

**The third (educational and scientific) level
For doctors of philosophy 2020 entry
Disciplines for second-year students to choose
(carried out at the beginning of the autumn semester)**

Educational component B1

Discipline	<i>Problematic issues of pharmaceutical biotechnology</i>
Level of higher education	Third (educational and scientific)
Course	2 (3 semester)
Credits	5 ECTS
Language of instruction	Ukrainian
Department	FBT Industrial Biotechnology
Requirements for the beginning of the study	Based on the knowledge gained by students in the study of disciplines: Fundamentals of pharmaceutical production, Problematic issues of modern biotechnology, Design of biotechnological and pharmaceutical production, Regulatory support of biotechnological production
What will be studied	Principles of development of innovative pharmaceuticals, problems of creation of ready dosage forms on the basis of biotechnological substances, biopharmaceutical technologies and features of production
Why it is interesting / necessary to study	The course will provide an opportunity to form students' abilities: <ul style="list-style-type: none"> - to the study of biotechnological substances as the basis of innovative pharmaceuticals; - to search, process and analyze information on the design of promising dosage forms; - to critical assessment of problematic issues and situations in the implementation of technological processes of production of biopharmaceuticals
What you can learn (learning outcomes)	<p>knowledge:</p> <ul style="list-style-type: none"> - problematic issues of modern pharmaceutical biotechnology for the creation of new drugs and industries; - modern methods of conducting research in the design and development of effective finished dosage forms based on biotechnological substances; - modern biochemical and biopharmaceutical approaches for the improvement of biotechnological substances and design of technological processes. <p>skills:</p> <ul style="list-style-type: none"> - to apply modern tools and technologies of search, processing and analysis of information in the field of pharmaceutical biotechnology; - to develop new and improve existing pharmaceutical biotechnologies for the production of practically valuable products; - critically analyze the results of their own research and the results of other researchers in the context of the whole set of modern knowledge on the development of biopharmaceutical products
How to use the acquired knowledge and skills (competencies)	Ability to perform original research, achieve scientific results that create new knowledge in the field of pharmaceutical biotechnology and pharmaceutical bioengineering and can be the basis for the development of innovative technologies of biopharmaceuticals or improvement of existing ones.
Information support	Curriculum and working program of the discipline, rating system.
Form of classes	Lectures, practical classes, technologies of blended and distance learning
Semester control	Exam

Discipline	<i>Problematic issues of microbial biotechnology</i>
Level of higher education	Third (educational and scientific)
Course	2 (3 semester)
Credits	5 ECTS
Language of instruction	Ukrainian
Department	FBT Industrial Biotechnology
Requirements for the beginning of the study	Based on the knowledge gained by students in the study of disciplines: General microbiology and virology, General biotechnology, Technology of microbial synthesis products, Biotechnology of antibiotics, Biotechnology of agricultural production, Biotechnology of food production
What will be studied	Problems of increasing the activity and stability of microbial producers of practically valuable substances, problems of scaling the processes of biosynthesis and selection of target products, promising finished forms of microbial synthesis products for various purposes
Why it is interesting / necessary to study	The course will provide an opportunity to form students' abilities: - to generate new ideas and conduct research to improve microbial biotechnology at the current level; - to the analysis and solution of problematic issues at the stages of development and implementation of microbial biotechnologies
What you can learn (learning outcomes)	knowledge: - problematic issues of modern microbial biotechnology and bioengineering for the creation of new biotechnologies; - and the use of modern physiological, biochemical and genetic approaches to improve microbial producers and regulate microbial biotechnology skills: - plan and perform experimental and theoretical research in microbial biotechnology using modern specialized knowledge and instrumental methods; - critically analyze the results of their own research and the results of other researchers in the context of the whole set of modern knowledge about the studied problem microbial biotechnology; - to develop and implement scientific and innovative engineering projects that provide an opportunity to rethink existing and create new holistic knowledge or professional practice and solve significant scientific and technological problems of microbial biotechnology
How to use the acquired knowledge and skills (competencies)	Develop new and improve existing microbial biotechnologies to obtain practically valuable products for various purposes based on the analysis and solution of problematic issues and the use of innovative bioengineering approaches
Information support	Curriculum and working program of the discipline, rating system.
Form of classes	Lectures, practical classes, technologies of blended and distance learning
Semester control	Exam

Discipline	<i>Modern development of biotechnologies of waste processing and bioenergy</i>
Level of higher education	Third (PhD)
Course	2
Credits	5 ECTS
Language of instruction	Ukrainian
Department	Department of Ecobiotechnology and Bioenergy FBT
Requirements for the beginning of the study	The course is based on knowledge gained by students from previous fundamental and professionally-oriented disciplines of the "master" level, namely analytical chemistry, microbiology, biochemistry, bioenergy, biophysics, methods of analysis in biotechnology, human and animal physiology.
What will be studied	Trends in the development of bioenergy and biotechnology of waste processing in the world and in Ukraine, in particular. Modern technologies for the production and use of biofuels, namely solid biofuels for heat supply, varieties of liquid biofuels for use as motor fuels, gaseous biofuels for heat and electricity. Cogeneration technologies. Thermochemical energy processes (combustion, gasification, pyrolysis), chemical processes, biochemical processes. Methods for assessing the quality of biofuels and raw materials for their production.
Why it is interesting / necessary to study	The search for new energy sources and the processing of waste of various origins into products useful to mankind is the main modern world trend. By using resources such as waste biomass energy, humanity will stop polluting the environment and save valuable resources.
What you can learn (learning outcomes)	<ul style="list-style-type: none"> • Develop new and improve existing environmental biotechnologies (water, soil, air purification). • Develop new and improve existing biotechnologies to obtain practically valuable biotechnological products for various purposes from waste. • Assess the risks of the introduction of modern biotechnology for the natural environment, human health. • Perform original research, achieve scientific results that create new knowledge in the field of environmental biotechnology and bioenergy.
How to use the acquired knowledge and skills (competencies)	<ul style="list-style-type: none"> - apply modern biotechnology to obtain liquid and gaseous fuels from biomass; - use physico-chemical methods to obtain solid biofuels; - use physico-chemical and biological methods of waste processing to obtain useful products.
Information support	Curriculum and working program of the discipline, rating system.
Form of classes	Lectures and seminars.
Semester control	Exam

Discipline	<i>Modern methods and technologies of water purification</i>
Level of higher education	Third (PhD)
Course	2
Credits	5 ECTS
Language of instruction	Ukrainian
Department	Department of Ecobiotechnology and Bioenergy FBT
Requirements for the beginning of the study	The course is based on knowledge gained by students from previous fundamental and professionally oriented disciplines at the bachelor's and master's levels, such as microbiology, biochemistry, biotechnology of water purification, hydrobiological processes in aquatic ecosystems, equipment and design in bioenergy and water treatment.
What will be studied	Methods of physico-chemical and biological water purification and their research, combination of purification methods in complex technologies to increase the degree of removal of various pollutants, such as antibiotics, synthetic surfactants, heavy metal ions, to obtain from the resulting energy waste .
Why it is interesting / necessary to study	Physico-chemical methods are widely used for water purification, in which huge volumes of sludge are formed, which need to be disposed of. Because of this, a new approach to water purification is especially important – the use of biological methods in combination with physico-chemical, whose task is to remove toxic substances from the water. Biological processes of water purification can occur not only with the participation of bacteria, protozoa, algae, but also higher aquatic plants, mollusks, shrimp, oligochaetes, which not only purify water but also use other aquatic organisms as a nutrient substrate, reducing the amount of biomass in the treatment system.
What you can learn (learning outcomes)	<ul style="list-style-type: none"> - Carry out the choice of methods and technologies for wastewater treatment depending on the composition of pollutants contained in them, taking into account the effectiveness of methods and sanitary requirements for the quality of treated water;; - master methods of research of processes of sewage treatment; - to model wastewater treatment processes using experimental and computer methods; - to acquire knowledge about technological processes of biological water purification at existing treatment facilities of pharmaceutical plants, dairy and meat processing enterprises, malt and breweries, pulp and paper mills, tanneries, gas production stations, etc. and ways to increase their efficiency, solving the problem of processing waste generated to obtain energy.
How to use the acquired knowledge and skills (competencies)	<ul style="list-style-type: none"> - The acquired knowledge will allow future highly qualified specialists to develop the latest integrated technologies for wastewater treatment of industrial enterprises, utilities, agriculture, taking into account the pollution contained in wastewater; - to manage technological processes of biological water purification at industrial enterprises of pharmaceutical, food industry, etc .; - will open perspective for research of new directions in biotechnology of water purification: processes with immobilized microorganisms; with granular sludge; anaerobic bioreactors with biogas production; membrane bioreactors; phytoreactors with higher aquatic plants – duckweed, wolfia, eichhornia; bioreactors with the inclusion of mollusks in the biocenosis, as well as crustaceans and oligochaetes, which will increase the efficiency of water treatment, reduce the amount of sediment and the cost of obtaining the original product - clean and useful water, to obtain energy.
Information support	Curriculum and working program of the discipline, rating system.
Form of classes	Lectures and seminars.
Semester control	Exam.

Discipline	Progress of bioinformatics in drug development
Level of higher education	Third (PhD)
Course	2
Credits	5 ECTS
Language of instruction	English
Department	Bioinformatics
Requirements for the beginning of the study	Enroll in graduate school at the Department of Bioinformatics
What will be studied	Bioinformatics methods and modern bioinformatics databases for the needs of personalized medicine, especially for the development of drugs for the treatment of cancer.
Why it is interesting / necessary to study	Bioinformatics methods can significantly reduce the amount of high-cost experimental work in the development of drugs
What you can learn (learning outcomes)	<ul style="list-style-type: none"> ✓ Analyze scientific, educational and educational-methodical literature on bioinformatics, use it in the educational process; ✓ determine the optimal method of solving problems in drug development; ✓ analyze and interpret the results of solving problems of bioinformatics; ✓ to find connections between single nucleotide polymorphisms and diseases.
How to use the acquired knowledge and skills (competencies)	The acquired knowledge can be applied in scientific work of development of medicines, in educational process at teaching of courses: "Bioinformatics", "Databases".
Information support	Curriculum and working program of the discipline, textbook, lecture presentations.
Form of classes	Lectures, practical classes.
Semester control	Exam

Educational component B2

Discipline	<i>Genetic research in biotechnology</i>
Level of higher education	Third (educational and scientific)
Course	2 (3 semester)
Credits	5 ECTS
Language of instruction	Ukrainian
Department	FBT Industrial Biotechnology
Requirements for the beginning of the study	Based on the knowledge gained by students in the study of disciplines: Cell Biology, General and Molecular Genetics, Fundamentals of Genetic and Cell Engineering, Problematic issues of modern biotechnology, Systems analysis of biotechnological objects, Cellular biotechnology, Immunobiotechnology
What will be studied	Medical and genetic research methods, gene therapy and DNA diagnostics, regulation of gene expression, mobile genetic elements, genetic monitoring
Why it is interesting / necessary to study	The course will provide an opportunity to form students' abilities: - to generate new ideas and conduct research in modern areas of genetic research in biotechnology; - to analyze and solve problems in planning and conducting genetic research in biotechnology and bioengineering
What you can learn (learning outcomes)	knowledge: - problematic issues and methods of modern genetic research in biotechnology and bioengineering; - and the use of modern genetic research methods and genetic approaches to improve biological objects and regulate the biological processes of a living cell skills: - to plan modern genetic experimental and theoretical researches with use of modern specialized knowledge and instrumental methods; - critically analyze the results of their own genetic research and the results of other researchers in the context of the whole set of modern knowledge about the studied problem biotechnology; - to develop and implement research projects that provide an opportunity to rethink existing and create new holistic knowledge or professional practice and to solve significant scientific and practical problems of genetic research
How to use the acquired knowledge and skills (competencies)	Plan and perform modern genetic research, achieve scientific results that create new knowledge in the field of genetics, biotechnology and bioengineering, get practical results using the acquired competencies
Information support	Curriculum and working program of the discipline, rating system.
Form of classes	Lectures, practical classes, technologies of blended and distance learning
Semester control	Exam

Discipline	<i>Innovative ready-made forms of biological products</i>
Level of higher education	Third (educational and scientific)
Course	2 (3 semester)
Credits	5 ECTS
Language of instruction	Ukrainian
Department	FBT Industrial Biotechnology
Requirements for the beginning of the study	Based on knowledge gained by students in the study of disciplines: General Biotechnology, Problematic issues of microbial biotechnology, Problematic issues of pharmaceutical biotechnology, Problematic issues of modern biotechnology, Biotechnology of agricultural products, Biotechnology of food production
What will be studied	The main types of modern and promising finished forms of biomolecules and cells in accordance with the purpose of drugs, methods of design and production of innovative finished forms of biologicals, the principles of their application, features of finished forms of biologicals in accordance with areas of application
Why it is interesting / necessary to study	The course will provide an opportunity to: <ul style="list-style-type: none"> - analysis, creation and use of promising ready-made forms based on cells and biomolecules in various fields and research practice; - to develop ready-made forms of biologicals for various industries, medicine, agriculture, etc.
What you can learn (learning outcomes)	<p>knowledge:</p> <ul style="list-style-type: none"> - basic methods and principles of designing biological products for different areas of practical application; - principles of choosing an effective finished form of biological product and optimization of existing forms; - features of production and finishing stages of biotechnologies for obtaining modern and promising finished forms of biological products <p>skills:</p> <ul style="list-style-type: none"> - ability to choose the finished form of the biological product in accordance with the type of biological object and the tasks of its further use; - to analyze the effectiveness of the finished form and the activity of biomolecules in the composition of such structures and drugs; - to determine the feasibility of creating a certain finished form of the biomolecule and the prospects for the use of the created drugs.
How to use the acquired knowledge and skills (competencies)	Apply the acquired knowledge and experience to solve complex problems and problems in specialized areas of professional activity or training, which involves the creation of new innovative and improved already used ready-made forms of biologicals or biosynthesis processes and finishing stages to obtain target products in effective and stable finished forms
Information support	Curriculum and working program of the discipline, rating system.
Form of classes	Lectures, practical classes, technologies of blended and distance learning
Semester control	Exam

Discipline	<i>Controlled synthesis of metabolites</i>
Level of higher education	Third (PhD)
Course	2
Credits	5 ECTS
Language of instruction	Ukrainian (english)
Department	Department of Ecobiotechnology and Bioenergy FBT
Requirements for the beginning of the study	The discipline is based on the knowledge received by students from previous fundamental and professionally-oriented disciplines of the level "bachelor and master" such as microbiology, biochemistry, chemistry of nutrients.
What will be studied	Influence of physical and chemical factors of the environment during cultivation on cell metabolism in order to increase the yield of the target product; bioengineering techniques to provide the necessary properties to the cells of microorganisms.
Why it is interesting / necessary to study	<ol style="list-style-type: none"> 1) The possibility of developing innovative biotechnologies to increase the yield of the target product, improve the environment, energy synthesis; 2) Methods and approaches to control the metabolism of microorganisms for the production of various substances by one species; 3) Understanding of problematic issues in the creation of novel biotechnologies.
What you can learn (learning outcomes)	<ul style="list-style-type: none"> - Analyze the possibilities of using biotechnological, chemical and physico-chemical methods and their combinations for the development of technologies for the cultivation of microorganisms to obtain the target product. - Use advanced methods to offer technological solutions for the cultivation of microalgae to obtain specific nutrients of different directions. - Manage the metabolism of microorganisms.
How to use the acquired knowledge and skills (competencies)	<p>the student will have the ability to:</p> <ul style="list-style-type: none"> - Analyse existing technologies and generation of new ideas (hypotheses) to create the latest biotechnologies or improve existing ones by managing the metabolism of microorganisms; - use modern methods of influencing the microorganism to obtain a specific product - perform original research to achieve new knowledge in the field of biotechnology and bioengineering.
Information support	Curriculum and working program of the discipline, rating system.
Form of classes	Lectures and seminars.
Semester control	Exam

Discipline	Influence of physicochemical environmental factors on biopolymers and water
Level of higher education	Third (PhD)
Course	2
Credits	5 ECTS
Language of instruction	Ukrainian
Department	Bioinformatics
Requirements for the beginning of the study	Enroll in graduate school at the Department of Bioinformatics
What will be studied	The main parameters and methods of research of normal and catastrophic physico - chemical factors of the Earth, the Sun and other cosmic factors that have a significant impact on biologically important molecules, natural and artificially created biopolymers and water, which is important for biotechnological processes.
Why it is interesting / necessary to study	Biological macromolecules (proteins, nucleic acids, carbohydrates, lipids, water, molecular cell formations), as biological objects are maximally adapted for normal existence to the physicochemical characteristics of the Earth and space, so knowledge of changes in their properties under the influence physicochemical environmental factors are of great interest to molecular biotechnology.
What you can learn (learning outcomes)	<ul style="list-style-type: none"> - Use the obtained theoretical knowledge and methods of monitoring studies of the functions of biopolymers and physicochemical environmental factors; - work with software and mathematical and statistical methods of competent processing of research results -use methods of modeling of physicochemical factors of the environment to determine their impact on the properties, structure and function of biopolymers in their work in organisms of plants, animals and humans
How to use the acquired knowledge and skills (competencies)	<p>The graduate student will be able to:</p> <p>Have engineering, professional and research competencies to understand the research methods of biological macromolecules and physicochemical environmental factors;</p> <ul style="list-style-type: none"> -know the principles and software tools for reliable processing of research results; - know the equipment and systems used in research.
Information support	Course of lectures, professional and educational literature, available in the library and on the Internet, software in free access.
Form of classes	Lectures, practical classes
Semester control	Exam

