

**«KAZAKH NATIONAL AGRARIAN RESEARCH UNIVERSITY»  
Non-commercial joint-stock company**

**EDUCATIONAL PROGRAM DEVELOPMENT PLAN  
6B05104 - BIOINFORMATICS**

**2024-2028**

Recommended by the Academic Committee  
of the Faculty of Agrobiology  
Protocol №10 dated 24.05.2024  
Reviewed at the extended meeting of the  
Department of Agronomy, breeding and  
biotechnology  
Protocol №11 dated 15.05.2024

**Almaty, 2024**

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## 1. Passport development plan for the educational program «6B05104 - Bioinformatics» on 2024-2028

|   |   |   |
|---|---|---|
| 1 | Reasons for developing a development plan for the EP  | Strategy and themes of the development plan of the EP created based on the request of employers in accordance with the educational policy of the Republic of Kazakhstan, the Development Strategy of the Kazakh National Agrarian Research University for 2024-2028 development of the Kazakh National Agrarian Research University 2024-2028                                       |
| 2 | The main developers of the development plan of the EP   | Urazaliev K.R. k.b.s., assoc. professor<br>Bogdanchikov A. The Vice-Rector for Academic Affairs of Establishment «SDU University»<br>Baiseitova G.A. PhD, senior lecturer<br>Employer: General Director «Institute of Plant Biology and Biotechnology» of the Committee of Science of the Ministry of Science and Higher Education of the Republic of Kazakhstan<br>K.Zh. Zhambakin |
| 3 | Deadlines for the implementation of the development plan of the EP                                | 2024 – 2028   |
| 4 | Volume and sources of the development plan of the EP  | State budget and contractual basis of financing   |
| 5 | Expected final results of the implementation of the development plan of the EP                    | To prepare undergraduate bioinformaticians with skills in using information technology in their professional activities in biological sciences, annotating genomic sequences, conducting genome analysis, assessing biodiversity and the basics of computational biology.   |
| 6 | The number of appendix to the licenses for the training direction                                 | KZ89LAA00031870<br>05.08.2021   |
| 7 | Accreditation of EP<br>The name of the accreditation body<br>The period of accreditation validity | №: AB 4884<br>IAAR<br>16.06.2023 – 15.06.2028   |

## 2. Analytical justification programs

### 2.1. Information about the educational program.

The content of the educational program is established by the following documents:



- «On Education» The Law of the Republic of Kazakhstan dated 27 July, 2007 No. 319-III;

Order of the Minister of Science and Higher Education of the Republic of Kazakhstan dated July 20, 2022 №2;

Classifier of training programs for personnel with higher and post-graduate education. Order of the Minister of Education and Science of the Republic of Kazakhstan of October 13, 2018 No. 569;

Standard Rules for the activities of educational organizations implementing educational programs of higher and (or) postgraduate education. Order of the Minister of Education and Science of the Republic of Kazakhstan of October 30, 2018 No. 595;

Rules of the organization of the educational process on credit technology of training. Order of the Minister of Education and Science of the Republic of Kazakhstan dated 12.10.2018 No. 563;

Algorithm of inclusion and exclusion of educational programs in the Register of educational programs of higher and postgraduate education. Order of the Minister of Education and Science of the Republic of Kazakhstan No. 665 dated December 4, 2018;

Order No. 106 of the Minister of Science and Higher Education of the Republic of Kazakhstan dated October 12, 2022. Rules for keeping the register of educational programs, implemented by the organizations of higher and (or) postgraduate education, as well as the grounds for inclusion in the register of educational programs and exclusion from it

**Professional Standard: <http://atameken.kz/>**

1. Professional standard «Software maintenance support» Appendix № 5 to the Order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan «Atameken» dated 15.12.2022, № 222.

2. Professional standard «Creation and management of information resources» Appendix № 8 to the Order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan «Atameken» dated 17.07.2017, № 171.

3. Professional standard «Software development» Appendix № 7 to the Order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan «Atameken» dated 05.12.2022, № 222.

4. Professional standard «Database Administration» Appendix № 1 to the Order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan «Atameken» dated 15.12.2022, № 222.

5. Professional standard «Organization of interaction between science and innovators» Appendix № 1 to the Order of the Deputy Chairman of the Board of the National Chamber of Entrepreneurs of the Republic of Kazakhstan «Atameken» dated 24.12.2019, № 259.

Atlas of new professions:

1. Biotechnologist in the field of synthetic biology  
<https://www.enbek.kz/atlas/profession/226>

2. Biotechnologist-microbiologist of aquatic systems  
<https://www.enbek.kz/atlas/profession/210>



**The goal of the educational program «6B05104 Bioinformatics»** - training undergraduate degrees in Bioinformatics skilled in the use of information technology in their professional activities in the biological sciences, annotation of genomic sequences, genome analysis, biodiversity assessment, and the basics of computational biology

It is intended for the implementation of bachelor's degree education in the educational program «6B05104-Bioinformatics» in the NCJSC «Kazakh National Agrarian Research University» joint with the «SDU University» establishment.

## **2.2. Information about students.**

Currently, 15 students are studying under the program “6B05104 - Bioinformatics” on a grant basis (5 students in the 3rd year, 10 students in the 1st year) .

## **2.3. Internal conditions for the development of the EP.**

To achieve the above-mentioned goal of the educational program, the faculty has the appropriate material and technical resources;

- lecture halls equipped with computers with installed software and a projector for demonstrating presentations;
- classrooms for practical classes, which include computer labs with installed software and access to the Internet for disciplines conducted in computer labs;
- multimedia classrooms for conducting foreign language classes;
- for students to complete independent study work - access to electronic teaching aids, methodological recommendations for writing term papers and theses;
- for students to conduct research work, the graduation department has all the necessary equipment and reagents;
- The financial resources of the educational program are provided by the university budget, as well as by research and international scientific and educational projects;
- information resources are at the disposal of the educational institution and are represented by a library (including electronic publications), access for all students and the educational institution to the Internet, computer software, etc.;
- the staff is fully staffed, in accordance with the development plan of the EP;
- the material and technical base meets the requirements of the State Standard.

Educational and methodological documents for the specialty have been developed in accordance with existing regulatory documents such as state compulsory educational standards, standard curricula for the specialty, working curricula, academic calendars, catalogs of elective disciplines, and teaching and methodological complexes for all areas of study have been developed.

The direction of preparation of diploma theses corresponds to the subject of scientific research of the department (initiative topics of scientific research). Particular attention is paid to such issues as increasing the degree level of the teaching staff, their completion of advanced training courses in domestic universities, in universities of the near and far abroad, and research institutions.

## **2.4. Characteristics of the surrounding society**

The University has created conditions for the implementation of practical training: programs have been developed, the content of which corresponds to the goals and



objectives of training specialists; long-term and short-term contracts for conducting practical training have been concluded; during the practical training, the managers from the University and the practice base provide ongoing consultation to the student, guide, and help to conduct professional activities; upon completion, the students' reporting documentation is collected and analyzed; work is carried out to summarize the results of the practical training together with the approved composition of the commission; the students pass the test based on the results of the practical training in accordance with the established procedure. The final assessment for the practical training is determined as the assessment of the practical training manager from the enterprise 100% and the assessment of the practical training manager from the department upon the defense of the report.

The result of satisfaction of students, faculty and employers with places, conditions and content of practices, as well as the level of students and teachers is the opinion and feedback of organizations providing bases for undergoing practices. After completing a certain type of practice, a survey of students is conducted with the chain of identifying the assessment of students' satisfaction with places and organization of undergoing practice, and a survey of the heads of practice bases is also conducted in order to assess satisfaction with the level of training of students.

Monitoring of the internship and tracking of its organization quality is carried out by the Department of Agronomy, Selection and Biotechnology and the Department of Internship and Employment. As a result of monitoring, the Department of Internship and Employment and the Department formulate recommendations for improving the organization of the internship.

The practice bases for the educational program «6B05104 – Bioinformatics» are: «Institute of Plant Biology and Biotechnology», JSC «Kazakh Research Institute of Agriculture and Plant Growing», «Kazakh Research Institute of Animal Husbandry and Forage Production».

## **2.5 . Information about the teaching staff implementing the educational program.**

The implementation of the bachelor's degree program in the direction is provided by scientific and pedagogical staff in accordance with the requirements of the State Educational Standard of the Republic of Kazakhstan. The list of scientific and pedagogical workers involved in the implementation of this program is presented in the certificate on the staffing of the educational process and staffing.

Qualitative and quantitative composition of the department's teachers:

The Department of Agronomy, Selection and Biotechnology employs 23 teachers, including 3 doctors of science, 13 candidates of science and 5 PhD doctors . The department's degree holders rate is 91%, the average age of the teaching staff is 53 years, 100% of teachers conduct classes in the state language and the language of interethnic communication, and 1 in English.

The teaching staff takes refresher courses every year, which affects the quality of the educational content.

Employment of graduates of "6B05104 Bioinformatics" - these are the first recruitments according to the YP, in connection with this, there has not been a graduation yet.



3rd year students in the 5th semester study at «SDU University».

The department's teaching staff works towards developing academic mobility, attracting the best foreign teachers, and conducting joint research in the implementation of the OP «6B05104 – Bioinformatics»

All professional information regarding the PPS is available and posted on the KazNARU website at the following address:

[https://www.kaznaru.edu.kz/page/department/?name=agronomiia\\_selektciia\\_zhane\\_biotekhnologii&var=okytushyprofessorlar\\_kuramy\\_1341&lang=ru](https://www.kaznaru.edu.kz/page/department/?name=agronomiia_selektciia_zhane_biotekhnologii&var=okytushyprofessorlar_kuramy_1341&lang=ru)

## **2.6 Characteristics of the achievements of the EP**

The department conducts scientific research on initiative topics, in which students directly participate. The topics of their student projects/diplomas correspond to this area of scientific research.

In accordance with the requirements of the labor market and at the suggestion of employers, new elective disciplines are being introduced into the work curricula and catalogs of elective disciplines.

## **3. Characteristics of the problems that the development plan of the EP is aimed at solving, and justification for the need to solve them.**

Today the department faces the following problems:

Insufficient proficiency of students and teaching staff in professional English.

Insufficient mobility and motivation of teaching staff to use innovative teaching methods.

Reduction in the share of teaching staff of EPs holding a doctorate in biological sciences or a doctorate in agricultural sciences due to their age.

Shortage of teaching staff specializing in bioinformatics.

Annual increase in tuition fees for the educational program.

## **4. The main goals and objectives of the development plan of the EP.**

The main goal of the educational program development plan is to improve it in accordance with the vision, mission and strategies of the university, aimed at developing competitive personnel in bioinformatics, in demand in the industries and areas of bioinformatics in Kazakhstan and in the global scientific and educational space, as well as for the development of a socially oriented, highly cultured and competent individual.

To achieve the goal, it is necessary to solve the following tasks:

| No. | Task name  | Event   |
|-----|--|---|
| 1   | Improving and improving the conditions for obtaining a full-fledged, high-quality professional education | Development of measures to improve educational services for the formation of professional competencies and skills |



|   |  |  |
|---|--|--|
| 2 | Involvement in the process of improving the educational program, determining the professional competencies of the graduate, preparing educational and methodological support for the disciplines proposed by the employer                    | When updating the content of the EP, include disciplines that meet the needs of the labor market, recommended by employers                               |
| 3 | Establishing strong ties with foreign partners for the purpose of implementing joint scientific and publishing educational and methodological literature   | Implementation of joint scientific research and publication of educational and methodological literature   |
| 4 | Providing conditions for independent research activities of the student within the framework of conducting research work throughout the entire training process  | Inclusion of research work in the EP for the purpose of its development and improvement  |
|   | Organization of consultations for employers and scientists of research institutes in choosing relevant and practically significant topics for diploma theses, conducting student research in the leading research institutes of the republic | Creation of a list of relevant and practically significant topics taking into account proposals from employers and scientists of the research institutes |

To achieve the goal, it is necessary to solve the following tasks:

- a. Creation of an innovative educational environment;
- b. Expansion of the educational space;
- c. Attracting talented young people to scientific work;
- d. Development of multilingual education with the aim of expanding the range of languages studied;
- e. Development of human resources;
- f. Development of a system for improving the qualifications of teaching staff;
- g. Expansion of international cooperation between the university and universities in neighboring and distant countries within the framework of scientific projects and academic mobility of students and teaching staff;
- h. Ensuring that graduates are in demand in the labour market;
- i. It is necessary to update and improve the content of the educational program, modernize the material base of educational laboratories, update the content of lecture materials and laboratory practical training taking into account the latest scientific achievements;
- j. With the improvement of the system of interaction with employers;
- k. Improving the qualifications of teaching staff in the field of innovative teaching technologies at the national and international levels.

To further increase the number of faculty members with degrees, the university needs to strengthen its efforts to attract young teachers and doctoral students to scientific research and their subsequent doctoral studies.

Taking into account the further development of the educational program, it is necessary to carry out work to increase the share of teaching staff with an academic degree; plan to take courses to improve professional qualifications at the international level;



increase the number of teaching staff who speak a foreign language to form multilingual education groups; increase the number of scientific papers published in journals with a high citation index; participate in the development and implementation of scientific projects under international grants.

#### **5. Expected final results of the implementation of the development plan of the EP.**

Training of highly qualified bioinformatics specialists with professional skills in bioinformatics, capable of solving theoretical and practical problems of professional activity in modern conditions.

#### **6. Measures to reduce the impact of risks for the EP.**

Increasing the number of students, full provision of educational and methodological literature, concluding contracts with business entities for internships and further employment, timely planned purchase of modern equipment.

#### **7. List of activities of the development plan of the EP**

| No | Events  | Completion form   | Deadlines |
|----|---|---|-----------|
| 1  | Justification and implementation of educational programs that ensure continuous education of students , activation of the introduction of innovations into the educational process                            | EP bachelor's degree  | 2024-2028 |
| 2  | Improving the EP with the direct participation of potential employers   | EP bachelor's degree  | 2024-2028 |
| 3  | Improving the qualifications and degrees of the teaching staff through training in master's and doctoral PhD programs, and attracting teachers with academic degrees  | Share The teaching staff with academic degrees will make up 95% | 2026-2028 |
| 4  | Providing students with various types of practical training   | Agreements with enterprises, research institutes                | 2024-2028 |
| 5  | Publication of educational and methodological literature prepared by the teaching staff of the department and acquisition of educational and methodological literature for students at all levels of training | Published and acquired by MLP                                   | 2024-2028 |
| 6  | Activation of relations with foreign partners with the aim of implementing joint scientific research and publishing MLP   | Projects in progress, published MLP                             | 2024-2028 |
| 7  | Attracting professors from foreign universities to teaching and research activities at KazNARU  | Conducting classes  | 2026-2028 |



|    |   |   |           |
|----|---|---|-----------|
| 8  | Involvement of leading bioinformaticians in the educational process   | Conducted classes   | 2024-2028 |
| 9  | Organization of student research in leading research institutes of the republic, including joint ventures with foreign partners | Agreements with research institutes                       | 2025-2028 |
| 10 | Providing ongoing academic mobility for students and teaching staff   | Study and internship at a foreign university, certificate | 2025-2028 |

### **Plan of events**

| №  | Events   | Deadlines execution |
|----|--|---------------------|
| 1  | Formation of a commission for the development of an educational program  |                     |
| 2  | Development of the goals and objectives of the educational program   | 2024                |
| 3  | Determination of student competencies and EP disciplines   | 2024                |
| 4  | Developing a common position on the competencies of the bachelor's degree program with employers                                 | 2024                |
| 5  | Development of a common position on the competencies of the educational program of specialty disciplines with employers          | 2024                |
| 6  | Formation and coordination of student competencies and specialty disciplines with Dublin descriptors                             | 2024                |
| 7  | Formation of an educational program in accordance with professional standards  | 2024                |
| 8  | Drawing up an academic calendar and a working curriculum for the specialty in accordance with the developed educational programs | 2024                |
| 9  | Consideration of the EP at an extended meeting of the department with the participation of employers                             | 2024                |
| 10 | Review and approval of the educational program by the academic council of the faculty  | 2024                |

### **8. Justification of resource provision of the plan**

- information resources;
- library collection of electronic educational materials and other accessible educational and methodological support;
- personnel;
- qualified teaching staff;
- material and technical base

### **9. Mechanism for implementing the development plan of the EP.**

Conduct targeted work to increase the number of grants for the EP. To implement the educational program, the department staff has developed catalogs of elective



disciplines with the direct participation of employers. Student trips to basic farms, to higher educational institutions of neighboring and distant countries will be organized. Leading scientists from neighboring and distant countries will be invited to conduct lectures and practical classes.

### 10. SWOT analysis

|   |  |
|---|--|
| <b>S (strength) – strengths</b> <ul style="list-style-type: none"> <li>the presence of students with basic competencies in biology and computer science;</li> <li>qualitative composition of EPS;</li> <li>participation of students in scientific projects of department staff.</li> </ul>   | <b>W(weakness) – weak points</b> <ul style="list-style-type: none"> <li>high workload of teaching staff;</li> <li>low level of scientific developments;</li> <li>weak level of foreign language proficiency among teaching staff;</li> <li>low level of wages.</li> </ul>  |
| <b>O (opportunity) – favorable opportunities</b> <ul style="list-style-type: none"> <li>the possibility of self-study on international online courses;</li> <li>cooperation with foreign universities and research institutes in scientific research;</li> <li>acquisition of advanced equipment within the framework of the State Investment Project.</li> </ul> | <b>T (thread) – threats and risks</b> <ul style="list-style-type: none"> <li>high competition in attracting talented students and young teachers;</li> <li>low probability of increasing salary levels to a level above the average for universities;</li> <li>lack of bioinformatics specialists in the country.</li> </ul> |

### 11 . Model of a graduate of this EP.

| Name of EP | 6B05104 - Bioinformatics  |
|------------|---|
| Be able to | <p>Solve professional tasks based on information and bibliographic literature using information and communication technologies and taking into account the basic requirements of information security;</p> <ul style="list-style-type: none"> <li>- report orally and in writing in Russian and foreign languages on solutions to problems of professional activity;</li> <li>- readiness to lead a team in the area of their professional activity;</li> <li>- tolerantly perceive religious and cultural differences;</li> <li>- apply bioinformatics methods to obtain new knowledge and to obtain biological objects with purposefully modified properties, apply modern research methods, determine relevance of the goals and objectives and practical significance of the research;</li> <li>- observations, descriptions, identification and scientific classification of biological objects (prokaryotes, fungi, plants and animals);</li> </ul> |



|                     |   |
|---------------------|---|
|                     | <ul style="list-style-type: none"> <li>- find and use information accumulated in databases on the structure of genomes, proteins and other biological information, possession of basic bioinformatics tools for analyzing genomic, structural and other biological information;</li> <li>- the ability to create computer programs, databases and other software products used in bioengineering and bioinformatics;</li> <li>- conducting laboratory work taking into account safety requirements and first aid techniques in case of accidents;</li> <li>- research and analysis of living systems, mathematical methods for processing the results of biological research;</li> <li>- organize your work on a scientific basis, based on knowledge of labor legislation, rules and regulations of labor protection, taking into account the current administrative documents, methodological and regulatory materials in the field of your professional activity;</li> <li>- possess professional competencies corresponding to the type(s) of professional activity to which the program is oriented;</li> <li>- independently conduct theoretical and experimental research work in the field of bioengineering, bioinformatics and related disciplines, as well as present it in writing, present it orally and participate in various forms of discussions.</li> </ul> |
| Know and understand | <p>Know the fundamental problems of the functioning of the economy, the mechanism of action and manifestation of economic laws, as well as the main features of the leading schools and directions of economic science;</p> <ul style="list-style-type: none"> <li>- know the current state and development trends of bioinformatics;</li> <li>- be familiar with biological and informational terms and categories and use them in their educational activities;</li> <li>- apply the acquired knowledge to build an effective system for creating bioinformatics and have the competence necessary to develop arguments and solve a problem in the field of studying bioinformatics;</li> <li>- be able to select appropriate equipment for performing technological operations and processes;</li> <li>- be able to calculate the need for material and technical resources to implement the production program;</li> <li>- have basic knowledge of ethical standards in the field of business relations;</li> <li>- understand the ethics of official behavior and actions of a bioinformant.</li> </ul>  |
| Be competent        | <ul style="list-style-type: none"> <li>- describe application processes and organize information support for application tasks;</li> </ul>  |



|  |   |
|--|---|
|  | <ul style="list-style-type: none"> <li>- use various approaches and methods of bioinformatics to solve practical problems;</li> <li>- apply the acquired knowledge in the field of molecular biology and genetics;</li> </ul> <p>Have the ability to:</p> <ul style="list-style-type: none"> <li>- apply a systems approach, as well as mathematical methods in solving applied problems of bioinformatics;</li> </ul> <p>Own:</p> <ul style="list-style-type: none"> <li>- skills of practical work with biological data banks and other data sources;</li> <li>- the ability to search for bioinformation data in various databases.</li> </ul> |
|--|---|

**As a result of training, the graduate must:**



| Codes | Learning outcomes of the program "6B05104 - Bioinformatics"  |
|-------|--|
| LO1   | Analyze events and actions from the point of view of the field of legal regulation and be able to refer to the necessary regulatory acts. To be able to protect their rights and interests using the laws, to carry out professional activities based on developed legal awareness, legal thinking and legal culture.  |
| LO2   | To know the fundamental problems of the functioning of the economy, the mechanism of action and manifestation of economic laws, as well as the main features of the leading schools and areas of economics science; to apply the knowledge gained to build an effective system of business and entrepreneurship, to have the competence necessary to develop arguments and solve a problem in the field of study |
| LO3   | Apply methods for the implementation of low-waste industries and assess the environmental efficiency of economic activities, establish cause-and-effect relationships between phenomena that occur in nature and society, apply environmental knowledge to solve and predict possible environmental problems.  |
| LO4   | To be able to organize scientific work, synthesize new knowledge, generalize research results and present them using knowledge and skills in the field of research. Know the main legislative acts on industrial safety, labor protection, environmental protection and civil protection in scientific research and labor organization.  |
| LO5   | Understand the principles and basis of natural phenomena and processes from a physical and chemical point of view. Explain the structure and properties of inorganic and organic compounds and the principles of work. Know the chemical composition of plants and the physical structure of biological objects.   |
| LO6   | Know the morphological features of plants, the basics of botany and zoology, biological systematics, physiological, biochemical and molecular mechanisms of processes occurring in cells. Be able to explain the structure and properties of cell organelles, cells, organs, organisms and populations and the principles of their interaction. Know the basics of the mechanisms of heredity and                |



|      |   |
|------|---|
|      | variability, as well as methods for their study and modification. Use research methods designed for different levels of process organization.   |
| LO7  | To know the theoretical and practical basis of plant growing, plant life factors, design and drawing up crop rotation schemes, tillage systems, etc. To use modern methods of selection and seed production with the participation and breeding of varieties of agricultural crops. To apply in practice the methods of the selection process and methods of reproduction.  |
| LO8  | Know the necessary basic mathematical concepts and laws of mathematical logic, statistics and probability theory. To be able to apply the methods of mathematical statistics to solve various agrobiological research problems. Possess the ability to apply knowledge in practice and the skills to build probabilistic models for the study of agrobiological processes and phenomena.  |
| LO9  | Know the basic laws of modern information and communication technologies, the types and purpose of applied IS, models and processes of the product life cycle, the stages of creating applied information systems, the principles of operation of various devices, their functional composition and subsystems. To know the methods of analysis of the field of information systems, the methodology and technology of development and design of information systems, the physical foundations of CT and data transmission devices. Possess skills in working in various operating systems and skills in working with technologies for searching, collecting, storing, processing and transmitting information. |
| LO10 | Know the basics of bioinformatics and practical technologies used in bioinformatics, how to search, receive and analyze data. Be able to use various approaches and methods of bioinformatics to solve practical problems. Be able to apply the acquired knowledge in the field of molecular biology and genetics. Possess the skills of practical work with biological data banks and other data sources, the ability to search for bioinformation data in various databases.  |

Head of the department  
«Agronomy, breeding and biotechnology»

Dean of the Faculty of «Agrobiology»

 Y. Zhanbyrbaev  
 E. Abildaev