of dissertations, patents.	From any computer on the Internet, using an individual login and password	Not limited

8.4.2. Electronic educational resources acquired by the University

No.	Name of the electronic resource	Brief description (content)	Access conditions	Number of users
1	Electronic database "Student Advisor"	Educational literature + additional materials (audio, video, interactive materials, test tasks) for higher medical and pharmaceutical education. Editions are structured by specialties and disciplines in accordance with the current Federal State Educational Standards of Higher Professional Education.	From any computer on the Internet, using an individual login and password [Electronic resource] - Access mode: http://www.studmedlib.ru/	General subscription of PIMU
2	Electronic library system "Bukap"	Educational and scientific medical literature of Russian publishing houses, incl. translations of foreign	From any computer located on the Internet by login and password, from the computers of the academy. Subscribed editions are available for reading. [Electronic resource] - Access mode: http://www.books-up.ru/	General subscription of PIMU

		publications.		
3	"Bibliopoisk"	Integrated search service "single window" for electronic catalogs, ELS and full-text databases. The results of a single search in the demo version include documents from domestic and foreign electronic libraries and databases available to the university as part of a subscription, as well as from open access databases.	For PIMU, access to the demo version of the Bibliopoisk search engine is open: http://bibliosearch.ru/pimu .	General subscription of PIMU
4	Domestic electronic periodicals	Periodicals on medical topics and higher education	From the computers of the Academy on the platform of the electronic library eLIBRARY.RU Access mode: https://elibrary.ru/	Not limited
5	International scientometric database "WebofScienceCoreCollection"	WebofScience covers materials on natural, technical, social, humanities; takes into account the mutual citation of publications developed and provided by ThomsonReuters ; has built-in search, analysis and management of bibliographic information.	Free access from PIMU computers Access mode: http://apps.webofknowledge.com	Free access from PIMU computers

8.4.3 Open access resources

No.	Name of the electronic resource	Brief description (content)	Access conditions
1	Federal Electronic Medical Library (FEMB)	Includes electronic analogues of printed publications and original electronic	from any computer on the

		publications that have no analogues recorded on other media (dissertations, abstracts, books, magazines, etc.). [Electronic resource] - Access mode: http://neb.rf/	Internet
2	Scientific electronic library eLIBRARY.RU	The largest Russian information portal in the field of science, technology, medicine and education, containing abstracts and full texts of scientific articles and publications.[Electronic resource] - Access mode: https://elibrary.ru/	from any computer on the Internet.
3	Scientific electronic library of open access CyberLeninka	Full texts of scientific articles with annotations published in scientific journals in Russia and neighboring countries.[Electronic resource] - Access mode: https://cyberleninka.ru/	from any computer on the Internet
4	Russian State Library (RSL)	Abstracts for which there are copyright agreements with permission for their open publication[Electronic resource] - Access mode: http://www.rsl.ru/	from any computer on the Internet
5	Reference and legal system "Consultant Plus"	Federal and regional legislation, judicial practice, financial advice, legislative comments, etc. [Electronic resource] - Access mode: http://www.consultant.ru/	from any computer on the Internet

9. Material and technical support for mastering an academic discipline

9.1. List of premises for classroom activities for the discipline

1. Audience for lectures
2. Audiences for practical classes

9.2. List of equipment for classroom activities for the discipline

1. Multimedia complex (laptop, projector, screen, TV)
2. Autoclave
3. Apparatus for filtration
4. Bubbling devices
5. Electronic scales (including analytical)
6. Water bath
7. Disintegrator
8. Microscope
9. Mixers
10. Cell culture laboratory equipment
11. A set of general-purpose weights of accuracy class II
12. Steam jacketed reactor with mechanical agitation
13. Rotary evaporator
14. Steam sterilizer

15. Thermostat
16. Laboratory fermenter.
17. Fridge
18. Refrigerators glass laboratory
19. Centrifuge
20. Continuous extractor
21. Pull out drobe

9.3. A set of licensed and freely distributed software, including domestic production

22.

Item no.	Software	number of licenses	Type of software	Manufacturer	Number in the unified register of Russian software	Contract No. and date
1	Wtware	100	Thin Client Operating System	Kovalev Andrey Alexandrovich	1960	2471/05-18 from 28.05.2018
2	MyOffice is Standard. A corporate user license for educational organizations, with no expiration date, with the right to receive updates for 1 year.	220	Office Application	LLC "NEW CLOUD TECHNOLOGIES"	283	without limitation, with the right to receive updates for 1 year.
3	LibreOffice		Office Application	The Document Foundation	Freely distributed software	
4	Windows 10 Education	700	Operating systems	Microsoft	Azure Dev Tools for Teaching Subscription	
5	Yandex. Browser		Browser	«Yandex»	3722	
6	Subscription to MS Office Pro for 170 PCs for FGBOU VO "PIMU" of the Ministry of Health of Russia	170	Office Application	Microsoft		23618/HN10030 LLC "Softline Trade" from 04.12.2020

10. List of changes to the working program (to be filled out by the template) "Biotechnology"

Federal State Budgetary Educational Institution of Higher Education
 "Privolzhsky Research Medical University"
 Ministry of Health of the Russian Federation
 (FSBEI HE "PRMU" of the Ministry of Health of Russia)

Department of
Name of the department

CHANGE REGISTRATION SHEET

working program for the academic discipline
NAME OF THE ACADEMIC DISCIPLINE

Field of study / specialty / scientific specialty: _____ (code, name)

Training profile: _____
(name) - for master's degree programs

Mode of study: _____
full-time/mixed attendance mode/extramural

Position	Number and name of the program section	Contents of the changes made	Effective date of the changes	Contributor's signature
1				

Approved at the department meeting
Protocol No. _____ of _____ 20__

Head of the Department

department name, academic title / signature