

Kazan (Volga region) Federal University, Kazan, Russia

Institute of Fundamental Medicine and Biology

Master's program

Bioinformatics

I. THEORETICAL BASIS

The development of effective technologies of theoretical analysis and computer simulation of genetic systems and processes provides a breakthrough in the field of genome function regulation, breeding, in the creation of transgenic animals and plants, medicine, pharmacology, agrobiological, biotechnology, gene therapy, gene diagnostics, and other high technologies. Hopes for a solution to many problems that are critical for the sustainable development of mankind in the XXI century are closely associated with the development of these high-tech. Therefore, research in bioinformatics are conducted on a broad front in the leading research organizations and universities in the US, England, Germany, Japan, France, Italy, where this work is given the rank of national programs. The largest pharmacological, biotechnological and agrobiological companies in the world carry a huge investment in the development of information technology in modern biology. The rapid development of this area of knowledge creates a huge labor market and its filling required to prepare a huge number of professionals who own methods of bioinformatics.

In Russia, there is a potential range of organizations that require specialists in the field of bioinformatics - more than 100 scientific organizations Russian Academy of Sciences, Medical Sciences, Agricultural Sciences, University of the Russian Federation, pharmaceutical and biotechnology companies engaged in research and training specialists in the fields of knowledge, such as molecular biology, molecular genetics , genetic engineering, biotechnology, molecular evolution, molecular physiology, gene therapy, cell biology, bioinformatics.

Successful functioning of master's program in bioinformatics with simultaneous intensification of scientific research in this area in Kazan University will ensure its entry into the market bioinformation technology.

The main purpose of the master's program in bioinformatics at the Kazan Federal University is to train professionals with a high competitive capacity in this field. Students have the opportunity to learn all the advanced techniques of bioinformatics and molecular modeling.

Intellectual and scientific resources

At the KFU in the Biochemistry Department research in bioinformatics carried out from the middle of 90s. Master educational program on bioinformatics functions at the Department of Biochemistry and Biotechnology on the basis of bioinformatics and molecular modeling research laboratory since 2012. Research team of the Bioinformatics Lab has accumulated considerable experience in computer analysis of the nucleotide sequences, the development of special programming languages for molecular biological processes simulation, classification of microorganisms, in the modelling of the structure and the interactions of

biological macromolecules, biochemical reactions, in creating computer programs and approaches, including with the use of graphics processors.

Currently, studies on modelling of the biological macromolecules structure and their interactions are carried out actively in the laboratory, the effective computer modelling techniques for elucidating the mechanism of cholinesterase inhibition by ligands synthesized in the Butlerov Chemical Institute are developed. Such computer simulations are an essential step in the design of new drugs.

The Lab team conducted a world-class research in the field of position-managed mechanosynthesis (using precisely applied mechanical forces to induce chemical transformations). Mechanosynthetic techniques development will create nanodevices and materials with a predetermined arrangement of atoms. Due to their exceptional mechanical characteristics and components of nanomechanical devices it will form the basis of new medical applications, part of biosensors, biomonitoring systems. Currently, both experimental and theoretical work in the field of position-managed mechanosynthesis carried out in the world. Two key works on the of molecular tools working simulation and stability of diamond nanocrystals study are made by members of our research group in collaboration with the foreign colleagues from the Institute for Molecular Manufacturing (USA).

The staff of the research group on Bioinformatics has published more than 60 scientific papers, including 26 articles in peer-reviewed journals, 5 publications in leading international journals, has a certificate of the original computer program registration.

2 PhD and 3 Master's dissertation in the field of bioinformatics have been implemented and successfully defended.

Bioinformatics courses teaching at the Department of Biochemistry is conducted since 2000 and more than ten textbooks were published. The staff of the group developed innovative educational distance technologies by use of virtual worlds, which are actively used for educational and scientific seminars and scientific conferences.

Biochemistry and Biotechnology department has close collaboration with the Institute of Information Transmission Problems of Russian Academy of Sciences (Moscow), the Institute of Genetics, Molecular and Cellular Biology (Strasbourg, France), Fox Chase Cancer Center (Philadelphia, United States), Institute of Genetics and Molecular Cell Biology, Fox Chase Cancer Center (Philadelphia). Number of our students performed their master works during internship in the collaborating scientific centers.

II. Conditions of implementation of the Master Programme

2.1. Staffing of the educational process

Implementation of master program in Bioinformatics is provided by highly qualified teaching staff with basic education, corresponding to the profile of the discipline and systematically engaged in research, methodological and practical activities.

Qualified teaching staff provides implementation of the Master in Pharmacology program, with 100% of the teachers holding doctorate (DSci) or PhD degrees.

General supervision and management of research content and educational part of the Masters program is provided by Associate Professor Natalia Akberova, PhD, the head of Bioinformatics and Molecular Modelling Lab.

Direct student supervision is carried out by the staff of the Department of Biochemistry and Biotechnology, holding a PhD degree and the title of associate professor and by guest lecturers.

2.2. Teaching methods and information support of educational process

Implementation of the Masters in Bioinformatics program is ensured by appropriate teaching materials: textbooks and manuals, reference books, calendar-thematic plan, methodological brochures for seminars and workshops.

In accordance with the approved working curricula the catalogue of teaching programs for academic disciplines is created. The competences are established in accordance with Federal State Basic Standard of the highest professional education (FSBS of HPE) of the third and third-plus generation.

Implementation of the Masters program is supported by establishing access of each and every student to databases and library collections, put together according to the full list of disciplines (modules) of the program.

Rapid information exchange with domestic and foreign universities, institutions and organizations is provided for Masters students.

2.3. Logistical support of the educational process

KFU has the necessary and sufficient basis for theoretical, practical, laboratory and clinical teaching sessions.

Benefits of the KFU are obvious:

- One of the Russia's largest scientific library which hosts numerous educational and research publications in pharmacology, biology, chemistry, medicine, computer science, and others.
- Logistics base provides all the necessary resources to support the teaching - learning process with the modern multimedia projection and interactive equipment.
- KFU has strong connections with research institutes, enterprises, and organizations in Russia and abroad, providing the basis for effective scientific and practical training of masters students. The level of provision of students with educational literature complies with the State normative of 0.5 units per student in each discipline.
- Master students in bioinformatics have an opportunity to have short term scholarships and perform their thesis in the best laboratories in the world: the Institute of Information Transmission Problems of the Russian Academy of Sciences (Moscow), the Institute of Genetics, Molecular and Cellular Biology (Strasbourg, France), Fox Chase Cancer Center (Philadelphia, United States)

III. EMPLOYMENT

Kazan (Volga Region) Federal University, Department of Biochemistry and Biotechnology offers a complete comprehensive program in bioinformatics, which allows obtaining Master's degree in bioinformatics. Applicants for placement with Masters program are offered laboratory and non-laboratory options for studies and research to choose from, depending on their needs and prior qualifications.

Analysis of the labour market of the Republic of Tatarstan, shows that the demand for highly qualified personnel in the field of bioinformatics significantly exceeds the offer. The demand for specialist holding Masters in Bioinformatics degree, capable of working in the

new economic environment, with pressing requirement for scientific thinking, professional mobility and knowledge of modern research methods is obvious.

Competence and qualification characteristics of a graduate of the Masters in Bioinformatics program are based on the FSBS of HPE of the third generation.

Professional activities of a graduate of the masters in Bioinformatics program require in-depth fundamental training, experience in research and teaching. The Master in Bioinformatics is prepared to work in a variety of research, academic and educational institutions; in pharmaceutical and biotechnology companies, research institutes and educational and research universities, including teaching bioinformatics

A Master in Bioinformatics degree holder is prepared to perform the following types of professional activities and tasks:

- 1) research activities;
- 2) educational activities;
- 3) analytical work at ministries and governmental and non-governmental departments/organisations;

Graduates of the Masters in Bioinformatics program possess the following professional competences: a) interpersonal professional; b) general professional; c) implementation-professional.

Graduates are trained in modern methods and techniques of teaching bioinformatics at higher and secondary educational institutions.

Upon completion of Masters program, graduates can participate in the contest for the PhD program. Holding a master's degree in Bioinformatics will undoubtedly be a starting advantage.

IV. Applying for a Masters in Bioinformatics Program (Admissions)

Normative period of implementation of the basic educational training program for Master in Bioinformatics degree is 2 years.

Budget funded places: up to 10 people a year. Tuition fee for the contract form of training is determined in accordance with the defined order of the KFU.

Admission to the Masters program is based on competitive selection procedure.

It is carried out in a form of examination in general biology, mathematics and informatics with subsequent review of applicant's documentation.

The Admissions Committee, formed by the representatives of the Medicine-Biology Faculty, carries out competitive selection procedure. Competition ensures admission to the Masters Program of the most capable students, prepared for their further development.

To enrol into the competitive selection procedure the applicants to the Masters in Bioinformatics program should submit the following documents:

- A personal application form with statement indicating the area of training and the chosen masters program;
- The original or a copy of the state document about higher education (bachelors or specialist level), with the corresponding annex; or another recognized in the Russian Federation document confirming holding a graduate degree of higher education (state bachelor's diploma, or specialist, or master's diploma);

- A copy of the identity document.

List of additional documents:

- The diplomas, certificates of continuing professional development;
- Diplomas of winners and/or laureates of research projects, design work and student competitions at various levels;
- Scientific work of the applicant in electronic or/and paper form (published or handwritten);
- Documents, confirming awards: scholarships from ministries, agencies, funds, etc.
- In addition, applicants can provide a letter of recommendation from her/his supervisor (recognised expert in the field, lecturer of high school).

Head of the master's program in bioinformatics, Natalia Akberova, PhD, Associate Professor, the head of Bioinformatics and Molecular Modelling Lab.