

**L.N. GUMILYOV EURASIAN NATIONAL UNIVERSITY**

**EDUCATION PROGRAM**

**Program Level:** Master degree

**Code and names of areas of training:**

7M051 – Biology and Related Sciences

7M05103 – Molecular biotechnology and biomedicine  
(Code and name of education programme)

**2022 Admission**

**Typical period of study:** 2 years

**Qualification level:** 7 NQF, 7 EQF

## **The content of the educational program**

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## 1 Passport of Education Program

<b>Application area</b>	The educational program is dedicated to train biotechnologists for scientific research institutions, microbiological, medical and processing industries, expert services, standardization and certification centers, as well as university instructors.
<b>The code and name of education program</b>	7M05103 – Molecular biotechnology and biomedicine
<b>The regulatory and legal support</b>	Law “On Education” of the Republic of Kazakhstan State General Education Standard on Postgraduate Education (31.10.2018, №604) Standard Rules for the Activities of Educational Organizations that Implement Study Programs of Higher and (or) Postgraduate Education (30.10.2018 №595) Rules for the Organization of the Educational Process on the Credit Technology of Education (12.10.2018, №563) Classifier of Areas of Training with Higher and Postgraduate Education (13.10.2018 №569)
<b>Profile map of education program</b>	
<b>Objective of EP</b>	Preparation of masters with in-depth knowledge and modern methods of scientific research and technological developments in the field of molecular and cellular technologies, bioinformatics, metabolic engineering, biomedical and biopharmaceutical technologies, capable of working in research institutes of biological and medical profile, teaching in institutions of higher education.
<b>The concept of education program</b>	The educational program regulates the goals, results, content, conditions and technologies of the educational process, evaluation of the quality of training of graduates in this field of training and includes materials that ensure the quality of training of students and the implementation of appropriate educational technology aimed at meeting the needs of scientific and industrial institutions by specialists with modern molecular, cellular, bioinformatics and biomedical methods for the creation of a new generation of biotechnologies.
<b>Graduate Qualification Characteristics</b>	
<b>Awarded degree</b>	Master of Natural Sciences under the educational program «7M05103 – Molecular biotechnology and biomedicine»
<b>List of as pecialist’s positions</b>	Researchers, innovation project coordinators, industry managers, experts, biological and biotechnological disciplines instructors in higher education institutions, heads of departments of retraining of middle technical staff in biotechnological enterprises.
<b>The area of professional activity</b>	Research, research-production, design organizations; organization of nature protection and environmental management; general educational institutions and educational institutions of vocational education
<b>The object of professional activity</b>	Biological, bioengineering, biomedical, environmental technologies; biological assessment and monitoring; Instruments and methods used microorganisms, cell cultures derived from them, and using the substances in laboratory and industrial settings; regulations on the production of biotechnology products,

	international standards, regulatory, design and technological documentation; database technology, technical nature; environmental monitoring data and biological safety of the environment.
<b>Functions of professional activity</b>	Training of graduates capable of professional activities in the implementation, maintenance and control, design of new and modernization of existing biotechnology industries; to research activities to solve fundamental and applied problems; to production activities to solve problems related to the quality management system of production of products, to professional activities for the organization and implementation of the educational process in the field of biotechnology.

## 2 Profile of Competences

General professional competences (GPC)	The result of training(GPC units)	The name of courses that form the results of training(units of competences)
<b>GPC<sub>A</sub></b> - The ability to put the latest achievements in the field of pedagogical activity into practice, to expand and deepen their knowledge in the field of scientific research.	<b>RT<sub>1</sub></b> - to analyze the main world outlook and methodological problems, including cross-disciplinary ones, arising in science at the present stage of its development as well as uses its results in professional activities.	1. Foreign Language (Professional) 2. History and Philosophy of Science 3. Methodological foundations of scientific research 4. Scientific-research work of undergraduate student
	<b>RT<sub>2</sub></b> – to know modern pedagogical technologies and possesses communication skills.	1. Foreign Language (Professional) 2. Higher School Pedagogy 3. Management psychology 4. Teaching internship
<b>GPC<sub>B</sub></b> - readiness for theoretical analysis and experimental verification of theoretical hypotheses; - ability to use modern biotechnology instruments and scientific instruments; - to use databases, software and Internet resources, the products of digitization for the decision of tasks of professional activity;	<b>RT<sub>3</sub></b> – to analyze data collection, make a comprehensive analysis and analytical synthesis of scientific information and technical documentation in the field of biotechnology and related disciplines for the purpose of scientific, patent and marketing support for ongoing fundamental research and technological developments; to have the skills of planning, organizing and conducting scientific research, to correctly process the results of experiments and to make informed conclusions and conclusions, to master the methodology of the design of scientific results (articles, articles, theses).	1. Methodological foundations of scientific research 2. Scientific-research work of undergraduate student 3. Protein engineering 4. Molecular genomics 5. Molecular regulation of eukaryotic gene expression
	<b>RT<sub>4</sub></b> – to be able to apply knowledge and skills to manage the biotechnological process. To have the skills to implement quality management systems for biotechnology products in accordance with the requirements of Kazakhstan and international quality standard.	1. Methods for isolation and purification of biological macromolecules 2. Methods for isolation and purification of BAS 3. Research practice
Professional Competences (PC)	The result of training(PC units)	The name of courses that form the results of training (units of competences)
<b>PC<sub>A</sub></b> -research, project, organizational and managerial, pedagogical competences: - the ability to plan, organize and conduct research in the field of biotechnology; - the ability to professional growth, to self-study new research methods; - ability to implement and manage biotechnological processes;	<b>RT<sub>5</sub></b> –to know the principles of structural and functional organization of biological objects and mechanisms of their activities; owns a wide range of molecular biological and biochemical methods, including the cultivation of eukaryotic cells, the allocation of genomic DNA and RNA, PCR amplification and sequencing of genes, isolation and identification of plasmids, restriction analysis; electrophoresis, various methods of genotyping, chromatographic methods, owns methods of analysis and control of safety of biotechnological products.	1. Bionanotechnology 2. Immunogenetics 3. Protein engineering 4. Scientific-research work of undergraduate student 5. Methods for isolation and purification of biological macromolecules 6. Methods for isolation and purification of BAS 7. Free radical processes regulation mechanisms

<p><b>PC<sub>B</sub></b>          -the ability and willingness to use the scientific methodology of research in accordance with current trends and prospects for the development of biotechnology and related sciences, reasonably choose theoretical and experimental methods and means to solve the tasks;          - the ability to carry out the biotechnological process in accordance with the regulations; use technical means to measure the main parameters of biotechnological processes, the properties of raw materials and products;          - the ability to implement quality management systems for biotechnology products in accordance with the requirements of Kazakhstan and international quality standards; apply the acquired knowledge</p>		<ol style="list-style-type: none"> <li>8. Legal bases for biosafety of GMOs</li> <li>9. Biosecurity and risks of GMOs</li> </ol>
	<p><b>RT<sub>6</sub></b> – to be able to use creatively and theoretical knowledge in the field of structural features and evolution of genomes, key metabolic processes occurring in Pro - and eukaryotic cells, molecular post-transcription mechanisms of gene regulation and expression at different levels.</p>	<ol style="list-style-type: none"> <li>1. Molecular regulation of eukaryotic gene expression</li> <li>2. Apoptosis and necrosis mechanisms</li> </ol>
	<p><b>RT<sub>7</sub></b> - to know the methods of bioinformatics at the level of genomic, proteomic analysis to solve biochemical, biotechnological, medical and pharmacological problems of applied and fundamental nature; to work with bioinformatic programs and resources, to independently collect, process, interpret biological information to solve scientific and practical problems; to know the methods of working with cells in vitro, to use cell cultures for diagnosis and treatment; to demonstrate readiness to participate in research on bionanotechnology.</p>	<ol style="list-style-type: none"> <li>1. Bioinformatics and proteomics</li> <li>2. Biomedical bases of regeneration</li> <li>3. Protein engineering</li> <li>4. Molecular genomics</li> <li>5. Immunogenetics</li> <li>6. Bionanotechnology</li> <li>7. Protein markers in modern clinical diagnosis</li> <li>8. Genetherapy</li> <li>9. Free radical processes regulation mechanisms</li> </ol>
	<p><b>RT<sub>8</sub></b> – to search for and development of new and effective ways of obtaining biotechnological products, the creation of modern biotechnology, including DNA technology and cell technology. Being able to isolate, identify and analyze the products of biosynthesis and biotransformation, the acquisition of new producing strains of biologicals. Own technology expected outcome prediction and analysis in molecular - genetic experiment.</p>	<ol style="list-style-type: none"> <li>1. Genetherapy</li> <li>2. Bionanotechnology</li> <li>3. Biosecurity and risks of GMOs</li> <li>4. Protein engineering</li> <li>5. Molecular genomics</li> <li>6. Methods for isolation and purification of biological macromolecules</li> </ol>

### 3 Content of the education program

Module name and code	Course code	Course name	Cycle, component	Language of instruction	Amount of credits	The volume of hours by types of occupations				Type of control	Developed competences	Department in charge
						Lectures	Seminars	Laboratory classes	SIW			
<b>Semester 1</b>												
EDUC 52003 Higher School Pedagogy	HSP 5201	Higher School Pedagogy	BD UK	Kazakh/ Russian	4	15	22		83	Exam	GPC <sub>A</sub>	Social pedagogy and self-cognition
PSYC 52004 Management psychology	MP 5202	Management psychology	BD UK	Kazakh/ Russian	4	15	22		83	Exam	GPC <sub>A</sub>	
EDUC 51001 Methodology The Master Training	SRWG 5401 (1)	Scientific-research work of graduate students		Kazakh/ Russian	7				210	Report		
<b>Choose one</b>												
BIOT 52001 Bioinformatics in genomics and proteomics	BGP 5205	Bioinformatics in genomics and proteomics	BD EC	Kazakh/ Russian	8	30	45		165	Exam	GPC <sub>A</sub> PC <sub>B</sub>	Department of Biotechnology and Microbiology
BIOT 52002 Protein engineering	PE5207	Protein engineering	BD EC	Kazakh/ Russian	8	30	45		165	Exam	PC <sub>A</sub> PC <sub>B</sub>	
<b>Choose one</b>												
BIOT 52003 Molecular genomics	MG 5206	Molecular genomics	BD EC	Kazakh/ Russian	7	30	45		135	Exam	GPC <sub>B</sub> PC <sub>B</sub>	Department of Biotechnology and Microbiology
BIOT 52004 Immunogenetics	IG5208	Immunogenetics	BD EC	Kazakh/ Russian	7	30	45		135	Exam	PC <sub>A</sub>	
<b>Semester 2</b>												
ENGL 52002 Foreign language (professional)	FL 5203	Foreign language (professional)	BD UK	English	4		37		83	Exam	GPC <sub>A</sub>	Foreign Languages Department
PHIL 52001 History and Philosophy of Science	HPS5204	History and Philosophy of Science	BD UK	Kazakh/ Russian	4	15	22		83	Exam	GPC <sub>A</sub>	Philosophy
BIOT 52005	MREGE	Molecular regulation of	PD UK	Kazakh/	5	30	15		105	Exam	PC <sub>A</sub>	Department of

Molecular regulation of eukaryotic gene expression	5301	eukaryotic gene expression		Russian								Biotechnology and Microbiology
EDUC 51001 Methodology The Master Training	SRWG 5401 (2)	Scientific-research work of graduate students		Kazakh/Russian	7				210	Report	PC <sub>A</sub> PC <sub>B</sub> GPC <sub>B</sub>	
<b>Choose one</b>												
BIOT 52006 Biomedical bases of regeneration	BBR 5302	Biomedical bases of regeneration	PD EC	Kazakh/Russian	5	30	15		105	Exam	PC <sub>A</sub> PC <sub>B</sub>	Department of Biotechnology and Microbiology
BIOT 52007 Protein markers in modern clinical diagnosis	PMMCD 5304	Protein markers in modern clinical diagnosis	PD EC	Kazakh/Russian	5	30	15		105	Exam	PC <sub>A</sub>	
<b>Choose one</b>												
BIOT 52008 Bionanotechnology	BNT 5303	Bionanotechnology	PD EC	Kazakh/Russian	5	30	15		105	Exam	PC <sub>A</sub> PC <sub>B</sub>	Department of Biotechnology and Microbiology
BIOT 52009 Genetherapy	GT5305	Genetherapy	PD EC	Kazakh/Russian	5	30	15		105	Exam	PC <sub>B</sub>	
<b>Total credits for 1<sup>st</sup> year</b>					<b>60</b>	<b>195</b>	<b>238</b>		<b>1367</b>			
<b>Semester 3</b>												
BIOT 52010 The methodology of scientific research	MFSR 5306	Methodological foundations of scientific research	PD UK	Kazakh/Russian	5	30	15		105	Exam	PC <sub>A</sub> PC <sub>B</sub> GPC <sub>B</sub>	Department of Biotechnology and Microbiology
TEIN 62005 Pedagogical practice module	TI 6403	Teaching internship	BD UK	Kazakh/Russian	4				120	Report		Department of Biotechnology and Microbiology
EDUC 51001 Methodology The Master Training	SRWG 5401 (3)	Scientific-research work of graduate students		Kazakh/Russian	4				120	Report	PC <sub>A</sub> PC <sub>B</sub> GPC <sub>B</sub>	
<b>Choose one</b>												
BIOT 52011 Apoptosis and necrosis mechanisms	ANM 5307	Apoptosis and necrosis mechanisms	PD EC	Kazakh/Russian	6	30	30		120	Exam	PC <sub>A</sub>	Department of Biotechnology and Microbiology
BIOT 52012 Methods for isolation and purification of BAS	MIPBAS 5310	Methods for isolation and purification of BAS	PD EC	Kazakh/Russian	6	30	30		120	Exam	PC <sub>A</sub> PC <sub>B</sub>	
<b>Choose one</b>												
BIOT 52013	FRPRM53	Free radical processes	PD EC	Kazakh/	5	30	15		105	Exam	PC <sub>A</sub>	Department of



Free radical processes regulation mechanisms	08	regulation mechanisms		Russian								Biotechnology and Microbiology
BIOT 52014 Biosecurity and risks of GMOs	BRGMO 5311	Biosecurity and risks of GMOs	PD EC	Kazakh/ Russian	5	30	15		105	Exam	GPC <sub>B</sub> PC <sub>B</sub>	
<b>Choose one</b>												
BIOT 52015 Methods for isolation and purification of biological macromolecules	MIPBMM 5309	Methods for isolation and purification of biological macromolecules	PD EC	Kazakh/ Russian	6	30	30		120	Exam	PC <sub>A</sub> PC <sub>B</sub>	Department of Biotechnology and Microbiology
BIOT 52016 Legal bases for biosafety of GMOs	LBBGMO 5312	Legal bases for biosafety of GMOs	PD EC	Kazakh/ Russian	6	30	30		120	Exam	PC <sub>A</sub> PC <sub>B</sub> GPC <sub>B</sub>	
<b>Semester 4</b>												
REEX 62006 Research practice module	RP 6405	Research practice	PD UK	Kazakh/ Russian	12					Report	PC <sub>A</sub> PC <sub>B</sub> GPC <sub>B</sub>	
EDUC 51001 Methodology The Master Training	SRWG 5401 (4)	Scientific-research work of graduate students		Kazakh/ Russian	6				180	Report	PC <sub>A</sub> PC <sub>B</sub> GPC <sub>B</sub>	
MFA 62006 Module of final assessment	Accomplishment and defense of Master's degree thesis		FA		12				360	Defense of degree work		
<b>Total credits for 2<sup>nd</sup> year</b>					<b>60</b>	<b>120</b>	<b>90</b>		<b>1590</b>			
<b>Total for education program</b>					<b>120</b>	<b>315</b>	<b>328</b>		<b>2957</b>			

#### 4 Summary table displaying the amount of obtained credits within the modular education program

Course	Semester	Amount of modules to be studied	Amount of subjects		Total credits						Total amount in hours	Amount		
			UC	EC	Theoretical classes	SRWG	Research practice	Teaching internship	Final assessment	Total		Exam	Report	Course paper
1	1	3	2	2	23	7				30	900	4	1	
	2	3	3	2	23	7				30	900	5	1	
2	3	4	2	3	22	4		4		30	900	3	2	
	4	3	1			6	12		12	30	900	1	2	
Total:		13	8	7	68	24	12	4	12	120	3600	13	6	

## 5 Organization of educational process

**1. Specific admission requirements:** University graduates enrolled on a master's program take a comprehensive test for groups of education programs, consisting of a test in a foreign language, a test for the major of a group of education programs, a test for determining readiness for learning. Persons entering a master's program with the English language of instruction, shall take a comprehensive test, consisting of a test on the major of a group of education programs in English and a test to determine readiness for learning in Kazakh or Russian (optional). Admission to a master's program is carried out on a competitive basis based on the results of entrance examinations of persons who have a bachelor degree on education programs of higher education. Admission of foreign citizens to a master's program is carried out on a fee basis.

**2. Specific arrangements for recognition of prior learning:** The condition for the recognition of previous education is carried out in accordance with the current Rules for admission to study at the L.N. Gumilyov Eurasian National University. The document confirming the results of non-formal education is a diploma of completion or a certificate of completion.

**3. Qualification requirements and regulations:** Persons who have mastered no less than 120 academic credits for the entire period of study, including all types of educational and research activities of the undergraduate, and successfully passed the final certification, are awarded the degree of "Master" and issued a diploma of postgraduate education with a transcript.

**4. Occupational profile/s of graduates:** Graduates with a «master's» degree are qualified to work in the field of organizational, technological, industrial, managerial, design, research, teaching, environmental and other activities. In addition, they can carry out professional tasks in research institutes conducting research in the field of molecular biotechnology, genetic and protein engineering, DNA diagnostics, molecular phylogeny, hybrid technologies, computer processing of data analysis of proteomes and genomes, as well as the properties and structure of biomolecules, in enterprises to create new biologically active substances and drugs for medicine.

**5. Methods and techniques for program delivery:** For realization of EP innovation technologies and interactive methods of teaching are widely used in academic classes.

**6. Assessment criteria of learning outcomes:**

Learning achievements (knowledge, skills, abilities and competencies) of students are scored according to a 100-point scale corresponding to the international letter grading system (positive grades, as they decrease, from «A» to «D», «unsatisfactory» – «FX», «F») with the corresponding digital equivalent on a 4-point scale (see *Table*).

Grade-rating letter system for assessing educational achievements of students with their transfer into the traditional grading scale and ECTS

Evaluation by letter grading system	Equivalent in numbers	Points(in %)	Assessment by traditional system
A	4,0	95-100	Excellent
A-	3,67	90-94	
B+	3,33	85-89	Good
B	3,0	80-84	
B-	2,67	75-79	
C+	2,33	70-74	Satisfactory
C	2,0	65-69	
C-	1,67	60-64	
D+	1,33	55-59	
D-	1,0	50-54	Unsatisfactory
FX	0,5	25-49	