

BELARUSSIAN STATE UNIVERSITY  
BIOLOGICAL FACULTY

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CATALOG MODULES

2018

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1	Course Title	Agricultural Microbiology
2	Year	5
3	Academic Semester	9
4	Number of credits	2
5	Lecturer	Doctor of Biological Sciences Aleschenkova Zinaida Mikhailovna
6	Goal	Assimilation of knowledge about microorganisms possessing economically valuable properties; mechanisms for stimulating their growth and development of crops; composition and structure of microbial communities of the soil, which play an important role in the formation of its fertility; the main directions of using microbial drugs in agricultural production.
7	Prerequisites	Microbiology, Systematics of microorganisms
8	Course Description from Program Guide	The role of agricultural microbiology in solving practical problems of agricultural production. Microorganisms of the soil and their communities. Microbial soil-fertilizing preparations and their role in nutrition of plants and increase of soil fertility. Growth-stimulating microbial preparations on the basis of associative nitrogen fixing and phosphate-solubilizing bacteria. Epiphytic and endophytic microorganisms, their influence on the growth and development of agricultural crops. Microbial preparations for combating diseases and pests of agricultural plants. Microbial transformation of plant raw materials.
9	Recommended Textbooks (in Russian)	1.Емцев, В. Т. Сельскохозяйственная микробиология : учебник для академического бакалавриата / В. Т. Емцев, Е. Н. Мишустин. — М. : Издательство Юрайт, 2017. — 205 с. 2.Звягинцев, Д. Г. Биология почв : учебник для вузов / Д. Г. Звягинцев, И. П. Бабьева, Г. М. Зенова. - 3-е изд., испр. и доп., М.:Изд-во МГУ, 2005. - 445с. 2. Rangaswami, G. Agricultural Microbiology / G. Rangaswami, D. J. Bagyaraj. – PHI Learning Pvt.Ltd. New Delhi. – 2007. – 440p. 3. Subba Rao N.S. Advances in Agricultural Microbiology. – Publisher by Elsevier. – 2016. – 726 p.
10	Methods	active, interactive, verbal, visual, problematic
11	Language	Russian
12	Student evaluation	- protection of individual tasks in the performance of laboratory work; - testing; - oral polls
13	Final examination	credit



1	The discipline	Agroecology
2	Year of study	2
3	Semester	4
4	Number of credits	1
5	Name of lecturer	doctor of biological sciences, professor Kulikov Yaroslav Konstantinovich
6	Learning objectives	Creation of an idea about the nature protection system in agriculture, about the competent combination of scientific and technological progress achievements with resource-saving principles in the organization and implementation of various types of production activities in the agro-industrial complex
7	Prerequisites	General ecology; plant growing
8	Contents of the discipline	Introduction. Agricultural ecosystems. Ecological problems of agricultural production. Agroecological monitoring. Optimization of agro landscapes and organization of sustainable agroecosystems.
9	Recommended literature	1. Chernikov VA, Aleksakhin RM, Golubev A.V. and others. Agroecology. - M: Kolos, 2000 2. Gudkov I.N. Fundamentals of general and agricultural radiobiology. - Kiev: USHA, 1991 3. Dobrovolsky GV, Nikitin EF. Ecological functions of soils. - Moscow: MSU, 1993
10	Teaching Methods	A problematic, visual, method of forming the personal significance of knowledge
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	credit

1	Name of disciplines	Algology and mycology
2	Course of Study	1
3	Semester of training	1
4	Amount of credits	4
5	FULL NAME lecturer	Ph. D. in Botany and Mycology, Associated professor, KHRAMTSOV Alexander K.
6	Objectives of studying the discipline	To form the integral system of knowledge about algae, fungi, pseudofungi and lichens taking into account modern scientific achievements.
7	Prerequisites	
8	Contents of the discipline	Short essay of development of algology and mycology. Modern classification of algae, fungi, pseudofungi and lichens. Algae as set of several independent departments of photosynthesizing thalline organisms (Cyanophyta, Euglenophyta, Dinophyta, Cryptophyta, Crysophyta, Bacillariophyta, Xanthophyta, Phaeophyta, Rhodophyta, Chlorophyta, Charophyta). Structure of thallus and cage, reproduction, life cycles, ecological groups of algae. A general description of fungi and pseudofungi: vegetative body, cage, reproduction, cycles of development, ecological groups, origin. Slime fungi. Oomycota, Chytridiomycota, Zygomycota, Ascomycota, Basidiomycota. Anamorphic, imperfect, or mitosporic fungi. Lichens, or lichenized fungi. Role of algae, fungi, pseudofungi and lichens in nature and their human use.
9	Literature Recommended	1. Algology and mycology / A. S. Shukanov [, etc.]. – Minsk: BSU, 2009. (in Russian) 2. Botany: the Rate algology and mycology: the Textbook / Under edition J. T. Djakov. – M.: Publishing house of the Moscow State University, 2007. (in Russian) 3. Lemeza N. A. Algology and mycology. A practical work: studies. The manual. – Minsk: Vysh. shkola, 2008. (in Russian)
10	Teaching Methods	Explanatory-illustrative, reproductive, heuristic.
11	Language of instruction	Russian
12	Conditions (requirements), current control	Self-managed work
13	Form of current certification	Exam

1	The name of the discipline	Analysis and quality control of medicines
2	The course of the study	3
3	Semester of training	5
4	The amount of credits	1,5
5	Full name of the lecturer	Alekseev Nikolay Alexandrovich PhD; CORIK Elena Olegovna PhD, Associate Professor
6	The objectives of the discipline studying	Obtaining new and systematizing previous knowledge with regard to standardization, methods of analysis and testing of medicines.
7	The prerequisites	Organic chemistry, biochemistry, analytical chemistry.
8	Contents of the discipline	Physical properties of medicinal substances. Quality control of medicines. Sampling and sample preparation. Methods of analytical chemistry used in the analysis of drugs. Methods of analytical biochemistry, used for analysis of drugs. Validation of methodologies
9	Literature recommended	1. Pharmaceutical analysis of medicines. Ed. Shapovalova VA Kharkov: IMP «Rubicon», 1995. 400 p. 2. Polyudek-Fabini R., Beirich T. Organic Analysis: Guidance on the Analysis of Organic Compounds, Including Drugs. Trans. with him. L.: Chemistry, 1981. 622 p. 3. Ovchinnikov Yu.A. Bioorganic chemistry. M.: Enlightenment. 1987. 815 p. 4. Belikov V.G. Pharmaceutical chemistry. M.: Medicine, 1985. 768 p. 5. Pogodina L.I. Analysis of multicomponent dosage forms. Mn.: Higher School, 1985. 240 p. 6. Maksyutina N.P. Methods of drug analysis. Kiev.: Health, 1984. 224 p. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes; - execution of tasks in the test form; - checking the conduct of laboratory journals; - protection of the student's prepared essay.
13	The form of current certification	credit

1	The name of the discipline	Analytical Biochemistry
2	The course of the study	4
3	Semester of training	7
4	The amount of credits	3
5	Full name of the lecturer	Korik Elena PhD, assistant professor
6	The objectives of the discipline studying	to form students understanding of the principles, conditions of applicability and limitations in the use of methods for qualitative, quantitative and structural analysis of biologically significant chemical compounds in biological samples and the ability to adequately choose the necessary approaches for solving specific problems in biochemical analysis
7	The prerequisites	Metabolic biochemistry, structural biochemistry, physical and chemical methods of analysis
8	Contents of the discipline	Biometric methods in biochemical analysis. Metrological bases of analytical biochemistry. General laboratory methods in biochemical analysis. Physicochemical methods in biochemical analysis. Comprehensive use of analytical approaches in biochemical analysis. Preparation and preparation of biological samples. Evaluation of the results of biochemical analysis
9	Literature recommended	<ol style="list-style-type: none"> <li>1. Blokhin A.V. The theory of experiment. Lecture course. In 2 parts. Minsk, 2002-2003. (in Russian)</li> <li>2. High-performance liquid chromatography in biochemistry. Ed. A. Henshnen and others. Moscow: Mir, 1988. 622 p. (in Russian)</li> <li>3. Garmash AV, Sorokina NM Metrological bases of analytical chemistry. (in Russian)</li> <li>4. Drago R. Physical Methods in Chemistry. In 2 vols. Moscow: Mir, 1981. (in Russian)</li> <li>5. Kamyshnikov VS Reference book on clinical and biochemical research and laboratory diagnostics. Moscow: MEDpress-Inform, 2004. 920 p. (in Russian)</li> <li>6. Kunze U., Schwedt G. Fundamentals of qualitative and quantitative analysis. Moscow: Mir, 1997. 424 p. (in Russian)</li> </ol>
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	<ul style="list-style-type: none"> <li>- oral and written interviews in laboratory classes;</li> <li>- execution of tasks in the test form;</li> <li>- checking the conduct of laboratory journals;</li> <li>- protection of the student's prepared essay.</li> </ul>
13	The form of current certification	Exam

1	The name of the discipline	Animal Population Ecology
2	The course of the study	3
3	Semester of training	6
4	The amount of credits	2,5
5	Full name of the lecturer	PhD, Associate Professor O.Yu. Kruglova
6	The objectives of the discipline studying	The course «Animal Population Ecology» is based on data of zoology of Invertebrates and Vertebrates, ecology and other biological courses. The aim of the course is give students' knowledge about the population approach in the animal ecology.
7	The prerequisites	Zoology
8	Contents of the discipline	Characteristics of natural populations. Structure of populations. Age structure of the population. The sex structure of populations. Spatial structure of populations. Ethological structure of populations. Ecological structure of populations. Genetic structure of populations. Population phenetics. Isolation and connectivity between populations. Relationships between populations.
9	Literature recommended (in Russian)	1. Бигон М. Экология. Особи, популяции и сообщества / М. Бигон, Дж. Харпер, К. Таунсенд. М.: Мир, 1989. Т. 1. 2. Гиляров А.М. Популяционная экология. М.: Изд-во МГУ, 1990. 3. Галковская Г.А. Основы популяционной экологии. Минск: Лексис, 2001. 4. Одум Ю. Экология. М.: Мир, 1986. Т. 2. 5. Яблоков А.В. Популяционная биология. М.: Высшая школа, 1987.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, oral survey, preparation of abstracts
13	The form of current certification	Exam

1	Course Title	Applied aspects of immunology
2	Year	4
3	Academic Semester	8
4	Number of credits	3,5
5	Lecturer	Candidate of Chemical Sciences (=PhD) Gerlovsky Denis Olegovich
6	Goal	Training of students of methodology of obtaining fundamental knowledge and the solution of applied tasks, using an arsenal of immunological approaches and methods and also to use of the gained theoretical knowledge in further practical activities.
7	Prerequisites	Immunology, human physiology, Phytopathogenic microorganisms
8	Course Description from Program Guide	Introduction. Properties of antigens and antibodies. Receiving and application poliklonalnykh of antibodies Receiving and application poliklonalnykh of antibodies Receiving monoclonal antibodies: gibridomny technology. Engineering of antibodies. Methods on the basis of antibodies Types of serological reactions and their use. Qualitative and quantitative analysis of antigens (antibodies). The tags used in the immunoanalysis, ways of introduction of tags to molecules of antibodies (antigens). Immunochemical methods of a research in clinical laboratory practice. Radio immunological methods. IRMA and RIA. Immunofermental analysis (IFA (ELISA)). EL-JSpot. Vestern-blot. Immunofluorimetrichesky analysis. Flowing tsitoflyuorimetriya. Biotechnology of immuno-magnetic sorbents. Immunochemistry in experimental biology The immunological approaches and methods applied in medicine Immunodiagnosics. Immunoprevention. Immunotherapy.
9	Recommended Textbooks (in Russian)	Эхуд Газит Нанобиотехнология: необъятные перспективы развития / Газит Эхуд. Перевод с англ. — А.Е. Соловченко, 2011. Огурцов А.Н. Введение в молекулярную биотехнологию / А.Н. Огурцов. - Х.: НТУ "ХПИ", 2008.
10	Methods	Active, interactive, verbal, problem and evident methods
11	Language	Russian
12	Student evaluation	- preparation of the essay; - testing.
13	Final examination	examination

1	Name of the discipline	Applied genomics
2	Course of Study	4
3	Semester of training	8
4	Amount of credits	1,5
5	lecturer FULL NAME	Candidate of Biological Sciences, Associate Professor LAGONENKO Alexander Leonidovich
6	Objectives of studying the discipline	Studying of modern problems of system biology and functional genomics, and also methods of bioinformatics actively used for the decision of these problems.
7	Prerequisites	Genomics; molecular biology
8	Contents of the discipline	History of the development of genomic research. Modern approaches to DNA sequencing, their advantages and disadvantages. Functional genomics and proteomics. Molecular databases. Evolution of genomes. Mechanisms of genomic rearrangements, increase and decrease in the size of genomes. Families of homologous genes. Molecular phylogeny. Synthetic genomics. Organization of genomes of pro and eukaryotes. Organization of the genomes of mitochondria and plastids. Annotation of genomic sequences. Computer analysis of DNA and protein sequences.
9	Recommended literature	1. <i>Попов В.В.</i> Геномика с молекулярно-генетическими основами / В.В. Попов.- М.: Книжный дом “ЛИБРОКОМ”, 2009. – 304 с. 2. <i>Леск А.</i> Введение в биоинформатику. / А. Леск; пер. с англ. – М.: БИНОМ. Лабораторные знания, 2009. – 318 с
10	Teaching Methods	Comparative, problematic, dialog-heuristic, visual
11	Language of instruction	Russian
12	Conditions (requirements), current control	- Preparation of essays; - preparation of the report on the genomic sequence annotation
13	Form of current certification	credit

1	Name of disciplines	Applied mycology
2	Course of Study	3
3	Semester of training	6
4	Amount of credits	2,5
5	FULL NAME lecturer	Ph. D. in Botany and Mycology, Associated professor, KHRAMTSOV Alexander K.
6	Objectives of studying the discipline	To form the integral system of knowledge about the role of fungi and pseudo-fungi in human life, and possibilities and prospects of their practical use.
7	Prerequisites	Algology and mycology. Microbiology. Phytophysiology.
8	Contents of the discipline	Fungi and Pseudofungi as producers of poisonous substances, causative agents of plants, fungi, animals and human illnesses. Fungi- biodestructors. Edible mushrooms and their cultivation. Recyclization. Prospects of the use of mushrooms in bioenergetics. Fungi in biotechnology. Using of fungi in bread and cheese production. Biological basics of making alcohol products. Tea, rice and milk fungi: their nature and use. Organic acids, amino acids and albumen, enzymes, vitamins. growthsubstances, hormones, medicinal substances from fungi. Fungi in agroculture (mycorrhiza, biocontrol of weeds, wreckers and causative agents of plants illnesses based on phyto - and zoopathogenic, mycophilous, carnivorous fungi). Fungi in bioremediation. Fungi as model objects in biology. Applied aspects of study of lichens (lichened fungi).
9	Literature Recommended	1. Kuznetsov A.F. Veterinarnaya mikologiya. – SPb.: Izd-vo «Lan», 2001. (in Russian) 2. Meditsinskaya mikologiya s osnovami mikotoksikologii. Uchebnik dlya vysshih uchebnyih zavedeniy / D.V. Leontev [i dr.]; pod red. D.V. Leonteva, A.G. Serbina. – Harkov, 2010. (in Russian) 3. Fundamentalnyie osnovyi mikologii i sozdanie lekarstvennyih preparatov iz mitselialnyih gribov / E.P. Feofilova [i dr.]. – M.: Natsionalnaya akademiya mikologii, 2013. (in Russian)
10	Teaching Methods	Explanatory-illustrative, reproductive, heuristic, research.
11	Language of instruction	Russian
12	Conditions (requirements), current control	Self-managed work
13	Form of current certification	Exam



1	The name of the discipline	Biochemical and molecular biological assessment of food and drug safety
2	The course of the study	4
3	Semester of training	7
4	The amount of credits	2,5
5	Full name of the lecturer	KUKULIANSKAYA Tatsiana Aleksandrovna PhD, associate professor
6	The objectives of the discipline studying	Form a complete system of knowledge about the methodology for assessing the chemical and biological safety of food products and the toxicity of medicines.
7	The prerequisites	Metabolic biochemistry. Medical biochemistry.
8	Contents of the discipline	Chemical contamination of food (PP). Methods for the detection of xenobiotics in PP. Methods for assessing the genotoxic effect of chemicals contained in PP. Evaluation of safety of PP obtained using recombinant microorganisms. Characteristics of the toxic effect of drugs (LS). Toxicity assessment of drugs. Methods for evaluating the toxicity of drugs in vivo. Biomodels in drug toxicology. Alternative methods for assessing the toxicity of drugs.
9	Literature recommended	1. Donchenko, L.V. Food Safety / L.V. Donchenko, V.D. Nadykta. - Moscow: DeLiPrint, 2007. - 540 p. 2. Karkishchenko, N.N. Classical and alternative models in drug toxicology / N.N. Karkishchenko. - Biomedicine. - 2004, No. 4, p. 5 - 23. 3. Krasovsky, G.N. Extrapolation of toxicological data from animals to humans / G.N. Krasovsky, Yu.A. Rakhmanin, N.A. Egorova. - M.: Medicine, 2009. 208 with. 4. Kutsenko, S.A. Fundamentals of Toxicology / S.A. Kutsenko. - SPb.: Science, 2002. - 396 p. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	-preparation of abstracts, - oral surveys, -protection of individual tasks in the performance of laboratory work, written tests on specific topics of the course
13	The form of current certification	exam

1	Name of the discipline	Bases of Biology and Human Physiology
2	Course of Study	2
3	Semester	3
4	Amount of credits	2
5	Lecturer	Kazakevich Victor Bernhardovich
6	Objectives of the discipline	The objective is to give students an idea of the physiology of cell and functional systems of the human body. Since this course is read for future specialists in the chemistry of medicines, much attention is paid to the consideration of the most important systems of the human body as objects of pharmacological action.
7	Prerequisites	Human and animals physiology
8	Content of the discipline	Introduction. The physiology of the cell. Neuromuscular physiology. Bases of the regulation of functions. Physiology of the blood and immune system. Physiology of the cardiovascular system. Physiology of metabolism.
9	Recommended literature	1. Орлов Р.С., Ноздрачев А.Д. Нормальная физиология. / «Гэотар-Медиа», 2005. 2. Шмидт Р., Тевс Г., Физиология человека / «Мир», в 3 томах, 2005.
10	Teaching Methods	When reading the course, technical training tools are used to demonstrate the presentations. The theoretical bases of the course are consolidated on practical lessons.
11	Language	Russian
12	Conditions and control	control of self-directed work
13	Form of current certification	credit

1	Name of disciplines	Basic Cellular Physiology
2	Course of Study	4
3	Semester of training	8
4	Amount of credits	3,5
5	FULL NAME lecturer	Kostyuk V.A.
6	Objectives of studying the discipline	To give the basis for modern knowledge about bioenergetics, signaling and free radical processes occurring at the cell level and individual intracellular structures.
7	Prerequisites	Physics, chemistry, cytology and histology, physiology, biochemistry, biophysics, molecular biology.
8	Contents of the discipline	Molecular organization and physiological functions of intracellular structures. General principles of cellular and intracellular signaling. Signal molecules, reception and intracellular transduction of biosignals. Bioradicals and their role in the physiology and pathophysiology of cells. Aging and cell death.
9	Recommended Textbooks (in Russian)	Костюк В.А. Основы клеточной физиологии. Курс лекций. Минск: БГУ, 2016. Биорадикалы и биоантиоксиданты: Монография. В.А. Костюк, А.И.Потапович. – Мн.: БГУ, 2004. – 174с. Дерябин Д.Г. Функциональная морфология клетки / Д.Г. Дерябин. – М.: КДУ, 2005.
10	Teaching Methods	Problematic, dialog-heuristic, search-research, reproductive (laboratory studies).
11	Language of instruction	Russian.
12	Conditions (requirements), current control	Methods of oral, written and laboratory-practical control
13	Form of current certification	Exam.

1	Course Title	Basics of Biotechnology
2	Year	4
3	Academic Semester	8
4	Number of credits	2,5
5	Lecturer	Doctor of biological sciences, professor of the department of microbiology Prokulevich V. A.
6	Goal	The goal of the course is to develop students' ideas about the main methodological principles, achievements and prospects for the development of biotechnology, problems solved by it, the characteristics of the biological objects used, the methods of their creation, and the technological approaches to obtaining targeted products.
7	Prerequisites	«Microbiology», «Genetic», «Molecular biology», «Chemistry».
8	Course Description from Program Guide	Practical tasks of biotechnology in the field of energy, medicine, agriculture, food industry. Objects of biotechnology, requirements for their application, principles of selection. Requirements for producers used in biotechnology production. Fundamentals of molecular biotechnology. Genetic engineering and technology of recombinant DNA. Tools of genetic engineering. Characteristics and features of vector molecules. Vector systems used for cloning in cells of prokaryotes and eukaryotes. Raw materials base of biotechnology. The role of environmental factors. Stages of biotechnological production. The device of bioreactors. Fermentation technologies: periodic, continuous. The final stages of obtaining the desired product. Immobilized cells and enzymes, the advantages of their use, ways of immobilization. Preparation and application of callus and suspension cultures of cells of higher plants. Cultivation of cells and tissues of animals. Reception of transgenic organisms. Advances in biotechnology.
9	Recommended Textbooks (in Russian)	1. <i>Егорова Т. А.</i> Основы биотехнологии: Учеб. Пособие для высших педагогических учебных заведений / Т. А. Егорова, С. М. Клунова, Е. А. Живухина. – М.: Изд. Центр «Академия», 2008. 2. <i>Евтушенков А. Н.</i> Введение в биотехнологию: курс лекций/ А. Н. Евтушенков, Ю. К. Фомичев. – Мн.: БГУ, 2004. 3. <i>Желдакова Р. А.</i> Основы биотехнологии: Методические указания к лабораторным занятиям для студентов биологического факультета / Р.А. Желдакова, В.Е. Мямин, Е.И. Игнатенко, Ю. В. Селезнева. – Минск: БГУ, 2009. – 48 с.
10	Methods	Problematic, visual methods, heuristic dialogue
11	Language	Russian
12	Student evaluation	- training of seminars; preparation of abstracts; - writing tests
13	Final examination	Credit

1	The name of the discipline	Basics of computer science in biology
2	The course of the study	1
3	Semester of training	2
4	The amount of credits	4,5
5	Full name of the lecturer	Doctor of Biological Sciences, Professor S.V. Buga
6	The objectives of the discipline studying	The purpose of teaching this discipline «Basics of computer science in biology» is the formation of a holistic view of information, the specifics of information processes in biological and ecological systems, the development of experience in applying information approaches to the analysis of biological objects, processes and systems, the implementation of scientific and information activities, the effective use of modern information technologies in professional activities in the field of biology and ecology. Teaching the course is largely based on the use of modern computer technology and software.
7	The prerequisites	Computer science in biology
8	Contents of the discipline	Introduction to informational biology. Information and information processes. Information technology. Scientific and information activities in biology and ecology. Information-based approaches to the analysis of biological and ecological processes and systems. Computer biology. Information technologies of data analysis and documentation of biological and ecological research results.
9	Literature recommended (in Russian)	<ol style="list-style-type: none"> <li>1. Буга С.В. Информационные технологии в работе с текстом. Минск: БГУ, 2005.</li> <li>2. Буга С.В. Подготовка и оформление квалификационных работ. Минск: БГУ, 2010.</li> <li>3. Буга С.В. Использование расширения Zotero браузера Mozilla Firefox для аккумуляции и представления научной библиографической информации / С. В. Буга, Т. В. Шелепова. Минск: БГУ, 2011.</li> <li>4. Каменская М.А. Информационная биология. М.: Academia, 2006.</li> <li>5. Сауткин Ф.В. Использование программных средств анализа цифровых изображений для определения размерных характеристик биологических объектов. Минск: БГУ, 2013.</li> <li>6. Сахвон В.В. Основы использования системы управления библиографической информацией EndNote. Минск: БГУ, 2013.</li> </ol>
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, oral survey, preparation of abstracts
13	The form of current certification	Exam

1	The name of the discipline	Basics of Toxicology
2	The course of the study	5
3	Semester of training	9
4	The amount of credits	3
5	Full name of the lecturer	KUKULIANSKAYA Tatsiana Aleksandrovna PhD, associate professor
6	The objectives of the discipline studying	Studying the theoretical bases of toxic effects of chemicals, toxicodynamics and toxicokinetics, as well as methodological principles for assessing the toxicity of xenobiotics.
7	The prerequisites	Metabolic biochemistry. Biorganic chemistry.
8	Contents of the discipline	Characteristics of toxicity of substances. Toxicodynamics. Mechanisms of toxic effects of substances. Toxicometry. Dependence of "dose-effect" in toxicology. Toxicokinetic regularities. Factors affecting the toxicity of xenobiotics. Special types of toxic effect. Antidotes .
9	Literature recommended	1. Kutsenko, S.A. Osnovy toksikologii / S.A. Kutsenko. – SPb.: Nauka, 2002. – 396 p. 2. Obshchaya toksikologiya / pod red. B.A.Kurlyadskogo, V.A.Filova. – M.: Meditsina, 2002. – 608 p. 3. Tarasov, A.V. Osnovy toksikologii / A.V. Tarasov, T.V. Smirnova. – M. : Marshrut, 2006. – 160 p. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	-preparation of abstracts, - oral surveys, -protection of individual tasks in the performance of laboratory work, written tests on specific topics of the course
13	The form of current certification	credit

1	Name of disciplines	Basis of Developmental Biology
2	Course of Study	3-d year, full-time department
3	Semester of training	6
4	Amount of credits	2,0
5	FULL NAME lecturer	Sidorov A.V., Maslova G.T.
6	Objectives of studying the discipline	To form a complete system of knowledge about the animal embryonic development and its cellular, molecular and genetic mechanisms
7	Prerequisites	Human anatomy. Cytology and histology. Zoology. Biochemistry. Human and Animal Physiology. Genetics.
8	Contents of the discipline	Introduction. Structure and development of germ cells. Fertilization. Cleavage. Gastrulation. Neurulation. A brief review of early embryonic development of various classes of invertebrates and vertebrates: Echinoderms, Lancelet, Amphibians, Aves, Mammals, peculiarities of Human embryonic development. Formation of organs and tissues (organogenesis). Molecular and genetic mechanisms of ontogenesis.
9		Maslova, G.T., Sidorov A.V. Basis of developmental biology. Minsk: BSU, 2013; Maslova, G.T., Sidorov A.V. A brief atlas on the biology of individual development: Minsk BSU, 2008; Sidorov A.V. et al. Fundamentals of Developmental Biology. Workshop. Minsk, BSU, 2016 Dondua A.K. Developmental biology. T. 1, 2. St. Petersburg: Publishing House of St. Petersburg State University, 2005. Gilbert S. Developmental biology. 9 <sup>th</sup> Ed. 2009.
10	Teaching Methods	Problematic, dialog-heuristic, visual, search-research, reproductive
11	Language of instruction	Russian
12	Conditions (requirements), current control	Preparation of abstracts, testing, fulfillment of control tasks and solution of situational tasks, managed independent work of students (USR)
13	Form of current certification	credit

1	The name of the discipline	Biochemical basis of immunity
2	The course of the study	5
3	Semester of training	9
4	The amount of credits	2,5
5	Full name of the lecturer	Yauhen Bandaruk
6	The objectives of the discipline studying	Learning of molecular mechanisms underlying the functions of immune system, forming the understanding of applicability of main physical-chemical regularities to functions of immune system.
7	The prerequisites	Biochemistry, Immunology, Molecular biology.
8	Contents of the discipline	Structure-functional organization of antigens and antibodies. Mechanisms of forming of antibodies diversity. Processing and presentation of antigen. Molecular regulators of the immune system functions. Cellular signaling pathways in the cells of immune system. Molecular mechanisms of histocompatibility, inflammation, hypersensitivity, immunodeficiency, autoimmunity, antitumor protection. Principles of production and application of monoclonal antibodies.
9	Literature recommended	1. Ярилин А.А. Иммунология / А.А. Ярилин. М.: ГЕОТАР-Медиа, 2010 2. William E. Paul. Fundamental Immunology. Seventh edition. LIP-PINCOTT WILLIAMS & WILKINS 2013. 3. Peter J. Delves, Seamus J. Martin, Dennis R. Burton, Ivan M. Roitt - Roitt's Essential Immunology (12th ed.) – 2011. Wiley-Blackwell. 4. Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai - Cellular and molecular immunology – 2012. Elsevier.
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- the preparation of abstracts, - 1 tests, - the preparation of presentation for the workshops
13	The form of current certification	credit



1	The name of the discipline	Biochemical ecology and monitoring of the environment
2	The course of the study	5
3	Semester of training	9
4	The amount of credits	2,5
5	Full name of the lecturer	Candidate of Biology, associate professor ORYOL Natalia Mikhaelovna
6	The objectives of the discipline studying	Development by students of theoretical bases of biochemical mechanisms of interactions of organisms in natural ecosystems; opportunities of ekologo-biochemical monitoring, its value in the solution of theoretical and applied questions of assessment of quality of the environment, conservation and rational environmental management.
7	The prerequisites	Structural biochemistry, metabolic biochemistry, functional biochemistry, enzymology
8	Contents of the discipline	Biochemical mechanisms of interactions in natural ecosystems; intraspecific and trans-species interactions by means of hemoregulatory; ecological danger of environmental pollution by chemicals; ekologo-biochemical monitoring, value, scope, solvable tasks.
9	Literature recommended	1. <i>Matasova L.V.</i> Biochemical ecology: Manual of. L.V. of Matasov, L.N. Hitsov, T.N. Popov. - Voronezh: VSU publishing house, 2003. - 63 pages. 2. <i>Salovarova V. P.</i> Introduction to biochemical ecology: studies. grant / Accusative of Salovarov, A.A. Pristavk, O.A. Bersenev. – Irkutsk: Irkut publishing house. state. Un-ta, 2007. – 159 pages. 3. <i>Ostroumov S.A.</i> Introduction to biochemical ecology. / S.A. Ostroumov Izvo Moskovskogo un-ta, 1986. 4. <i>Telitchenko M.M.</i> Introduction to problems of biochemical ecology: Biotechnology, agriculture, protection of the environment / M.M. Telitchenko, S.A. Ostroumov Publishing house M.: Science, 1990. 5. <i>Harborn J.</i> Introduction to ecological biochemistry./J. Harborn M.: World, 1985.
10	Teaching methods	Explanatory and illustrative, research, dialogue and heuristic, problem
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- written examination, - oral polls on laboratory researches, - preparation of the report on results of a practical work
13	The form of current certification	credit

1	Name of the discipline	Biochemistry and Physiology of Microorganisms
2	Course	4
3	Semester of training	8
4	Amount of credits	2
5	Full name of the lecturer	Candidate of Biological Sciences, Associate Professor Miamin Vladislav Evgen'evich
6	Objectives of the study of the discipline	Obtaining students a systematic knowledge of the basic microbiological and physiological-biochemical methods of studying microorganisms with their subsequent use for solving problems of an applied and fundamental nature. Forming students practical skills in working with microorganisms.
7	Prerequisites	Structural organization of microorganism cells, Physiology of microorganisms, Biochemistry, Systematics of microorganisms, Molecular biology.
8	Contents of the discipline	Measurement of extracellular and intracellular enzymes of bacteria. Separation and identification of degradation products of pectin substances using the paper chromatography method. Separation of biological molecules by gel filtration. Separation of proteins by ion-exchange chromatography on CM cellulose. Fractionation of bacterial cells. Stepwise electrophoresis of proteins in the Lammley system. Identification of virulence genes of <i>Erwinia carotovora</i> subsp. <i>carotovora</i> by polymerase chain reaction. Determination of the nucleotide composition of bacterial DNA by melting temperature.
9	Recommended literature	1. Мямин В.Е. Биохимия и физиология микроорганизмов: учеб.-метод. пособие / В. Е. Мямин. Мн.: БГУ, 2004. 2. Досон, Р. Справочник биохимика / Р. Досон, Д. Эллиот, У. Эллиот, К. Джонс М.: Мир, 1991. 3. Практикум по микробиологии: учебное пособие для студентов высших учебных заведений. (ред. Нетрусов А.И.) М: Академия, 2005. 4. Современная микробиология: Прокариоты / Под ред. Й. Ленгелера, Г. Дрекса, Г. Шлегеля. М.: Мир: т.1-2, 2005.
10	Teaching Methods	Active, dialog-heuristic verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), current control	Preparation of abstracts
13	Form of current certification	credit

1	Название дисциплины	Biochemistry of Medicinal Plants
2	Курс обучения	2
3	Семестр обучения	3
4	Количество кредитов	3
5	Ф.И.О. лектора	PhD, associate professor Shapchits Maria Pavlovna
6	Цели изучения дисциплины	the study of the main classes of pharmacologically active substances that are part of medicinal plants, their chemical structure, physico-chemical properties and medical and biological significance; the study of methods for the isolation and purification of pharmacologically active substances from medicinal plants, as well as their quantitative determination.
7	Пререквизиты	Structural biochemistry, metabolic biochemistry, botany, pharmacognosy.
8	Содержание дисциплины	Chemical composition of medicinal plants. Terpenoids, biogenesis of terpenoids in plants. Chemical composition, classification and methods of obtaining essential oils. Alkaloids: biogenesis, classification, physicochemical properties and methods of determination. Glycosides: structure, classification and biogenesis. Methods of isolation and methods for quantifying cardiac glycosides in plant raw materials. Chemical structure and properties of saponins. Anthracene derivatives and their glycosides. Phenolic compounds and their glycosides. Classification and biogenesis of flavonoids in plants. Medico-biological significance of flavonoids. Tannins: characteristic and biological role in plants.
9	Рекомендуемая литература	Муравьева Д.А. Фармакогнозия: Учебник. - 4-е изд., перераб. и доп./ Д.А. Муравьева, И.А. Самылина, Г.П. Яковлев - М.: Медицина, 2002. - 656 с. Племенков В.В. Введение в химию природных соединений / В.В. Племенков -Казань, 2001.-376 с. Химический анализ лекарственных растений: Учеб. пособие для фармацевтических вузов./ Е. Я. Ладыгина, В.Э. Отряшенкова и др./ Под ред. Гринкевич Н. И., Сафронич Л.Н. - М. : Высш. шк., 1983. — 176 с. Георгиевский В.П. Биологически активные вещества лекарственных растений / В.П. Георгиевский, П.Ф. Комиссаренко, С.Е. Дмитрук - Новосибирск, Наука, Сиб. отд-ние, 1990. - 333с.
10	Методы преподавания	Explanatory-illustrative, research, problem, dialog-heuristic.
11	Язык обучения	Russian
12	Условия (требования), текущий контроль	- 2 test papers, - preparation of a report on the results of a laboratory work
13	Форма текущей аттестации	exam

1	Discipline title	Biochemistry of Plants
2	Course of study	2
3	Semester of training	4
4	Amount of credits	1,5
5	Full name of lecturer	PhD, Docent, FILIPTSOVA Halina Grygorievna
6	Learning goals of discipline	To expand and deepen the knowledge of students about the chemical composition of plant organisms, structure, functions and features of the exchange of the main groups of chemical compounds synthesized by the plant cell.
7	Prerequisites	Biochemistry, Plant physiology.
8	Content of discipline	The plants as a source of biologically active compounds and industrial raw materials. Features of plant aminoacids and proteins. Monosaccharides, oligosaccharides and polysaccharides of plants: structure and functions. The lipid composition of plant organisms. Exchange of organic acids in plants. Secondary metabolites of plants: phenolic compounds, alkaloids, terpenoids, glycosides; their chemical structure, functions in plants, use in industry.
9	Recommended literature	1. Filiptsova, G. G. Fundamentals of plant biochemistry / G.G Filiptsova, I.I. Smolich. Minsk: BSU, 2004. 2. Heldt, G.-V. Plant Biochemistry / G.-V. Heldt. Moscow: "Binomial. Laboratory of Knowledge ", 2011. 3. Plant biochemistry / L.A. Krasilnikov [and others]. Rostov on Don: "Phoenix", 2004.
10	Teaching methods	Active types of lectures, visual training, discussion, practical and heuristic methods.
11	Language of training	Russian
12	Requirements, current control	Testing, Written control work Abstract writing
13	Form of current certification	Credit

1	The name of the discipline	Bioenergetic
2	The course of the study	4
3	Semester of training	8
4	The amount of credits	3
5	Full name of the lecturer	Hubich Aksana PhD, assistant professor
6	The objectives of the discipline studying	To form an integral system of knowledge about the main ways, mechanisms of regulation and the relationship of energy processes in the cell.
7	The prerequisites	human and animal physiology, cytology and histology, metabolic biochemistry
8	Contents of the discipline	The energy sources of life. The ways of energy formation in the cell. The main ways of using energy in the body of animals and humans. The integration and regulation of energy metabolism.
9	Literature recommended	Boldyrev, A.A. Biochemistry of membranes. M.: High School, 1986. 112 p. (in Russian) Kucherenko, N.E. Bioenergetics. Kiev: High School, 1989. (in Russian) Marie, R. Biochemistry Rights. Moscow: Mir. 1993. (in Russian) Skulachev, V.P. Bioenergetics. Membrane energy converters. M .: High School, 1989. (in Russian) Strayer, L. Biochemistry. Moscow: Mir, 1985. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- the preparation of abstracts, - 1 test, - the preparation of a report on the results of the workshop
13	The form of current certification	exam

1	Course Title	Biogeochemical Activities of Microorganisms
2	Year	5
3	Academic Semester	10
4	Number of credits	3,5
5	Lecturer	Candidate of Biological Sciences (=PhD) Maryia I. Charniauskaya
6	Goal	The goal of the course Biogeochemical Activities of Microorganisms is advancing of theoretical knowledge in the field of microbial ecology, and particularly system ecology and geomicrobiology.
7	Prerequisites	Structural Organization of Microbial Cells, Physiology of Microorganisms, Systematics of Microorganisms, Microbial Genetics, Cultivation of Microorganisms, Microbial Ecology
8	Course Description from Program Guide	Introduction. System of biogeochemical cycles. Microbes and atmosphere. Water microbiology. Microbial communities of amphibial landscapes, ecotones, and geochemical barriers. Soil microbiology. Biogeotechnology.
9	Recommended Textbooks (in Russian)	<i>Заварзин Г.А.</i> Лекции по природоведческой микробиологии / Г.А. Заварзин; Отв. ред. Н.Н. Колотилова; Ин-т микробиологии. – М.: Наука, 2004. – 256 с. <i>Кузнецов А.Е.</i> Научные основы экобиотехнологии: Учебное пособие для студентов / А.Е. Кузнецов, Н.Б. Градова – М.: Мир, 2006. – 504 с.
10	Methods	Comparative, problematic, visual methods, heuristic dialogue, method of forming the personal significance of knowledge
11	Language	Russian
12	Student evaluation	-presentation of scientific project; -writing tests; -labs report.
13	Final examination	Exam

1	The discipline	Bioindication of environmental quality
2	Year of study	3
3	Semester	6
4	Number of credits	2
5	Name of lecturer	PhD, Associate Professor Zhukova Anna Anatolievna
6	Learning objectives	Formation of the concept of methods for determining biologically significant anthropogenic loads on the basis of reactions of living organisms and their communities to them
7	Prerequisites	General ecology
8	Contents of the discipline	Bioindication as an integral element of the environmental quality assessment system. Tests for detecting toxicity. Use of the phenomenon of bioaccumulation in assessing the quality of the environment The use of biomarkers in assessing the quality of the environment. Bioindication based on the structural characteristics of communities. Assessment of the state of terrestrial ecosystems on the basis of the structure of biological communities. Assessment of the quality of the aquatic environment on the basis of the structure of the communities of hydrobionts. Protocols for rapid bioindication of flowing waters. Analysis of the structure of aquatic and terrestrial communities: calculation of indices of similarity and diversity. Assessment of environmental risk and the role of its bioindication.
9	Recommended literature	1. Bioindication of the quality of the natural environment / Zhukova AA, Mastitsky S.E. - Minsk: BSU, 2014. 2. Melekhova, O.P. Biological control of the environment: Bioindication and biotesting / O.P. Melekhov [and others]. - M.: Academia, 2007. 3. Lebedeva, N.V. Biodiversity and methods for its evaluation: Textbook / N.V. Lebedeva, N.N. Drozdov, D.A. Krivolutsky. Moscow: Moscow State University, 1999.
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Tests, task solving
13	Form of current certification	Exam

1	The name of the discipline	Bioinformatics and drug design
2	The course of the study	5
3	Semester of training	9
4	The amount of credits	3,5
5	Full name of the lecturer	DICHENKO Yaroslav Vladimirovich PhD
6	The objectives of the discipline studying	To create a system of competences for students, allowing, with the use of modern computer technologies, to conduct a targeted search for molecular structures of new physiologically active compounds with predicted types of biological activity.
7	The prerequisites	Organic chemistry, biochemistry
8	Contents of the discipline	Computer representation of molecules. Computer modeling of proteins. Virtual screening and docking. Rational development of medicinal substances by methods of chemogenomics. Prospects for the further development and application of computer technologies for the search for compounds possessing a given spectrum of biological activity.
9	Literature recommended	1. Molecular modeling. Theory and practice / H.D. Heltier [and others]; Ed. VA Palyulina, EV Radchenko. - Moscow: BINOM. Laboratory of Knowledge, 2010. - 318 pp. 2. Ramachandran, K. I. Computational Chemistry and Molecular Modeling: Principles and Applications / K. I. Ramachandran, G. Deepa K. Namboori. - Berlin: Springer, 2008. - 405 p. 3. Young, D.C. Computational drug design: a guide for computational and medicinal chemists / D.C. Young. N.Y. : Wiley, 2009. - 344 p. 1. Andrianov, AM Conformational analysis of proteins: theory and applications / AM Andrianov. - Minsk: Belarus. Navuka, 2013. - 518s. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes; - execution of tasks in the test form; - checking the conduct of laboratory journals; - protection of the student's prepared essay.
13	The form of current certification	exam



1	The name of the discipline	Bioinorganic chemistry
2	The course of the study	4
3	Semester of training	7
4	The amount of credits	2
5	Full name of the lecturer	Yauhen Bandaruk
6	The objectives of the discipline studying	Learning of the subject and main directions of research and theoretical developments in different branches of bioinorganic chemistry, applicability of physical methods of investigation for biological complexes with metals; view of the main results, problems and perspectives.
7	The prerequisites	Biochemistry, Enzymology, Chemistry of coordination compounds.
8	Contents of the discipline	Bioinorganic chemistry as independent discipline. Structure and stereochemistry of coordination compounds. Principles of hard and mild acids and bases. Biometals. Bioligands. Metal enzymes.
9	Literature recommended	1. <i>Яцимирский К.Б.</i> Введение в бионеорганическую химию./ К.Б. Яцимирский. Киев: Наукова думка, 1976. 2. <i>Г. Эйхгорн.</i> Бионеорганическая химия./ Г. Эйхгорн. М.: Мир, 1978.-Т. 1, - Т. 2. 3. <i>Х. Зигель.</i> Ионы металлов в биологических системах./ Х. Зигель, М.: Мир, 1982. 4. <i>К. МакОлифф.</i> Методы и достижения бионеорганической химии./ К. МакОлифф. М.: Мир, 1978. 5. <i>Уильямс Д.</i> Металлы жизни./ Уильямс Д. М.: Мир, 1985. 6. <i>Ленский А.С.</i> Введение в бионеорганическую и биофизическую химию./ Ленский А.С. М.: Высшая школа, 1989.
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- the preparation of abstracts, - 1 tests, - the preparation of a report on the results of the workshop
13	The form of current certification	credit

1	Name of the subject	Biologically active metabolites of microorganisms
2	Year of education	4
3	Term	7
4	Quantity of credits	2,5
5	Lecturer's full name	Semashko Tatiana Vladimirovna Candidate of Biological Sciences
6	Aims of studying the subject	To get knowledge about microorganisms which produce biologically active metabolites, basic principles and approaches necessary for their use in industry, and the way of obtaining metabolites, their properties and application.
7	Prerequisites	"Metabolic Biochemistry", "Pharmacognosy", "Engineering Enzymology", "Microbial Objects in Biotechnology"
8	Content of the subject	The main groups of microorganisms and biologically active metabolites they produce; the growth features of microorganisms-producers and formation of practically-significant compounds are studied; knowledge on the regulation of metabolic processes is formed; information on the methods of obtaining biologically active compounds and aspects of their practical use are given.
9	Recommended literature (basic)	1. Безбородов, А.М. Микробиологический синтез / А.М. Безбородов, Г.И. Квеситадзе. – СПб.: Проспект Науки, 2011. – 144 с. 2. Луканин, А.В. Инженерная биотехнология: основы технологии микробиологических производств : учебное пособие / А.В. Луканин. – М.: ИНФРА-М, 2016. – 304 с. 3. Нетрусов, А.И. Микробиология: теория и практика в 2 ч.: учебник для бакалавриата и магистратуры: / А.И. Нетрусов, И.Б. Котова. – Юрайт Москва, 2017 – .312 с. 4. Шмид, Р. Наглядная биотехнология и генетическая инженерия / Р. Шмид // пер. с нем. А.А. Виноградовой ; под ред. Т.П. Мосоловой, А.А. Сянюшина. – БИНОМ. Лаборатория знаний; 2014. – 324 с.
10	Teaching Methods	Organizing methods of educational and cognitive activity: a) verbal, visual, practical; b) search, research; c) inductive, deductive. Teaching methods based on the degree of awareness for the perception of educational material: passive (lecture), active (dialog-heuristic), interactive (work in small groups, teaching game (imitation), presentation). Stimulating methods of learning and cognitive activity: promoting the formation of motivation, interest in the acquisition of knowledge and skills.
11	Language	Russian
12	Conditions (requirements), current control	Use of electronic technical means of teaching for lecturing and control of students' knowledge. Methods of control: oral questioning, testing
13	Form of current certification	Exam

1	The name of the discipline	Biologically active substances
2	The course of the study	3
3	Semester of training	5
4	The amount of credits	1
5	Full name of the lecturer	Korik Elena PhD, assistant professor
6	The objectives of the discipline studying	formation of students' system of ideas about the diversity of biologically active compounds and their role in the metabolism of plants, animals and humans. Acquaintance with the methods of isolation, purification and testing of biological activity of substances.
7	The prerequisites	Structural biochemistry, organic chemistry
8	Contents of the discipline	The history of the study of biologically active substances, their classification. Characteristics of individual groups of biologically active substances: pheromones, poisons and toxins, biologically active amino acids, peptides, proteins, phytohormones, alkaloids, phenolic compounds, glycosides, terpenes, vitamins, biogenic amines, prostaglandins, hormones. Methods for assessing biological activity. Isolation and purification of BAS. Molecular mechanism of drug dependence development. Doping.
9	Literature recommended	1. Yu.B. Filippovich Fundamentals of Biochemistry - M.: Agar, 1999 (in Russian) 2. Biochemical pharmacology / Ed. Sergeeva A.S. - M.: High School, 1982 (in Russian) 3. Muraveva D.A. Pharmacognosy with the fundamentals of the biochemistry of medicinal substances - M.: Meditsina, 1981. Kolman Ya., Rem K.-G. Navlyadnaya biochemistry. Trans. with him., 2004 (in Russian) 4. Biologically active substances of vegetable origin. In 3 volumes / BN Golovkin, RN Rudenskaya, IA Trofimova, AI Shreter - M.: Science, 2001 (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes - execution of tasks in the test form; - checking the conduct of laboratory journals; - protection of the student's prepared essay.
13	The form of current certification	credit

1	The discipline	Biometry
2	Year of study	3
3	Semester	5
4	Number of credits	2
5	Name of lecturer	PhD, Associate Professor Zhukova Anna Anatolievna
6	Learning objectives	Formation of the idea of methods of statistical analysis of biological data, formation of skills and computer processing of experimental data
7	Prerequisites	Higher mathematics; computer science
8	Contents of the discipline	The definition of biometrics and the main stages of its development. Data in biology. Grouping of data. Descriptive statistics. The laws of probability distribution of random variables. Assessment of the reliability of sample indicators. Statistical hypothesis. Checking the normality of the distribution. Nonparametric and parametric tests. Dispersion analysis. Comparison of two groups. Correlation analysis. Regression analysis. Elements of multivariate statistics.
9	Recommended literature	1. Lakin G.F. Biometrics. - M.: Higher education. school, 1990. 2. Vukolov E.A. Fundamentals of statistical analysis (a workshop on statistical methods and investigation of operations using STATISTICA and EXCEL packages). - 2nd ed. - Moscow, 2008. - 464 p. 3. Glantz S. Medico-biological statistics. - M., Practice, 1999. - 459 p.
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Task solving
13	Form of current certification	credit

1	The name of the discipline	Biophysics
2	The course of the study	4, 5
3	Semester of training	7, 9
4	The amount of credits	5
5	Full name of the lecturer	NOVIKOV Dmitry Alekseevich PhD, assistant professor
6	The objectives of the discipline studying	Form students of biologists an idea of the most important physical processes occurring in living organisms, the basic principles and theoretical positions of biophysics. Explain the relationship between the physical and biological aspects of the functioning of living systems. Forming the skills of the biophysical approach in the study of biological processes and systems.
7	The prerequisites	Physics
8	Contents of the discipline	Thermodynamics of biological systems, kinetics of bioprocesses, molecular biophysics, biophysics of membranes and transport of substances through biomembranes, bioelectrogenesis, molecular mechanisms of energy conjugation processes, biophysics of contractile systems, photobiological processes, regulation of biological processes.
9	Literature recommended	1. Novikov DA, Filimonov M.M. Biophysics. Course of lectures / D.A. Novikov, M.M. Filimonov Mn .: BSU, Ch. 1-2, 2010-2011. 2. Rubin AB Biophysics. / ABRubin. Moscow: The Book House "University", 1999-2000. T. 1-2. 3. Antonov VF Biophysics / VF Antonov. M .: Gum. pub. center "Vlados", 2002. 4. Kostyuk PG Biophysics / PG Kostyuk. Kiev: High School, 1988. 5. Konev SV, Volotovskiy ID Photobiology / SV Konev, ID Volotovskiy. Mn .: Publishing house of the Belarusian University, 1979. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- the preparation of abstracts, - 2 tests, - the preparation of a report on the results of the workshop
13	The form of current certification	exam

1	Course Title	Biopolymers of the cell and methods of their analysis
2	Year	2
3	Academic Semester	4
4	Number of credits	1,5
5	Lecturer	RUS Olga Borisovna, associate professor
6	Goal	To create idea of a structure of natural biopolymers and of various experimental approaches to a research of structure
7	Prerequisites	Organic chemistry, Biochemistry
8	Course Description from Program Guide	Main classes of natural biopolymers. Principles of physical and chemical methods of the analysis of biopolymers. Structural organization of proteins, research methods. Structural organization of nucleic acids, research methods. Interaction of proteins with other proteins, nucleic acids and low-molecular ligands.
9	Recommended Textbooks (in Russian)	1. <i>Альбертс Б.</i> Молекулярная биология клетки / Б. Альбертс, А. Джонсон, Дж. Льюис и др. М.: Ижевск, 2013, Т. 1-3. 2. <i>Кольман Я.</i> Наглядная биохимия / Я. Кольман, К.-Г. Рем. М: Мир, 2004. 3. <i>Нельсон Д.</i> Основы биохимии Ленинджера / Д. Нельсон, М. Кокс. М.: Бином, 2015, Т. 1-3.
10	Methods	Research, practical, problem and modular, evident, method of formation of the personal importance of knowledge
11	Language	Russian
12	Student evaluation	- testings
13	Final examination	credit

1	Name of the discipline	Biosafety and bioethics in biotechnology
2	Course of study	2
3	Semester	4
4	Number of credits	1
5	Name of the Lecturer	Candidate of biological sciences, associate professor LAHODZICH Aliaksei Viktaravich
6	Objectives of studying the discipline	Form a presentation among students in the field of principles and methods of genetic engineering and the biosafety system, as well as the formation of a sense of responsibility for the actions performed before themselves, the scientific community and all living beings on the planet.
7	Prerequisites	Genetic engineering, bioethics, biotechnology.
8	Contents of the discipline	Legal basis for regulating biosafety. Basic principles and strategy for obtaining GMOs. Basic principles and methodology for assessing the risk of adverse consequences of genetic engineering activities. Assessment of the risk of possible adverse effects of genetically engineered organisms for human health and the environment. Place and role of bioethics in the system of applied ethical knowledge. Freedom and responsibility of a modern scientist. Moral and legal aspects of transplantation of human organs and tissues. Legal and bioethical foundations of legislation. Ethical and legal basis for regulating biomedical research on humans and animals.
9	Recommended literature	1.Ермишин А.П. Биотехнология. Биобезопасность. Биоэтика / А. П. Ермишин и др.; под ред. А.П. Ермишина. – Мн.: Тэхналогія, – 430 с. 2. Яскевич Я.С. Основы биоэтики: учебное пособие / Я.С. Яскевич и др.; под ред. Я.С. Яскевич, С.Д. Денисова. – Мн.: Вышэйшая школа, – 351 с. 3.Закон Республики Беларусь «О безопасности генно-инженерной деятельности» от 09.01.2006 № 96-З.
10	Teaching methods	Lectures, problem discussions, abstracts
11	Language	Russian
12	Conditions (requirements), control	Preparation of abstracts
13	Form of current certification	credit

1	The name of the discipline	Biochemistry
2	The course of the study	2
3	Semester of training	4
4	The amount of credits	5
5	Full name of the lecturer	KUZNETSOVA Ekaterina Igorevna PhD, associate professor; KUKULIANSKAYA Tatsiana Aleksandrovna PhD, associate professor; OREL Natalia Mikhailovna PhD, associate professor
6	The objectives of the discipline studying	Form the students an integral system of knowledge about the chemical composition of living organisms, the physico-chemical and biological properties of natural compounds, the main ways of metabolism, the mechanisms of regulation and the interrelation of metabolic processes.
7	The prerequisites	Organic chemistry. Analytical chemistry.
8	Contents of the discipline	Structurally functional characteristics of amino acids, peptides, proteins, enzymes, nucleosides, nucleotides, nucleic acids, carbohydrates, lipids, vitamins. Metabolism of DNA, RNA, proteins, peptides, amino acids, carbohydrates, lipids. Energy of biochemical processes. Integration and regulation of the metabolism.
9	Literature recommended	1. Berezov TT Biological Chemistry / T.T. Berezov, B.F. Korovkin. M.: Medicine, 1990. 2. Biochemistry: Textbook for high schools / Ed. E.S. Severin. Moscow: GEOTAR-Media, 2006. 3. Komov V. P., Shvedova V.N. Biochemistry / V.P. Komov, V.N. Shvedova. M.: Drofa, 2004. 4. Filippovich Yu.B. Fundamentals of biochemistry / Yu.B. Filippovich. M., 1999. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	-preparation of abstracts, - oral surveys, -protection of individual tasks in the performance of laboratory work, written tests on specific topics of the course.
13	The form of current certification	Examination



1	Course Title	Biotechnology - principles and application
2	Year	5
3	Academic Semester	10
4	Number of credits	3,5
5	Lecturer	Doctor of Biological Sciences Prokulyevich Vladimir Antonovich
6	Goal	The goal of the discipline is to broaden the notion of what modern biotechnology is, to highlight the main problems of biotechnology and to show the ways to solve them at the present stage of the development of science. Formation of students' ideas about the economics of the biotechnological process and the main points of impact on economic indicators.
7	Prerequisites	Microbiology, Genetics, Fundamentals of Molecular Biology, Genomics
8	Course Description from Program Guide	Prospects of biotechnology. Economic and commercial aspects of biotechnology. Characteristics of various types of biotechnological processes. Application of biotechnological approaches in energy, medicine, for solving agricultural problems.
9	Recommended Textbooks (in Russian)	<i>Глик Б.</i> Молекулярная биотехнология (принципы и применение) / Б. Глик, Дж. Пастернак. М.: Мир, 2002. <i>Егорова Т. А.</i> Основы биотехнологии: Учеб. Пособие для высших педагогических учебных заведений / Т. А. Егорова, С. М. Клунова, Е. А. Живухина. – М.: Изд. Центр «Академия», 2008. <i>Сассон А.</i> Биотехнология: свершения и надежды / А. Сассон. М.: Мир, 1987.
10	Methods	active, interactive, verbal, visual, problematic
11	Language	Russian
12	Student evaluation	- essay preparation; -Written works -UCP
13	Final examination	Exam

1	The name of the discipline	Biotechnology objects and their industrial use
2	Course	4
3	Semester of training	7
4	Amount of credits	3,5
5	Full Name lecturer	Candidate of Biological Sciences, Associate Professor Fomina Olga Valentinovna
6	Objectives of studying the discipline	Formation of modern ideas about the objects of biotechnology at different levels of development, as well as the basic principles of their creation and effective use in various areas of biotechnology production.
7	Prerequisites	Biotechnology, Microbiology, Plant and animal physiology, Cytology, Histology
8	Contents of the discipline	General characteristics of biotechnology objects (DNA, RNA, proteins, viruses, plant and animal cells, microorganisms, plants and animals) and their uses (food and chemical industry, agriculture, medicine, energy, environmental protection). The basic requirements for the objects and biological systems used in biotechnology. Methods of optimization and creation of highly productive organisms (new varieties of plants and breeds of animals, microorganisms-overproducers, somatic hybrids of bacteria, fungi, plants, animals).
9	Recommended literature	1. Глик Б. Молекулярная биотехнология. Принципы и применение / Б. Глик, Дж. Пастернак. М.: Мир, 2002. 2. Горбунов, Ю. Основы генетической инженерии и биотехнологии / Ю. Горбунов, Г. Медведев, Н. Минина Издательство: ИВЦ Минфина, 2010. 3. Загоскина, Н. В. Биотехнология. Теория и практика / Н. В. Загоскина, Л. В. Назаренко, Е. А. Калашникова, Е. А. Живухина. Издательство: Оникс, 2009.
10	Training Methods	Active, interactive, verbal, problematic, visual
11	Language of training	Russian
12	Conditions (requirements), operating control	-preparation of abstracts; - written tests; -computer testing
13	Form of current certification	Exam

1	Course Title	Biotechnology of industrial waste treatment
2	Year	5
3	Academic Semester	9
4	Number of credits	2
5	Lecturer	Candidate of Biological Sciences, associate professor of the department of microbiology Puchkova T. A.
6	Goal	The goal of the course is the formation of ideas about the current state, the main directions and prospects for the development of biotechnology in environmental matters, and the characteristics of the methods used for this.
7	Prerequisites	«Microbiology», «Fundamentals of molecular biology», «Introduction to biotechnology», «Biochemistry», «Biotransformation of substances».
8	Course Description from Program Guide	Scientific and technological progress and pollution of the environment. The most common and dangerous substances are pollutants. Normalization of air, water and soil pollution. Types of microbiological transformation of pollutants. Peculiarities of processes of decomposition of pesticides by microorganisms, the role of processes and reactions of peripheral and central cell metabolism. Oil and products of its processing as pollutants. Types of bioremediation technologies. Selection of strains-destroyers of pollutants. Biotechnology for the purification of gas-air emissions. Characteristics of sewage and cleaning methods. Processes of aerobic wastewater treatment. Types of treatment facilities in natural (irrigation fields, filtration fields and biological ponds) and artificial (biofilters, aerotanks) conditions. Microorganisms of activated sludge and biofilm. Processes of anaerobic wastewater treatment and biogas generation. Methods of biological treatment of organic waste (industry and agriculture).
9	Recommended Textbooks (in Russian)	1. Прикладная экобиотехнология: учеб. пособие: в 2 т. / А.Е. Кузнецов [и др.]. – М.: БИНОМ, Лаборатория знаний, 2010. 2. Экологическая биотехнология : учеб. пособие для студентов специальности «Биоэкология» / Н.С. Ручай, Р.М. Маркевич, Мн. : БГТУ, 2006. 3. Глик Б. Молекулярная биотехнология. Принципы и применение / Б. Глик, Дж. Пастернак. М.: Мир, 2002. 4. Егорова Т. А. Основы биотехнологии: Учеб. пособие для высших педагогических учебных заведений / Т. А. Егорова, С. М. Клунова, Е. А. Живухина. – М.: Изд. Центр «Академия», 2003.
10	Methods	Problematic, visual methods, heuristic dialogue
11	Language	Russian
12	Student evaluation	- training of seminars; preparation of abstracts; - writing tests
13	Final examination	Credit

1	The discipline	Biotic cycle
2	Year of study	4
3	Semester	7
4	Number of credits	4
5	Name of lecturer	Grichik V.V., Makarevich T.A., Nesterova O.L.
6	Learning objectives	Formation of a holistic view of energy flows and the circulation of substances in the biosphere
7	Prerequisites	Global Ecology, Hydroecology, Agroecology
8	Contents of the discipline	General ideas about the biotic cycle. The place of primary producers in the biogeochemical cycle and in the organic world of the Earth. Types of primary producers. Biogeochemical functions of primary producers. Primary production. Primary producers of aquatic ecosystems. Methods of field research. Methods for determining primary production: general principles, classification of methods. "Biomass" and "oxygen methods." Determination of primary production of plankton. Determination of quantitative indicators of phytoplankton by the example of the pond ecosystem. Assimilation of carbon dioxide in water and terrestrial ecosystems. Determination of primary production by CO <sub>2</sub> assimilation. Determination of the primary production of plankton by the content of chlorophyll. Distribution of primary production in the biosphere. Consumers as a functional element of the ecosystem. The role of consumers in the biotic (biogeochemical) cycle. Energy approach in the study of consumer goods. Consumption of food by consumers. Phytophages and detritophages. These predators. Intermediate offset on the topic "Functional types of consumers". Secondary products. Methods of calculating secondary products. Biomanipulation and fishing. Biomanipulation: principles, approaches and methods. Alien types of consumers and their role in ecosystems. Invasive corridors. General characteristic of the stress-reducing link. The main functional groups of decomposers. The main ways of destruction of organic remains in terrestrial and aquatic ecosystems. Detrital food chains. Invertebrates (detritophages) and processes of decomposition of organic matter. Microorganisms as the main link of decomposers and their functions in the biosphere. The main groups of decomposers in the aquatic environment. Heterotrophic bacteria. Detritus. Fungi and mushroom-like organisms, their place and role in ecosystems. The main groups of mushroom-decomposers. The place and role of fungi in biocenoses. Decomposition of plant litter and wood. Types of environmental strategies of fungi. Reducers and issues of environmental biotechnology: biological treatment of wastewater, treatment of solid waste, bioremediation of contaminated soils and soils. Bioremediation. Basic directions of bioremediation. General characteristics of the process and advantages in use. The main stages of soil purification using bioremediation. Bioremediation in situ and ex situ.
9	Recommended literature	1. Alimov A.F. Productive hydrobiology / A.F. Alimov, V.V. Bogatov, S.M. Golubkov. - SPb.: Science, 2013. 2. Anderson J.M. Ecology and environmental sciences: the biosphere, ecosystems, people / JM. Anderson. - L.: Gidrometeoizdat, 1985. 3. Bigon M. Ecology. Individuals, populations and communities. In 2 volumes / M. Bigon, J. Harper, K. Townsend. - Moscow: Mir, 1989.
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Testing, problem solving, problem analysis, writing and protecting essays
13	Form of current certification	credit

1	The name of the discipline	Biotransformation of matters
2	The course of the study	4
3	Semester of training	7
4	The amount of credits	1,5
5	Full name of the lecturer	Yauhen Bandaruk
6	The objectives of the discipline studying	Learning of biochemical basis of the biotransformation of endogenous and exogenous compounds (xenobiotics) in living creatures; the forming of conception of the community of the reaction of biotransformation of endogenous and exogenous compounds; learning of main principles and theoretical basis for application of biotransformation enzymes for the solving of ecological, biotechnological, pharmacological, toxicological and medical problems.
7	The prerequisites	Biochemistry of human and animals. Metabolism of drugs and xenobiotics.
8	Contents of the discipline	Structure-functional organization of the system of biotransformation of exogenous compounds. Main types of the reaction of biotransformation of xenobiotics. Special features of the metabolism of xenobiotics by different groups of organisms. Regulation of the biotransformation processes. Application of biotransformation enzymes in biotechnology and ecology. Biotransformation of drugs.
9	Literature recommended	1. Metabolism of Drugs and Other Xenobiotics. Edited by Pavel Anzenbacher and Ulrich M. Zanger. 2012 Wiley-VCH Verlag & Co. KGaA, Boschstr. 2. Головенко Н.Я. Сравнительная биохимия чужеродных соединений / Н.Я. Головенко, Т.Л. Карасева – Киев: Наукова думка, 1983. 3. Голиков С.Н. Общие механизмы токсического действия / С.Н. Голиков, И.В. Саноцкий, Л.А. Тиунов – Л.: Медицина, 1986. 4. Промышленная микробиология: учеб. пособие для вузов по спец. «Микробиология» и «Биология» / Под ред. Н.С. Егорова. – М.: Высш. шк., 1989. 5. Бутова С.Н. Теоретические основы биотехнологии. Биохимические основы синтеза биологически активных веществ / С.Н. Бутова, И.А. Типисева, Г.И. Эль-Регистан / Под ред. И.М. Грачевой. – М.: Элевар, 2003. – 554 с. 6. Саприн А.Н. Детоксикация ксенобиотиков в организме / А.Н. Саприн. Итоги науки и техники. Общие проблемы физико-химической биологии. - М.: ВИНТИ, 1990.
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- 1 tests, - the preparation of a report on the results of the workshop
13	The form of current certification	credit

1	The name of the discipline	Biotransformation of substances
2	The course of the study	5
3	Semester of training	9
4	The amount of credits	2
5	Full name of the lecturer	Candidate of Biology, associate professor ORYOL Natalia Mikhaelovna
6	The objectives of the discipline studying	Development by students of theoretical bases of biotransformation of endogenous and alien connections (xenobiotics) in live organisms; formation of ideas of use of knowledge of system of biotransformation of xenobiotics for the solution of ecological, biotechnological, pharmacological, toxicological and medical tasks.
7	The prerequisites	Structural biochemistry, metabolic biochemistry, functional biochemistry, enzymology
8	Contents of the discipline	Processes of biotransformation of endogenous and alien connections, including medicinal substances; ways of protection of an organism against action of free radicals; the characteristic of the fermental and transport systems participating in metabolism of xenobiotics. Applied aspects of biotransformation of substances
9	Literature recommended	1. <i>Golovenko N.Ya.</i> Comparative biochemistry of alien connections / N.Ya. Golovenko, T.L. Karasyova – Kiev: Navukova thought.1983. 2. <i>Kuznetsov A.E.</i> Scientific bases of ecobiotechnology / A.E. Kuznetsov, N.B. Gradova – Moscow "World". 2006. 3. Free radical oxidation / Under the editorship of N.D. Eshchenko. S-PB.: Prod. Page - Peterb. un-that, – 2008. 4. Industrial microbiology: studies. a grant for higher education institutions on the specialist. "Microbiology" and "Biology" / Under the editorship of N.S. Egorov. – M.: Vyssh. shk. 2003. 5. <i>Saprin A.N.</i> A detoxication of xenobiotics in an organism / A.N. Saprin. Results of science and technology. Common problems of physical and chemical biology. - M.: VINITI, 1990.
10	Teaching methods	Explanatory and illustrative, research, dialogue and heuristic, problem
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- preparation of papers, - poll in the form of dialogue on laboratory researches, - preparation of the report on results of a practical work
13	The form of current certification	credit

1	Name of disciplines	Botany
2	Course of Study	1-2
3	Semester of training	2-3
4	Amount of credits	7
5	FULL NAME lecturer	PhD, Associated Professor Sautkina T.A., PhD, Associated Professor Juice M.A., PhD, Associated Professor Tikhomirov V.N.
6	Objectives of studying the discipline	Form students a complete system of knowledge about the features of the structure, reproduction, diversity, distribution, classification of higher plants, plant communities, the importance of plants in nature.
7	Prerequisites	Algology and Mycology
8	Contents of the discipline	General idea of the origin of higher plants. Characteristic features of higher plants as a result of adaptation to life on land. Evolution of the body shape. Features of the structure and a variety of plant cells and tissues, vegetative and reproductive organs. Reproduction of plants, features of life cycles. Flower as a special reproductive organ of angiosperms. Scientific approaches to the classification of plants. Taxonomic categories and taxa. General characteristics (structural features, distribution, significance, origin, phylogenetic connections and classification) of different taxa. The concept of flora, vegetation, phytocenosis. The relationship of plants with each other and the environment. Composition and structure of plant communities, principles and methods of phytocenosis classification.
9	Recommended literature	1. Сауткина Т.А. / Сауткина Т.А, Поликсенова В.Д. Морфология растений. Минск: БГУ, 2012. 2. Сауткина, Т.А./ Сауткина Т.А., Поликсенова В.Д. Ботаника. Практикум по морфологии растений. Минск: БГУ, 2017. 2. Черник, В.В Систематика высших растений. Покрытосеменные. Класс Двудольные / В.В. Черник, М.А Джус, Т.А. Сауткина, В.Н. Тихомиров. Минск: БГУ, 2010. 2. Черник, В.В. Высшие споровые растения / В.В. Черник. Минск: БГУ, 2008. 3. Зубкевич, Г.И. Систематика высших растений. Голосеменные / Г.И. Зубкевич. Минск: БГУ, 2004. 4. Черник, В.В Систематика высших растений. Покрытосеменные, Класс Однодольные / В.В. Черник, М.А. Джус. Минск: БГУ, 2012. 5. Еленевский А.Г. Ботаника / А.Г. Еленевский, М.Л. Соловьева, В.Н. Тихомиров. М.: Академия, 2004.
10	Teaching Methods	Visual, system, group, modular-rating learning technologies
11	Language of instruction	Russian
12	Conditions (requirements), current control	- protection of abstracts and written tests; - oral survey, colloquium; - Testing
13	Form of current certification	examination

1	The Name of the Discipline	Cell Pathology
2	The Year of the Study	2
3	The Semester of the Study	4
4	The Amount of Credits	3,5
5	Lecturer's Full Name	assistant professor PhD Gloushen Sergey V.
6	The Objectives of Studying the Discipline	To provide students with a set of knowledge necessary both in itself and in understanding and uptake the information from Cell Pathology in such areas as Virology, Cell Death and Oncology
7	Prerequisites	Общая биология, Цитология, Генетика
8	Discipline Contents	The subject, methods and objectives of the cell pathology. Development of research on the cell pathology. The current state of the cell pathology and prospects of its development. Cell cultures as model systems for the study of pathological processes. Viral cytopathology. Classification of types of cell death. Comparative analysis of necrosis, apoptosis and autophagy. Neoplastic transformation of cells. The theory of carcinogenesis. Clonal selection mechanisms of tumor progression.
9	The Recommended Literature	<ol style="list-style-type: none"> <li>Weinberg R.A. The Biology of Cancer / R.A. Weinberg. – NY: Garland Science, 2014. – 876 pp.</li> <li>Parrish, A.B. Cellular mechanisms controlling caspase activation and function / A.B. Parrish, C.D. Freel, S. Kornbluth // Cold Spring Harb. Perspect. Biol. – 2013, 5 (doi:10.1101/cshperspect.a008672)</li> <li>Koff, J.L. A Time to Kill: Targeting Apoptosis in Cancer / J.L. Koff, S. Ramachandiran, L. Bernal-Mizrachi // Int. J. Mol. Sci. – 2015, 16. – P. 2942-2955.</li> </ol>
10	Teaching Methods	<p>The main technologies of training are</p> <ul style="list-style-type: none"> <li>- elements of problem training implemented in lectures, practical and laboratory classes;</li> <li>- competence approach implemented in lectures, practical and laboratory classes, as well as in students' independent work.</li> </ul>
11	Study Language	Russian and English
12	Conditions (Requirements), Current Assessment	<p>Selective monitoring at lectures</p> <p>Checking students' lecture notes</p> <p>Carrying out tests in the group</p> <p>Questions in the defense of reports on laboratory works</p> <p>Questions at practical classes</p>
13	Current Assessment Form	credit



1	The name of the discipline	Clinical Biochemistry
2	The course of the study	4
3	Semester of training	7
4	The amount of credits	2,5
5	Full name of the lecturer	Hubich Aksana PhD, assistant professor
6	The objectives of the discipline studying	To form a full view of the rational and effective use of biochemical methods and laboratory results of biological fluids for timely diagnosis, adequate prognosis and clear control of the chosen strategy for the treatment of human diseases.
7	The prerequisites	Medical biochemistry, functional biochemistry, metabolic biochemistry
8	Contents of the discipline	The analytical bases of laboratory diagnostics. The laboratory evaluation of protein metabolism. The Fundamentals of enzymodiagnosics. The clinical methods for assessing of lipid metabolism. The investigation of the disorders of pigment metabolism. The assessment of the parameters of water-electrolyte exchange. The laboratory analysis of the parameters of the acid-base state of the organism. The diagnosis of violations of the endocrine system. The molecular and biochemical markers of tumor growth. The methods of laboratory investigation of the hemostasis system.
9	Literature recommended	Kamyshnikov V.S. Methods of clinical laboratory research. Minsk: Belarusian Science, 2002. (in Russian) Marshal V. J. Clinical Biochemistry M.: BINOM, 1999. (in Russian) Nikulin B.A. Manual on Clinical Biochemistry. Moscow: GEOTAR-MED, 2007. (in Russian) Tkachuk V.A. Clinical biochemistry. Moscow: GEOTAR-MED., 2004. (in Russian) 5. Tsyganenko A.Y., Zhukov V.I., Myasoedov V.V., Zavgorodny I.V. Clinical biochemistry. M.: Triada, 2002. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- the preparation of abstracts, - 2 tests, - the preparation of a report on the results of the workshop
13	The form of current certification	exam

1	Name of the discipline	Comparative physiology
2	Course of Study	4
3	Semester	7
4	Amount of credits	1,5
5	Lecturer	Kazakevich Victor Bernhardovich
6	Objectives of the discipline	The objective is to reveal the logic of the development of the functions of organs and their systems in a variety of groups of organisms, revealing the general principles of their functional organization. An important aim of the course is to determine the place of human in biological history, since the existing textbooks on physiology are anthropocentric (written by physicians).
7	Prerequisites	Zoology, Human and animals physiology, Physiology of intercellular communications.
8	Content of the discipline	Introduction to comparative physiology. Comparative physiology of respiratory systems. Comparative physiology of blood and circulatory systems. Comparative physiology of excretion systems. Comparative physiology of nutrition and digestion systems. Comparative physiology of the nervous system. Comparative physiology of mediators. Endocrinology of vertebrates and invertebrates.
9	Recommended literature	1. Присный А.А. Эволюционная физиология. – Белгород, 2013. 2. Романенко В.Н. Основы сравнительной физиологии беспозвоночных. – Т. 2013. 3. Лапицкий В.П. Сравнительная физиология нервной системы. – Л.: 2004.
10	Teaching Methods	When reading the course, technical training tools are used to demonstrate the presentations. The theoretical bases of the course are consolidated on laboratory exercises.
11	Language	Russian
12	Conditions and control	control of self-directed work
13	Form of current certification	- credit

1	The name of the discipline	Cultivation of cells
2	Course	2
3	Semester of training	4
4	Amount of credits	2
5	Full Name lecturer	Candidate of Biological Sciences, Associate Professor Fomina Olga Valentinovna
6	Objectives of studying the discipline	Forming students' modern ideas about the main directions and possibilities of cell cultivation (especially the cultivation of cells of higher plants and animals outside the organism), the ways of cultivation, various cultural systems, as well as the principles of making nutrient media and equipping cultural laboratories and industrial production.
7	Prerequisites	Microbiology, Cytology, Histology, Plant and Animal Physiology
8	Contents of the discipline	Historical development of cultivation of microorganisms. Features of growth and development of cells of microorganisms belonging to different taxonomic groups. Classification and characteristics methods of cultivation of microorganism cells. The main types of cultural systems. Historical development of plant cells cultivation. Methods of creating cell cultures. Methods of cultivation of plant cells and types of culture systems. Features of cultivated plant cells. Methods of production and features of cultivation of plant protoplasts. Historical development of the cultivation of animal cells. The main sources of cultured animal cells. Primary, diploid and heteroploid cells. Substrates and nutrient media. Types of cultural systems. Features of cells cultivation of invertebrates and vertebrates.
9	Recommended literature	1. Методы культивирования клеток. – Л.: Наука, 1988. 2. Темников Д.А., Винтер В.Г. Основы культивирования клеток. Обучающий интернет-курс. Бюл. «Клеточные культуры», 2003. 3. Блажевич О.В. Культивирование клеток. – Минск: БГУ, 2005.
10	Training Methods	Active, interactive, verbal, problematic, visual
11	Language of training	Russian
12	Conditions (requirements), operating control	-preparation of abstracts; -written tests; -computer testing
13	Form of current certification	Exam

1	The name of the discipline	Cultivation of microorganisms
2	Course	2
3	Semester of training	4
4	Amount of credits	2
5	Full Name lecturer	Candidate of Biological Sciences, Associate Professor Fomina Olga Valentinovna
6	Objectives of studying the discipline	Formation of modern ideas about the main directions and possibilities of cultivation of microorganism cells of various taxonomic groups, methods and various systems of cultivation, the principles of preparation of nutrient media and equipping laboratories and industrial production, the relevance of the use and role of cultures of microorganisms in the technological process in the production of biologically active substances, their application in various fields of biology, medicine and agriculture.
7	Prerequisites	Bacteriology, Mycology, Algology
8	Contents of the discipline	Historical development of microorganism's cultivation. The main methods of microorganism's cultivation. The relevance of the application of microorganism cultures in various fields of biology, medicine and agriculture. Principles of the nutrient medias formation. Influence of cultivation conditions on vital activity of microorganisms. Ways of optimization of conditions, providing the maximum level of production of biomass and microbial metabolites. Features of cultivation of anaerobic microorganisms. Methods for the isolation and maintenance of pure cultures of aerobic and anaerobic microorganisms.
9	Recommended literature	1. Глик Б. Молекулярная биотехнология. Принципы и применение / Б. Глик, Дж. Пастернак. М.: Мир, 2002. 2. Перт С. Дж. Основы культивирования микроорганизмов и клеток / С. Дж. Перт. М.: Мир, 1978. 3. Темников Д.А. Основы культивирования клеток / Д. А. Темников, В. Г. Винтер. Обучающий интернет-курс. Бюл. «Клеточные культуры», 2003.
10	Training Methods	Active, interactive, verbal, problematic, visual
11	Language of training	Russian
12	Conditions (requirements), operating control	-preparation of abstracts; - written tests; -computer testing
13	Form of current certification	Exam

1	The discipline	Ecological physiology
2	Year of study	3
3	Semester	6
4	Number of credits	1
5	Name of lecturer	PhD, associate professor Nesterova Oxana Lvovna
6	Learning objectives	Formation of the concept of the main eco-physiological concepts, the essence of physiological processes, occurring in living organisms in a natural environment, the interconnection of processes and phenomena.
7	Prerequisites	General ecology, Human and animal physiology, Plant physiology
8	Contents of the discipline	Tasks, methods of ecological physiology. Correspondence between organisms and the environment. Conditions and resources. Types of adaptive reactions; temperature adaptations. Thermoregulation: ecto-, endo- and heterothermia. The patterns of energy exchange. Regularities of food processes, filtration. Regularities of development, types of development. Regularities of growth processes.
9	Recommended literature	1. Odum Yu. Fundamentals of Ecology / Yu. Odum. - M.: 1975. 2. General basis for the study of aquatic ecosystems / Ed. G. G. Vinberg. - L.: 1979. 3. Comparative physiology of animals / ed. L. Prosser. - M.: 1987.
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Preparation and protection essay, task solving
13	Form of current certification	credit

1	The discipline	Ecological problems of Belarus
2	Year of study	3
3	Semester	5
4	Number of credits	1,5
5	Name of lecturer	doctor of biological sciences, professor Kulikov Yaroslav Konstantinovich
6	Learning objectives	Formation of a system of scientific views on the main directions of environmental protection and the improvement of the ecological situation in the Republic of Belarus
7	Prerequisites	General ecology; plant growing
8	Contents of the discipline	Ecological situation in Belarus: formation, changes, regional features. Problems of natural water pollution in Belarus. Anthropogenic changes in the biosphere functions of soils. Ecological problems in connection with the extraction of minerals. Ecological problems of Soligorsk mining area. Environmental problems associated with anthropogenic impact on forests. Ecological problems of biodiversity conservation. Problems of production and consumption wastes. Problems of radioactive contamination of the natural environment of Belarus.
9	Recommended literature	1. Kulikov Ya.K. Ecological problems of Belarus: a course of lectures. - Minsk: BSU, 2008 2. The state of the environment of Belarus: an environmental bulletin. - Minsk: Minsk Type Project, 2016 3. Podolyako V.M. etc. Biosphere-compatible use of forest and marsh ecosystems. - Minsk: Polycraft LLC, 2003
10	Teaching Methods	A problematic, visual, method of forming the personal significance of knowledge
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	credit

1	The discipline	Ecology and environmental management
2	Year of study	5
3	Semester	9
4	Number of credits	3,5
5	Name of lecturer	doctor of biological sciences, professor Grichik Vasily Vitalyevich
6	Learning objectives	Forming a system of knowledge about the basic concepts and laws of the structural and functional organization of superorganismic biosystems, the role of man in ensuring the stable functioning of populations, ecosystems and the biosphere.
7	Prerequisites	Zoology, Geobotany
8	Contents of the discipline	Ecology as a science on the functioning and interaction of superorganismic systems of different levels of organization. Conditions of organism's life and their diversity. Environmental factors and its classification. Ecology of the population (static and dynamic characteristics). Interaction of populations. The main types of interpopulation relationships. The concept of an ecological niche. Biocoenosis is the level of organization of living systems. Biogeocenoses, ecosystems, ecological successions. The concept of the biosphere. The role of man in the evolution of the biosphere. Biogeochemical cycles. Resources of the biosphere and the basis of nature management.
9	Recommended literature	1. Grichik V.V., Kamlyuk L.V., Semenyuk G.A. Ecology and rational nature management. Me, BSU, 2013.
10	Teaching Methods	Verbal, practical
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	Exam

1	The discipline	Ecology of the urban environment
2	Year of study	4
3	Semester	7
4	Number of credits	2
5	Name of lecturer	PhD, Associate Professor Semenyuk Galina Alekseevna
6	Learning objectives	Formation of a modern understanding of the environmental problems of cities, their negative impact on the inhabitants of megacities and the natural environment of urbanized areas. Show effective ways and techniques to optimize the quality of the urban environment.
7	Prerequisites	General ecology
8	Contents of the discipline	The city as a complex living polystructural system. Characteristics of the human environment and the main environmental problems of urban systems. Volume of municipal and industrial water consumption. Hygienic requirements for the quality of drinking water: national and international standards. Ways to restore the quality of surface and groundwater. Pollution of the air basin of cities, its scale and consequences. Change in climatic characteristics in urban areas. "Islands of heat." The state of the suburban green zone and its impact on the environment of urbanized territories. Traditional and modern methods of waste disposal. Treatment of TCR in the Republic of Belarus. Features of adaptation of the human body in the modern megalopolis, risk factors. An integrated multidisciplinary approach to urban planning and environmental management. Bioclimatic architecture and energy saving. Energy-efficient (passive) house: characteristics, history and development prospects.
9	Recommended literature	1. Semenyuk G.A. Ecology of the urban environment: a course of lectures / Minsk: BSU, 2009.- 99 p. 2. Chelnokov A.A. Ecology of the urban environment: a textbook / Minsk: Vysheyshaya school, 2016. - 368 p.
10	Teaching Methods	Dialog-heuristic, problematic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	credit



1	The name of the discipline	Entomology
2	The course of the study	2
3	Semester of training	4
4	The amount of credits	1,5
5	Full name of the lecturer	Doctor of Biological Sciences, Professor S.V. Buga
6	The objectives of the discipline studying	The purpose of the special course «Entomology» is to form a holistic view about the Insecta taxon among students and the role of its representatives in ecosystems.
7	The prerequisites	Zoology
8	Contents of the discipline	The history of entomology. Morphology of insects. The anatomy of insects. Reproduction and development of insects. Ecology of insects. Insects and humans. Systematics of insects
9	Literature recommended (in Russian)	1. Бей-Биенко Г.Я. Общая энтомология / Г.Я. Бей-Биенко. М.: Высшая школа, 1990. 2. Захваткин Ю.А. Курс общей энтомологии / Ю.А. Захваткин. М.: Колос, 2001. 3. Нестерова О.Л. Энтомология [электронный ресурс]: пособие / О.Л. Нестерова. Минск, БГУ, 2013. 4. Росс Г. Энтомология / Г. Росс, Ч. Росс, Д. Росс. М.: Мир, 1985. 5. Тыщенко В.П. Физиология насекомых / В. П. Тыщенко. М.: Высшая школа, 1986.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, oral survey, preparation of abstracts
13	The form of current certification	Credit

1	Course Title	Environmental Biotechnology
2	Year	3
3	Academic Semester	6
4	Number of credits	2,5
5	Lecturer	Candidate of Biological Sciences, associate professor of the department of microbiology Puchkova T. A.
6	Goal	The goal of the course is to form students' understanding of the main achievements of modern biotechnology aimed at solving environmental problems used for this biological objects and processes.
7	Prerequisites	«Microbiology», «Radioecology», «Hydroecology», «Environmental monitoring, control and examination».
8	Course Description from Program Guide	Ecological biotechnology as a branch of general biotechnology, stages of emergence and development prospects. Objects of biotechnology and ways to improve them. Use in biotechnology of immobilized bioobjects. Nutritional substrates, including waste products used in biotechnological processes. The device of fermenters and bioreactors. Cultivation of microorganisms, cells of higher plants, cells and tissues of animals. General concept of environmental pollution. Ecological bases of bioindication. Biotesting as a method for assessing the toxicity of chemicals and natural environments. Methods of biological sewage treatment. Types of treatment plants in natural and artificial conditions. The role of microorganisms in wastewater treatment processes, their main groups. Processes of anaerobic treatment and biogas formation. Biological cleaning of gas-air emissions, used installations. Biological methods of soil remediation. Principles of obtaining microbial biological preparations for bioremediation. Bioremediation technologies. Phytoremediation. Bioenergetics. Use of biotechnology achievements in agriculture. Prospects for the production of bioplastics from renewable resources. Factors affecting the decomposition of biopolymers in nature.
9	Recommended Textbooks (in Russian)	1. Прикладная экобиотехнология: учеб. пособие: в 2 т. / А.Е. Кузнецов [и др.]. – М.: БИНОМ, Лаборатория знаний, 2010. 2. Егорова Т.А. Основы биотехнологии: Учеб. пособие для высших педагогических учебных заведений / Т.А. Егорова, С.М. Клунова, Е.А. Живухина. – М.: Изд. Центр «Академия», 2008.
10	Methods	Problematic, visual methods, heuristic dialogue
11	Language	Russian
12	Student evaluation	- training of seminars; preparation of abstracts; - writing tests
13	Final examination	Credit

1	The discipline	Environmental monitoring, control and expertise
2	Year of study	4
3	Semester	7
4	Number of credits	2,5
5	Name of lecturer	PhD, Associate Professor Makarevich Tamara Aleksandrovna
6	Learning objectives	Formation of a holistic view of the existing in the world and in Belarus, in particular, the system of monitoring the state of the environment, assessing and regulating this state
7	Prerequisites	General ecology
8	Contents of the discipline	Quality of the environment. Ecological rationing. Environmental standards and methods for their establishment. Environmental monitoring: methodology, methods and tools. The National Environmental Monitoring System of the Republic of Belarus (NES). Implementation of NES in Belarus. System of state management of environmental protection and nature management in Belarus. General strategy for regulating the quality of the environment, regulatory mechanisms.
9	Recommended literature	1. Israel A.Yu. Ecology and environmental monitoring. - Moscow: Gidrometeoizdat, 1984. 2. Klyuchenovich V.I. [and others] National Environmental Monitoring System of the Republic of Belarus: Results and Prospects. - Minsk: "BelNIC" Ecology ", 2013. 3. Makarevich T.A., Utochkina S.P. Environmental monitoring, control and examination: a training manual. - Minsk, BSU, 2012.
10	Teaching Methods	Dialog-heuristic, problematic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	Exam

1	The name of the discipline	Enzyme Kinetics
2	The course of the study	3
3	Semester of training	6
4	The amount of credits	1,5
5	Full name of the lecturer	SEMAK Igor V., PhD, associate professor
6	The objectives of the discipline studying	To develop the student's an understanding of principles, applicability and limitations of Enzyme Kinetics, the ability to use kinetic studies for decryption of enzyme catalysis mechanism.
7	The prerequisites	Enzymology, biochemistry, analytical biochemistry
8	Contents of the discipline	Basic principles and pattern of chemical kinetics applied in Enzyme Kinetics. Velocity of enzyme reaction and mode of it quantification. Quasi stationary nature of enzyme kinetics. Classification of enzyme reactions. Influence of temperature on enzyme reaction. Thermodynamic probability of enzyme reaction. Influence of pH on enzyme reaction. Inhibition of enzyme reaction. Allosteric regulation of enzyme activity. Computer methods for data processing and presenting results of analysis of enzyme kinetics.
9	Literature recommended	1. Keleti T. Basic Enzyme Kinetics / M.: «Mir», 1990. In russian. 2. Bender M.L. et al. The Bioorganic Chemistry of Enzymatic Catalysis / M.: «Mir», 1987. In russian. 3. Walter Ch. Enzyme Kinetics. Open and Closed Systems / M.: «Mir», 1969. In russian. 4. Cornish-Bowden, Athel (2004). Fundamentals of enzyme kinetics (3rd ed.). London: Portland Press. 5. Cleland, William Wallace; Cook, Paul (2007). Enzyme kinetics and mechanism. New York: Garland Science.
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes - execution of tasks in the test form; - checking the conduct of laboratory journals; - The public defence of the student's prepared essay.
13	The form of current certification	credit

1	The name of the discipline	Enzyme Linked Immunosorbent Assays
2	The course of the study	4
3	Semester of training	7
4	The amount of credits	2,5
5	Full name of the lecturer	SEMAK Igor V., PhD, associate professor
6	The objectives of the discipline studying	To develop the student's an understanding of principles, applicability and limitations of Enzyme Linked Immunosorbent Assays (ELISA), the ability to select appropriate approaches to perform specific analytical tasks using ELISA.
7	The prerequisites	Immunology, analytical chemistry
8	Contents of the discipline	Structure and properties of antigens and antibodies. The physico-chemical properties of antigen - antibody interaction. Enzyme label in immunoassay. Production of reagents for ELISA. Methods of ELISA. Methods for data processing and presenting results.
9	Literature recommended	1. Collins W. P. Complementary immunoassays / М.: «Mir», 1987. In russian. 2. Catty D. Antibodies: A Practical Approach / М.: «Mir», 1991. In russian. 3. Wild D. The Immunoassay Handbook 4th Edition (Theory and Applications of Ligand Binding, ELISA and Related Techniques) / Elsevier Science, 2013. 4. Теория и практика иммуноферментного анализа / А.М. Егоров, А.П. Осипов, Б.Б. Дзантиев, Е.М. Гаврилова – М.: Высшая школа, 1991. In russian.
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes - execution of tasks in the test form; - checking the conduct of laboratory journals; - The public defence of the student's prepared essay.
13	The form of current certification	exam

1	Object of Study	Ethnic and confessional history of Belarus
2	Year, Specialty	2
3	Semester	3
4	Number of Credits	2
5	Lecturer	KARPOVICH Natalia Valeryanovna
6.	Purposes of the Discipline Studies	The study of the peculiarities of the formation of the Belarusian ethnos, the study of the development of confessional relations in Belarus in different historical periods
7	Prerequisites	History of Belarus in the context of European civilization
8	Content of the Discipline	Periodization of the ethnic and confessional history of Belarus, a description of the main stages. Historical forms and components of the ethnos. Classification of ethnoses. Confessional map of the world. Structure, functions, typology of religions. Classification of religions: archaic religions and religions of ancient civilizations, national - state and world religions, non - traditional religions. Typological features, features of creed, cult and the organization of religious organizations. Atheism. Religious legislation of the Republic of Belarus: evolution and current status. Ethnic and confessional structure of modern Belarus. The main groups of non-traditional religions: neo-Christian associations, neo-oriental cults, synthetic religions, Scientology directions, neo-pagan organizations. The reasons for the formation of new religious organizations. European Congress of Ethnic Religions (ECER). National-cultural revival in the late XX - early XXI century. Characteristic features of the mentality and ethnic image of the Belarusians. Emigration of Belarusians, the main stages.
9	Recommended Literature	Беларусь: государство, религия, общество. Материалы Международной научно-практической конференции. Минск – Жировичи, 7 июня 2007 г. – Минск: Белорусская наука, 2008. Закон Республики Беларусь «О свободе вероисповеданий и религиозных организациях: Закон Республики Беларусь», 17 декабря 1992 г. С изм. и доп. от 17.01.95 г. – Ведамасці Вярхоўнага Савета Рэспублікі Беларусь – 1995 – № 13. Дубянецкі, Э. С. Ментальнасць беларусаў. Нацыянальны характар // Беларусазнаўства: Навуч. Дапам. / Пад рэд. П. Брыгадзіна. Мн., 1998. С. 123-151. Калубовіч, А. Восем волн беларускай эміграцыі // Неман. – 1992. – №2 Этнаграфія беларусаў: гістарыяграфія, этнагенез, этнічная гісторыя – Мінск, 1985.
10	Methods of Teaching	Technologies of problem-module education and training and research activities, communication technologies (discussion, press conference, brainstorming, training debate), case method (situation analysis)
11	Languages of Teaching	Belarusian, Russian
12	Papers and Tests during the Semesters	– preparation of a research project; – conducting testing
13	Semester Result	credit

1	Name of the discipline	Eukaryotic cell culture
2	Course of Study	2
3	Semester of Study	3
4	Amount of credits	2
5	Lecturer	Candidate of biological sciences, associate professor DITCHENKO Tatiana I.
6	Goals	Study of initiation methods and physiological and biochemical bases of maintenance <i>in vitro</i> of cell cultures of plants, animals and humans, as well as the directions of their biotechnological and biomedical use
7	Prerequisites	Cytology and Histology
8	Content	Maintenance of aseptic conditions in the technology of plant and animal cell cultures. Physiological and biochemical basis of plant cell cultivation. Methods for the induction and cultivation of plant cells (callus and suspension cultures, protoplast cultures). Directions of using cell cultures and plant tissues. Cellular plant engineering. Types of cell cultures of animals and humans. Physiological and biochemical foundations and systems of cultivation of cells of animals and humans. Directions of using cell cultures of animals and humans. Preparation of pharmaceutical proteins. Cellular animal engineering. Use of cell cultures of animals and humans in medicine.
9	Recommended literature (in Russian)	1. Ditchenko, T.I. Plant cell, tissue and organ culture: course of lectures. – Mn.: BSU, 2007. 2. Freshni, R.Ya. Culture of animal cells [Electronic resource]: a practical guide. – Moscow: BINOM. Knowledge lab, 2014. 3. Biotechnology of biologically active substances / ed. THEM. Grachevoy, L.A. Ivanovo. – Moscow: Izd-vo Elevar, 2006.
10	Teaching Methods	Verbal, practical, research
11	Language of instruction	Russian
12	Requirements of current control	Testing, written examination, preparation and defense of the essay
13	Form of current attestation	credit

1	Name of the discipline	Evolutionary biochemistry
2	Course of Study	5
3	Semester of Study	9
4	Amount of credits	2,5
5	Lecturer	PhD, associate professor Shapchits Maria Pavlovna
6	Goals	Form an understanding of the main theoretical and methodological approaches to the study of biochemical mechanisms of the evolution of living organisms.
7	Prerequisites	Metabolic biochemistry, enzymology, proteomics, molecular biology, the fundamentals of developmental biology, the theory of evolution.
8	Content	Basic mechanisms and strategies for biochemical adaptation. Biochemical approaches to the study of evolution. Biochemistry of prokaryotes and eukaryotes. Respiratory proteins and phylogenesis of hemoglobin. Molecular-genetic and biochemical foundations of embryonic development. The main features of metabolism at different stages of human development.
9	Recommended literature (in Russian)	<ol style="list-style-type: none"> <li>1. Чиркин А.А., Данченко Е.О., Бокуть С.Б. Биохимия филогенеза и онтогенеза – Минск: Новое знание; М: Инфа-М, 2012. - 288 с.</li> <li>2. М. Серых, Ю. П. Фролов Эволюционная биохимия - Самара: Самарский университет, 2007. - 236 с. Солвей Дж. Наглядная медицинская биохимия. М.: ГЭОТАР-Медиа, 2011.</li> <li>3. Hochachka, P. W. and Somero, G. N. (1984). Biochemical Adaptation. Princeton, NJ: Princeton University Press.</li> <li>4. Чиркин, А.А. Биохимия с основами геномной инженерии / А.А.Чиркин – Витебск: УО «ВГУ им. П.М.Машерова, 2010. – 181 с.</li> <li>5. Чиркин А.А., Данченко Е.О. Биохимия: Учебное руководство. М.: Мед. лит., 2010. – 624 с.</li> <li>6. Бокуть, С.Б. Молекулярная биология: молекулярные механизмы хранения, воспроизведения и реализации генетической информации: учеб. пособие / С.Б.Бокуть, Н.В.Герасимович, А.А.Милютин. – Мн.: Выш. шк., 2005. – 463 с.</li> <li>7. Ярыгин, В.Н. (ред.) Биология. Т.1. – М.: Высшая школа, 2003. – 432 с.</li> <li>8. Титок М.А. Молекулярные аспекты эволюции – Мн: Изд-во БГУ, 2011.</li> </ol>
10	Teaching Methods	Explanatory-illustrative, research, problem, dialog-heuristic.
11	Language of instruction	Russian
12	Requirements of current control	<ul style="list-style-type: none"> <li>- prepare reports,</li> <li>- oral questioning,</li> <li>- 2 test papers</li> </ul>
13	Form of current attestation	credit



1	Name of the discipline	Extrachromosomal genetic structures of bacteria
2	Course	4
3	Semester of training	7
4	Amount of credits	2,5
5	Full name lecturer	Doctor of Biological Sciences, Professor Titok Marina Alekseevna
6	Objectives of studying the discipline	Consideration of the organization of the main types of extrachromosomal genetic elements, their role in the variability of bacterial genomes, the principles of their use in genetic engineering.
7	Prerequisites	Genetics, Microbiology, Biotechnology
8	Contents of the discipline	The role of mobile genetic structures (plasmids, transposons, integrons) in the variability of bacterial organisms. Features of the molecular organization of plasmids, determining resistance to antibiotics, the degradation of organic and inorganic compounds, the synthesis of toxins, the formation of nodules and crown galls. Organization of replication systems of plasmid replicons and systems that ensure their stable inheritance in cells (mrs-, kil- and par-systems). Evolution of plasmids. Methods of studying plasmids.
9	Literature	1. <i>Thomas C.M.</i> The Horizontal gene pool / Harwood Academic Publishers, Amsterdam, 2000. 2. <i>Titok M.A.</i> Plasmids of Gram-positive bacteria / J.K. Fomichev, editor / BSU Publishers, Minsk, 2004.
10	Teaching Methods	Problematic, dialog-heuristic, visual.
11	Language of instruction	Russian
12	Conditions (requirements), current control	-testing -writing essays
13	Form of current certification	exam

1	The name of the discipline	The Fauna of Belarus
2	The course of the study	3
3	Semester of training	6
4	The amount of credits	1,5
5	Full name of the lecturer	PhD, Associate Professor O.I. Borodin; PhD, Associate Professor V.V. Sakhvon
6	The objectives of the discipline studying	«The fauna of Belarus» is the zoological discipline basing on knowledge's of Vertebrate and Invertebrate zoology, animal ecology and others branches of biological science. The main purpose of this course is acquaintance with fauna diversity in Belarus.
7	The prerequisites	Zoology
8	Contents of the discipline	The history of the animal world of Belarus. Taxonomic review: the Kingdom Protista, Lower Multicellular, Lower Worms, The Group Coelomata. Phylum Chordata. Animals of terrestrial ecosystems. Animals of aquatic ecosystems. National strategies for the use of wildlife in Belarus. National strategy for protection of fauna of Belarus.
9	Literature recommended (in Russian)	1. Бурко Л.Д. Позвоночные животные Беларуси / Л.Д. Бурко, В. В. Гричик. Минск: БГУ, 2013. 2. Энциклопедия природы Беларуси / ред. кол. Ю. В. Александров [и др.]. Минск: Беларус. Энцыкл. імя П. Броўкі, 2014. 3. Жуков П.И. Рыбы Беларуси. Минск: Наука и техника, 1965. 4. Жуков П.И. Справочник по экологии пресноводных рыб. Минск: Наука и техника, 1988. 5. Птицы Беларуси на рубеже XXI века: статус, численность, распространение / М.Е. Никофоров [и др.]. – Минск: Изд-во Н. А. Королев, 1997.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing
13	The form of current certification	Credit

1	The name of the discipline	Functional biochemistry
2	The course of the study	2
3	Semester of training	4
4	The amount of credits	4
5	Full name of the lecturer	Candidate of Biology, associate professor ORYOL Natalia Mikhaelovna
6	The objectives of the discipline studying	Formation at students of complete system of knowledge of biochemical functions of bodies and fabrics; mechanisms of regulation and interrelation of biochemical processes in bodies and fabrics and an organism in general; value of a functional biochemical kompartmentalization for maintenance of a gomeostazis; biochemical adaptation of an organism to internal and external factors.
7	The prerequisites	Structural biochemistry, metabolic biochemistry
8	Contents of the discipline	Functional biochemistry of blood, liver, kidneys, muscles, connecting fabric, brain: a role in ensuring processes of activity of an organism in general. Mechanisms of regulation of biochemical processes in bodies and fabrics and their integration. Applied aspects of functional biochemistry.
9	Literature recommended	1. <i>Oryol N.M.</i> Functional biochemistry: grant. In 2 h. P 1. Functional biochemistry of blood, liver, kidneys, muscles / N.M. Oryol. – Minsk: BGU. – 2015. 2. Biochemical bases of activity of the person / Under the editorship of Filippovich Yu.B., Konichev A. S.//M.: VLADOS. - 2005. 3. Biochemistry. / Under the editorship of Severin E. With//M.: GEOTAR – MEDICAL – 2011. 4. <i>Kamenyuk L.K.</i> Functional biochemistry. Uchebno methodical grant/L. K. Kamenyuk, E.Sh. Enikeev, R.I. Yagudina, Yu.V. Saenko / Under the editorship of the prof. V.S. Tishkin//Ulyanovsk: Prod. - in Ulyanovsk un-that. – 1998. 5. <i>Kolman Ya.</i> Evident Biochemistry / Ya. Kolman, K.G. Ram//M.: World. – 2009.
10	Teaching methods	Explanatory and illustrative, research, dialogue and heuristic, problem
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- written examination, - the current examinations on laboratory researches, - oral poll on laboratory researches, - preparation of the report on results of a practical work
13	The form of current certification	exam

1	Name of the discipline	Functional genomics
2	Course of study	3
3	Semester	6
4	Number of credits	2.5
5	Name of the Lecturer	Candidate of biological sciences, associate professor LAHODZICH Aliaksei Viktaravich
6	Objectives of studying the discipline	Forming an integral system of knowledge about the implementation of genetic information in biological systems, studying and mastering various approaches and methods for its analysis, demonstrating the possibilities for their application, identifying factors that affect the inheritance of traits, developing algorithms and recommendations for selecting appropriate methods for analyzing the results of genetic experiments.
7	Prerequisites	Genetics, molecular genetics, molecular biology of a gene, biochemistry
8	Contents of the discipline	Genomics, its goals and tasks, a place among other biological sciences. Sequencing of complete genomes and analysis of the structure of the genome. The main structural and functional elements of the carriers of genetic material. Molecular databases and annotation of genomic sequences. The organization of the genome and evolution. Archives and retrieval of information. Bioinformatics. Aligning sequences and building phylogenetic trees. Prediction of protein function. Computer design of medicines.
9	Recommended literature	1. Попов В.В. Геномика с молекулярно-генетическими основами. / В.В. Попов.- М.: Книжный дом “ЛИБРОКОМ”, 2009. – 304 с. 2. Леск А. Введение в биоинформатику. / А. Леск; пер. с англ. – М.: БИНОМ. Лабораторные знания, 2009. – 318 с. 3. Глик Б., Пастернак Дж. Молекулярная биология. Принципы и применение: Пер. с англ. / под ред. Н.К. Янковского. – М.: Мир. 2002. – 589 с.
10	Teaching methods	Lectures, work with databases
11	Language	Russian
12	Conditions (requirements), control	Computer testing
13	Form of current certification	exam

1	Name of disciplines	Fundamentals of botany
2	Course of Study	1-2
3	Semester of training	2-3
4	Amount of credits	7
5	FULL NAME lecturer	PhD, Associated Professor Poliksenovaa V.D., PhD, Associated Professor Tikhomirov V.N., PhD, Associated Professor Lemeza N.A., PhD, Associated Professor Chernik V.V.
6	Objectives of studying the discipline	Form students a complete system of knowledge about the features of the structure, reproduction, diversity, distribution, classification of higher plants, plant communities, the importance of plants in nature.
7	Prerequisites	Biology, VII, X, XI grade of secondary school
8	Contents of the discipline	Characteristic features of higher plants as a result of adaptation to life on land. Features of the structure and a variety of plant cells, tissues, vegetative and reproductive organs. Reproduction of plants, features of life cycles. Flower as a special reproductive organ of angiosperms. The concept of flora, vegetation, phytocenosis. The relationship of plants with each other and the environment. Scientific approaches to the classification of plants, algae, fungi. Taxonomic categories and taxa. General characteristics of different taxa.
9	Recommended literature	1.Сауткина Т.А. / Сауткина Т.А, Поликсенова В.Д. Морфология растений. Минск: БГУ, 2012. 2. Сауткина, Т.А./ Сауткина Т.А., Поликсенова В.Д. Ботаника. Практикум по морфологии растений. Минск: БГУ, 2017. 2.Черник, В.В Систематика высших растений. Покрытосеменные. Класс Двудольные / В.В. Черник, М.А Джус, Т.А. Сауткина, В.Н. Тихомиров. Минск: БГУ, 2010. 2. Черник, В.В. Высшие споровые растения / В.В. Черник. Минск: БГУ, 2008. 3. Зубкевич, Г.И. Систематика высших растений. Голосеменные / Г.И. Зубкевич. Минск: БГУ, 2004. 4. Черник, В.В Систематика высших растений. Покрытосеменные, Класс Однодольные / В.В. Черник, М.А. Джус. Минск: БГУ, 2012. 5. Еленевский А.Г. Ботаника / А.Г. Еленевский, М.Л. Соловьева, В.Н. Тихомиров. М.: Академия, 2004.
10	Teaching Methods	Visual, system, group, modular-rating learning technologies
11	Language of instruction	Russian
12	Conditions (requirements), current control	- protection of abstracts and written tests; - oral survey, colloquium; - Testing
13	Form of current certification	examination.

1	The name of the discipline	Fundamentals of Ethology
2	The course of the study	4
3	Semester of training	8
4	The amount of credits	3,5
5	Full name of the lecturer	PhD, Associate Professor V.I. Khvir
6	The objectives of the discipline studying	One of the main tasks of the course is the formation of a scientific view on the processes of behavioral adaptations of animals in different environmental conditions, the notions of the ecological conditioning of the behavioral repertoire that allows animals to occupy various ecological niches.
7	The prerequisites	Zoology
8	Contents of the discipline	Basic laws and patterns of manifestation of various forms of animal behavior. Regularities in the development of behavior in ontogeny. Peculiarities of social behavior of animals. Mechanisms that determine the formation and consolidation of various forms of behavior. Regularities of the evolutionary development of behavior.
9	Literature recommended (in Russian)	1. Дьюсбери Д. Поведение животных: Сравнительные аспекты. М: Мир, 1981. 2. Зорина З.А. Зоопсихология. Элементарное мышление животных / З.А. Зорина, И.И. Полетаева. М: Высшая школа, 2001. 3. Зорина З.А. Основы этологии и генетики поведения / З.А. Зорина, И.И. Полетаева, Ж.И. Резникова. М: Высшая школа, 2002. 4. Мак-Фарленд Д. Поведение животных: психобиология, этология и эволюция. М: Мир, 1988. 5. В.І. Хвiр Этология: тезаурус. Часть 1. Общие и теоретические термины и понятия. Минск: БГУ, 2010.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, oral survey
13	The form of current certification	Exam

1	Course Title	Fundamentals of Immunology
2	Year	3
3	Academic Semester	6
4	Number of credits	2,5
5	Lecturer	Candidate of biological sciences, associate professor Pesnyakevich Alexander Georgievich
6	Goal	The main goal of the course is to form a general view of students, regardless of their narrow specialization, about the natural factors of protecting the mammalian organism from infectious agents and about the mechanisms that determine individuality at the cellular and molecular levels. The course should also serve as a basis for meaningful application by students in their further scientific activity of modern methods of research of biological objects, which are based on the use of antibodies.
7	Prerequisites	Human anatomy, human and animal physiology, cytology and histology, biochemistry; molecular biology, genetics, microbiology, virology
8	Course Description from Program Guide	The role of the immune system in maintaining homeostasis. General characteristics of the immune system of mammals (organs, cells, molecules). Differences and interrelation of constitutive and inducible mechanisms protect the body from foreign antigens. Impenetrability of the integument, inflammatory reaction, phagocytosis, complement system as the main manifestations of constitutive mechanisms. Immune response to thymus-dependent antigens as the main inducible mechanism. Immunological memory, mechanisms of its origin and realization. Hypersensitivity as a form of response to the antigen. Types of immunity to infectious diseases. The concept of vaccines and serums as preventive and therapeutic agents. General properties and classification of antigens. Structure, classification and properties of antibodies. The principle of obtaining monoclonal antibodies. Antigen-antibody reactions and their application in scientific research. Immunodeficiency and immunopathology in humans.
9	Recommended Textbooks (in Russian)	1. Ярилин А.А. Иммунология. М.: ГЕОТАР-МЕДИА, 2010 2. Ройт А. , Бростофф Дж., Мейл Д. Основы иммунологии. М.: Мир. 2000. 3. Галактионов В.Г. Иммунология. М., Академия, 2004 4. Л.В. Ковальчук, Л.В. Ганковская, Р.Я. Мешкова. Клиническая иммунология и аллергология с основами общей иммунологии М.: ГЕОТАР-Медиа, 2011 5. Песнякевич А.Г. Основы иммунологии. Курс лекций Минск, БГУ, 2008.
10	Methods	Comparative, problematic, visual methods, heuristic dialogue, method of forming the personal significance of knowledge
11	Language	Russian
12	Student evaluation	Lectures Laboratory classes (compulsory attendance) Testing
13	Final examination	Exam

1	Name of the discipline	Fundamentals of Intellectual Property Management
2	Course of Study	4
3	Semester of training	8
4	Amount of credits	1,5
5	Name of the speaker	Senior Lecturer Staganovich Anastasia Leonidovna
6	Objectives of studying the discipline	Formation of knowledge of intellectual property; studying by students of general issues of registration, registration and implementation of rights to the results of intellectual activity; inculcation of skills of conducting patent information retrieval, including using the Internet.
7	The re-requisites	Economy
8	Contents of the discipline	Intellectual property as a factor of socio-economic development. Copyright and related rights. Industrial property. Patent Information. Patent research. Introduction of intellectual property in civil circulation. Commercial use of intellectual property. Protection of the rights of authors and rights holders. Settlement of disputes about infringement of intellectual property rights. State management of intellectual property.
9	Recommended literature	1. Kudashov V.I. Intellectual property: protection and implementation of rights, management: training. allowance. - Mn .: BNTU, 2004. - 322 p. 2. Yakimakho A.P. Management of intellectual property in the Republic of Belarus. - Mn .: Amalfeya, 2005. - 472 p.
10	Teaching Methods	The problematic, dialog-heuristic, visual, method of forming the personal significance of knowledge
11	Language of instruction	Russian
12	Conditions (requirements),	-testing - preparation of abstracts
13	Current control	credit



1	Name of the discipline	Fundamentals of molecular biology
2	Course	3
3	Semester of training	5
4	Amount of credits	1,5
5	Full name lecturer	Doctor of Biological Sciences, Professor Titok Marina Alekseevna
6	Objectives of studying the discipline	Review of molecular genetic processes that ensure the evolution of organisms in a series of generations.
7	Prerequisites	Cytology, Biochemistry, Genetics
8	Contents of the discipline	The concept of biological systems, the features of their organization and functioning. Cell as a structural unit of the organism, cell types, non-cellular biological systems and their principal characteristic. Basic biological polymers and their functions in living systems. The principle of the structure and functioning of DNA as a substance of heredity. Molecular mechanisms of replication, transcription, translation and recombination. Mutational process and repair systems.
9	Recommended literature	<ol style="list-style-type: none"> <li>1. <i>Alberts B.</i> Molecular Cell Biology / <i>B. Alberts, D. Brey, D. Luis, M. Reff, K. Roberts</i>, editors / Mir Publishers, Moscow, V. 2, 1986.</li> <li>2. <i>Spirin A.S.</i> Structure and functions of nucleic acids / <i>A.S. Spirin</i>, editor / High school Publishers, Moscow, 1990.</li> <li>3. <i>Bokut S.B.</i> Molecular biology / <i>S.B. Bokut, N.V. Gerasimovich, A.A. Milutin</i>, editors / High school Publishers, Minsk, 2005.</li> <li>4. <i>Singer M.</i> Genes and genomes / <i>M. Singer, P. Berg</i>, editors / Mir Publishers, Moscow, 1998.</li> </ol>
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language of instruction	Russian
12	Conditions (requirements), current control	-testing -writing essays
13	Form of current certification	credit

1	Name of the discipline	Fundamentals of Plant Biotechnology
2	Course of Study	3
3	Semester of Study	6
4	Amount of credits	1,5
5	Lecturer	Candidate of biological sciences, associate professor DITCHENKO Tatiana I.
6	Goals	Form a system of knowledge about the basic principles and methods of cellular and genetic engineering of higher plants, its achievements and prospects
7	Prerequisites	Plant Physiology Eukaryotic cell culture
8	Content	Plants as objects of biotechnology. Growth regulators and their use in plant biotechnology. Fundamentals of plant cell engineering. Somatic hybridization. Cybridization. Cell selection <i>in vitro</i> . Getting somaclonal variants. Genetic engineering of plants. Directions and methods of creating transgenic plants. Biotechnology of medicinal plants. Technologies of microclonal reproduction and creating virus-free plants. Biotechnological methods for preserving the gene pool of higher plants.
9	Recommended literature (in Russian)	1. Voinov, N.A. Modern problems and methods of biotechnology. - Krasnoyarsk: IPK SFU, 2009. 2. Ditchenko, T.I. Culture of plant cell, tissue and organ: course of lectures. – Mn.: BSU, 2007. 3. Ermishin, A.P. Plant Biotechnology and Biosafety: a Handbook. – Mn.: BSU, 2015.
10	Teaching Methods	Verbal, practical, research
11	Language of instruction	Russian
12	Requirements of current control	Testing, written examination, preparation and defense of the essay
13	Form of current attestation	credit

1	The name of the discipline	Fundamentals of Radiation Biochemistry
2	The course of the study	4
3	Semester of training	7
4	The amount of credits	2
5	Full name of the lecturer	FILIMONOV Mikhail Mikhailovich, PhD, Associate Professor
6	The objectives of the discipline studying	To form a system of ideas about the role of radiation-biochemical research in solving the main problems of modern radiobiology among students of biologists
7	The prerequisites	Biochemistry, Radiation Biophysics.
8	Contents of the discipline	Actual problems of radiobiology and radiation biochemistry from the perspective of the consequences of the Chernobyl accident. The state and changes in the metabolism of the most important biomolecules and systems in the irradiated organism. Biochemical aspects of the action of small doses and powers of ionizing radiation, taking into account the phenomena of radiation hormesis.
9	Literature recommended	1. Kuzin, A.M. Radiation Biochemistry / A.M. Kuzin .- Moscow: Atomizdat, 1962. 2. Eidus, L.Kh. Nespecific reaction of cells and radiosensitivity / L.Kh. Eidus.-M.: Atomizdat, 1977. 3. Kuzin, A.M. The idea of radiation hormesis in the atomic age / A.M. Cousin. Moscow: Nauka 1995. 4. Nefedov, I.Yu., Nefedova, I.Yu., Palpa, GF, Actual aspects of the problem of the genetic consequences of irradiation of mammals. // Radiation Biology. Radioecology. vol.40, №4, p.358. Fundamentals of biochemistry / Yu.B. Filippovich. M., 1999. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes; - execution of tasks in the test form; - checking the conduct of laboratory journals; - protection of the student's prepared essay.
13	The form of current certification	credit

1	The name of the discipline	Fundamentals of Zoology
2	The course of the study	1
3	Semester of training	1–2
4	The amount of credits	7
5	Full name of the lecturer	PhD, Associate Professor O.Yu. Kruglova; PhD, Associate Professor V.I. Khvir
6	The objectives of the discipline studying	The course «Fundamentals of Zoology» is one of the fundamental courses in the system of university biological education. It's goal is to detail for students the diversity of the animal world and the features of organization and life activity of representatives of different taxonomic groups. The objectives of the course include detail for students with the spread of animals, the main ways of their evolution, the formation of specific adaptive features of the organization in connection with the diversity of habitats.
7	The prerequisites	Zoology
8	Contents of the discipline	Kingdom Protista. Kingdom Animalia. Subkingdom Parazoa. Subkingdom Phagocytellozoa. Subkingdom Eumetazoa. Bilateralia. Protostomia. Deuterostomia. Main stages and regularities of animal evolution.
9	Literature recommended (in Russian)	1. Лопатин И.К. Зоология беспозвоночных: учебное пособие / И.К. Лопатин, Ж.Е. Мелешко. Минск: БГУ, 2009. 2. Шарова И.Х. Зоология беспозвоночных. 1999 3. Наумов Н.П. Зоология позвоночных / Н.П. Наумов, Н.Н. Карташев. М.: Высшая школа, 1979. 4. Шалапенок Е.С. Практикум по зоологии беспозвоночных / Е.С. Шалапенок, С.В. Буга. Минск, 2002. 5. Тихомиров И.А. Малый практикум по зоологии беспозвоночных / И.А. Тихомиров, А.А. Добровольский, А.И. Гранович. 2005. 6. Лопатин И.К. Методическое пособие по систематике и словарь систематических групп по курсу «Зоология беспозвоночных животных» / И.К. Лопатин, Е.С. Шалапенок, С.В. Буга, Ж.Е. Мелешко. Минск: БГУ, 2013. 7. Ромер А., Парсонс Т. Анатомия позвоночных / А. Ромер, Т. Парсонс. М.: Мир, 1992. – Т. 1, Т. 2. 8. Терентьев П.В. Практикум по зоологии позвоночных, 1956. 9. В.И. Хвир Основы зоологии: низшие хордовые, бесчелюстные, рыбы. / В.И. Хвир, О.Ю. Круглова. Минск: БГУ, 2016. 10. Догель В.А. Зоология беспозвоночных. М.: Высшая школа, 1981.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, oral survey, preparation of abstracts, drawing albums
13	The form of current certification	Exam

1	Name of discipline	Gene molecular biology
2	Training course	2
3	Semester	4
4	The number of credits	1,5
5	Lecture name and surname	Maximova Natalia
6	The goal of the discipline	The motto of the course is "New ideas based on new knowledge." The aim of the course is to acquaint students with the latest achievements of molecular biology of the gene and molecular genetics and their scientific basis and perspectives of use to solve theoretical and applied problems of biology, medicine and agriculture.
7	Prerequisites	Cell biology, organic and inorganic chemistry, biochemistry.
8	The content of the discipline	The course program includes issues of structural – functional organization of genes and genomes, the basic mechanisms of realizing the hereditary information of organisms of different level of complexity. The study of molecular genetic mechanisms of the matrix processes – replication, transcription, reverse transcription and translation. The deciphering of the genetic code. Familiarity with modern methods of gene analysis and their use in genetic engineering, when creating transgenic animals and plants, microorganisms, as well as in gene therapy.
9	Recommended literature	1. Lewin B. Genes. M: Laboratory of knowledge, 2012. 2. Mulkambarov N. N., Kuznetsov, S. A. Molecular biology: OOO "Medical information Agency", 2007. 3. Sverdlov E. D. Problems and prospects of molecular genetics. / Sverdlov E. D.: M.: Nauka, 2003. 4. Sverdlov E. D. Look at life through the window of the genome: In 3 T. T. 1: Essays on modern and molecular genetics. Vol. 1. M.: Nauka, 2009.
10	Teaching methods	Comparative, problem, a visual method based on the use of multimedia, the method of formation of the personal meaning of knowledge.
11	Language learning	Russian
12	Conditions (requirements), the current control	Oral responses test-control, control of independent work, writing abstracts and essays.
13	Form current certification	Credit

1	Name of discipline	Gene therapy
2	Training course	5
3	Semester	9
4	The number of credits	3,5
5	Lecture name and surname	Maximova Natalia
6	The goal of the discipline	The purpose of the course is to form understanding of modern aspects of gene therapy and methods of treating hereditary human diseases by molecular genetic approaches. To achieve this purpose the material is presented in a logical sequence, starting from acquaintance with hereditary human diseases and their molecular genetic basis, the development of methods of gene transfer and expression in human cells, the prospects of gene therapy.
7	Prerequisites	Genetics, molecular biology, genomics, modern aspects of genetic analysis, genetic engineering, virology, human and animal physiology, biochemistry, immunology.
8	The content of the discipline	Gene therapy – changes in the genetic apparatus of human somatic cells to treat diseases. Classification of monogenic and polygenic human diseases. The genetic nature of HIV infection. The strategy and methods of correction of genetic defects. Methods of introducing genes into human cells. Achieving the therapeutic effect of gene-therapy tools. The success of gene therapy. The actual tasks, successes and problems of gene therapy.
9	Recommended literature	1. Ivanov V. I., Baryshnikova N. In. etc. Genetics / Textbook for universities. – Moscow: IKTS Akademkniga, 2007. 2. Sverdlov E. D. Look at life through the window of the genome: In 3 T. T. 1: Essays on structural molecular genetics. Vol. 1. M.: Nauka, 2009. 3. Gene Correction. Methods and Protocols. Series: Methods in Molecular Biology, Vol. 1114 . Storici, Francesca (Ed.), 2014.
10	Teaching methods	Comparative, problem, a visual method based on the use of multimedia, the method of formation of the personal meaning of knowledge.
11	Language learning	Russian
12	Conditions (requirements), the current control	Oral responses test-control, control of independent work, writing abstracts and essays.
13	Form current certification	Exam

1	The discipline	General ecology
2	Year of study	3
3	Semester	5
4	Number of credits	4
5	Name of lecturer	doctor of biological sciences, professor Grichik Vasily Vitalyevich
6	Learning objectives	Formation of knowledge about basic concepts, laws of structural and functional organization of superorganismic biosystems
7	Prerequisites	Zoology, Geobotany
8	Contents of the discipline	Ecology as a science. Conditions of the environment and the organism. Abiotic factors and organisms. Population and structure. Population dynamics. Intrapopulation interactions. Interpopulation interactions. Population fluctuations. Biocenosis (biotic community). Biogeocenosis and ecosystem. Efficiency of ecosystems. Dynamics of the ecosystem. Biomes of the Earth. Water ecosystems, their features. Composition and structure of the biosphere. The role of human in the evolution of the biosphere. The technosphere and noosphere. Biogeochemical cycles. Biosphere resources.
9	Recommended literature	1. Odum Yu. Fundamentals of Ecology. - Moscow: Mir, in 2 volumes., 1986. 2. Shilov I.A. Ecology. - Moscow: Higher School, 1997. 3. Bigon M., Harper J., Townsend K. Ecology: individuals, populations and communities. - Moscow: Mir, in 2 volumes, 1989. 4. Grichik V.V., Kamlyuk L.V., Semenyuk G.A. Ecology and rational nature management. Minsk, BSU, 2013.
10	Teaching Methods	Verbal, practical
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	Exam

1	Name of the discipline	Genetic analysis
2	Course of study	3
3	Semester	5
4	Number of credits	1,5
5	Name of the Lecturer	Candidate of biological sciences, associate professor LAHODZICH Aliaksei Viktaravich
6	Objectives of studying the discipline	Forming an integral system of knowledge about the implementation of genetic information in biological systems, studying and mastering various approaches and methods for its analysis, demonstrating the possibilities for their application, identifying factors that affect the inheritance of traits, developing algorithms and recommendations for selecting appropriate methods for analyzing the results of genetic experiments.
7	Prerequisites	Genetics, molecular genetics, molecular biology of a gene, biochemistry
8	Contents of the discipline	The subject, tasks and methods of genetic analysis. The role of the model object in genetic analysis. Genetic analysis at the organism level, at the cellular level, at the molecular level of the organization, its features and resolving power. Mapping of genes. Crossing systems. Stages and methods of studying the gene. The main approaches for studying the organization of nucleic acid molecules.
9	Recommended literature	1. Айала Ф. Современная генетика / Ф. Айала, Дж. Кайгер. М.:Мир. Т.1-3, 1987. 2. Инге-Вечтомов С.Г. Введение в молекулярную генетику / С.Г. Инге-Вечтомов. М., Высшая школа, 1983. 3. Льюин Б. Гены / Б. Льюин. М., Мир. 1987.
10	Teaching methods	Lectures, the solution of genetic problems
11	Language	Russian
12	Conditions (requirements), control	Written examinations
13	Form of current certification	credit



1	Name of discipline	Genetic engineering
2	Course	3 (biology, direction biotechnology)
3	Semester	6 (biology, direction biotechnology)
4	ECTS (Credits)	3
5	Lecturer(-s)	Doctor of biological sciences, professor EVTUSHENKOV Anatoli Nikolaevich (biology, direction biotechnology)
6	Goal	Form a theoretical understanding of the basic methods of genetic engineering and give elementary skills in setting up a genetic engineering experiment
7	Prerequisites	Biochemistry, introduction to biotechnology, microbiology, genetics
8	Content	Introduction. Enzymes used in genetic engineering, their basic properties and applications. Vectors used in genetic engineering, their main characteristics. Construction and screening of gene libraries. Polymerase chain reaction. DNA sequencing. Mutagenesis of cloned DNA. Expression of proteins. Prospects for using the achievements of genetic engineering
9	Literature (in Russian)	1. Глик Б. Молекулярная биотехнология / Б. Глик, Дж. Пастернак. Принципы и применение. М.: Мир, 2002. 2. Рыбчин В.Н. Основы генетической инженерии / В.Н. Рыбчин. Санкт-Петербург: Издательство СПбГТУ, 2002. 3. Щелкунов С.Н. Генетическая инженерия / С.Н. Щелкунов. Новосибирск: Сибирское университетское издательство, 2008. Петербург: Издательство СПбГТУ, 2002. 3. Щелкунов С.Н. Генетическая инженерия / С.Н. Щелкунов. Новосибирск: Сибирское университетское издательство, 2004.
10	Teaching methods	Comparative, problematic, dialog-heuristic, visual
11	Language	Russian
12	Requirements, current control	Test work
13	Form of students reporting	Exam

1	The name of the discipline	Genetics in the Animal Biotechnology
2	The course of the study	4
3	Semester of training	7
4	The amount of credits	3,5
5	Full name of the lecturer	PhD, Associate Professor N.V. Voronova; PhD, Associate Professor M.E. Mikhailova
6	The objectives of the discipline studying	The course «Genetics in the Animal Biotechnology» is one of the special zoological courses, which based on knowledge of Invertebrate and Vertebrate zoology, genetics, molecular biology and ecology. The course «Genetics in the Animal Biotechnology» is aimed to forming a system of knowledge of modern approaches and methods which are used in zoological research related to biotechnology.
7	The prerequisites	Zoology, Biotechnology, Molecular Biology
8	Contents of the discipline	Basic methods and techniques of animal biotechnology. Population-genetic diversity of wild and farm animals. Modern methods of producing transgenic animals. Molecular taxonomy of animals, principles and methods
9	Literature recommended (in Russian)	1. Эрнст Л.К. Биологические проблемы животноводства в XXI веке / Л.К. Эрнст, Н. А. Зиновьева. М.: РАСХН, 2008. 2. Зиновьева Н.А. Введение в молекулярную генную диагностику сельскохозяйственных животных. Дубровицы: ВИЖ, 2002. 3. Введение в ДНК-технологии / В.И. Глазко [и др.]. М.: ФГНУ «Росинформмагротех», 2001. 4. Лукашов В.В. Молекулярная эволюция и филогенетический анализ. М.: Бином, 2009. 5. Воронова Н.В. Основы статистического анализа ДНК / Н.В. Воронова, М.М. Воробьева. Минск: БГУ, 2015. 6. Воронова Н.В. Идентификация видов и построение филогений / Н.В. Воронова, М.М. Воробьева. Минск: БГУ, 2015.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing
13	The form of current certification	Exam

1	Name of the discipline	Genetics of microorganisms
2	Course	4
3	Semester of training	7
4	Amount of credits	3
5	Full name lecturer	Doctor of Biological Sciences, Professor Titok Marina Alekseevna
6	Objectives of studying the discipline	Review the features of the organization, functioning and ways of changing the hereditary apparatus of microorganisms and viruses.
7	Prerequisites	Genetics, Microbiology, Biotechnology
8	Contents of the discipline	Features of the genetic organization of microorganisms (fungi, protozoa, algae, bacteria and viruses). Features of transcription and translation systems in microorganisms. Mutational process and mechanisms of reparation. Mobile genetic elements and their role in the variability of microorganisms. Recombination systems as a way of genetic exchange in microorganisms (homologous, ectopic, site-specific, illegal, transposition of mobile elements). Methods of transferring genetic material from bacteria (conjugation, transduction and transformation). Genetic analysis of microorganisms and viruses. Main directions and methods of selection of microorganisms.
9	Literature	1. Modern microbiology: Prokaryotes /Y. Lengeler, G. Drevs, G. Shlegel, editors / Mir Publishers, Moscow, V. 1–2, 2005. 2. <i>Kvitko K.V., Zacharov I.A.</i> Genetics of microorganisms / SPbSTU Publishers, St. Petersburg, 2012. 3. <i>Lisak V.V.</i> Microbiology / BSU Publishers, Minsk, 2007.
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language of instruction	Russian
12	Conditions (requirements), current control	-testing -writing essays
13	Form of current certification	exam

1	Name of the discipline	Genetics of ontogenesis
2	Course of Study	4
3	Semester of training	7
4	Amount of credits	3,5
5	FULL NAME lecturer	Candidate of Biological Sciences, Associate Professor Verameyenka Ekatsiaryna Gennadyevna
6	Objectives of studying the discipline	The purpose of this course is to form a complete system of knowledge about the mechanisms of genetic regulation of the most important processes of embryonic, prenatal and postnatal development of organisms belonging to different realms of the living world.
7	Prerequisites	Molecular Genetics
8	Contents of the discipline	Subject, objectives and objectives of the course. Definition of the concept of ontogeny. The history of development of genetics of ontogenesis. Methodological approaches to investigating the differential activity of genes during ontogenesis. Systems of regulation of gametogenesis, fertilization and polarization of a unicellular embryo. Genetic regulation of embryonic development of various groups of organisms. The role of epigenetic factors in the regulation of the expression of genes that control development. Characteristics and causes of malformations. Regulation of postnatal development. Genetic aspects of aging.
9	Recommended literature	<ol style="list-style-type: none"> <li>1. Moskalev, A.A. Aging and genes / A. A. Moskalev. SPb.: Science, 2009</li> <li>2. <i>Moody, S.A.</i> Principles of developmental genetics / S.A. Moody. Suit: Elsevier Inc, 2007.</li> <li>3. Anisimov, V.N. Molecular and physiological mechanisms of aging. Anisimov. SPb.: Science, 2003.</li> <li>4. <i>Howell, S.H.</i> Molecular genetics of plant development / S.H. Howell, Cam.: Univer. Press, 1998.</li> <li>1. <i>Alberts, B.</i> Molecular biology of the cell / B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts, P. Walter. NY.: Garl. Sc. 2002.</li> </ol>
10	Teaching Methods	Comparative, problematic
11	Language of instruction	russian
12	Conditions (requirements), current control	Abstracts, testing
13	Form of current certification	exam

1	Name of discipline	Genetics
2	Training course	3
3	Semester	5
4	The number of credits	5,0
5	Lecture name and surname	Maximova Natalia
6	The goal of the discipline	The aim of the course is the formation of a scientific view of genetic processes, ensuring the development and reproduction of organisms, their vital functions; study the cellular and molecular mechanisms of heredity and variation of organisms using classical approaches and latest achievements in the field of molecular genetics, biotechnology and genetic engineering.
7	Prerequisites	Botany, Zoology, Human and Animal physiology, Cytology, Biochemistry, Microbiology and Molecular biology.
8	The content of the discipline	Inheritance of characters during mono-, di - and poly-hybrid crosses, cytological basis of heredity. Structure and function of the gene. Molecular mechanisms of heredity and variability of organisms. The genetic basis of ontogenesis, of extrachromosomal inheritance, human genetics, population genetics, principles of breeding. The role of genetics in biotechnology, medicine, agriculture, environmental protection and social aspects of society.
9	Recommended literature	1. Ayala, F., J. Kayger. The modern genetics. In three volumes. Moscow. – Mir, 1987. 2. Ivanov V. I., Baryshnikova N. etc. Genetics / Textbook for universities. – Moscow: Akademkniga, 2007. 3. Maximova N. P. Genetics. Part 1. The laws of heredity. A course of lectures. – Minsk. BSU, 2008. 4. Maximova N. P. Genetics. Part 2. The chromosomal theory of heredity. A course of lectures. – Minsk. BSU, 2012. 5. Maximova N. P. Titok M. A., Anokhina V. S., Khramtsova E. A., Grinev V. V., kunitskaya M. P. / Collection of problems on genetics. – Minsk. BSU, 2008.
10	Teaching methods	Comparative, problem, a visual method based on the use of multimedia, the method of formation of the personal meaning of knowledge.
11	Language learning	Russian
12	Conditions (requirements), the current control	Oral responses, the solution of genetic problems, testirovanie, control of independent work writing abstracts and essays.
13	Form current certification	Exam

1	Course Title	Genomics
2	Year	2
3	Academic Semester	4
4	Number of credits	1,5
5	Lecturer	Yevgeny Nikolaichik, Ph. D.
6	Goal	Studying of modern technologies of decoding and analysis of genomic sequences. Introduction to the basic principles of application and capabilities of bioinformatics in the study of the structure and function of genomic sequences. A review of the unique capabilities of genomic technologies in biological research. Review the structure of genomes of different groups of organisms and the relationship between the genome structure and biology of the organism.
7	Prerequisites	Organic chemistry, physics
8	Course Description from Program Guide	<p>Methods for decoding genomic sequences. Principles of action and capabilities of the second and third generation sequencers.</p> <p>The diversity of genomes and their structure. Evolution of genomes. Horizontal and vertical gene transfer. Pangenome.</p> <p>Molecular databases. Programs for comparing nucleotide and protein sequences. Bioinformatics and experimental approaches to the determination of the functions of nucleic acids and proteins by their sequences.</p> <p>Technologies of gene inactivation: knockouts and RNA interference.</p> <p>Transcriptomics and proteomics as systemic experimental approaches based on genomic information. Metabolic reconstructions and virtual cell models.</p> <p>Synthetic genomics, metagenomics, paleogenomics.</p>
9	Recommended Textbooks (in Russian)	<p>Браун Т.А. Геномы / М.: Институт компьютерных исследований, 2011.</p> <p>Льюин Б. Гены / М.: БИНОМ, 2011. – 896 с.</p> <p>Чемерис А. В. Секвенирование ДНК / А.В. Чемерис, Э.Д. Ахунов В.А. Вахитов. М.: Наука, 1999.</p>
10	Methods	Comparative, problematic, visual methods, heuristic dialogue, method of forming the personal significance of knowledge
11	Language	Russian
12	Student evaluation	-essay; -writing tests; -labs report.
13	Final examination	Credit

1	Object of Study	Integrated module "History" (History of Belarus in the context of European civilization)
2	Year, Specialty	1
3	Semester	1
4	Number of Credits	2
5	Lecturer	Ph.D., Maksimchik Andrei Nikolaevich; Ph.D., Kukharenko Artur Andreevich.
6	Purposes of the Discipline Studies	The academic course should teach students to analyze the patterns and features of the state-political, socio-economic, confessional, cultural, spiritual development of the Belarusian people. The discipline provides students with a sense of responsibility for the fate of the country, based on the foundations of the civilizational development. Students will get acquainted with the system of material, cultural and spiritual values that were created in the process of historical development of the Belarusian people. The course will allow students to develop the ability to self-actualize in a modern socio-cultural situation.
7	Prerequisites	Political science
8	Content of the Discipline	Historical periods of the formation of the Belarusian ethnos. The ancient population on the territory of the Belarusian lands. Formation of early state formations on Belarusian lands. Polatsk and Turau princedoms, their political and economic ties with Kiev and Novgorod. Belarusian lands in the Grand Duchy of Lithuania and the Rzecz Pospolita (middle 13 – the end of the 18 century.) The political and economic status of the Belarusian lands as part of the Russian state (the end of the 18th century – October 1917). The February Revolution and the formation of new authorities. The role of the October Revolution in the historical destiny of the Belarusian people. Soviet social and political system in Belarus (October 1917 – June 1941). Socio-political, economic and national-cultural development of Western Belarus as a part of Poland. Belarus during the Second World War and the Great Patriotic War. Achievements and problems of the creative work of the Belarusian people in the post-war period (1945–1991). The August events in 1991 in the Union of Soviet Socialist Republics. Proclamation of the Republic of Belarus. Socio-political, socio-economic and cultural development of the Republic of Belarus at the end of the 20th – the early 21st century. Geopolitical status of the Republic of Belarus in the context of the global globalization processes.
9	Recommended Literature	Бригадин, П.И. История Беларуси в контексте европейской истории: курс лекций / П.И. Бригадин. – Минск: ГИУСТ БГУ, 2007. – 336 с. Гісторыя Беларусі і сусветная цывілізацыя: дапам. для студэнтаў прыродазн. фак. / А. Г. Каханюўскі [і інш.]. – Мінск, 2008. Гісторыя Беларусі. Ад старажытных часоў па 2010 г.: вучэб. дапам. / Я.К. Новік, І.Л. Качалаў, Н.Я. Новік; пад рэд. Я.К. Новіка. – 3-е выд. – Мінск: Вышэйшая школа, 2011. – 512 с. Гісторыя Беларусі: у 6 т. / рэдкал.: М. Касцюк (гал. рэд.) [і інш.]. – Мінск: Экаперспектыва, 2007–2011. История Беларуси в контексте европейской цивилизации: учебное пособие для студентов учреждений высшего образования / С. А. Елизаров [и др.] – 2-е изд., испр. – Минск: Вышэйшая школа, 2016. - 398 с.
10	Methods of Teaching	Technologies of the problem-module education, training and research activities; communication technologies (discussion, press conference, brainstorming, training debate), case method (situation analysis).
11	Languages of Teaching	Belarusian, Russian
12	Tests during the Semesters	Writing an essay; testing
13	Semester Result	credit

1	The discipline	History of Biology and Ecology
2	Year of study	4
3	Semester	7
4	Number of credits	1
5	Name of lecturer	PhD, associate professor Nesterova Oxana Lvovna
6	Learning objectives	The formation of a system of ideas about the laws of the development of biological and ecological knowledge since the birth of rational science and the beginning of the 21st century.
7	Prerequisites	General ecology
8	Contents of the discipline	The subject and methods of the history of biology and ecology. The origin of the term "biology". The role of the scientific method in the formation and development of biology. The division into periods of the history of biology. Biological knowledge in the ancient world. Middle Ages. Development of biological sciences in modern times. Revival of rational science. The development of botany and zoology in the XV-XVIII centuries. Development of human and animal physiology in the XV-XVIII centuries. The formation of classical biology and ecology in the XIX century. Morphology, paleontology and embryology of animals. Ecology. Theory of Biological Evolution. Physiology of man and animals. Microbiology. Cytology. Development of biology and ecology in the XX-XXI centuries. Preconditions for the development of biology in the XX century. Ecology. Biochemistry. Genetics. Molecular biology. History of biology in the Republic of Belarus.
9	Recommended literature	1. Glushen S.V. History of Biology / S.V. Silly. - Moscow: BSU, 2010. 2. Novikov A.N. Essays on the history of ecology. - M., 1990.
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Writing and protecting essays
13	Form of current certification	credit



1	The Name of the Discipline	History of Biology
2	The Year of the Study	4
3	The Semester of the Study	7
4	The Amount of Credits	1
5	Lecturer's Full Name	assistant professor PhD Gloushen Sergey V.
6	The Objectives of Studying the Discipline	To give knowledge about the patterns of development of biological knowledge since the birth of science in Ancient Greece to the end of the XX century as the changing cognitive models
7	Prerequisites	General Biology
8	Discipline Contents	The patterns of development of natural Sciences. Evolutionary and revolutionary periods of scientific development. The theory of paradigm of T. Kuhn. The role of paradigms in science and education. The history of biology as the interaction and change of paradigms. Cognitive models of biology. Biological knowledge in the Ancient world and the middle Ages. Development to Give to Give ideas about the regularities of development of biological knowledge since the birth of science in Ancient Greece to the end of the XX century as the changing cognitive models.
9	The Recommended Literature	Глушен С.В. История биологии. Минск: БГУ, 2010, 90 с. (in Russian)
10	Teaching Methods	The main technology of training is competence approach implemented in lectures, as well as in students' independent work.
11	Study Language	Russian and English
12	Conditions (Requirements), Current Assessment	Selective monitoring at lectures Checking students' lecture notes
13	Current Assessment Form	credit

1	Name of the Discipline	History of the Belarusian Culture
2	Training course	2
3	Semester	3
4	Number of credits	2
5	Name of the Lecturer	KNYSH Olga
6	The purpose of the Discipline	While studying the discipline students shall form an integral system of knowledge about periods, events and names connected to the History of the Belarusian Culture; shall form understanding of the role of History of the Culture in the system of humanities and social knowledge; introduce students to the world and national cultural treasures in order to create personal self-determination and development of the sense of participation in the destiny of the country and it's history.
7	Prerequisites	History of Belarus in the context of European civilization
8	Context	European civilization and culture: theoretical aspects of the problem. Cultural heritage of the ancient world, early feudalism and Belarus. Primitive cultures and cults on the territory of Belarus. Medieval Europe and Belarus: the problems of cultural interactions. Cultural development of Belarus in the context of the European Renaissance and Reformation. Culture of Belarus in the context of the era of European Enlightenment. The development of the Belarusian culture in the 19 <sup>th</sup> century. The culture of the Belarusian national revival in the early 20 <sup>th</sup> century. The socio-political situation and its impact on the cultural development of the BSSR (20-30-ies of the 20 <sup>th</sup> century). Problems of preservation and use of the historical and cultural heritage of Belarus.
9	Recommended reading	Асветнікі зямлі Беларускай, X – пачатак XX ст.ст.: энцыклапедычны даведнік / С.А. Акуліч [и др.]; гал. рэд. Г. П. Пашкоў. – 2-е выд. – Мінск: и Беларуская Энцыклапедыя, 2006. – 492 с. Баландзін, К.І. Гісторыя культуры Беларусі: дапаможнік / К.І. Баландзін; кол. авт. Беларускі нацыянальны тэхнічны універсітэт, Кафедра "Гісторыя, сусветная і айчынная культура". - Мінск : БНТУ, 2014. - 239 с. Лыч, Л.М. Гісторыя культуры Беларусі / Л.М. Лыч, У.І. Навіцкі. – 3-е выд., дап. – Мінск: Современная школа, 2008. – 511 с. Парашкоў, С.А. Гісторыя культуры Беларусі / С.А. Парашкоў –2-е выд. – Мінск: Бел. навука, 2004. – 444 с. Славутыя імёны Бацькаўшчыны / уклад. А.У. Гілеп [і інш.] – Мінск: Беларускі фонд культуры, 2000. – 383с. Цітоў, В.С. Этнаграфічная спадчына: Беларусь: Традыцыйна-бытавая культура / В.С. Цітоў. – 2-е выд. – Мн.: Беларусь, 2001.—207 с.
10	Teaching methods	Technologies of problem-module teaching and educational and research activities, communication technologies (discussion, press conference, brainstorming, training debate), case method (situation analysis).
11	Language of the Course	Belarusian, Russian
12	Conditions (requirements), monitoring	- Preparation of a review - Final test
13	Form of current attestation	Credit

1	Discipline	Human and animals Physiology
2	Year of Study	2
3	Term of Study	4
4	Number of Credits	5
5	Tutors	Chumak AG
6	Study Objectives	Form an idea of the modern level of knowledge in physiology, which studies the general and particular mechanisms of the functioning of a healthy organism and its structural elements in various conditions of life.
7	Prerequisites	Physics, chemistry, mathematics, human anatomy, cytology and histology, zoology, biochemistry
8	Course Content	The physiology of the cell. General and particular physiology of the nervous system. Endocrine system and hormonal mechanisms of homeostasis. Physiology of the heart and vascular system. Physiology of the digestive system. Metabolism and energy. Excretory processes and their nervous and humoral regulation. Physiology of sensory systems. Neurobiology of behavior. The role of emotions and motivations. Mechanisms of memory and learning. The importance of physiology.
9	Literature Recommended	The foundations of physiology: Textbook / ed. acad. Nozdracheva. – S-Pb .: Publishing house "Lan", 2011. Normal physiology in 2 volumes / Ed. A.I. Kubarko. - Minsk. BSMU, 2014. Workshop on the physiology of man and animals. // Ed. AG Chumak. Minsk, BSU, 2011.
10	Methods of Teaching	Problem, dialogue-heuristic, visual, search-research, reproductive (in the part of laboratory exercises).
11	Language of Teaching	Russian
12	Requirements, Current Assessment	Methods of oral, written and laboratory-practical control. Abstracts. testing
13	Form of Current Assessment	exam

1	The discipline	Human Ecology (extramural)
2	Year of study	4
3	Semester	8
4	Number of credits	2
5	Name of lecturer	PhD, Associate Professor Yeremova Nina Georgievna
6	Learning objectives	The study of human interaction and the natural environment of its habitat at the present stage of anthropogenesis
7	Prerequisites	General Ecology, Environmental Physiology
8	Contents of the discipline	Human ecology as a general biological science. The noosphere, the technosphere, the humanised environment. Human ecology as a synthetic science. Anthropogenic ecosystems. Schematic diagrams of the structure of the NIS (natural-industrial system). Anthropogenic impact on the components of the natural environment. Human health and life support systems. Adaptation strategy: ranks and goals. Types of anthropoecological stress, and its role in the formation of pathology.
9	Recommended literature	1. Tegako, L.I. Fundamentals of human anthropology and ecology / LI. Tegako, I.I. Salivon. Mn .: Technology, 1997. 2. Fundamentals of Ecology / V.I. Kormilitsin [and others]. M .: Interstyle, 1997.
10	Teaching Methods	Dialog-heuristic, problematic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	Exam

1	Name of the discipline	Human microbial ecology
2	Year	5
3	Semester	9
4	Quantity of credits	3
5	Lecturer's surname and name	PhD Sidarenka Anastasiya
6	Objectives of studying the discipline	Formation of student's concepts about human microbial ecology, structure and functions of intestinal microbiome in health and disease, modern approaches to studying microbiota of gastrointestinal tract, the possibilities of application of fundamental knowledge about microbiota in medicine and biotechnology
7	Prerequisites	Microbiology Ecology of microorganisms Biotechnology
8	Content of the discipline	1. Introduction 2. Structure of gut microbiome 3. Functions of gut microbiome 4. Human microbiota in disease 5. Mechanisms microbiota-host interaction 6. Postgenomic approaches in studying of human microbiome 7. Microecological aspects of human nutrition
9	Recommended literature	1. The human microbiota: how microbial communities affect health and disease / ed. D.N. Fredricks. – New Jersey: Willey Blackwell, 2013. – 368 p. 2. Intestinal Microbiota in Health and Disease. Modern Concepts / Eds: E.J. Schiffrin, P. Marteau, D. Brassart. – CRC Press, 2014. – 335 p. 3. Saleem, M. Microbiome Community. Ecology Fundamentals and Applications / M. Saleem. – Springer, 2015. – 157 p. 4. Ткаченко, Е.И. Питание, микробиоценоз и интеллект человека / Е.И.Ткаченко, Ю.П. Успенский. – СПб.: СпецЛит, 2006. – 590 с. 6. Шендеров, Б.А. Медицинская микробная экология и функциональное питание: в 3 т. / Б.А. Шендеров. – М.: Грантъ, 2001.
10	Teaching methods	Comparative, problematic, dialog-heuristic, visual
11	Teaching language	Russian
12	Conditions (demands), running control	- preparation of essays, library-research papers, oral reports; - oral examination - written test work
13	Form of running attestation	exam

1	The discipline	Hydroecology
2	Year of study	3
3	Semester	6
4	Number of credits	3
5	Name of lecturer	PhD, Associate Professor Makarevich Tamara Aleksandrovna
6	Learning objectives	Formation of a holistic view of the structural and functional organization of aquatic ecosystems
7	Prerequisites	General ecology
8	Contents of the discipline	The history of the emergence and development of hydroecology. Water resources. Morphometric characteristics of reservoirs. The concept of trophism of water bodies. Trophic types of lakes. Water environment and its characteristics: temperature and temperature stratification of water bodies; light in an aquatic environment; salt composition of fresh and sea water; dissolved in water gases; biogenic elements. Ecological zones in aquatic ecosystems. Communities of aquatic ecosystems: neuston, metaphyton, plankton, benthos, periphyton. Seston and detritus. Fundamentals of production hydrobiology. Global environmental problems and ways of water resources management.
9	Recommended literature	1. Alimov A.F., Bogatov V.V., Golubkov S.M. Productive hydrobiology. - St. Petersburg: 2013. 2. Konstantinov A.S. General hydrobiology. - M.: High School, 1986 3. Protasov A.A. Life in the hydrosphere. Essays on general hydrobiology. - Kiev: Academic period, 2011.
10	Teaching Methods	Dialogue-heuristic, problematic, research
11	Language learning	Russian
12	Conditions (requirements), current control	Tests, problem solving, problem analysis
13	Form of current certification	Exam

1	The name of the discipline	Ichthyology
2	The course of the study	4
3	Semester of training	7
4	The amount of credits	2,5
5	Full name of the lecturer	PhD, Associate Professor V.G. Kostousov
6	The objectives of the discipline studying	The purpose of the special course «Ichthyology» is forming a holistic view of the taxon and the role of its representatives in ecosystems.
7	The prerequisites	Zoology
8	Contents of the discipline	External morphology and anatomy of fish. Physiology and biochemistry of fish. The biology of the representatives of fish. Ecology of fish. Systematics and evolution of fish. Applied aspects of ichthyology.
9	Literature recommended (in Russian)	1. Анисимова И.М. Ихтиология / И.М. Анисимова, В.В. Лавровский. М.: Высшая школа, 1983. 2. Моисеев П.А. Ихтиология / П.А. Моисеев, Н.А. Азизова, И.И. Куранова. М.: Легкая и пищевая промышленность, 1981. 3. Моисеев П.А. Ихтиология и рыбководство / П.А. Моисеев, А.С. Вавилкин, И.И. Куранова. М.: Пищевая промышленность, 1975. 4. Никольский Г.В. Частная ихтиология. М.: Высшая школа, 1971. 5. Никольский Г.В. Экология рыб. М.: Высшая школа, 1974. 6. Микулин А.Е. Зоогеография рыб. М.: Изд-во ВНИРО, 2003.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, oral survey
13	The form of current certification	Credit

1	The name of the discipline	Immobilized cells and enzymes of microorganisms
2	Course	4
3	Semester of training	8
4	Amount of credits	1
5	Full Name lecturer	Candidate of Biological Sciences, Associate Professor Fomina Olga Valentinovna
6	Objectives of studying the discipline	Consideration of immobilized cells and enzymes of microorganisms as one of the most important objects of biotechnology, as well as familiarization of the basic principles and approaches used for their creation and effective use in various technologies.
7	Prerequisites	Cytology, Biochemistry, Biophysics, Microbiology
8	Contents of the discipline	Microorganisms as objects of immobilization, their general characteristics and spheres of use. General principles of immobilization of various bioobjects. Features and capabilities, advantages and disadvantages of physical and chemical immobilization of microbial bioobjects. Impact of immobilization on the main characteristics of the bioobject. Physical methods of immobilization. Chemical methods of immobilization. Insoluble carriers of organic and inorganic nature. Requirements for carriers for immobilization. The use of immobilized cells and enzymes of waste utilization, in environmental biotechnology, agriculture, medicine, food. pharmaceutical and chemical industry, biogeotechnology, etc.
9	Recommended literature	1. Иммобилизованные клетки и ферменты. Методы / Под ред. Дж. Вудворда. М.: Мир, 1988. 2. Синицин, А. П. Иммобилизованные клетки микроорганизмов / А.П. Синицин, Е.И Райнина, В.И. Лозинский, С.Д. Спасов. М.: Изд-во Моск. ун-та, 1994. 3. Юрин, В. М. Иммобилизованные клетки и ферменты: курс лекций / В.М. Юрин. Минск: БГУ, 2006.
10	Training Methods	Active, interactive, verbal, problematic, visual
11	Language of training	Russian
12	Conditions (requirements), operating control	-preparation of abstracts; -testing
13	Form of current certification	Credit



1	Course Title	Immunology
2	Year	4
3	Academic Semester	7
4	Number of credits	4
5	Lecturer	Candidate of biological sciences, associate professor Pesnyakevich Alexander Georgievich
6	Goal	The main goal of the course is to form a general view of students, regardless of their narrow specialization, about the natural factors of protecting the mammalian organism from infectious agents and about the mechanisms that determine individuality at the cellular and molecular levels. The course should also serve as a basis for meaningful application by students in their further scientific activity of modern methods of research of biological objects, which are based on the use of antibodies.
7	Prerequisites	Human anatomy, human and animal physiology, cytology and histology, biochemistry; molecular biology, genetics, microbiology, virology
8	Course Description from Program Guide	The role of the immune system in maintaining homeostasis. General characteristics of the immune system of mammals (organs, cells, molecules). Differences and interrelation of constitutive and inducible mechanisms protect the body from foreign antigens. Impenetrability of the integument, inflammatory reaction, phagocytosis, complement system as the main manifestations of constitutive mechanisms. Immune response to thymus-dependent antigens as the main inducible mechanism. Immunological memory, mechanisms of its origin and realization. Hypersensitivity as a form of response to the antigen. Types of immunity to infectious diseases. The concept of vaccines and serums as preventive and therapeutic agents. General properties and classification of antigens. Structure, classification and properties of antibodies. The principle of obtaining monoclonal antibodies. Antigen-antibody reactions and their application in scientific research. Immunodeficiency and immunopathology in humans.
9	Recommended Textbooks (in Russian)	6. Ярилин А.А. Иммунология. М.: ГЕОТАР-МЕДИА, 2010 7. Ройт А. , Бростофф Дж., Мейл Д. Основы иммунологии. М.: Мир. 2000. 8. Галактионов В.Г. Иммунология. М., Академия, 2004 9. Л.В. Ковальчук, Л.В. Ганковская, Р.Я. Мешкова. Клиническая иммунология и аллергология с основами общей иммунологии М.: ГЕОТАР-Медиа, 2011 10. Песнякевич А.Г. Основы иммунологии. Курс лекций Минск, БГУ, 2008.
10	Methods	Comparative, problematic, visual methods, heuristic dialogue, method of forming the personal significance of knowledge
11	Language	Russian
12	Student evaluation	Lectures Laboratory classes (compulsory attendance) Testing
13	Final examination	Exam

1	Course Title	Industrial microbiology
2	Year	5
3	Academic Semester	9
4	Number of credits	3
5	Lecturer	Candidate of Biological Sciences, associate professor of the department of microbiology Puchkova T. A.
6	Goal	The goal of the course is to study the most important processes for obtaining products of microbiological synthesis.
7	Prerequisites	«Systematics of microorganisms», «Structural organization of microorganism cells», «Physiology of microorganisms», «Structural biochemistry», «Metabolic biochemistry», «Microbial objects in biotechnology», «Genetics», «Molecular biology», «Microbial transformation of substances».
8	Course Description from Program Guide	The most important directions of modern industrial microbiology. Requirements for microorganisms-producers. Methods of storage of cultures of microorganisms. Raw material base of industrial microbiology. General scheme of a typical microbiological production. Principles and modes of operation of the main process equipment. Technologies of fermentation processes. Main parameters of microorganisms growth. Isolation of the desired fermentation products. Microbiological production based on the production of microbial biomass: production of protein, bacterial fertilizers and plant protection products. Industrial use of microbiological processes: lactic acid, alcohol fermentation. Preparation of vinegar, organic acids. Industrial use of microbial metabolites. The main groups of industrially produced enzymes and their application in various branches of the national economy. Preparation of biologically active substances and individual components of microbial cells (amino acids, vitamins, lipids, polysaccharides). Damage by microorganisms of materials and methods of their protection. Normative documents for the production of microbiological production.
9	Recommended Textbooks (in Russian)	1. Аркадьева З.А. Промышленная микробиология / Под ред. Н.С. Егорова. М.: Высшая школа, 1989. 2. Волова Т.Г. Введение в биотехнологию [Электронный ресурс] / электронное учебное пособие. – Красноярск: ИПК СФУ, 2008. 3. Waites, M. J. Industrial microbiology: an introduction / M. J. Waites, N. L. Morgan, J. S. Rockey, G. Higton. - Blackwell Science Ltd, 2001.
10	Methods	Problematic, visual methods, heuristic dialogue
11	Language	Russian
12	Student evaluation	- training of seminars; preparation of abstracts; - writing tests
13	Final examination	Credit

1	The name of the discipline	Information structures of the plant cell
2	Course of study	4
3	Semester of study	7
4	Amount of credits	2,5
5	Full name of the lecturer	Chizhik Olga Vladimirovna
6	Object-matters of the discipline study	To give students an integrated view and knowledge of the organization of information systems (DNA in the deoxyribonucleoprotein complex) of the cell nucleus, plastids and mitochondria of the plant cell, their dynamic interaction, and the possibilities for functional activity regulation.
7	Prerequisites	Biology
8	Contents of the discipline	To study the structure and compartments of intracellular organelles, including nucleic acids carrying informational support of the plant cell; to examine the parameters and informational capacity of the cell nucleus DNA and intracellular organelles; to consider mechanism and levels of DNA compaction in the deoxyribonucleic complexes, as well as substances that determine the compactization and decompactization of DNA and RNA. To study the possibility of regulatory and biotechnological impact on information systems of plant cell structures.
9	Recommended literature	1.Reshetnikov V/N, Spiridovich E.V. Information structures of plant cells / Course of lectures. / V.N. Reshetnikov, E.V. Spiridovich / Moscow: BSU, 2008. 2. Chemeris A.V. New old DNA / A.V. Chemeris and others. Ufa: URC RAS, 2005. 3.Knoffe D.G. Biological Chemistry / D.G. Knoffe, S.D. Myzin. Moscow: Higher School, 2000. 5.Danilenko N.G. Worlds of organell's genomes / N.G.Danilenko, O.G. Davydenko. Minsk: Technology, 2003.
10	Teaching Methods	Visual (multimedia presentation), interactive, problematic
11	Language	Russian
12	Conditions (requirements), current control	- oral control of knowledge, - testing tasks, - written tests, - abstracts preparing
13	Form of current certification	Examination test

1	Name of discipline	Introduction to biotechnology
2	Course of study	2
3	Semester of training	3
4	Number of credits	3
5	Name and surname of lector	Doctor of Biological Sciences, Professor EVTUSHENKOV Anatoly Nikolayevich
6	Objectives of the discipline studying	To form a representation among students about the main directions of development of modern biotechnology and problems solved with the help of biotechnological approaches
7	Prerequisites	Biochemistry
8	Contents of the discipline	Introduction. Principles of selection of biotechnological objects: model and basic microorganisms, strains of microorganisms used in biotechnology. Isolation and selection of microorganisms that produce biologically active substances. Raw base of biotechnology. Technology of fermentation processes. Types and modes of fermentation: periodic and continuous processes. Principles of scaling of technological processes. Production of microbial protein. Enzyme technology. Immobilized enzymes. Production of recombinant proteins with the help of pro- and eukaryotic systems. Features of the production of protein products for medical purposes. Using the achievements of molecular biotechnology in agriculture and environmental protection.
9	Recommended literature	1. Evtushenkov A.N. Introduction to Biotechnology / A.N. Evtushenkov, Yu.K. Fomichev. Minsk, BSU, 2004. 2. Introduction to biotechnology in terms and notions. Reference book of the biotechnologist student / Aut.-orig.: O.B. Rus, A.M. Khodosovskaya, A.N. Evtushenkov. - Minsk: BSU, 2012. 3. Prischep T.P. Fundamentals of pharmaceutical biotechnology. Textbook. / T.P.Prischep [and others]. Rostov on / D. : Phenix; Tomsk: Ed. NTL, 2006. 4. Glik B. Molecular biotechnology. Principles and applications / B. Glik, J. Pasternak. Moscow: Mir, 2002 .
10	Methods of teaching	Comparative, problematic-modular, dialog-heuristic, visual, practical, the method of forming the personal significance of knowledge
11	Language of teaching	Russian
12	Conditions (requirements), routine monitoring	- oral interview, - writing work
13	Form of the current attestation	exam

1	Discipline	Introduction to system biology
2	Year of Study	3
3	Term of Study	5
4	Number of Credits	3
5	Tutors	Candidate of Biological Sciences, Associate Professor Sokolik A. I.
6	Study Objectives	To make initial acquaintance of students with modern directions of researches in biology using methods of mathematical modeling and bioinformatics, to form representations about biological processes and phenomena as interconnected system, about theoretical and computational methods of research of biological systems of various kinds, to introduce students to some classical examples of mathematical models of biological processes that reflect the main features of these processes and demonstrate efficient use of mathematical models for the understanding of biological systems functioning mechanisms
7	Prerequisites	Biology
8	Course Content	Introduction. The subject of systemic biology is biological systems. Modeling is the main method of studying biological systems. Basic models in biology. Examples of modeling complex biological systems .
9	Literature Recommended	1. Ризниченко Г. Ю. Лекции по математическим моделям в биологии. Часть 1. – Ижевск: НИЦ «Регулярная и хаотическая динамика», 2002. – 232 с. 2. Романовский Ю.М., Степанова Н.В., Чернавский Д.С. Математические модели в биофизике. Введение в теоретическую биофизику. 2-е изд. Доп.– Москва-Ижевск: Институт компьютерных исследований, 2004. – 472 с. 3. Рубин А.Б. Биофизика. Том. 1-2. М.: 1987. 4. Рубин А.Б., Пытьева Н.Ф., Ризниченко Г.Ю. Кинетика биологических процессов. Учебное пособие. Изд-во МГУ, 1977. – 330 с. 5. Computational Cell Biology / editors C. Fall et al. Springer-Verlag, New York Inc. – 2002 – 469 p.
10	Methods of Teaching	Visual training, elements of problem training, competence approach, heuristic method
11	Language of Teaching	Russian
12	Requirements, Current Assessment	Ranking and block-modular knowledge assessment system (USR, oral polls, tests, writing essays)
13	Form of Current Assessment	Exam

1	The name of the discipline	Introduction to the specialty microbiology
2	Course	1
3	Semester of training	2
4	Amount of credits	1
5	Full Name lecturer	Candidate of Biological Sciences, Associate Professor Fomina Olga Valentinovna
6	Objectives of studying the discipline	The students receiving deep, systematic knowledge of the world of microorganisms, their properties, expansion and role in nature, the characteristics of vital processes, the importance for humans, as well as the chronological development of microbiology and the achievements of outstanding scientists who have contributed to the development of microbiology as the science.
7	Prerequisites	Microbiology, Virology, Mycology, Algology
8	Contents of the discipline	Microbiology as the science. The subject, tasks, achievements and prospects for the development of microbiology. The main sections of microbiology. The role of microorganisms in a unified system of the organic world and human life. Relationship of microbiology with other sciences. The main stages of microbiology development. Scientists who made a significant contribution to the microbiology development. The significance of the works of A. Levenhuk, E. Jenner, L. Pasteur, R. Koch, E. Haeckel, S. N. Vinogradsky, D. I. Ivanovski, M. Beijerinck, A. Kluyver, A. Fleming, Z. A. Waxman, D. H. Berdzhi and others in the microbiology development as a science. Use of microorganisms in biotechnology. Perspectives of microorganisms in various branches of the national economy. Microbial preparations for agriculture. Microbial degradation of xenobiotics in technogenically disturbed natural and industrial environments.
9	Recommended literature	1. Биотехнология / Под ред. Е.С.Воронина. М.: Гиорд, 2005. 2. Современная микробиология: Прокариоты. В 2-х томах / Под ред. Й. Ленгелера, Г. Дрекса, Г. Шлегеля. М.: Мир, 2005. 3. Bergey's Manual of Systematic Bacteriology / Editor-in-Chief G. M. Garrity. New York: Springer, 2001–2003, V. 1–5.
10	Training Methods	Active, interactive, verbal, problematic, visual
11	Language of training	Russian
12	Conditions (requirements), operating control	-preparation of abstracts; - written tests; -computer testing
13	Form of current certification	Credit

1	The name of the discipline	Introduction to the specialty biochemistry
2	The course of the study	1
3	Semester of training	2
4	The amount of credits	1
5	Full name of the lecturer	Hubich Aksana PhD, assistant professor
6	The objectives of the discipline studying	To form a full view of the profile of their chosen specialty and the prospects for future professional work, the organization of the educational process and the training and research work of future biochemist specialists.
7	The prerequisites	-
8	Contents of the discipline	The objects of study and tasks of biochemistry. The methods and methodology of biochemical research. The relationship of biochemistry with other sciences. The importance of biochemistry for medicine and the national economy. The brief description of the most important sections of modern biochemistry. The history of the development of biological chemistry. The prospects for the development of biochemistry in the 21st century.
9	Literature recommended	Shamin A.N. The history of biological chemistry. Moscow: Nauka, 1993. (in Russian) Kretovich V.L. The Essays on the history of biochemistry in the USSR. Moscow: Nauka, 1984. (in Russian) Pavlovich S.A., Pavlovich N.V. The history of biology and medicine in persons. Minsk: Higher Education. School, 2010. (in Russian) Straier L. Biochemistry. Moscow: Higher School, 1985. (in Russian)
10	Teaching methods	Dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	-
13	The form of current certification	credit

1	The discipline	Introduction to the specialty bioecology
2	Year of study	1
3	Semester	2
4	Number of credits	1
5	Name of lecturer	Doctor of Biological Sciences, Professor Grichik Vasily Vitalyevich
6	Learning objectives	Formation of the idea of common properties occurring in living systems, regardless of the level of their organization
7	Prerequisites	Botany, Zoology
8	Contents of the discipline	Biological diversity. Problems of hydroecology. Productive hydroecology. Ground ecology. Soil ecology. Preparation of bioecologists.
9	Recommended literature	1. Dobrovolsky G.V. Preservation of soils as an indispensable component of the biosphere / G.V. Dobrovolsky, E.D. Nikitin. - M.: 2000. 2. Lebedeva N.V. Biodiversity and methods for its evaluation: Textbook / N.V. Lebedeva, N.N. Drozdov, D.A. Krivolutsky. - Moscow: Izd. Moscow University, 1999.-95 p. 3. Alimov A.F. Introduction to productional hydrobiology / A.F. Alimov. - L.: Gidrometioizdat, 1989. - 152 p.
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	credit



1	Название дисциплины	Isolation and purification of biotechnology products
2	Курс обучения	4
3	Семестр обучения	8
4	Количество кредитов	2
5	Ф.И.О. лектора	PhD, associate professor Shapchits Maria Pavlovna
6	Цели изучения дисциплины	Obtaining students knowledge and skills in the isolation and purification of biologically active substances.
7	Пререквизиты	Biochemistry. Actual problems of biotechnology.
8	Содержание дисциплины	Technical and technological characteristics of biotechnology products. Isolation and purification of hormonal drugs. Preparation of nucleotides and nucleic acids. Sources for obtaining lipids and the main ways of their isolation. Preparation of fermentation products. Obtaining of sugars, polysaccharides and the field of their use. Getting fat and water-soluble vitamins. Principles of obtaining antibiotics. Basic principles of obtaining alkaloids. Obtaining vaccines.
9	Рекомендуемая литература	9. Новиков Д.А. Выделение и очистка продуктов биотехнологии. Методическое пособие – Минск.: БГУ, 2014. – 256 с. 10. Безбородов А.М. Биохимические основы микробиологического синтеза – М.: Легкая и пищевая промышленность, 1984. 11. Бекер М.Е. Биотехнология / Бекер М.Е., Лиепинен Г.К., Райпулис Е.П. М. - Агропромиздат, 1990. 12. Грачева И.М. Технология ферментных препаратов / Грачева И.М., Кривова А.Ю. – 3-е изд. – М.: Изд-во «Элевар», 2000. 13. Квеситадзе Г.И. Введение в биотехнологию / Квеситадзе Г.И., Безбородов А.М. – М.: Наука, 2002.
10	Методы преподавания	Explanatory-illustrative, research, problem, dialog-heuristic.
11	Язык обучения	Russian
12	Условия (требования), текущий контроль	- prepare reports, - oral questioning, - defend individually given tasks during laboratory trainings, - achievement tests on selected topics.
13	Форма текущей аттестации	credit

1	The discipline	Landscape ecology
2	Year of study	3
3	Semester	6
4	Number of credits	1,5
5	Name of lecturer	doctor of biological sciences, professor Kulikov Yaroslav Konstantinovich
6	Learning objectives	Formation of a system of general ecological concepts on the structural and functional organization of landscapes, its optimization and protection on the basis of the main theoretical provisions of modern landscape ecology
7	Prerequisites	General ecology; plant growing
8	Contents of the discipline	Introduction. Dynamics, evolution and the main components of landscapes. The main types of landscape complexes of the Earth. Forest landscapes of Belarus, origin, distribution and problems of protection. Marsh landscapes of Belarus and its global ecological significance. The system of protected natural territories as a basis for the preservation of landscapes. Anthropogenic transformation of landscapes of Belarus
9	Recommended literature	1. Kulikov Ya. K., Grichik V.V. Landscape ecology: a course of lectures. - Minsk: BSU, 2006. 2. Marcinkevich GI, Schastnaya II Landscape science. - Minsk: BSU, 2015 3. Schastnaya N.N. General landscape studies. - Minsk: BSU, 2002
10	Teaching Methods	A problematic, visual, method of forming the personal significance of knowledge
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	credit

1	Course Title	Mechanisms of biosynthesis of antibiotics and their action on microorganisms cells
2	Year	2
3	Academic Semester	3
4	Number of credits	2,5
5	Lecturer	Candidate of Chemical Sciences (=PhD) Gerlovsky Denis Olegovich
6	Goal	The goal of the course.
7	Prerequisites	"Microbiology", "Biochemistry"
8	Course Description from Program Guide	Introduction Biochemical bases of regulation of synthesis of antibiotics Principles of classification of antibiotics Biosynthesis of a cellular wall and possible targets for action of antibiotics The characteristic of antibiotics - inhibitors of biosynthesis of protein The characteristic of the antibiotics interacting with DNA Practical use of antibiotics
9	Recommended Textbooks (in Russian)	1. Гэйл И., Кандлифф Э., Рейнолдс П., и др. Молекулярные основы действия антибиотиков. / И. Гэйл, Э. Кандлифф, П. Рейнолдс и др. Мир, 1975. 500 с. 2. Егоров Н. С. Основы учения об антибиотиках. / Н. С. Егоров. М.: Высшая школа., 2005. 512 с.
10	Methods	Active, interactive, verbal, problem and evident methods
11	Language	Russian
12	Student evaluation	- preparation of the essay; - testing.
13	Final examination	Examination

1	Course Title	Medical and Sanitary Microbiology
2	Year	5
3	Academic Semester	9
4	Number of credits	2
5	Lecturer	Candidate of biological sciences, associate professor Pesnyakevich Alexander Georgievich
6	Goal	To give an idea about the diversity and taxonomy of pathogenic bacteria, the factors of their pathogenicity and virulence, the methods of prevention and treatment of infectious diseases, as well as the methods of sanitary and microbiological control of air, soil, water and food.
7	Prerequisites	Human anatomy, human and animal physiology, cytology and histology, biochemistry; molecular biology, genetics, microbiology, immunology
8	Course Description from Program Guide	Pathogenicity and virulence of bacteria as biological phenomena are considered, classification and description of the factors determining them, as well as their secreting systems, are given. It gives an idea of the ways of infection of the host organism, the dynamics of the infectious process, the prevention and treatment of infectious diseases. Data on the systematic position of the causative agents of human bacterial diseases and the nature of the infectious processes caused by them are cited. Groups of sanitary-demonstration microorganisms and methods for their detection are characterized, the necessity of sanitary-microbiological control of objects of the human environment is grounded.
9	Recommended Textbooks (in Russian)	11. Медицинская микробиология, вирусология и иммунология. В 2-х томах. Под ред. В.В.Зверева и М.Н. Бойченко, М.: ГЕОТАР-Медиа, 2010 12. Поздеев О.К. Медицинская микробиология . М.: Гэотар Медицина, 2001. 13. Борисов Л.Б.. Медицинская микробиология, вирусология, иммунология , М.: МИА. 2002. 14. Песнякевич А.Г. Медицинская и санитарная микробиология, Минск, БГУ, 2017.
10	Methods	Comparative, problematic, visual methods, heuristic dialogue, method of forming the personal significance of knowledge
11	Language	Russian
12	Student evaluation	Lectures Laboratory classes (compulsory attendance)
13	Final examination	Credit

1	The name of the discipline	Medical Biochemistry
2	The course of the study	3
3	Semester of training	5
4	The amount of credits	3
5	Full name of the lecturer	Hubich Aksana PhD, assistant professor
6	The objectives of the discipline studying	To form an integral system of knowledge about the biochemical basis of the physiological functions of the organism in a normal manner, taking into account the stage of ontogenesis, the molecular causes of the development of pathological processes and possible ways of their prevention and treatment.
7	The prerequisites	functional biochemistry, human and animal physiology, cytology and histology, metabolic biochemistry
8	Contents of the discipline	The general characteristics of the most common metabolic disorders. The molecular and biochemical mechanisms of a tumor growth. The biochemical basis of nervous and mental diseases. The pathochemistry of blood. The molecular and biochemical mechanisms of the most important immune reactions. The pathological mechanisms of the development of diseases of the digestive system. The biochemistry of connective tissue in norm and in pathology. The biochemical preconditions for the development of kidney disease. The features of plastic and energy exchange of extreme age groups.
9	Literature recommended	The biochemical bases of the pathological processes. Ed. E.S. Severin. M.: Medicine, 2000. (in Russian) Klenova N.A. The biochemistry of the pathological conditions. Samara: Samara University, 2006. (in Russian) Mikhailov V.V. The fundamentals of the pathological physiology. M.: Medicine, 2001. (in Russian) Solvay J. The visual medical biochemistry. Moscow: GEOTAR-Media, 2011. (in Russian) The elements of the pathological physiology and biochemistry / Ed. I.P. Ashmarin. Moscow: Publishing House of Moscow University, 1992. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- the preparation of abstracts, - 2 tests, - the preparation of a report on the results of the workshop
13	The form of current certification	exam

1	Name of disciplines	Medicinal Herbs
2	Course of Study	4
3	Semester of training	7
4	Amount of credits	2,5
5	FULL NAME lecturer	PhD, Associated Professor Poliksenova V.D.
6	Objectives of studying the discipline	Forming students scientific knowledge about medicinal plants as a source of natural pharmacologically active substances and rational use of plant resources.
7	Prerequisites	Botany, Algology and Mycology, Biochemistry
8	Contents of the discipline	Brief history and current state of research of medicinal plants. Resources of medicinal plants. Requirements for medicinal plant raw materials. Normative and technical documentation. Chemical composition of medicinal plants and its variability. Medicinal plants of various habitats (deciduous and coniferous forests, meadows, marshes, coastal areas, agricultural, weed, flower-decorative, mushrooms and algae).
9	Recommended literature	1. Лекарственные растения и их применение. Минск: Наука и техника, 1978. 2. Гаммерман А.Ф., Кадаев Г.Н., Яценко-Хмелевский А.А. Лекарственные растения (растения-целители). М.: Высшая школа, 1983. 3. Муравьева Д.А. Тропические и субтропические лекарственные растения. М.: Медицина, 1997. 4. Растения для нас / Под ред. Г.П. Яковлева и К.Ф. Блиновой. СПб.: Учебная книга, 1996. 5. Сенчило В.И., Сенчило Ю.В. Лекарственные растения Беларуси. Минск: БГУ, 2004. 6. Карпук В.В. Фармакогнозия. Минск: БГУ. 2011.
10	Teaching Methods	Visual, system, group, modular-rating learning technologies
11	Language of instruction	Russian
12	Conditions (requirements), current control	- preparation of the presentation and report on the topic; - oral interview; - Testing
13	Form of current certification	credit

1	The name of the discipline	Metabolic Biochemistry
2	The course of the study	2
3	Semester of training	3
4	The amount of credits	3,5
5	Full name of the lecturer	KUKULIANSKAYA Tatsiana Aleksandrovna PhD, associate professor
6	The objectives of the discipline studying	Form the students an integral system of knowledge about the main ways of metabolism, the mechanisms of regulation and the relationship of metabolic processes.
7	The prerequisites	Inorganic chemistry. Organic chemistry.
8	Contents of the discipline	Metabolism of DNA, RNA, proteins, peptides, amino acids, carbohydrates, lipids. Energy of biochemical processes. Integration and regulation of the metabolism.
9	Literature recommended	1. Anisimov A.A. Basics of Biochemistry /A.A. Anisimov. M.: High School, 1987. 2. Berezov T.T. Biological chemistry / T. Berezov, B.F. Korovkin. M.: Medicine, 1990. 3. Biochemistry: Textbook for high schools / Ed. E.S. Severin. Moscow: GEOTAR-Media, 2006. 4. Komov V.P., Shvedova V.N. Biochemistry / V.P. Komov, V.N. Shvedova. M.: Drofa, 2004. 5. Filippovich Yu. B. Fundamentals of Biochemistry / Yu. B. Filippovich. M., 1999. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	-preparation of abstracts, - oral surveys, -protection of individual tasks in the performance of laboratory work, written tests on specific topics of the course
13	The form of current certification	Examination (oral)

1	The name of the discipline	Metabolic Engineering
2	The course of the study	2
3	Semester of training	4
4	The amount of credits	1,5
5	Full name of the lecturer	Korik Elena PhD, assistant professor
6	The objectives of the discipline studying	the formation in students of modern ideas about the possibilities, tasks and methods of metabolic engineering, used to study the metabolism of various organisms and its directional modification.
7	The prerequisites	Structural biochemistry, metabolic biochemistry, organic chemistry, genetics, molecular biology
8	Contents of the discipline	Stages and methods of studying metabolism for the purpose of its directional modification and further practical use. Objects of metabolic engineering. Mathematical models of the directed change in metabolism. Metabolic engineering of bacteria. Metabolic engineering of plants.
9	Literature recommended	<ol style="list-style-type: none"> <li>1. Glik B., Pasternak J. Molecular Biotechnology. / Under. Ed. Yankovsky NK-M.: Mir, 2002 (in Russian)</li> <li>2. Shchelkunov S.N. Genetic engineering. Siberian university publishing house. Novosibirsk, 2004 (in Russian)</li> <li>3. G. N. Stephanopoulos, A.A. Aristidou and J. Nielsen Metabolic Engineering. Principles and Methodologies. – 1998 Elsevier</li> <li>4. C. Wittmann, S. Yup Lee Systems Metabolic Engineering Springer. - 2012, 387 pages</li> </ol>
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	<ul style="list-style-type: none"> <li>- protection of the essay prepared by the student;</li> <li>- written tests on specific topics of the course;</li> <li>- Oral interviews</li> </ul>
13	The form of current certification	credit



1	The name of the discipline	Metabolomics
2	The course of the study	4
3	Semester of training	8
4	The amount of credits	2,5
5	Full name of the lecturer	Korik Elena PhD, assistant professor
6	The objectives of the discipline studying	to form in students an integral system of knowledge about metabolites of microorganisms, plants and animals, the mechanisms of their regulation, and modern methods and approaches used to study the metabolom.
7	The prerequisites	Metabolic biochemistry, analytical biochemistry, physical and chemical methods of analysis
8	Contents of the discipline	Introduction. Methods of studying metabolom. Reconstruction of metabolism. Statistical and mathematical methods for processing metabolic profiles of biological objects. Features of metabolites of microorganisms, animals, and plants. A human metabolite. The use of data metabolomics in various areas of the national economy, biology, medicine, pharmacy.
9	Literature recommended	R. Murray, "Biochemistry of Rights." R.Marry, D.M. Grenner, M.M., Mir, 2004. (in Russian) The Handbook of Metabonomics and Metabolomics /Edited by John Lindon, Jeremy Nicholson, Elaine Holmes // Elsevier, 2006 Metabolomics, Metabonomics and Metabolite Profiling / William J Griffiths // Elsevier, 2008 Metabolomics in Practice: Successful Strategies to Generate and Analyze Metabolic Data / <u>Michael Lammerhofer</u> , <u>Wolfram Weckwerth</u> // Wiley-VCH, 2013 The Handbook of Metabolomics /Fan, Teresa Whei-Mei, Lane, Andrew N, Higashi, Richard M. // Humana Press, 2012.
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes - execution of tasks in the test form; - checking the conduct of laboratory journals; - protection of the student's prepared essay.
13	The form of current certification	exam

1	Name of disciplines	Methodology and methodology physiological experiment
2	Course of Study	2
3	Semester of training	2
4	Amount of credits	1,5
5	Full namelecturer	Dmitry B. Sandakov
6	Objectives of studying the discipline	Consideration of the principles of planning and organization of scientific research, as well as familiarity with the methods used for experimental research in the field of physiology.
7	Prerequisites	Physiology, biochemistry, zoology
8	Contents of the discipline	In studying this course, students get acquainted with the methodological foundations of experimental research in the field of biology, learn how to plan an experiment independently, get acquainted with the arsenal of techniques of modern experimental physiology, master the skills of searching and analyzing scientific literature.
9		Buresh Ya., Methods and basic experiments on the study of the brain and behavior / Buresh Ya., Bureshova O., Houston DP M., 1991. Methods of Behavior Analysis in Neuroscience, 2nd edition. Edited by Jerry J Buccafusco. Boca Raton (FL): CRC Press; 2009.
10	Teaching Methods	Verbal, practical, visual, heuristic, problematic, research
11	Language of instruction	Russian
12	Conditions (requirements), current control	Oral and written control, abstracts.
13	Form of current certification	Pass/fail exam

1	The discipline	Methodology of biology and ecology teaching with the basics of educational work
2	Year of study	4
3	Semester	7
4	Number of credits	4,5
5	Name of lecturer	doctor of biological sciences, professor Grichik Vasily Vitalyevich
6	Learning objectives	Forming a system of knowledge about the methods and technologies of teaching biology in the general education school, as well as the principles and forms of organization of educational work with schoolchildren
7	Prerequisites	Psychology; Pedagogy
8	Contents of the discipline	Introduction. Objectives of biology and ecology teaching in the general education school. General characteristics of teaching methods, its typology and application conditions. Traditional class-lesson learning technology. Innovative educational technologies. School excursion. Control in the lessons of biology. Features of private techniques. Organization of extracurricular work in biology. The organization principles of educational work in the school and the place in it of the biology teacher.
9	Recommended literature	1. Grichik V.V., Kamlyuk L.V., Semenyuk G.A. Ecology and rational nature management. Minsk., BSU, 2013.
10	Teaching Methods	Verbal, practical
11	Language learning	Verbal, practical
12	Conditions (requirements), current control	Russian
13	Form of current certification	exam

1	The discipline	Methodology of teaching biology with the basics of educational work
2	Year of study	4
3	Semester	7
4	Number of credits	4,5
5	Name of lecturer	doctor of biological sciences, professor Grichik Vasily Vitalyevich
6	Learning objectives	Forming a system of knowledge about the methods, techniques and techniques of teaching biology in the general education school, as well as the principles and forms of organization of educational work with schoolchildren
7	Prerequisites	Psychology, Pedagogy
8	Contents of the discipline	Introduction. The tasks of teaching biology in a comprehensive school. General characteristics of teaching methods, its typology and application conditions. Traditional class-lesson learning technology. Innovative educational technologies. School excursion. Control in the lessons of biology. Features of private techniques. Organization of extracurricular work in biology. Principles of the organization of educational work in the school and the place in it of the teacher of biology.
9	Recommended literature	1. Grichik V.V. Methods of teaching biology: a course of lectures. - Minsk: BSU, 2012. 2. Bogacheva, I.V. Handbook of the teacher of biology: methodological recommendations and regulatory requirements. - Minsk: Sir-Wit, 2008. 3. Konyushko V.S., Pavlyuchenko S.E., Chubarov S.V. Methodology of teaching biology. - Mn.: Book House, 2004.
10	Teaching Methods	Verbal, practical
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	Exam

1	The discipline	Methods of field environmental research
2	Year of study	2
3	Semester	4
4	Number of credits	1,5
5	Name of lecturer	Senior Lecturer, Minets Margarita Leonidovna
6	Learning objectives	Training for planning, implementation and presentation of environmental research.
7	Prerequisites	General ecology, Vegetable and animal resources, Hydroecology, Bioindication, Agroecology
8	Contents of the discipline	Structure of scientific research. Planning and organization of research work. The main directions of environmental research. General requirements for the organization of field research. Abiotic factors of the terrestrial ecosystem, their description and analysis. Methods of study of insect communities, based on the use of various types of traps. Techniques active insect collection: mowing, shelters examination, exhauster collection. Methods of studying species richness and biological diversity of birds. Methods of bird counting and mapping. Observation of birds in the field using different technical means. Methods for assessing the absolute and relative abundance of small mammals. Methods for assessing the abundance of large mammals. General conception of the methods of studying aquatic ecosystem. Methods for studying communities of aquatic ecosystems: phytoplankton, zooplankton, periphyton, macrophytes, benthic communities. Methods of soil ecology. Biological diagnostics and indication of soils. Formation of data sets, preparation of reports and presentation of research results.
9	Recommended literature	1. Abakumov V.A. and others. A manual on methods for the hydrobiological analysis of surface waters and bottom sediments. - L.: Gidrometeoizdat, 1983. 2. Bibby K. et al. Methods of field expeditionary research. Research and bird counting. Moscow: Union of Bird Protection of Russia, 2000. 3. Zvyagintsev D.G. and other biology of soils. -M.: Publishing house of Moscow University, 2005. 4. Karaseva E.V. Methods of studying rodents in the field. - Moscow: LKI. 2008. 5. S.M. Sheiner, J. Gurevich. Development and analysis of ecological experiments. -Oxford University Press - 2001.
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	credit

1	Name of the discipline	Methods of molecular diagnostics in agriculture, medicine, forensics
2	Course of Study	4
3	Semester of training	8
4	Amount of credits	2,5
5	FULL NAME of lecturer	PhD, Associate Professor Leonid N.Valentovich
6	Objectives of studying the discipline	Form students' ideas about modern methods of molecular diagnostics, the main achievements of applied biochemistry, microbiology, genetics and molecular biology, as well as the consequences of the revolution in molecular diagnostic methods for medicine, pharmacology, agriculture and forensics.
7	Prerequisites	Biochemistry, microbiology, genetics and molecular biology
8	Contents of the discipline	The structure of biological macromolecules. Immunodiagnostic methods. Molecular biological methods. Physico-chemical methods. Characteristics of molecular diagnostics in medicine. Characteristics of molecular diagnostics in agriculture. Characteristics of molecular diagnostics in forensic science.
9	Recommended literature	1. Сафонова О. А. Современные иммунологические и молекулярно-генетические методы диагностики. Воронеж: Издательско-полиграфический центр Воронежского государственного университета, 2009. – 68 с. 2. Иллариошкин С. Н. ДНК-диагностика и медико-генетическое консультирование. М. : Медицинское информационное агентство, 2004. – 207 с. 3. Молекулярная клиническая диагностика. Методы / под ред. С. Херрингтона, Дж. Макги. – М. : Мир, 1999. – 558 с. 4. Patrinos G. Molecular Diagnostics / G. Patrinos. – Academic Press, 2009. – 618 p.
10	Teaching methods	Different.
11	Language learning	Russian
12	Conditions (requirements), current control	- an essay; - a colloquium; - oral surveys.
13	Form of current certification	credit

1	Course Title	Microbial Ecology
2	Year	3
3	Academic Semester	6
4	Number of credits	1,5
5	Lecturer	Candidate of Biological Sciences (=PhD) Maryia I. Charniauskaya
6	Goal	The goal of the course Microbial Ecology is forming of basic theoretical knowledge in this field on the assumption of modern scientific achievements.
7	Prerequisites	Structural Organization of Microbial Cells, Physiology of Microorganisms, Systematics of Microorganisms, Microbial Genetics, Cultivation of Microorganisms
8	Course Description from Program Guide	Introduction. Physical-chemical environmental of microbes. Symbiosis of microbes. Symbiosis of microbes and macroorganisms. Structure of microbial community. Water microbial community. Soil microbial community. Methods of Microbial Ecology. Environmental biotechnology.
9	Recommended Textbooks (in Russian)	<i>Нетрусов А.И.</i> Экология микроорганизмов / А.И. Нетрусов, Е.А. Бонч-Осмоловская, В.М. Горленко и др. – М.: Издательский центр «Академия», 2004. – 348 с. <i>Кузнецов А.Е.</i> Научные основы экобиотехнологии: Учебное пособие для студентов / А.Е. Кузнецов, Н.Б. Градова – М.: Мир, 2006. – 504 с. <i>Экологическая микробиология: учеб.-метод. пособие / М.И. Чернявская [и др.].</i> – Минск: БГУ, 2016. – 63 с.
10	Methods	Comparative, problematic, visual methods, heuristic dialogue, method of forming the personal significance of knowledge
11	Language	Russian
12	Student evaluation	-essay; -writing tests; -labs report.
13	Final examination	Credit

1	Course Title	Microbic objects in biotechnology
2	Year	2
3	Academic Semester	4
4	Number of credits	2
5	Lecturer	Candidate of Chemical Sciences (=PhD) Gerlovsky Denis Olegovich
6	Goal	Consideration of microorganisms as objects of biotechnology and also the basic principles and approaches which are applied to their effective use in industrial production.
7	Prerequisites	"Microbiology", "Biochemistry"
8	Course Description from Program Guide	Introduction Structurally functional features organizations of microorganisms as objects biotechnologies Almost significant metabolites of cages microorganisms Principles of genetic engineering microorganisms Principles of cellular engineering microorganisms Main requirements and principles of selection biotekhnologichesk significant microorganisms Main directions of use microorganisms and their products activity in industrial production
9	Recommended Textbooks (in Russian)	1. Волова Т. Г. Биотехнология / Т. Г. Волова Новосибирск: Из-во СО РАН, 1999. 2. Глик Б. Молекулярная биотехнология. Принципы и применение / Б. Глик, Дж. Пастернак. М.: Мир, 2002.
10	Methods	Active, interactive, verbal, problem and evident methods
11	Language	Russian
12	Student evaluation	- preparation of the essay; - testing.
13	Final examination	credit



1	Name of the discipline	Microbiological biotransformation of compounds
2	Year	4
3	Semester	8
4	Quantity of credits	2
5	Lecture's surname and name	PhD Sidarenka Anastasiya
6	Objectives of studying the discipline	Formation of student's concepts about microbiological transformation of compounds, possibilities of its application for solving practical tasks in the area of biotechnology and environmental protection
7	Prerequisites	Microbial Physiology. Genetics of Microorganisms. Ecology of microorganisms. Genetic engineering. Engineering enzymology. Producer's selection.
8	Content of the discipline	Introduction 1. Types of reactions and methods of microbiological biotransformation. 2. Microbiological biotransformation of xenobiotics. 3. Microbiological biotransformation of hydrocarbons. 4. Microbiological biotransformation of steroids. 5. Microbiological biotransformation of carbohydrates and heterocyclic compounds. 6. Microbiological biotransformation of metals. 7. Application of microbiological biotransformation in industry and environmental protection.
9	Recommended literature	1. Diaz, E. Microbial biodegradation: genomics and molecular biology / E. Diaz – Horizon Scientific Press, 2008 – 402 p. 2. Glazer, A.N. Microbial biotechnology: fundamentals of applied microbiology / A.N. Glazer, H. Nikaido. – Cambridge University Press, 2007. – 578 p. 3. Wackett, L.P. Biocatalysis and biodegradation: microbial transformation of organic compounds / L.P. Wackett, C.D. Hershberger – ASM Press, 2001. – 288 p. 4. Кузнецов, А.Е. Научные основы экобиотехнологии: Учеб. пособие для студентов / А.Е. Кузнецов, Н.Б. Градова – М.: Мир, 2006. – 504 с.
10	Teaching methods	Comparative, problematic, dialog-heuristic, visual
11	Teaching language	Russian
12	Conditions (demands), running control	- preparation of assays, library-research papers, oral reports; - oral examination - written test work
13	Form of running attestation	credit

1	The name of the discipline	Microbiology
2	Course	3
3	Semester of training	5
4	Amount of credits	5
5	Full Name lecturer	Candidate of Biological Sciences, Associate Professor Lysak Vladimir Vasilevich
6	Objectives of studying the discipline	To give representation about the most important properties of microorganisms, their role in natural processes, the national economy and health care
7	Prerequisites	Algology and Mycology; Biochemistry; Genetics
8	Contents of the discipline	History of development of microbiology. Classification of microorganisms. Morphology and structural organization of the bacterial cell. Cultivation and growth of bacteria. Effect of physical and chemical factors on the life activity of bacteria. Metabolism of bacteria. Bacterial Genetics. Regulation of the bacteria metabolism. The relationship between microorganisms, micro- and macroorganisms. Systematics and the major groups of bacteria. Distribution of microorganisms in nature. The role of microorganisms in the circulation of substances, in the soil-forming processes and soil fertility, in the primary production of water bodies, in mineralization of organic substances, substances recycling and detoxication. The role of microbiology in the national economy and health care
9	Recommended literature	1. Gusev M.V., Mineeva L.A. Microbiology. – M.: Publishing center "Academy", 2003 (in Russian). 2. Schlegel G. General microbiology. – M.: Mir, 1987 (in Russian). 3. Netrusov A.I., Kotova I.E. Microbiology. – M.: Publishing center "Academy", 2009 (in Russian). 4. Lysak V.V. Microbiology. – Minsk: BSU, 2008 (in Russian). 5. Lysak VV, Zheldakova RA, Fomina O.V. Microbiology. Practical work. – Minsk: BSU, 2015 (in Russian).
10	Training Methods	Active, interactive, verbal, visual, problematic
11	Language of training	Russian
12	Conditions (requirements), operating control	-written tests; -computer testing
13	Form of current certification	Exam

1	Course Title	Microbiology of industrial waste treatment
2	Year	5
3	Academic Semester	9
4	Number of credits	3
5	Lecturer	Candidate of Biological Sciences, associate professor of the department of microbiology Puchkova T. A.
6	Goal	The goal of the course is the formation of ideas about the current state, the main directions and prospects for the development of microbiology in environmental issues, and the characteristics of the methods used for this.
7	Prerequisites	«Microbiology», «Molecular biology», «Systematics of microorganisms», «Physiology of microorganisms», «Ecology of microorganisms», «Structural biochemistry», «Metabolic biochemistry», «Microbial transformation of substances».
8	Course Description from Program Guide	The impact of scientific and technological progress on the state of the environment. Technogenic and natural biogeochemical cycles of individual elements, their dimensions and comparison. The most common and dangerous substances are pollutants. Types of MAC for air, water and soil. Regularities in the transformation of pesticides and petroleum products by microorganisms. Types of bioremediation technologies. Selection of strains of microorganisms - destructors of pollutants. Biotechnology for the purification of gas-air emissions. Characteristics of sewage and cleaning methods. Processes and stages of aerobic wastewater treatment. Types of treatment facilities in natural (irrigation fields, filtration fields and biological ponds) and artificial (biofilters, aerotanks) conditions. Microorganisms of activated sludge and biofilm. Processes of anaerobic wastewater treatment and biogas generation. Methods of biological treatment of organic waste (industry and agriculture). Microbiological processes of metal leaching.
9	Recommended Textbooks (in Russian)	1. Прикладная экобиотехнология: учеб. пособие: в 2 т. / А.Е. Кузнецов [и др.]. – М.: БИНОМ, Лаборатория знаний, 2010. 2. Экологическая биотехнология : учеб. пособие для студентов специальности «Биоэкология» / Н.С. Ручай, Р.М. Маркевич, Мн. : БГТУ, 2006. 3. Егорова Т. А. Основы биотехнологии: Учеб. пособие для высших педагогических учебных заведений / Т. А. Егорова, С. М. Клунова, Е. А. Живухина. – М.: Изд. Центр «Академия», 2003.
10	Methods	Problematic, visual methods, heuristic dialogue
11	Language	Russian
12	Student evaluation	- training of seminars; preparation of abstracts; - writing tests
13	Final examination	Credit

1	Course Title	Microorganisms in the food industry
2	Year	4
3	Academic Semester	7
4	Number of credits	2,5
5	Lecturer	Candidate of Biological Sciences Vasilenko Svetlana Leonidovna
6	Goal	The purpose of the academic discipline is to form an integral system of knowledge about the role of microorganisms in food biotechnology, as well as the basic principles and approaches used for their effective use in the management of microbiological processes within the technological process of obtaining fermented food products with specified properties.
7	Prerequisites	Physiology of microorganisms, Cultivation of microorganisms, Systematics of microorganisms
8	Course Description from Program Guide	Microorganisms as objects of biotechnology, general characteristics and spheres of their use (food and chemical industry, agriculture, medicine, etc.). Characteristics of microorganisms used in the production of dairy products. Bacterial starter cultures: creation, storage, use, vices. Microbiology of bakery production, brewing. Microbiology of alcohol production and winemaking. Principles of microbiological and sanitary control.
9	Recommended Textbooks (in Russian)	<i>Ильяшенко Н.Г.</i> Микробиология пищевых производств / Н.Г. Ильяшенко, Е.А. Бетева, Т.В.Пичугина, А.В. Ильяшенко. – М.: Колос. 2008. – 412с. <i>Гудков, А.В.</i> Сыроделие: технологические, биологические и физико-химические аспекты / Под ред. С.А. Гудкова. – М.: ДеЛи принт, 2003. – 800 с. <i>Степаненко, П.П.</i> Микробиология молока и молочных продуктов / П.П. Степаненко. – М.: «Все для вас – Подмосковье», 1999. – 415 с. <i>Галынкина, В.А.</i> Микробиологические основы ХАССП при производстве пищевых продуктов: Учебное пособие / В.А. Галынкина, Н.А. Заикина, В.В. Карцев, С.А.Шевелева, Л.В.Белова, А.А.Пушкарев. – СПб.: Проспект Науки, 2007.–288с.
10	Methods	ctive, interactive, verbal, visual, problematic
11	Language	Russian
12	Student evaluation	- written tests on specific topics of the course; - protection of individual tasks when performing laboratory work; - protection of the essay prepared by the student; - oral polls
13	Final examination	exam

1	Discipline	Mineral nutrition of plants
2	Year of Study	3
3	Term of Study	6
4	Number of Credits	1
5	Tutors	Candidate of Biological Sciences, Associate Professor Sokolik A. I.
6	Study Objectives	Form students in-depth knowledge about the chemical forms, transport, transformations and physiological significance of elements of mineral nutrition.
7	Prerequisites	Biology
8	Course Content	Introduction. Assimilation of nutrients and their role in the processes of plant life. Transport of minerals. Regulation of the rate of intake of substances in plants. Radial movement of nutrients. Far transport of minerals. Soil as a source of nutrients for plants. Physiological basis of fertilizer application.
9	Literature Recommended	<p>1. Кузнецов В. В. Физиология растений: Учеб. для вузов / В. В. Кузнецов, 2005.</p> <p>2. Медведев С. С. Электрофизиология растений / С. С. Медведев. СПб.: Изд-во С.-Петербур. ун-та. 1998.</p> <p>3. Пильщикова Н. В. Физиология растений с основами микробиологии/ Н. В. Пильщикова. М.: Мир. 2004.</p> <p>4. Физиология и биохимия сельскохозяйственных растений / Под ред. Н.Н. Третьякова. М.: Колос. 1998.</p> <p>5. Юрин В.М. Минеральное питание растений. Учеб. пособие / В. М. Юрин, С.Н. Найдун Мн.: БГУ. 2004.</p> <p>6. Demidchik V. Ion channels and plant stress responses / V. Demidchik, F. J. M. Maathuis. Berlin: Springer-Verlag, 2010.</p>
10	Methods of Teaching	Visual training, elements of problem training, competence approach, heuristic method
11	Language of Teaching	Russian
12	Requirements, Current Assessment	Ranking and block-modular knowledge assessment system (USR, oral polls, tests, writing essays)
13	Form of Current Assessment	credit

1	Name of the discipline	Modern aspects of genetic analysis
2	Course of study	5
3	Semester	9
4	Number of credits	3,5
5	Name of the Lecturer	Candidate of biological sciences, associate professor LAHODZICH Aliaksei Viktaravich
6	Objectives of studying the discipline	To form students a complete system of knowledge on the implementation of genetic information in biological systems, to study and develop various approaches and methods for its analysis, to demonstrate the possibilities for their application, to identify factors that affect the inheritance of traits, to develop algorithms and recommendations for selecting appropriate methods for analyzing the results of genetic experiments.
7	Prerequisites	Genetics, molecular genetics, introduction to biotechnology, biochemistry
8	Contents of the discipline	The subject, tasks and methods of genetic analysis. The role of the model object in genetic analysis. Genetic analysis at the organism level, at the cellular level, at the molecular level of the organization, its features and resolving power. Mapping of genes. Crossing systems. Stages and methods of studying the gene. The main approaches for studying the organization of nucleic acid molecules.
9	Recommended literature	1. Айала Ф. Современная генетика / Ф. Айала, Дж. Кайгер. М.:Мир. Т.1-3, 1987. 2. Инге-Вечтомов С.Г. Введение в молекулярную генетику / С.Г. Инге-Вечтомов. М., Высшая школа, 1983. 3. Льюин Б. Гены / Б. Льюин. М., Мир. 1987.
10	Teaching methods	Lectures, the solution of genetic problems
11	Language	Russian
12	Conditions (requirements), control	Written examinations
13	Form of current certification	exam

1	Name of the discipline	Molecular aspects of evolution
2	Course	4
3	Semester of training	8
4	Amount of credits	4
5	Full name lecturer	Doctor of Biological Sciences, Professor Titok Marina Alekseevna
6	Objectives of studying the discipline	Review of molecular-genetic processes that ensure the evolution of living organisms.
7	Prerequisites	Genetics, Microbiology, Virology, Biotechnology
8	Contents of the discipline	Essence and significance of classical theories of evolution (J.B. Lamarck, C. Darwin, synthetic theory). The canonical and non-canonical forms of variability and their role in evolution. Horizontal gene transfer and its role in evolution. Molecular phylogeny, fundamental and applied aspects. Ways and mechanisms of complicating the genetic organization of living organisms. Gene networks, types and features of the organization. Destabilizing selection as a mechanism of molecular evolution. Evolution of ontogeny as the basis of phylogenies. The role of RNA in the genesis of life. History of the Earth. Anthropogenesis. Directions of human evolution.
9	Literature	1. <i>Lukashov V.V.</i> Molecular evolution and phylogenetic analysis / Binom Knowledge Lab Publishers, Moscow, 2009. 2. <i>Kunin E.V.</i> The logic of the case. About nature and origin of biological evolution / Center Poligraph Publishers, Moscow, 2014. 3. <i>Titok M.A.</i> Molecular aspects of evolution / BSU Publishers, Minsk, 2011.
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language of instruction	Russian
12	Conditions (requirements), current control	-testing -writing essays
13	Form of current certification	exam

1	Name of the discipline	Molecular Bacteriology
2	Course	3
3	Semester of training	5
4	Amount of credits	1,5
5	Full name of the lecturer	Candidate of Biological Sciences, Associate Professor Miamin Vladislav Evgen'evich
6	Objectives of the study of the discipline	Familiarization of students with macromolecular organization and molecular mechanisms of functioning of the most important structures of the main types of bacteria.
7	Prerequisites	"Structural organization of microorganism cells", "Physiology of microorganisms", "Genetics of microorganisms"
8	Contents of the discipline	General scheme of ultrastructural organization of procaryotic organisms. Macromolecular organization of bacterial chromosomes. The mechanism of segregation of bacterial nucleoids The concept of a replicon. Molecular mechanism of replication of bacterial chromosomes and plasmids. Transcription, its stages. RNA polymerase, promoter and terminator regions. Basic and alternative sigma factors of bacterial RNA polymerase. Operational organization of genes in bacteria. The concept of inducible and repressive operons. Mechanisms of regulation of gene activity in bacterio-phage lambda, lytic cycle and lysogenic state. The apparatus of translation, the stage of translation. Duration of life of bacterial RNA and factors affecting it. Features of the translation process in prokaryotes. The variety of mechanisms of the movement of bacteria. The structure of the flagellum and the principle of its functioning. Chemotaxis. Mechanisms of control switching flagella. Other taxis, the mechanism for their implementation through sensory systems. Examples of differentiated cells. Resting forms, exo- and endospores, heterocysts of cyanobacteria. Features of the mechanisms of the course of different cell cycles in bacteria.
9	Recommended literature	1. Брюханов А.Л. Молекулярная микробиология / А. Л. Брюханов, Рыбак К. В., Нетрусов А. И. М.: Из-во МГУ, 2012. 2. Гусев М. В. Микробиология / М. В. Гусев, Л. А. Минеева. – М.: Академия, 2010. 3. Современная микробиология: Прокариоты / Под ред. Й. Ленгелера, Г. Древса, Г. Шлегеля. М.: Мир: т.1-2, 2005.
10	Teaching Methods	Active, interactive, dialog-heuristic verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), current control	-preparation of abstracts; -testing
13	Form of current certification	credit



1	Name of discipline	Molecular basics of biosignalling
2	Course	4
3	Semester	8
4	ECTS (Credits)	3,5
5	Lecturer(-s)	Candidate of biological sciences KACHAN Alexandr Vjacheslavovich
6	Goal	To educate students about the principles of information exchange between cells of the multicellular organism and mechanisms of intracellular transduction and modulation of incoming signals at the molecular level
7	Prerequisites	Molecular biology
8	Content	General principles of the functioning of the system of intercellular communication. Signal molecules. Reception of biosignals. Signal transduction by activation of G-protein coupled receptors. Signal transduction by activation of receptors with a protein kinase domain. Biosignalling pathways, triggered by cytokines of various groups. Transduction of signals in cells of the immune system. Intercellular communication in the regulation of development. Molecular aspects of information transfer in neurons. Receptors of extracellular matrix molecules. Biosignalling in the regulation of cell movement. Biosignalling in apoptosis and necrosis
9	Literature (in Russian)	1. Зинченко В.П., Долгачева Л.П. Внутриклеточная сигнализация / В.П. Зинченко, Л.П. Долгачёва. Пушино: Аналит. микроскопия, 2003. – 84 с. 2. Альбертс Б. и др. Молекулярная биология клетки. В 3 т. / Б. Альбертс, А. Джонсон, Дж. Льюис и др. М.: Регулярная и хаотическая динамика, Институт компьютерных исследований, 2013. – 812 с. 3. Льюин Б. и др. – Клетки / ред. Б. Льюин, Л. Кассимерис, В. П. Лингаппа, Д. Плоппер. М.: БИНОМ. Лаборатория знаний, 2011. – 951 с.
10	Teaching methods	Comparative, problematic, dialog-heuristic, visual
11	Language	Russian
12	Requirements, current control	Test work
13	Form of students reporting	Exam

1	Name of discipline	Molecular basis of developmental biology
2	Course of study	4
3	Semester of training	7
4	Number of credits	3,5
5	Name and surname of lector	Candidate of Biological Sciences, Associate Professor KHODOSOVSKAYA Alina Mikhailovna
6	Objectives of the discipline studying	To give representation about molecular mechanisms underlying individual development of organism
7	Prerequisites	Molecular biology, Basis of developmental biology
8	Contents of the discipline	Molecular biology of ontogenesis as a science: basic objects and methods of research. General principles for the implementation of genetic development programs. Regulation of cell proliferation and differentiation. Transmission of information to cells due to intercellular signaling. Molecular basis of gametogenesis, fertilization. Regularities of the formation of a general plan of the structure in the early development of vertebrates and invertebrates. The phenomenon of embryonic induction. Formation of the mesoderm and its derivatives (molecular and cellular aspects). Mechanisms of neurogenesis, organogenesis. Molecular basis of apoptosis and aging.
9	Recommended literature	1 Dondua AK. Developmental biology. T.2. - Moscow: Publishing House of St. Petersburg. Un-ty, 2005. 2. Khodosovskaya A.M. Molecular basis of ontogenesis. - Minsk: BSU, 2014. 3. Gilbert S. F. Developmental Biology.10th Ed.- Sunderland: Sinauer Ass. Inc., 2014.
10	Methods of teaching	A comparative, problematic, dialog-heuristic, visual, method of forming the personal significance of knowledge
11	Language of teaching	Russian
12	Conditions (requirements), routine monitoring	- oral interview, - writing work
13	Form of the current attestation	exam

1	Name of the discipline	Molecular basis of epigenetics
2	Course of Study	3
3	Semester of training	6
4	Amount of credits	1
5	FULL NAME lecturer	Candidate of Biological Sciences, Associate Professor Verameyenka Ekatsiaryna Gennadyevna
6	Objectives of studying the discipline	The goal of the educational discipline is to form a complete system of knowledge concerning the structural organization of chromatin and its modifications, as well as the mechanisms of action of non-coding RNA as the basis for epigenetic changes.
7	Prerequisites	epigenetics
8	Contents of the discipline	Subject, objectives and objectives of the course. Definition of the concept of epigenetics. Epigen, methyl and proteome. Molecular mechanisms of epigenetic regulation involving histones. Methylation of DNA and its role in the regulation of gene expression. Epigenetic regulation involving non-coding RNA. Epigenetically regulated processes.
9	Recommended literature	2. Cary, N. Epigenetics / N. Carey; Rostov-on-Don, 2012. 2. Epigenetics / Ed. CM. Zakian, V.V. Vlasov, E.V. Dementieva. Novosibirsk: Izdat. SB RAS, 2012. 592 p. 3. Epigenetics / Ed. S.D. Ellis. M.: Technosphere, 2010. 496 s
10	Teaching Methods	Comparative, problematic
11	Language of instruction	russian
12	Conditions (requirements), current control	Abstracts, testing
13	Form of current certification	credit

1	Course Title	Molecular basis of function of antioxidant systems (special course)
2	Year	3
3	Academic Semester	6
4	Number of credits	1,5
5	Lecturer	Doctor of Biological Sciences, Corresponding member of the National academy of sciences Shalygo Nikolay Vladimirovich
6	Goal	The greatest modern achievements in the field of oxidative stress and molecular basis of action of cellular antioxidant defense systems.
7	Prerequisites	Biochemistry, Molecular biology, Plant physiology
8	Course Description from Program Guide	Subject «Molecular basis of function of antioxidant systems». Molecular basis of generation reactive oxygen species. Low-molecular antioxidants. Antioxidant enzymes. Stressful proteins. Molecular basis of function of protective antioxidant systems.
9	Recommended Text-books (in Russian)	1. Мерзляк М.Н. Активированный кислород и окислительные процессы в мембранах растительных клеток // Итоги науки и техники ВИНТИ. Сер. физиол. раст. 1989. Т 6. С. 1-168. 2. Костюк В.А., Потапович А.И. Биорадикалы и биоантиоксиданты. Мн.: БГУ.,2004. 3. Шальго Н.В. Биосинтез хлорофилла и фотодинамические процессы в растениях. Минск. ИООО «Право и экономика», 2004 4. Бараненко В.В. Супероксиддисмутаза в клетках растений // Цитология. 2006. Т.48. № 6. С.465-474.
10	Methods	Comparative, problematic, visual methods, heuristic dialogue, method of forming the personal significance of knowledge
11	Language	Russian
12	Student evaluation	- speaking report, - essay
13	Final examination	Credit

1	Name of discipline	Molecular basis of ontogenesis
2	Course of study	4
3	Semester of training	7
4	Number of credits	3,5
5	Name and surname of lector	Candidate of Biological Sciences, Associate Professor KHODOSOVSKAYA Alina Mikhailovna
6	Objectives of the discipline studying	To give representation about molecular mechanisms underlying individual development of organism
7	Prerequisites	Basis of developmental biology, genetics
8	Contents of the discipline	Molecular biology of ontogenesis as a science: basic objects and methods of research. General principles for the implementation of genetic development programs. Regulation of cell proliferation and differentiation. Transmission of information to cells due to intercellular signaling. Molecular basis of gametogenesis, fertilization. Regularities of the formation of a general plan of the structure in the early development of vertebrates and invertebrates. The phenomenon of embryonic induction. Formation of the mesoderm and its derivatives (molecular and cellular aspects). Mechanisms of neurogenesis, organogenesis. Molecular basis of apoptosis and aging.
9	Recommended literature	1 Dondua AK. Developmental biology. T.2. - Moscow: Publishing House of St. Petersburg. Un-ty, 2005. 2. Khodosovskaya A.M. Molecular basis of ontogenesis. - Minsk: BSU, 2014. 3. Gilbert S. F. Developmental Biology.10th Ed.- Sunderland: Sinauer Ass. Inc., 2014.
10	Methods of teaching	A comparative, problematic, dialog-heuristic, visual, method of forming the personal significance of knowledge
11	Language of teaching	Russian
12	Conditions (requirements), routine monitoring	- oral interview, - writing work
13	Form of the current attestation	exam

1	Course Title	Molecular biology of cancer
2	Year	3
3	Academic Semester	6
4	Number of credits	1
5	Lecturer	Andrei S. Babenka, PhD
6	Goal	To form an idea about the principles of initiation and development of malignant neoplasms, peculiarities of the phenotype and genotype of tumor cells, modern methods of molecular diagnostics
7	Prerequisites	Genomics, Molecular Biology of a Gene, Biochemistry, Structural Biochemistry, Metabolic Biochemistry, Genetics.
8	Course Description from Program Guide	Malignant neoplasms, their place in the world statistics of mortality caused by non-infectious diseases. Initiation of tumors: endo- and exogenous factors, mutagens, regulation of the process. Stages of tumor development. Genetic and phenotypic heterogeneity of tumor tissue. Peculiarities of use in clinical practice. Development of tumor resistance to therapy.
9	Recommended Textbooks (in Russian)	1. Киселев Ф.Л. Молекулярная онкология: от вирусной теории к лечению рака / Ф.Л. Киселев, Е.Н. Имянитов, Н.П. Киселева, Е.С. Левина. 2013. 2. Gelmann E.P., Molecular Oncology: Causes of Cancer and Targets for Treatment / E.P. Gelmann, Ch. L. Sawyers, F. J. Rauscher. 2014. 3. Camacho J. Molecular Oncology: Principles and Recent Advances / J. Camacho. 2012. 4. Diaz-Cano S.J. Tumor Heterogeneity: Mechanisms and Bases for a Reliable Application of Molecular Marker Design / S.J. Diaz-Cano. 2012.
10	Methods	active, interactive, verbal, visual, problematic
11	Language	Russian
12	Student evaluation	Individual communication (reading, analysis, followed by discussion of the article)
13	Final examination	credit

1	Name of the discipline	Molecular biology of yeast
2	Course of Study	5
3	Semester of training	9
4	Amount of credits	2
5	lecturer FULL NAME	Candidate of Biological Sciences, Associate Professor LAGONENKO Alexander Leonidovich
6	Objectives of studying the discipline	Familiarization of students with key molecular biological processes in yeast cells, modern methods of studying eukaryotic cells
7	Prerequisites	Microbiology; molecular biology
8	Contents of the discipline	Introduction to molecular biology of yeast. Application of yeast in biotechnology. Advantages of yeast as a model eukaryotic organism. Organization of the yeast genome. Subunits of yeast RNA polymerases. Sequence of events in the initiation of transcription of yeast genes. Transcriptional regulation by auxiliary complexes. Processing of RNA precursors in yeast. Initiation, elongation and termination of translation. The mechanism of protein transport to the endoplasmic reticulum, peroxisomes, mitochondria and nucleus. Ubiquitin-proteasome pathway of protein degradation. The structure of yeast 26S proteasome. Initiation of DNA replication in <i>S. cerevisiae</i> . Phases of the yeast cell cycle. Cyclins, cyclin-dependent kinases and regulation of the cell cycle. Laboratory and bioinformatic methods of studying yeast cells
9	Recommended literature	1. <i>Дьяков Ю.Т.</i> Введение в генетику грибов / Ю.Т. Дьяков, А.В. Шнырева, А.Ю.Сергеев. М.: Academia, 2005. 2. <i>Feldmann H.</i> Yeast molecular biology. A short compendium on basic features and novel aspects / Feldmann H. Adolf-Butenandt-Institute, University of Munich, 2005. 3. <i>Sherman F.</i> An Introduction to the Genetics and Molecular Biology of the Yeast <i>Saccharomyces cerevisiae</i> / Sherman F. University of Rochester Medical School, Rochester. 1998.
10	Teaching Methods	Comparative, problematic, dialog-heuristic, visual
11	Language of instruction	Russian
12	Conditions (requirements), current control	- Preparation of essays; - testing
13	Form of current certification	credit

1	Course Title	Molecular biology
2	Year	4
3	Academic Semester	7
4	Number of credits	4
5	Lecturer	Yevgeny Nikolaichik, Ph. D.
6	Goal	To form an intergal system of knowledge about the structure and properties of biological macromolecules, as well as the basic molecular mechanisms underlying the functioning of living cells and multicellular organisms: the metabolism of biological macromolecules (DNA, RNA and proteins), the principles of intracellular regulation and intercellular signaling.
7	Prerequisites	Biochemistry, genetics, microbiology
8	Course Description from Program Guide	Genome organization in different groups of organisms. The mechanism of DNA polymerization reaction and its catalysis. Structure of DNA polymerases, their enzymatic activities and biological functions. Control of initiation and termination of DNA replication. Reparation of DNA damage. Molecular mechanisms of general and site-specific recombination, transposition. The unit of transcription in pro and eukaryotes. Features of the structure of RNA polymerases. Promoters and mechanisms for their recognition. Splicing. Basic properties of the genetic code. Transport RNA and their aminoacylation. The structure of the ribosomes. Initiation, elongation and termination of translation in pro and eukaryotes. Folding and controlled degradation of proteins. Systems of protein secretion in prokaryotes. Distribution of proteins along the compartments of the eukaryotic cell. General principles of sensory regulation. Principles of molecular control of the individual development of the organism.
9	Recommended Textbooks (in Russian)	Альбертс Б. Молекулярная биология клетки / Б. Альбертс, А. Джонсон, Дж. Льюис, М. Рэфф, К. Робертс, П. Уолтер. Ижевск: Институт компьютерных исследований, 2013 Льюин Б. Гены / М.: БИНОМ, 2011. – 896 с. Николайчик Е.А. Регуляция метаболизма клетки / Мн.: Изд-во БГУ, 2006
10	Methods	Comparative, problematic, visual methods, heuristic dialogue, method of forming the personal significance of knowledge
11	Language	Russian
12	Student evaluation	-essay; -writing tests; -labs report.
13	Final examination	Exam



1	Course Title	Molecular mechanisms of genetic processes
2	Year	4
3	Academic Semester	7
4	Number of credits	2,5
5	Lecturer	Doctor of Biological Sciences Prokulyevich Vladimir Antonovich
6	Goal	The aim of the discipline is to form students' ideas about the basic mechanisms of genetic processes, to expand knowledge about what modern bacterial genetics is, to address the main problems related to mechanisms ensuring the preservation and realization of genetic information in the cell
7	Prerequisites	Structural organization of microorganism cells, Molecular bacteriology, Genetics, Biochemistry
8	Course Description from Program Guide	Features of bacteria as an object of genetic research. General properties of genetic processes that determine the stability and functioning of DNA as an information molecule. Heredity and variability in bacteria. Genetic analysis of bacteria. Genetic processes taking place in bacterial cells. Structural organization and replication of DNA. The concept of the stability of genetic information. Reparation processes in bacteria. Recombination process as a factor in the instability of the genome.
9	Recommended Textbooks (in Russian)	<i>Сингер М. Гены и геномы / М. Сингер, П. Берг. М.: Мир, 1998.</i> <i>Льюин Б. Гены / Б. Льюин. М.: Мир, 1987.</i> <i>Квитко К.В., Захаров И.А. Генетика микроорганизмов. Изд-во С.-Петербург. УН-та СПб, 2012.</i>
10	Methods	active, interactive, verbal, visual, problematic
11	Language	Russian
12	Student evaluation	- essay preparation; - written works; -laboratory laboratory work.
13	Final examination	exam

1	Description of the discipline	Molecular mechanisms of hormonal regulation
2	Course of study	2
3	Semester	4
4	Number of credits	1,5
5	Name of Lecturer	Senior Lecturer, ZYRYANOVA Tatyana Nikolaevna
6	The goal of the discipline	Form the students an integral system of knowledge about the regulatory role of hormones, hormone-like compounds at the organism, subcellular, molecular levels, taking into account the organization and functioning of receptors and genes encoding different classes of hormones
7	Prerequisites	functional biochemistry, human and animal physiology, structural and metabolic biochemistry
8	The content of the discipline	General characteristics of the molecular mechanisms of the action of hormones and the transfer of regulatory signals. Features of the structure, expression of genes, properties and molecular mechanisms of action of protein-peptide hormones. Modern concepts of biosynthesis, structure, reception, molecular mechanisms of action of steroid hormones and hormones, amino acid derivatives, regulation of cellular response by tissue hormones and growth factors. Interaction of regulatory mechanisms
9	Recommended literature	1. Biochemical basis of human life / Ed. Yu.B.Filippovich, ASKonicheva- M .: VLADOS, 2005 2. John F. Fundamentals of endocrinology / John F. Leacock, Peter G. Weiss .- M .: Medicine, 2000 3. Biological chemistry / Ed. SE Severin, M: "Geotard Media", 2011 4. Molecular endocrinology. Ed. B.D. Weintraub. - Moscow: Medicine, 2003 5. Sirnov A.N. Endocrine regulation / Ed. V.A. Tkachuka, M: "Geotar v Media», 2009
10	Methods of teaching	Explanatory-illustrative, problematic, dialog-heuristic
11	Language learning	Russian
12	Conditions (requirements), current control	-preparation of abstracts -2 tests,
13	Current appraisal form	credit

1	Name of the discipline	Molecular Phytopathology
2	Course of Study	3
3	Semester of training	6
4	Amount of credits	1,5
5	lecturer FULL NAME	Candidate of Biological Sciences, Associate Professor LAGONENKO Alexander Leonidovich
6	Objectives of studying the discipline	Familiarization of students with the key molecular mechanisms of interaction between plants and their parasites, the genetic bases of plant diseases, modern methods of diagnosing plant diseases.
7	Prerequisites	Microbiology; molecular biology
8	Contents of the discipline	Phytopathology as a science, its importance. History of the development of phytopathology. The concept of plant disease, parasitism, trophicity. The concept of the infectious cycle of the disease, its stages. Sources of infection, ways of penetration and spread of phytopathogens. The notion of horizontal and vertical stability. Factors of virulence of phytopathogens related to the horizontal pathosystem. Flor's "gene-to-gene" hypothesis, the hypothesis of "guardian". Basic elicitors and elicitors specific to rasses. The mechanism of action of bacterial and fungial Avr-proteins. Classes of plant R-proteins. R-genes and their evolution. PAMP, PTI, PTS. Signaling systems of plants. Hypersensitivity reaction and the mechanism of its development in a resistant plant. SAR. Chemical and biological methods of plant diseases control. Modern methods of diagnostics of causative agents of infectious diseases of plants. Diseases of plants of fungal bacterial and viral nature.
9	Recommended literature	1. Дьяков Ю.Т. Фундаментальная фитопатология / Ю.Т. Дьяков М.:Краснад, 2012. 2. Дьяков Ю.Т. Общая и молекулярная фитопатология / Дьяков Ю.Т., Озерцовская О.Л., Джавахия В.Г., Багирова С.Ф. М.: Общество фитопатологов. 2001. 3. Попкова К.В. Общая фитопатология / Попкова К.В., Шкаликов В.А., Стройков Ю.М. М.: Дрофа, 2005.
10	Teaching Methods	Comparative, problematic, dialog-heuristic, visual
11	Language of instruction	Russian
12	Conditions (requirements), current control	- preparation of reports; - testing
13	Form of current certification	credit

1	Name of disciplines	Molecular taxonomy
2	Course of Study	3
3	Semester of training	6
4	Amount of credits	1,5
5	FULL NAME lecturer	Phd. assistant professor Grushetskaya Z.E.
6	Objectives of studying the discipline	Formation of students' ideas about the basic concepts of molecular evolution, acquaintance with modern techniques for identification and bioinformation analysis of DNA polymorphism of plants, fungi, algae and lichens.
7	Prerequisites	Genetics, Molecular Biology, Biometrics, Fundamentals of Information Technology.
8	Contents of the discipline	Basic concepts of molecular evolution. Characterization and analysis of marker sequences. Database. Phylogenetic analysis of data. Method of validation of phylogenetic dendrograms and evolution models. Molecular phylogeny and taxonomy. Use of DNA polymorphism to solve scientific and practical problems.
9	Recommended literature	Лукашов, В.В. Молекулярная эволюция и филогенетический анализ /В.В. Лукашов // Москва: Бинум, 2009. Felstenstein, J. Inferring Phylogenies / J. Felstenstein // Sinauer Associates, Inc. 2004. Антонов, А.С. Основы геносистематики высших растений / А.С. Антонов // М.: Наука, 2000. Pascale Besse. Molecular Plant Taxonomy: Methods and Protocols/NY: Springer, 2014. Картавец, Ю.Ф. Молекулярная эволюция и популяционная генетика / Ю.Ф. Картавец // Владивосток, 2009. Молекулярна філогенія і сучасна таксономія наземних спорових рослин /С.Я. Кондратюк и др. Киев: Наукова думка, 2013.
10	Teaching Methods	Visual, system, group, modular-rating learning technologies
11	Language of instruction	Russian
12	Conditions (requirements), current control	- oral interview; - problem solving.
13	Form of current certification	credit

1	Course Title	Nanobiotechnologies
2	Year	5
3	Academic Semester	9
4	Number of credits	3
5	Lecturer	Candidate of Chemical Sciences (=PhD) Gerlovsky Denis Olegovich
6	Goal	Obtaining profound, system cross-disciplinary knowledge by students about the nanolevel bioobjects, approaches and methods used for the solution of a wide range of applied and research scientific tasks.
7	Prerequisites	"Genetics of microorganisms", "Vector systems", "Genetic engineering", "Engineering enzymology"
8	Course Description from Program Guide	Introduction Experimental analytical methods of nanobiotechnology Molecular and biological bases of nanobiotechnology Molecular and chemical bases of interaction of components of biological nanoassemblies Application of achievements of bionanotechnology in medicine and in other areas Application of assemblies from biomolecules in nanotechnology. Nanobionics and live systems as nanotechnology prototypes The prospects of nanobiotechnology on a joint of molecular biology and biotechnology
9	Recommended Textbooks (in Russian)	Эхуд Газит Нанобиотехнология: необъятные перспективы развития / Газит Эхуд. Перевод с англ. — А.Е. Соловченко, 2011. Огурцов А.Н. Введение в молекулярную биотехнологию / А.Н. Огурцов. - Х.: НТУ "ХПИ", 2008.
10	Methods	Active, interactive, verbal, problem and evident methods
11	Language	Russian
12	Student evaluation	- preparation of the essay; - testing.
13	Final examination	examination

1	The name of the discipline	Parasitology
2	The course of the study	3
3	Semester of training	6
4	The amount of credits	1
5	Full name of the lecturer	PhD, Associate Professor N.V. Voronova
6	The objectives of the discipline studying	Parasitology course is aimed on providing to students with special information about the complexity of relationships between hosts and parasites. The goals of the course include forming principal awareness about adaptations, morphology, anatomy, physiology, behavior, reproduction and development of parasites.
7	The prerequisites	Zoology
8	Contents of the discipline	Parasitism as a form of interspecific interpopulation interactions. Adaptation of morphology and biological cycles of parasitic animals. The doctrine of natural foci of vector-borne diseases
9	Literature recommended (in Russian)	<ol style="list-style-type: none"> <li>1. Беклемишев, В.Н. Биоценотические основы сравнительной паразитологии. М.: Наука, 1970.</li> <li>2. Гинецинская Т.А. Частная паразитология / Т.А. Гинецинская, А.А. Добровольский // В 2 кн. (кн.1: паразитические простейшие и плоские черви; кн. 2: Паразитические черви. Моллюски и членистоногие). М.: Высшая школа, 1978.</li> <li>3. Демидов Н. В. Гельминтозы животных. М.: Агропромиздат, 1987.</li> <li>4. Догель В.А. Общая паразитология. Л.: Изд-во ЛГУ, 1962.</li> <li>5. Павловский Е.Н. Природная очаговость трансмиссивных болезней в связи с ландшафтной эпидемиологией зооантропонозов. М.; Л.: Наука, 1964.</li> <li>6. Тарасов В.В. Простейшие, патогенные для человека. М.: Изд-во МГУ, 1987.</li> <li>7. Шалапенок Е.С. Основы общей паразитологии. Минск: БГУ, 2004.</li> <li>8. Шалапенок, Е.С. Прикладная паразитология. Минск: БГУ, 2009.</li> <li>9. Мяндина Т.И. Медицинская паразитология / Т.И. Мяндина, Е.В. Тарасенко. М.: Практическая медицина, 2013.</li> </ol>
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, oral survey
13	The form of current certification	Credit

1	Discipline	Pedagogics
2	Year of study	Second
3	Semester	IV
4	Accreditation	4 credits
5	Lecturer	Davidovsky Anatoly Grigorievich
6	Aims and objectives	Formation of psychological and pedagogical competences that contribute to the effective solution of professional social and personal problems in pedagogical activity
7	Prerequisites	Psychology
8	Summary	Fundamentals of pedagogics. Pedagogics in the system of human sciences. General patterns in personality development. Education as a socio-cultural phenomenon. The education system of the Republic of Belarus in the context of world educational processes. Educational process as an integrated system. Scientific basis for the education content. Learning methods and tools, forms of learning. Teaching technologies in the educational process. Information and communication technologies in education. Blended learning. The essence of problem-based learning, flipped learning, heuristic learning. The didactic system of developing education. The essence of person-oriented education. The essence of education and teaching process, its patterns and principles. The content of education and teaching process. Methods, tools and forms of education and teaching process. The education and teaching in the family, community and society. Basic aspects of the teaching profession. The essence of pedagogical activity and requirements for a teacher's personality. Pedagogical management. Management of educational establishments. Pedagogical monitoring. Diagnostics and assessment of learning achievements
9	References	<p>1. Zhuk, O. L. Pedagogika: ucheb.method. complex for students of PED. specialties / O. L. Zhuk. – Minsk: BSU, 2003. – 383 p</p> <p>2. Zagvyazinsky V. I. learning Theory and education: proc. for bachelors / V. I. Zagvyazinsky, I. N. Emelyanov. - Moscow: Yurayt, 2012. – 314 p.</p> <p>3. Kraevskij, V. V. Methodology of pedagogics: new stage: proc.a manual for students. ouch. proc. institutions – M.: Academy, 2006. – 394 p.</p> <p>4. Basics of pedagogy: an electronic textbook.-method. complex O. L. Zhuk. [Electronic resource]. – Minsk, 2011. – Mode of access: <a href="http://elib.bsu.bv/handle/123456789/2859">http://elib.bsu.bv/handle/123456789/2859</a> – date of access: 07.04.2014.</p> <p>5. Slastenin, V. A. Pedagogika: ucheb. a manual for students. ouch. PED. proc. institutions / ed. by V. A. Slastenin. – Moscow: Academy, 2012. – 608 p</p> <p>6. History of pedagogy: teaching materials: a manual for students;higher.proc.institutions enrolled in the PED. specialties / A. P. Orlov, N. To. Zenkova, V. V. Teterin. – Minsk: ITC Finance, 2010. – 286 p.</p>
10	Teaching Methods	Problem-based and research methods, active collaborative teaching methods and forms of education, involving ICT (research methods, heuristic teaching practices, gaming technologies, case study, teamwork, project methods, etc.)
11	Language	Russian
12	Requirements and current assessment	<p>Requirements for competence building: to be able to build a content of the education and teaching process, to establish interdisciplinary links and to develop (enhance) the provision of educational and methodical support; to be able to design and organize the educational process, better manage it by applying efficient technologies, including different diagnostic tools; to be able to reflect and adequately assess your own pedagogical activity, to maintain professional life-long learning</p> <p>The current assessment of learning outcomes: in the form of tests or multiple tasks of various levels of complexity, aimed at applying acquired knowledge in familiar (standard) or unfamiliar (non-standard) situations (heuristic activity); creative activities (research student-devised projects, creative individual or group tasks)</p>
13	Final Assessment	Exam

1	The name of the discipline	Pharmaceutical Biotechnology
2	The course of the study	4
3	Semester of training	8
4	The amount of credits	4
5	Full name of the lecturer	NOVIKOV Dmitry Alekseevich PhD, assistant professor
6	The objectives of the discipline studying	To form in students of biochemists an idea of the main types of biopharmaceuticals (recombinant therapeutic proteins, vaccines, plasma protein, therapeutic monoclonal antibodies); principles of obtaining and regularity of biotechnology of genetically engineered eukaryotic and prokaryotic producers; modern biotechnological methods and instrumentation of processes in biopharmaceuticals; the latest achievements in the field of pharmaceuticals in biotechnology
7	The prerequisites	Biotechnology, microbiology, biochemistry.
8	Contents of the discipline	Biotechnology of protein drugs. Biotechnology of amino acids. Biotechnology of vitamins and coenzymes. Biotechnology of steroid hormones. Eicosanoids and their biological role. Plant cell cultures and the production of medicinal substances. Antibiotics as biotechnological products. Immunobiotechnology.
9	Literature recommended	1. Bezborodov A.M. Biochemical bases of microbiological synthesis - M.: Light and food industry, 1984. 2. BE Becker ME Biotechnology / Becker ME, Liepinen GK, Raipulis EP M. - Agropromizdat, 1990. 3. Gracheva I.M. Technology of microbial protein preparations, amino acids and bioenergy / Gracheva IM, Ivanova LA, Kantere VM - M: Kolos, 1992. 4. Kashkin P.N. Antibiotics - L.: Medicine, 1994. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- the preparation of abstracts, - 2 tests, - the preparation of a report on the results of the workshop
13	The form of current certification	exam



1	Course Title	Pharmaceutical Microbiology
2	Year	3
3	Academic Semester	6
4	Number of credits	2,5
5	Lecturer	Candidate of Biological Sciences Litvinova Elena Valeryevna
6	Goal	Form students' understanding of the modern methods of microbiological research necessary to organize the production and quality control of pharmaceutical products in accordance with the requirements of good manufacturing practice and biological safety
7	Prerequisites	Physiology of microorganisms, Cultivation of microorganisms, Mechanisms of biosynthesis of antibiotics and their effect on cells of microorganisms, Structural biochemistry, Metabolic biochemistry
8	Course Description from Program Guide	Pharmacy, pharmaceuticals, pharmaceutical production. General ideas about the development and industrial production of medicines. Generic and original medicines. Sources and ways of microbial contamination in pharmaceutical production. Measures to prevent microbial contamination. Disinfectants, antiseptics, preservatives, used in pharmaceutical production. Quality assurance system. Microbiological control of non-sterile and sterile medicinal media. Quantitative determination of active substances. Validation of methods of quality control of medicines, technological processes.
9	Recommended Textbooks (in Russian)	<i>Галынкин В.А.</i> Основы фармацевтической микробиологии: Учебное пособие/ В.А.Галынкин, Н.А. Заикина, В.И. Кочеровец, Т.С.Потехина, Н.Д. Бунатян. – СПб.: Проспект Науки, 2008. – 304с. <i>Поздеев О.К.</i> Медицинская микробиология: Учебное пособие/ О.К. Поздеев, В.И. Покровский. – М.: ГЭОТАР-МЕД, 2001. – 765 с. <i>Государственная фармакопея Республики Беларусь.</i> (ГФ РБ II): Разработана на основе Европейской фармакопеи. Т.1 Общие методы контроля лекарственных средств/ М-во здравоохран. РБ, УП «Центр экспертиз и испытаний в здравоохранении»/ под общей редакцией А.А. Шеряков. – Молодечно: тип. «Победа», 2012. – 1220 с.
10	Methods	active, interactive, verbal, visual, problematic
11	Language	Russian
12	Student evaluation	- written tests on specific topics of the course; - protection of the essay prepared by the student; - oral polls
13	Final examination	Exam

1	Name of disciplines	Pharmacognosy
2	Course of Study	2
3	Semester of training	2
4	Amount of credits	3
5	FULL NAME lecturer(s)	Doctor of biological Sciences, Professor Karpuk V. V.; PhD, Associated Professor Poliksenova V. D.
6	Objectives of studying the discipline	The natural sources of pharmacologically active substances, familiarity with the methods of their diagnostics, rules of preparation, application in medicine.
7	Prerequisites	Botany; Chemistry (organic), Biochemistry.
8	Contents of the discipline	The pharmacognosy as an applied branch of botany, with main application in medicine. Medicinal plants and derived raw materials, included into the State Pharmacopoeia of the Republic of Belarus as sources of various valuable biologically active compounds. The principles and features of the procurement of medicinal plant raw material; documents regulating the quality of raw material; methods of diagnosis of its authenticity and purity. Feature the most important pharmacologically active substances of primary metabolites: polysaccharides, lipids, vitamins and secondary metabolites: terpenoids, (essential oils, bitters, etc.), fenoprofen (coumarins, flavonoids, tannides, anthracen derivates), cardio-steroids, saponins, alkaloids, and other groups of biologically active substances. Pharmacological action and areas of application of species medicinal plants.
9	Recommended reading	1. Карпук, В.В. Фармакогнозия: учеб. пособие для биол. спец. – Мн.: БГУ, 2011. 2. Сенчило, В.И. Лекарственные растения Беларуси: Учеб. пособ. для студ. специальностей 1-31 05 01-03 «Химия (фармацевтическая деятельность)» и 1-31 01 01-03 «Биология (биотехнология)» / В.И. Сенчило, Ю.В. Сенчило. – Мн.: БГУ, 2004. 3. Сенчило, В.И. Фармакогнозия: Практикум для студ. химического факультета специальности 1-31 05 01-03 «Химия (фармацевтическая деятельность)» / В.И. Сенчило, О.И. Костюченко, В.В. Карпук. – Мн.: БГУ, 2005. 4. Государственная фармакопея Республики Беларусь, в 2-х т. Т. 2. – Молодечно: Победа, 2016.
10	Teaching Methods	Visual, system, group, the technology module-rating training
11	Language of instruction	Russian
12	Conditions (requirements), current control	– verbal questioning; – protection of abstracts.
13	Form of current certification	– oral exam.

1	Discipline title	Photosynthesis
2	Course of study	3
3	Semester of training	6
4	Amount of credits	3,5
5	Full name of lecturer	PhD, Docent, FILIPTSOVA Halina Grygorievna
6	Learning goals of discipline	To expand and deepen the knowledge of students about the mechanism of conversion of solar energy by process of photosynthesis into the chemical energy of organic compounds, as well as the influence of environmental factors on this process.
7	Prerequisites	Plant physiology.
8	Content of discipline	The essence of photosynthesis, the role in the processes of transformation of matter and energy. Structural and biochemical organization of the photosynthetic apparatus at the level of leaf, chloroplast, thylakoid membrane. Photosynthetic pigments: chemical structure, physico-chemical properties, functions. Primary processes of photosynthesis. Structural and functional organization of the electron transport chain of chloroplasts. Photoenergy reactions in chloroplasts. Metabolism of carbon in photosynthesis. The effect of environmental factors on photosynthesis. Photosynthesis as the basis of plant productivity.
9	Recommended literature	1. Mokronosov A.T. Photosynthesis: physiological, ecological and biochemical aspects / A.T. Mokronosov, V.F. Gavrilenko, T.V. Zhigalov. - Moscow: "Academy." 2006. 2. Yurin V.M. Plant Physiology / B.M. Yurin. Lecture course. - Minsk. 2012. 3. Photosynthesis. Ed. Govindzhi. - Moscow: Mir. Vol. 1. 2. 1987.
10	Teaching methods	Active types of lectures, visual training, discussion, practical and heuristic methods.
11	Language of training	Russian
12	Requirements, current control	Two written tests, Abstract writing Testing
13	Form of current certification	Exam

1	Course Title	Physical and Colloid chemistry
2	Year	2
3	Semester	4
4	ECTS Credits	3
5	Lecturer (Name)	Ph.D., Lecturer, Associate Professor Savitsky Alexander Alexandrovich
6	Learning Objectives	Develop an understanding of the fundamental theoretical and experimental foundations of physical and colloid chemistry in its current state. Show the value of physical and colloid chemistry for the development of both chemistry and other natural sciences: biology, soil science, medicine, etc., as well as their numerous applications in engineering and agriculture
7	Prerequisites	Analytical chemistry Inorganic chemistry
8	Course Content	Physical chemistry as a theoretical basis of modern chemistry. Basic concepts, definitions and postulates of chemical thermodynamics. The first law of thermodynamics. Thermochemistry. The second law of thermodynamics. Fundamental equations of thermodynamics. Thermodynamics of solutions and heterogeneous systems. Chemical equilibrium. Colloidal state of matter. Classification of disperse systems. Methods for the preparation of disperse systems. Molecular-kinetic properties of disperse systems. Adsorption phenomena at various boundaries. Electrical and optical properties of disperse systems. Stability and methods of destruction of disperse systems
9	Literature	1.Тиноко И., Зауэр К., Вэнг Дж., Паглиси Дж. Физическая химия (Принципы и применения в биологических науках). – М.: Техносфера, 2005. 2. Мушкамбаров Н.Н. Физическая и коллоидная химия. – М.: ГЭОТАР–МЕД, 2002. 3.Уильямс В., Уильямс Х. Физическая химия для биологов. – М.; Мир, 1976. 4.Балезин С.А., Ерофеев Б.В., Подобаев Н.И. Основы физической и коллоидной химии. – М.: Просвещение, 1975. 5.Горшков В.И., Кузнецов И.А. Физическая химия. – М.: МГУ, 1986.
10	Teaching Methods	Explanatory-illustrative, laboratory, problem-searching, instructive-practical, situational method
11	Language	Russian
12	Conditions (requirements), Monitoring	Colloquiums Reports on laboratory works
13	Final Assessment	Credit

1	The name of the discipline	Physicochemical methods of analysis
2	The course of the study	3
3	Semester of training	5
4	The amount of credits	1,5
5	Full name of the lecturer	Korik Elena PhD, assistant professor
6	The objectives of the discipline studying	development of the students theoretical and methodological foundations of modern physical and chemical methods of research materials and design features of modern devices, for carrying out such research; to create skills of independent carrying out of analytical researches with use of physical and chemical methods of the analysis.
7	The prerequisites	Structural biochemistry, analytical chemistry
8	Contents of the discipline	Optical methods of analysis. Electrochemical methods of analysis. Chromatographic methods of analysis. Mass spectrometric methods of analysis. Physicochemical methods of separation and concentration of substances.
9	Literature recommended	7. Ioffe BV, Zenkevich IG, Kuznetsov MA, Bershtein I.Ya. New physical and chemical methods for studying organic compounds. L.LGU. 1984. (in Russian) 8. Physicochemical methods of analysis. Practical Guide: A manual for higher education. / Aleskovsky VB, Bardin VV, Bulatov MI et al., L.: Chemistry, 1988. (in Russian) 9. Kharitonov Yu.Ya. Analytical chemistry (analytics). In 2 books. Textbook. for universities. - M.: Higher education. shk., 2001. (in Russian) 10. Analytical chemistry: in 2 volumes. / G. Christian; trans. with eng. - Moscow: BINOM.Laboratory of Knowledge, 2009. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes - execution of tasks in the test form; - checking the conduct of laboratory journals; - protection of the student's prepared essay.
13	The form of current certification	credit

1	Discipline	Physics
2	Course	2
3	Semester	3
4	Number of credits	6,5
5	Lecturer's name, academic degree and rank	Doctor of Engineering, Professor SIDORENKO Alevtina Vasilievna Senior Teacher RATKEVICH Sergei Vladimirovich
6	Goals	Learning principal parts of general physics, forming fundamental and practical training of biologists in sphere life sciences according the present surrounding environment perception
7	Prerequisites	Mathematical analysis
8	Subject	Part 1: Mechanics. Cinematics. Principal laws of dynamics. Dynamics of solids. Mechanics of liquids and gases. Oscillations. Waves. Part 2: Molecular Physics and Thermodynamics. State of substance. Primary of molecular-cinetics theory and ideal gases. The first principle of thermodynamics. The second principle of thermodynamics. Real gases. Liquids. Solids. Part 3: Electricity and Magnetics. Constant electrical field. Electrical field in полупроводник and dielectrics. Constant electrical current. Electrical conductivity. Variable electrical current. Constant magnetic field. Magnetic field in substance. Electromagnetic oscillation and waves. Electrical phenomenon in biology systems. Part 4: Optics. Absorption and dispersion of light. Wave optics. Thermal radiation and it's utilization in medicine. Luminiscence. Photoelectrical effect. Part 5: Structure of Atom and Atom Nuclear. Theory of Hydrogen Atom. Rentgenous radiation. Elements of atom nucleus physics. Radioactivity.
9	Recommended literature	1. Sidorenko A. V. Physica / A. V. Sidorenko, T. P. Yanukovich. Mn.: BDU, 2004. 2. Trofimova T. I. Course of physics. / T. I. Trofimova M.: Higher school, 2006. 3. Saveliev I. V. Kurs of general physics./ I. V. Saveliev. M.: Knorus, 2008. 4. Leshenko V. G. Medical and biological physics./V/ G/ Leshenko, G. K. Ilyich. Mn.:Novoe znanie, 2012. 5. Sidorenko A. V. Physica. Practicum./ Mn.: BSU, 2005.
10	Teaching methods	Lectures, laboratory work and practical training in computer class, independent studies
11	Language	Russian
12	Conditions (requirements), current certification	Questioning, laboratory work reports, oral presentation of the results
13	Forms of current certification	Examination

1	Name of disciplines	Physiology of intercellular communication
2	Course of Study	3 (full-time and part-time departments)
3	Semester of training	6th
4	Amount of credits	2.5
5	FULL NAME lecturer	Sidorov A.V.
6	Objectives of studying the discipline	Prepare the student for independent work in the field of cellular physiology.
7	Prerequisites	human and animal physiology, human anatomy, histology and cytology, biochemistry
8	Contents of the discipline	Introduction. The structure of intercellular contacts. Transport of substances through the membrane. Electrical signals of cells. Ionic mechanisms of formation of membrane potential and action potential. Mechanisms of synaptic signal transmission. Signaling mechanisms of action of substances. Neurotransmitters. Neuromodulators.
9		Nichols JG From the neuron to the brain / JG Nichols, AR Martin, BJ Vallas, PA Fuchs. M.: Editorial URSS, 2012. 672 p. Sidorov A. V. The physiology of intercellular communication / A. V. Sidorov. Minsk: BSU, 2008.- 215 p. von Bohlen und Halbach O. Neurotransmitters and Neuromodulators / O. von Bohlen und Halbach, R. Dermietzel. Darmstadt: Wiley-VCH Verlag GmbH Weinheim, 2002. 285 p.
10	Teaching Methods	Problematic, visual, dialog-cognitive, use of presentations
11	Language of instruction	Russian
12	Conditions (requirements), current control	Methods of oral, written and laboratory-practical control. Abstracts, testing, solving of situational problems.
13	Form of current certification	Exam

1	The name of the discipline	Physiology of microorganisms
2	Course	2
3	Semester of training	4
4	Amount of credits	4
5	Full Name lecturer	Candidate of Biological Sciences, Associate Professor Lysak Vladimir Vasilevich
6	Objectives of studying the discipline	Form the students an integral system of knowledge about the metabolism of microorganisms and its regulation, the use of basic physiological patterns of the functioning of microorganisms in human practical activities
7	Prerequisites	Structural biochemistry; Metabolic biochemistry; Systematization of microorganisms
8	Contents of the discipline	History of the development of physiology of microorganisms. Nutrition of microorganisms. The way substances enter the cell of microorganisms. Metabolism of microorganisms. The variety of metabolic pathways in microorganisms. Energy metabolism in microorganisms. Aerobic respiration, anaerobic respiration and fermentation in microorganisms. Incomplete oxidation of organic substances by microorganisms. Oxidation of inorganic substances by chemolithotrophic microorganisms. Use of solar energy by bacteria. Oxygen, anoxygen and "chlorophyll" photosynthesis. Constructive metabolism of microorganisms. Fixation of molecular nitrogen by microorganisms. Bioluminescence of microorganisms. Regulation of Metabolism in Microorganisms
9	Recommended literature	1. Gottshalk G. Metabolism of bacteria. – M.: Mir, 1982 (in Russian). 2. Lysak V.V. Physiology of microorganisms. – Minsk: Publishing center of BSU, 2014(in Russian). 3. Gusev M.V., Mineeva L.A. Microbiology. – M.: Publishing center "Academy", 2003 (in Russian). 4. Netrusov A.I., Kotova I.E. Microbiology. – M.: Publishing center "Academy", 2009 (in Russian). 5. Lysak V.V., Ignatenko E.I. Physiology of microorganisms. – Minsk: BSU, 2016 (in Russian). 6. Modern microbiology / ed. I. Lengeler, Mr. Drews, Mr. Schlegel. – M.: Mir, 2005 (in Russian).
10	Training Methods	Active, interactive, verbal, visual, problematic
11	Language of training	Russian
12	Conditions (requirements), operating control	-computer testing
13	Form of current certification	Exam



1	Discipline	Physiology of the autonomic nervous system
2	Year of Study	4
3	Term of Study	7
4	Number of Credits	1,5
5	Tutors	Chumak AG
6	Study Objectives	The goal - on the basis of a systematic scientific approach to form the students' basic ideas about the sympathetic and parasympathetic mechanisms of maintaining homeostasis in various conditions of the organism's existence
7	Prerequisites	Human Anatomy, Cytology and Histology, Human and Animal Physiology
8	Course Content	Principles of the organization of neurohumoral regulation of visceral functions of the body. Centers for the regulation of vital functions. The participation of the autonomic nervous system in the regulation of respiration, circulation, digestion, endocrine glands and organs of the secretion system.
9	Literature Recommended	Chumak AG Physiology of the autonomic nervous system: a course of lectures. Chumak Minsk: BSU, 2010.-215 p . Chumak AG Methods for studying the activity of afferent systems. Chumak Minsk: BSU, 2008.-115 p. AG Chumak, S.A. Rutkevich, T.V. Karavay. Excitation and inhibition of interoceptive reflex reactions - Minsk: BSU, 2014. - 231 p .
10	Methods of Teaching	Problem, dialogue-heuristic, visual, search-research, reproductive (in the part of laboratory exercises).
11	Language of Teaching	Russian
12	Requirements, Current Assessment	Methods of oral, written and laboratory-practical control Abstracts testing
13	Form of Current Assessment	exam

1	Title discipline	Physiology of the cardiovascular system
2	Course of study	3
3	Semester of training	6
4	Number of credits	1,5
5	Name and surname lecturer	Polyukhovich Galina Sergeevna
6	Objectives of studying the discipline	The purpose of the academic discipline is to form on the basis of classical and modern scientific research the students' understanding of the structural and functional organization of the cardiovascular system and its role in the living organism.
7	Prerequisites	Human Anatomy, Human and Animal Physiology, Neuromuscular Physiology, Intercellular Communication Physiology
8	Content of the discipline	Evolution of transport systems in animals. The heart is a rhythmic pump: the ultrastructure of the mammalian myocardium; metabolism and energy in the myocardium; electrophysiology of the myocardium; contraction and relaxation of the myocardium; regulation of the heart; methods of studying the work of the heart. Functional organization of the vascular system: the structure of the vessel wall; basics of hemodynamics; Skeletal muscles as active factors of hemodynamics and peripheral "hearts" (works of Prof. AI Arinchin); regulation of blood circulation; regional blood circulation; lymphatic system. Disorders of the heart, blood pressure disorders.
9	Suggested Reading	Fundamental and classical physiology / Ed. A. Kamkin and A. Kamensky. M., Academia, 2004 Samoylov V.O. Medical Biophysics. SP: Spec. lit., 2007 Physiology and pathophysiology of the heart / Ed. N. Sperelakis. M: Medicine. T.1, 2, 1999 The physiology of blood circulation / Ed. B.I. Tkachenko. L. : Science, 1986.
10	Methods of teaching	Problem, visual, search-research, reproductive (laboratory work).
11	Language of learning	Russian
12	Conditions (requirements), current control	As a control self-directed work (SDW) is the final computer testing.
13	Form of current certification	credit

1	Name of disciplines	Physiology of the vital centers of the brain stem
2	Course of Study	3
3	Semester of training	5
4	Amount of credits	1.5
5	FULL NAME lecturer	Kulchitsky V.A.
6	Objectives of studying the discipline	To give a concept of the modern level of knowledge on the physiology of the vital centers of the brain stem, the division of physiological science, which studies the general and particular mechanisms of functioning of a healthy organism in various conditions of life activity
7	Prerequisites	human anatomy
8	Contents of the discipline	Physiology of the medulla oblongata. The concept of central chemoreceptors. Physiology of the bridge and reticular formation of the brain stem. Physiology of the midbrain and pain perception. Physiology of the hypothalamus. Neurophysiology of emotions, motivations. Physiology of sleep and wakefulness: circadian rhythms. Prospects for studying the functions of the brain stem, methodological features.
9		Здоровый и больной мозг человека//Бехтерева Н.П. // Л.:Наука,1988. Спинальный мозг//Вишневецкий А.А., Шулепова Н.В. //СПб: Фолиант, 2014. Функции вентральных отделов продолговатого мозга//Кульчицкий В.А// Минск: Наука и техника,1993
10	Teaching Methods	Verbal, practical, visual, heuristic, problematic, research
11	Language of instruction	russian
12	Conditions (requirements), current control	Oral and written control
13	Form of current certification	credit

1	Course Title	Phytopathogenic microorganisms
2	Year	3
3	Academic Semester	5
4	Number of credits	1,5
5	Lecturer	Candidate of Biological Sciences, associate professor of the department of microbiology Puchkova T. A.
6	Goal	The aim of the course is to present up-to-date information on the study of the characteristics of phytopathogenic microorganisms (bacteria and fungi).
7	Prerequisites	«Systematics of microorganisms», «Structural organization of microorganism cells», «Physiology of microorganisms», «Fundamentals of botany».
8	Course Description from Program Guide	Development of studies of phytopathogenic microorganisms. Classification of plant diseases and characterization of their symptoms. The main stages of the development of the disease. Factors determining the spread of phytopathogens. Characteristics of gram-positive and gram-negative phytopathogenic bacteria. Diseases of plants caused by mycoplasmas and viruses. Characteristics of fungi - causative agents of plant diseases. Phytopathogenic mucus. Phytopathogenic representatives of the departments of basidiomycota and deuteromycota. Characteristics of pathogenicity factors of microorganisms - causative agents of plant diseases. Role in the pathogenesis of plants with enzymes of microorganisms. Types of immunity, resistance, tolerance and susceptibility to diseases. Horizontal and vertical stability. Theory of the interaction between the pathogen and the host as a gene-on-gene. «Elicitor-receptor» and the model of «specific suppressor» when recognizing the host-pathogen. Induced resistance of plants. Characteristics of different groups of elicitors. Phytoalexins. Protective proteins of plants. Hypersensitivity reaction as a way of plant resistance to pathogen. System resistance of plants.
9	Recommended Textbooks (in Russian)	Желдакова Р. А. Фитопатогенные микроорганизмы: Учеб.- метод. комплекс для студентов биол. фак. спец. G - 31 01 01 «Биология» / Р. А. Желдакова, В. Е. Мямин. – Мн.: БГУ, 2005. Попкова, К. В. Общая фитопатология: учебник для ВУЗов / К. В. Попкова. – 2-е изд., перераб. доп. – М.: Дрофа, 2005. Шкаликов, В. А. Иммуитет растений / В. А. Шкаликов, Ю. Т. Дьяков А. Н. Смирнов и др.; под ред. В. А. Шкаликова. – М.: КолосС. 2005.
10	Methods	Problematic, visual methods, heuristic dialogue
11	Language	Russian
12	Student evaluation	- training of seminars; preparation of abstracts; - writing tests
13	Final examination	Credit

1	Name of the discipline	Plant cell, tissue and organ culture
2	Course of Study	4
3	Semester of Study	7
4	Amount of credits	2,5
5	Lecturer	Candidate of biological sciences, associate professor DITCHENKO Tatiana I.
6	Goals	Learning of theoretical basics and methodological principles for the plant cell, tissue and organ cultivation and studying of fundamental and applied aspects of using cultured plant cells
7	Prerequisites	Cultivation of cells Introduction to biotechnology
8	Content	Methodological basis for the plant cell and tissue cultivation <i>in vitro</i> . Callus culture: technology of obtaining, types, directions for use. Mechanisms of callusogenesis. Suspension cultures: preparation, types, methods of cultivation, areas of usage. Culture of single cells. Culture of isolated protoplasts: methods of obtaining and culturing the direction of use. Features of populations of long-cultured <i>in vitro</i> plant cells. Types of differentiation <i>in vitro</i> . Biotechnology of clonal propagation and obtaining of virus-free plants. Biotechnological methods of preservation of gene pool of higher plants. The production of secondary metabolites based on the culture of plant cells and organs. Technology of cell engineering in plant breeding.
9	Recommended literature (in Russian)	1. Butenko, R.G. the Biology of cells of higher plants in vitro and biotechnology based on them: proc. allowance. – M.: FBK–PRESS, 1999. 2. Ditchenko, T.I. Culture of plant cell, tissue and organ: course of lectures. – Mn.: BSU, 2007. 3. Ermishin, A.P. Plant Biotechnology and Biosafety: a Handbook. – Mn.: BSU, 2015.
10	Teaching Methods	Verbal, practical, research
11	Language of instruction	Russian
12	Requirements of current control	Testing, written examination, preparation and defense of the essay
13	Form of current attestation	Exam

1	The discipline	Population Ecology
2	Year of study	4
3	Semester	8
4	Number of credits	2
5	Name of lecturer	PhD, Associate Professor Zhukova Anna Anatolievna
6	Learning objectives	Formation of the concept of population ecology, the main methods of analysis of the structure and dynamics of populations, the types of interpopulation interactions
7	Prerequisites	General ecology
8	Contents of the discipline	Population density and methods of its evaluation. The main dynamic characteristics of the population. Models of growth, factor conditioning and self-regulation of population density. Sexual and age structure of populations. Genetic heterogeneity of populations. Fenetics of populations. Dynamics of natural populations. Classification of interactions between populations. Competition. Relationships of the "predator-prey" type. Parasitism. Symbiotic relationships between populations.
9	Recommended literature	1. Began M., Harper J., Townsend E. Ecology of individuals, populations, communities. 1989. 2. Gilyarov A.M. Population ecology. 1990. 3. Galkovskaya G.A. Fundamentals of population ecology. 2009.
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Tests, task solving
13	Form of current certification	Exam

1	The name of the discipline	Preparation of recombinant proteins, monoclonal therapeutic antibodies and vaccines
2	The course of the study	4
3	Semester of training	8
4	The amount of credits	2,5
5	Full name of the lecturer	Head of the Laboratory of Molecular Diagnostics and Biotechnology of the State Scientific Institution "Institute of Bioorganic Chemistry of the National Academy of Sciences of Belarus", GILEP Andrey Aleksandrovich PhD
6	The objectives of the discipline studying	Mastering students with knowledge and skills in obtaining, characterizing and using recombinant proteins, monoclonal antibodies and vaccines in medicine and veterinary medicine.
7	The prerequisites	Immunology, biochemistry, biotechnology
8	Contents of the discipline	Therapeutic recombinant proteins. Therapeutic antibodies. Recombinant proteins for diagnosis. Recombinant proteins for preclinical testing. The technology of obtaining recombinant antibodies. Methods for the production of recombinant proteins for therapeutic use. Methods for quality control of recombinant proteins. Market review of biopharmaceutical and molecular-diagnostic products.
9	Literature recommended	1. Prischep TP Fundamentals of pharmaceutical biotechnology. Textbook. / TPPriscnep, V.S. Chuchalin, K.L. Zaikov, L.K. Mikhaleva, L.S. Belova. Rostov n / a.,: Phoenix; Tomsk: Publisher of NTL, 2006. 2. Egorova T.A. Fundamentals of Biotechnology / TA Egorova, SM Klunova, E.A. Zhivukhin. M.: Academia, 2003. 3. Glik B. Molecular biotechnology. Principles and applications / B. Glik, J. Pasternak. Moscow: Mir, 2002. (in Russian) 4. EMEA / CHMP / BWP / 157653/2007 "Guideline on the development, production, characterization and specifications for monoclonal antibodies and related products", London, 18 December 2008, 11 p. 5. Breedveld F. Therapeutic monoclonal antibodies // Lancet. - 2000. - V. 355. - P. 735-740.
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes; - execution of tasks in the test form; - checking the conduct of laboratory journals; - protection of the student's prepared essay.
13	The form of current certification	exam

1	The name of the discipline	Proteomics
2	The course of the study	3
3	Semester of training	6
4	The amount of credits	1
5	Full name of the lecturer	YANTSEVICH Alexey Viktorovich PhD
6	The objectives of the discipline studying	Formation of students' ideas about proteomics, basic principles, methodological approaches and the importance of conducting proteomic analysis.
7	The prerequisites	Biochemistry, Organic Chemistry, Analytical Chemistry
8	Contents of the discipline	Structural and functional bases of proteomics. Principles and methods of proteome analysis. Electrophoretic methods. Chromatographic methods. Mass spectrometric methods. Methods of analysis of protein structure. Methods for the analysis of protein-protein interactions. Development of bioinformational technologies for data processing of proteomic experiments. Proteomics databases. Modeling of physicochemical properties and functions of proteins by known nucleotide sequences. Proteomics in medicine.
9	Literature recommended	1. Nolting B. The newest methods of studying biosystems 2005 2. Filippovich, Yu.B. Fundamentals of Biochemistry 1999 3. Finkelstein, AV, Ptitsyn, OB Physics of the protein: A course of lectures with color and stereoscopic illustrations and tasks. 2005 (in Russian) 4. Twyman, R.M. (2004). Principles Of Proteomics (Advanced Text Series). 2004 5. Naven T, Westermeier R. (2002). Proteomics in Practice: A Laboratory Manual of Proteome Analysis.
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes; - execution of tasks in the test form; - checking the conduct of laboratory journals; - protection of the student's prepared essay.
13	The form of current certification	credit



1	The name of the discipline	Quality assessment, bioavailability and bioequivalence of drugs and pharmacological substances
2	The course of the study	4
3	Semester of training	8
4	The amount of credits	2,5
5	Full name of the lecturer	Alekseev Nikolay Alexandrovich PhD
6	The objectives of the discipline studying	Assimilation of the basics of pharmacokinetics, analytical chemistry, biopharmation and the formation of a holistic view of the bioavailability and bioequivalence study for the solution of pharmacological, pharmaceutical, toxicological and medical problems
7	The prerequisites	Organic chemistry, biochemistry, analytical chemistry.
8	Contents of the discipline	Introduction to biopharmacy. Models for the study of drug release in vitro. Pharmacokinetics. Methods for isolating and determining LV and their metabolites in bioassays. Chromatographic analysis methods and their application for the analysis of LP and their metabolites in bioassays. Validation of test methods.
9	Literature recommended	1. Glanz S. Medico-biological statistics. Trans. with English. - M., Practice, 1999. (in Russian) 2. Guidance for Industry, Bioanalytical Method Validation, US Department of Health and Human Services, Food and Drug Administration Centre for Drug Evaluation and Research (CDER), Centre for veterinary Medicine (CVM), May 2001 BP, website: <a href="http://www.fda.gov/cder/guidance/index.htm">http://www.fda.gov/cder/guidance/index.htm</a> . 3. Guideline on Validation of Bioanalytical Methods EMEA/CHMP/EWP/192217/2009, London, 2009. 4. Clarke's Analysis of Drugs and Poisons. A.C. Moffat, M.D. Osselton, B. Widdop // Pharmaceutical Press. 2004.
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes; - execution of tasks in the test form; - checking the conduct of laboratory journals; - protection of the student's prepared essay.
13	The form of current certification	exam

1	The name of the discipline	Radiobiology
2	The course of the study	3
3	Semester of training	5
4	The amount of credits	1
5	Full name of the lecturer	FILIMONOV Mikhail Mikhailovich, PhD, Associate Professor
6	The objectives of the discipline studying	Forming in students of biologists a stable system of ideas about modern radiobiology, as a fundamental complex scientific discipline.
7	The prerequisites	Biochemistry, Radiation Biophysics.
8	Contents of the discipline	Physico-dosimetric basics of radiobiology. The problem of radiosensitivity in radiobiology. General characteristics of the effect of radiation on the body. Theoretical ideas about the mechanism of the biological effect of ionizing radiation. Natural sources of ionizing radiation. Protection of biological objects from the damaging effects of ionizing radiation
9	Literature recommended	1. Butomo N.V. Fundamentals of Medical Radiobiology / N.V. Butomo, A.N. Grebenyuk, V.I. Legeza and others. Ed. I.B.Ushakova. - SPb .: OOO "Publishing House Foliant", 2004. 2. SP Yarmonenko Radiobiology of Man and Animals: Textbook / S.P. Yarmonenko, A.A. Vainson: Ed. S.P. Yarmonenko. - Moscow: VSh, 2004. 3. Filimonov MM, Radiobiology, manual // Nilimonov MM, Novikov DA, Minsk: BSU, 2015 - 132 p. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes; - execution of tasks in the test form; - checking the conduct of laboratory journals; - protection of the student's prepared essay.
13	The form of current certification	credit

1	The discipline	Radioecology
2	Year of study	3
3	Semester	6
4	Number of credits	2
5	Name of lecturer	PhD, Associate Professor Makarevich Tamara Aleksandrovna
6	Learning objectives	Formation of the concept of the migration regularities of radionuclides in the biosphere and the effect of ionizing radiation on the biosystems of the sub organism's organization level
7	Prerequisites	General ecology
8	Contents of the discipline	Dosimetric concepts and quantities. Methods for measuring ionizing radiation and determining radiation doses. Radiation background of the environment: natural radioactivity and its components; artificial radioactivity and its sources. Distribution of radionuclides in the atmosphere and removal mechanisms from the atmosphere. Land routes for migration of radionuclides: migration of radionuclides in the soil; migration in the soil-plant system; transfer of radionuclides into the body of animals and inclusion in metabolism. Rational management of agriculture in contaminated areas. Migration of radionuclides in aquatic ecosystems. Inclusion of radionuclides in the biotic circulation. Mechanisms of self-purification of aquatic ecosystems.
9	Recommended literature	1. Appleby L.J. [and etc.]. Ways of migration of artificial radionuclides in the environment. Radioecology after Chernobyl. - Moscow: Mir, 1999. 2. Makarevich T.A. Radioecology. - Minsk: BSU, 2013. 3. Pivovarov Yu.P., Mikhalev V.P. Radiation ecology. - Moscow: Publishing Center "Academy", 2004.
10	Teaching Methods	Dialog-heuristic, problematic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Tests, problem solving, problem analysis
13	Form of current certification	credit

1	Name of the course	Reactive oxygen species in plant life
2	Year of education	4
3	Semester	8
4	Credits	3,5
5	Full name of the lecturer	Vadim Demidchik
6	Objectives of the course	Obtain a set of modern theoretical knowledge and practical skills in the field of physiology and biochemistry of reactive oxygen species (ROS) in plants. Get acquainted with modern themes and methods in the field of redox biology of plants.
7	Prerequisites	Plant physiology, inorganic chemistry, organic chemistry
8	Course content	Chemical and physical properties of the main biologically significant reactive oxygen species (ROS). Synthesis and transformation of ROS in a plant organism, their role in physiological and pathophysiological processes. Oxidative stress, redox-dependent programmed cell death, ROS signaling, antioxidant systems, modern approaches and the main topics of research of ROS -dependent processes in plants.
9	Recommended reading	Дубинина, Е.Е. – СПб.: Медицинская пресса, - 2006. - 400 с., Demidchik, V. / Mechanisms of oxidative stress in plants: From classical chemistry to cell biology // Environmental and Experimental Botany. – Vol. 109. – P. 212-228. Halliwell, B., Gutteridge, J.M.C. / Free radicals in biology and medicine // Oxford: Oxford University Press. – 2015. – 944 p.
10	Teaching methods	Heuristic, lectures, laboratory classes
11	Language	Russian (English is possible)
12	Conditions (requirements), current control	Defending essays in the form of presentation
13	Form of current attestation	Exam

1	Course Title	Regulation of cell metabolism
2	Year	3
3	Academic Semester	6
4	Number of credits	2,5
5	Lecturer	Yevgeny Nikolaichik, Ph. D.
6	Goal	To form an integral system of knowledge about the principles of controlling metabolic processes in a cell
7	Prerequisites	Biochemistry, Genetics, Microbiology
8	Course Description from Program Guide	Levels of regulation of metabolism. Regulatory proteins: structure, binding to DNA, interaction with RNA polymerase. The structure of operons and the principles of their control. The concept of a regulon. Regulation at the stage of termination of transcription. Catabolite repression and its mechanism. Principles of the organization of sensory systems. Two-component sensor systems. Sensory mechanisms of eukaryotes. Components of signaling pathways (receptors, G-proteins, effectors, secondary messengers). Cell reaction to stressful conditions. Control of nitrogen utilization. Oxygen stress and redox control. Heat shock, folding and degradation of proteins. Cold shock. Principles of intercellular communication. Regulation of mRNA stability. Regulatory RNA. RNA interference. Protein secretion and regulation. Control of cell division. Control of individual development of eukaryotes based on the example of <i>D. melanogaster</i> embryogenesis.
9	Recommended Textbooks (in Russian)	Браун Т.А. Геномы / М.: Институт компьютерных исследований, 2011. Льюин Б. Гены / М.: БИНОМ, 2011. – 896 с. Чемерис А. В. Секвенирование ДНК / А.В. Чемерис, Э.Д. Ахунов В.А. Вахитов. М.: Наука, 1999.
10	Methods	Comparative, problematic, visual methods, heuristic dialogue, method of forming the personal significance of knowledge
11	Language	Russian
12	Student evaluation	-essay; -writing tests; -labs report.
13	Final examination	Exam

1	The name of the discipline	Sanitary-microbiological investigation of water, air, soil, food and household items
2	Course	4
3	Semester of training	7
4	Amount of credits	5
5	Full Name lecturer	Candidate of Biological Sciences, Associate Professor Fomina Olga Valentinovna
6	Objectives of studying the discipline	Obtaining students a systematic knowledge of the basic microbiological and physiological-biochemical methods of microorganisms investigation with their subsequent use for solving problems of an applied and fundamental nature. Forming students practical skills in working with microorganisms.
7	Prerequisites	Structural organization of microorganism cells. Physiology of microorganisms. Systematics of microorganisms.
8	Contents of the discipline	Developing methods of sanitary assessment of microbial contamination of environmental objects: the determination of the total microbial number and sanitary-indicative microorganisms. Sanitary-indicative microorganisms used to indirectly determine the possible presence of pathogenic microorganisms in environmental objects and directly giving evidence to the contamination of the object by human and animal excreta containing microorganisms. Learning the basic methodical methods used at carrying out sanitary-microbiological analyzes of water, air, soil, food products and household items. Principles of assessing the sanitary-microbiological condition of the environment.
9	Recommended literature	1. Желдакова, Р. А. Выделение и идентификация микроорганизмов: учеб.-метод. пособие / Р. А. Желдакова. Мн.: БГУ, 2004. 2. Непрусов, А. И. Практикум по микробиологии / М.: Изд. Центр Академия, 2005. 3. Определитель бактерий Берджи: в 2 т. / Под ред. Дж. Хоулта, Н. Крига, П. Снита / М.: Мир, 1997.
10	Training Methods	Active, interactive, verbal, problematic, visual
11	Language of training	Russian
12	Conditions (requirements), operating control	Preparation of abstracts
13	Form of current certification	Credit

1	The name of the discipline	Segregation and identification microorganisms from environmental objects
2	Course	3
3	Semester of training	6
4	Amount of credits	2,5
5	Full Name lecturer	Candidate of Biological Sciences, Associate Professor Fomina Olga Valentinovna
6	Objectives of studying the discipline	Obtaining students systematic knowledge of the basic microbiological and physiological-biochemical methods of studying microorganisms with their subsequent use for solving problems of an applied and fundamental nature. Forming students practical skills in working with microorganisms.
7	Prerequisites	Structural organization of microorganism cells, Physiology of microorganisms, Systematization of microorganisms, Cultivation of microorganisms
8	Contents of the discipline	Study species diversity of microorganisms. The technique of nutrient media, solutions and reagents preparation. Obtaining of accumulative and pure cultures of microorganisms selected from environmental objects. Learning phenotypic signs of microorganisms: morphological, physiological-biochemical, etc. Acquisition an appropriate skills of competent and correct research results registration. Detailed description of each strain selected from natural or man-made sources to obtain a complete set of data on its properties in pure cultures. Identification of newly selected isolates. Preparing cultures for storage. Work with determinants.
9	Recommended literature	1. Желдакова, Р. А. Выделение и идентификация микроорганизмов: учеб.-метод. пособие / Р. А. Желдакова. Мн.: БГУ, 2004. 2. Нетрусов, А. И. Практикум по микробиологии / М.: Изд. Центр Академия, 2005. 3. Определитель бактерий Берджи: в 2 т. / Под ред. Дж. Хоулта, Н. Крига, П. Снита / М.: Мир, 1997.
10	Training Methods	Active, interactive, verbal, problematic, visual
11	Language of training	Russian
12	Conditions (requirements), operating control	Preparation of abstracts
13	Form of current certification	Credit

1.	Name of disciplines	Sociology of personality
2.	Course of Studi	3
3.	Semestr of training	6
4.	Amount of credits	2
5.	FULL NAME lecturer	Rubanov A., Pavlova C.
6.	Objectives of studying the discipline	Formation of personality
7.	Prereguvisites	Sociology, Psychology of personality
8.	Contents of the discipline	The concept of personality, mechanisms and stages of socialization, interpersonal relationships, creation, self-education
9.	Recommended literature	Hjell L., Ziegler D. Personality Theory. St. Petersburg., 1997.
10.	Teaching Methods	Lectures, seminars, independent work
11.	Language of instruction	Russian
12.	Conditions (requirements), current control	Reports, essays
13.	Form of current certification	Credit



1	The discipline	Soil resources
2	Year of study	2
3	Semester	4
4	Number of credits	1,5
5	Name of lecturer	doctor of biological sciences, professor Kulikov Yaroslav Konstantinovich
6	Learning objectives	Formation of a system of scientific ideas about the structural and functional organization of soils, their rational use and protection on the basis of the basic concepts of modern pedology as a science
7	Prerequisites	General ecology; plant growing
8	Contents of the discipline	Introduction. Composition and properties of soils. Factors and processes of soil formation. Classification, geography and use of soils. State of the soil cover of Belarus. Rational use and protection of soils in Belarus.
9	Recommended literature	1. Kulikov Ya.K. Soil resources. - Minsk: High School, 2013 2. Babieva I.P. Biology of soils. - Moscow: Moscow State University, 1989 3. Valkov VF, Kaseev KM, Kolesnikov SI Soil Science - Rostov-on-Don: Phoenix, 2004
10	Teaching Methods	A problematic, visual, method of forming the personal significance of knowledge
11	Language learning	Russian
12	Conditions (requirements), current control	Tests
13	Form of current certification	credit

1	Name of the discipline	Special practice Genetics
2	Course of study	3
3	Semester	5
4	Number of credits	2,5
5	Name of the Lecturer	senior lecturer KUNITSKAYA Maryna Pyatrouna, assistant LAHODZICH Aksana Uladzimirauna
6	Objectives of studying the discipline	Form students' practical skills in conducting molecular biological studies
7	Prerequisites	Cytology and Histology, Genetics, Molecular Genetics
8	Contents of the discipline	Preparation of material for the study. Microscopy. Analysis of the structure and function of chromosomes in the interphase. Analysis of the structure and function of chromosomes in mitosis. Analysis of the structure and function of chromosomes in meiosis. Isolation of plasmid and chromosomal DNA and their restriction. Ligation of plasmid DNA with fragments of chromosomal DNA. Transformation of bacteria with the resulting ligation mixture. Selection of recombinant DNA clones. Construction of a restriction map of a cloned DNA fragment.
9	Recommended literature	1. Куницкая, М.П. Цитогенетика: методические указания к проведению спецпрактикума / М.П. Куницкая. Мн.: БГУ, 2003. 2. Храмцова Е.А., Максимова Н.П. Молекулярная генетика. / Метод. указания к лаб. занятиям по спецпрактикуму для студентов специальности G 31 01 01. "Биология", Мн. - 2003. 3. Лагодич А.В., Лагодич О.В. Методы анализа нуклеиновых кислот : учеб. - метод. пособие для студентов биол. фак. / А.В. Лагодич, О.В. Лагодич. – Минск: БГУ, 2013.
10	Teaching methods	Laboratory exercises
11	Language	Russian
12	Conditions (requirements), control	-
13	Form of current certification	credit

1	Name of the discipline	Special practice Genetics
2	Course of study	3
3	Semester	5
4	Number of credits	2,5
5	Name of the Lecturer	Candidate of biological sciences, associate professor GLUSHAN Sergey Vitalevich, assistant SEMASHKO Anastasia Igaraua
6	Objectives of studying the discipline	Form students' practical skills in conducting molecular biological studies
7	Prerequisites	Cytology and Histology, Genetics, Molecular Genetics
8	Contents of the discipline	Theory of the microscope. Fourier analysis of microscopic images. Analysis of geometric and brightness parameters of cell images. Analysis of texture parameters of cell images. Data processing in cytometry. Drosophila as a model object of genetic research. Studying the lines of the genetic collection melanogaster and methods of its cultivation. Preparation of medium for the cultivation of Drosophila and the setting of crosses according to individual tasks. Analysis of the stages of Drosophila ontogenesis and phenotypes of individuals in F1, the establishment of crosses to obtain Fa and F2. Analysis of the results of Fa and F2.
9	Recommended literature	1. Глушен, С.В. Введение в микроскопию. Метод. указания для студентов биол-го фак-та БГУ / С.В. Глушен. Мн.: БГУ, 2007. 2. Анохина В.С. Генетический анализ Drosophila melanogaster / Метод. указания к лаб. занятиям по спецпрактикуму, Мн. - 2003. 3. Белоконь, Е.М. Генетический эксперимент в исследованиях на дрозофиле / Е. М. Белоконь. Львов, 1979.
10	Teaching methods	Laboratory exercises
11	Language	Russian
12	Conditions (requirements), control	-
13	Form of current certification	credit

1	Name of the discipline	Special practice Genetics
2	Course of study	4
3	Semester	7
4	Number of credits	3
5	Name of the Lecturer	Candidate of biological sciences, associate professor LAHODZICH Aliaksei Viktaravich Candidate of biological sciences, associate professor RAMANOUSKAYA Tatsiana Uladzimirauna
6	Objectives of studying the discipline	Form students' practical skills in conducting molecular biological studies
7	Prerequisites	Genetics, Molecular Genetics
8	Contents of the discipline	Analysis of plasmid DNA. Determination of the concentrations of DNA preparations. Restriction analysis. Sequence analysis of plasmid DNA. Basic PCR scheme. Development of primers. Preparation of the DNA template for PCR. PCR. Visualization and analysis of polymerase chain reaction products.
9	Recommended literature	1. Лагодич А.В., Лагодич О.В. Компьютерный анализ плазмидной ДНК. Программное обеспечение : учеб. - метод. пособие для студентов биол. фак. / А.В. Лагодич, О.В. Лагодич. – Минск : БГУ, 2013 2. Ведение в технику полимеразной цепной реакции : метод. пособие к лаб. занятиям по спецпрактикуму для студентов биол. фак. / авт.-сост. В.В. Гринев. – Минск : БГУ, 2008. 3. Жимулев, И. Ф. Общая и молекулярная генетика / И. Ф. Жимулев. Новосибирск: Изд-во Новосибирского ун-та, 2002.
10	Teaching methods	Laboratory exercises
11	Language	Russian
12	Conditions (requirements), control	-
13	Form of current certification	credit

1	Name of the discipline	Special practice Biotechnology Genetics
2	Course of study	3
3	Semester	6
4	Number of credits	2,5
5	Name of the Lecturer	Candidate of biological sciences, associate professor LAHODZICH Aliaksei Viktaravich, assistant LAHODZICH Aksana Uladzimirauna
6	Objectives of studying the discipline	Form students' practical skills in conducting molecular biological studies
7	Prerequisites	Genetics, Molecular Genetics
8	Contents of the discipline	Stages of conducting molecular genetic studies. Determination of the concentrations of DNA preparations. Restriction analysis. Principles and possibilities of the PCR method. Sequencing of nucleotide sequences. Isolation of total DNA from bacteria. Electrophoretic analysis. Formulation of PCR. Electrophoretic analysis of PCR products. PCR. Restriction analysis of amplification products. Cloning. Transformation.
9	Recommended literature	1. Лагодич А.В., Лагодич О.В. Методы анализа нуклеиновых кислот : учеб. - метод. пособие для студентов биол. фак. / А.В. Лагодич, О.В. Лагодич. – Минск: БГУ, 2013. 2. Жимулев, И. Ф. Общая и молекулярная генетика / И. Ф. Жимулев. Новосибирск: Изд-во Новосибирского ун-та, 2002. 3. Патрушев, Л. И. Искусственные генетические системы / Л. И. Патрушев. М.: Наука, 2005.
10	Teaching methods	Laboratory exercises
11	Language	Russian
12	Conditions (requirements), control	-
13	Form of current certification	credit

1	Name of the discipline	Special practice Biotechnology Genetics
2	Course of study	4
3	Semester	7
4	Number of credits	2,5
5	Name of the Lecturer	Candidate of biological sciences, associate professor GLUSHAN Sergey Vitalevich, candidate of biological sciences, associate professor Anokhina Vera Stepanovna, assistant Zhardetsky Sergey Stanislavovich
6	Objectives of studying the discipline	Form students' practical skills in conducting molecular biological studies
7	Prerequisites	Cytology and Histology, Genetics, Molecular Genetics
8	Contents of the discipline	Theory of the microscope. Fourier analysis of microscopic images. Analysis of geometric and brightness parameters of cell images. Analysis of texture parameters of cell images. Data processing in cytometry. Gamete selection. Preparation of material for study. Optimizing the breeding ground for the germination of pollen. Individual task Score reaction pollen of different species of plants for resistance to a cold temperature; use mikrogametofitnogo screening for differentiation of genotypes of plants of one species or hybrid population on the resistance to stress. Isolation of chromosomal DNA of marble methodical. Conducting PCR using standard primers to obtain DNA fragments carrying the gene ipdS bacteria Pseudomonas mendocina. Isolation of vector DNA. Restriction and Ligation of PCR fragments and the vector molecule. Transformation of bacteria obtained ligation mixture. Selection of recombinant clones and analysis. Construction of restriction maps of the cloned DNA fragment.
9	Recommended literature	1. Глушен, С.В. Введение в микроскопию. Метод. указания для студентов биол-го фак-та БГУ / С.В. Глушен. Мн.: БГУ, 2007. 2. Кильчевский, А. В. Гаметная и зиготная селекция растений /А. В. Кильчевский, И. Г. Пугачева // Сельскохозяйственная биотехнология. Горки, 2002. – С. 61-73. 3. Кони́чев, А. С. Молекулярная биология / А. С. Кони́чев, Г. А. Севастьянова. М.: Академия, 2005.
10	Teaching methods	Laboratory exercises
11	Language	Russian
12	Conditions (requirements), control	-
13	Form of current certification	credit

1	Name of the discipline	Special practice Biotechnology Genetics
2	Course of study	4
3	Semester	8
4	Number of credits	3,5
5	Name of the Lecturer	Candidate of biological sciences, associate professor RAMANOUSKAYA Tatsiana Uladzimirauna
6	Objectives of studying the discipline	Form students' practical skills in conducting molecular biological studies
7	Prerequisites	Genetics, Molecular Genetics
8	Contents of the discipline	Basic PCR scheme. Development of primers. Preparation of the DNA template for PCR. PCR. Visualization and analysis of polymerase chain reaction products.
9	Recommended literature	1. Ведение в технику полимеразной цепной реакции : метод. пособие к лаб. занятиям по спецпрактикуму для студентов биол. фак. / авт.-сост. В.В. Гринев. – Минск : БГУ, 2008. 2. Жимулев, И. Ф. Общая и молекулярная генетика / И. Ф. Жимулев. Новосибирск: Изд-во Новосибирского ун-та, 2002. 3. Zuker, M. Mfold web server for nucleic acid folding and hybridization prediction / M. Zuker. Nucleic Acids Research, 2003. Vol. 31, № 13.
10	Teaching methods	Laboratory exercises
11	Language	Russian
12	Conditions (requirements), control	
13	Form of current certification	credit

1	The name of the discipline	Special practice Biotechnology «Biotechnologies and Biotechnological Facilities in Food Industry»
2	The course of the study	3
3	Semester of training	6
4	The amount of credits	2,5
5	Full name of the lecturer	PhD, Associate Professor V.P. Kurchenko; Assistant O.V. Sinchuk; T.V. Butkevich
6	The objectives of the discipline studying	Practical course is a discipline aimed on forming a complex of skills and abilities in students, which specialized in the field of animal biotechnology. In the special practical course the attention is paid to using of molecular technologies in zoological research.
7	The prerequisites	Zoology, Biotechnology, Molecular Biology
8	Contents of the discipline	Isolation of chitin and chitosan from the shells of crustaceans. Interaction of milk whey proteins with chitosan. Spectrophotometric detection of the amount of protein. Comparative study of specificity of proteases of different origin. Biotechnology of extraction of enzymatic hydrolyzates from native and heat-treated whey proteins. Electrophoretic separation of milk proteins and their enzymatic hydrolysates. The use of high-performance liquid chromatography in controlling the depth of proteolysis and the composition of biotechnology products of fermentation of milk proteins (demonstration laboratory work). Preparation of anti-sera against milk proteins. Ouchterlony double radial immunodiffusion in an agarose gel. Competitive enzyme-linked immunosorbent assay for determination of residual AG serum proteins and enzymatic hydrolysates.
9	Literature recommended (in Russian)	1. Эрнст Л.К. Биологические проблемы животноводства в XXI веке / Л.К. Эрнст, Н.А. Зиновьева. М.: РАСХН, 2008. 2. Грачева И.М. Технология ферментных препаратов / И.М. Грачева, А.Ю. Кривова. М.: Изд-во «Элевар», 2000. 3. Квеситадзе Г.И. Введение в биотехнологию / Г.И. Квеситадзе, А.М. Безбородов. М.: Наука, 2002. 4. Скоупс Р. Методы очистки белков. М.: Мир, 1985. 5. Технология продуктов из гидробионтов. / Под ред. Т.М. Сафроновой, В.И. Шендерюка. М.: «Колос», 2001.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, preparation of abstracts
13	The form of current certification	Credit



1	The name of the discipline	Special practice «DNA Technologies for Working with Animal Objects. Computational Technologies and Modeling of Biological Processes»
2	The course of the study	4
3	Semester of training	7
4	The amount of credits	5
5	Full name of the lecturer	PhD, Associate Professor M.E. Mikhailova; PhD, Associate Professor N.V. Voronova
6	The objectives of the discipline studying	The special practical training (specialization workshop) is provided by curricula of biological specialties of classical universities in parallel with special courses of specialization and aims to further enhance the knowledge and skills of trainees.
7	The prerequisites	Zoology, Biotechnology, Molecular Biology
8	Contents of the discipline	Laboratory cultures of invertebrates and vertebrates. Recording of dynamic processes in cultures. Collection of biological material. Labeling and systematization of samples. Marker choice for solving specific research problems. Work with nucleotide sequences. DNA-barcoding. Subsidiary protocols for species identification: creation of PCR-RFLP keys and test systems. Selecting the target gene and primer design.
9	Literature recommended (in Russian)	<ol style="list-style-type: none"> <li>1. Зиновьева, Н.А. Введение в молекулярную генную диагностику сельскохозяйственных животных / Н.А. Зиновьева. Дубровицы: ВИЖ, 2002.</li> <li>2. Глазко, В.И. Введение в ДНК-технологии / В.И. Глазко, И.М. Дунин, Г.В. Глазко, Л.А. Калашникова. М.: ФГНУ «Росинформмагротех», 2001. – 434 с.</li> <li>3. Лукашов, В.В. Молекулярная эволюция и филогенетический анализ / В.В. Лукашов. М: Бином, 2009.</li> <li>4. Жимулев, И.Ф. Общая и молекулярная генетика / И.Ф. Жимулев. Новосибирск: Изд-во Новосибирского ун-та, 2002.</li> <li>5. Коничев, А.С. Молекулярная биология / А.С. Коничев, Г.А. Севастьянова. М.: Академия, 2005.</li> <li>6. Маниатис, Т. Методы генетической инженерии. Молекулярное клонирование / Т. Маниатис, Э. Фрич, Дж. Сэмбрук. М.: Мир, 1984.</li> <li>7. Патрушев, Л.И. Искусственные генетические системы / Л.И. Патрушев. М.: Наука, 2005.</li> <li>8. Чемерис, А.В. Секвенирование ДНК / А.В. Чемерис, Э.Д. Ахунов, В.А. Вахитов. М.: Наука, 1999.</li> <li>9. Технология продуктов из гидробионтов. / Под ред. Т.М. Сафроновой, В.И. Шендерюка. М.: «Колос», 2001.</li> </ol>
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, preparation of abstracts
13	The form of current certification	Credit

1	The name of the discipline	Special practice «Biotechnologies in Animal Breeding»
2	The course of the study	4
3	Semester of training	8
4	The amount of credits	2
5	Full name of the lecturer	PhD, Associate Professor M.E. Mikhailova
6	The objectives of the discipline studying	Practical course is a discipline aimed on forming a complex of skills and abilities in students, which specialized in the field of animal biotechnology. In the special practical course the attention is paid to using of molecular technologies in zoological research.
7	The prerequisites	Zoology, Biotechnology, Molecular Biology
8	Contents of the discipline	Preparation of tissue samples (ear pinches) for DNA extraction. Isolation of DNA. Verification of isolated DNA by quality and quantity. Composition of master mixes for amplification (ESTR gene). Conducting amplification. Conducting restriction analysis. Electrophoresis. Work with the gel-documenting system. Processing of the results. Identification of animal genotypes by the ESTR gene. Isolation of DNA from the blood. Verification of isolated DNA by quality and quantity. Compilation of master mixes for amplification (CSN gene). Conducting amplification. Conducting restriction analysis. Electrophoresis. Work with the gel-documenting system. Processing of the results. Identification of animal genotypes by CSN gene. Work with gel-documenting system. Isolation of DNA from the sperm. Verification of isolated DNA by quality and quantity.
9	Literature recommended (in Russian)	1. Глазко, В.И. Введение в ДНК-технологии / В.И. Глазко, И.М. Дунин, Г.В. Глазко, Л.А. Калашникова. М.: ФГНУ «Росинформмагротех», 2001. – 434 с. 2. Коницев, А.С. Молекулярная биология / А.С. Коницев, Г.А. Севастьянова. М.: Академия, 2005. 3. Маниатис, Т. Методы генетической инженерии. Молекулярное клонирование / Т. Маниатис, Э. Фрич, Дж. Сэмбрук. М.: Мир, 1984. 4. Патрушев, Л.И. Искусственные генетические системы / Л.И. Патрушев. М.: Наука, 2005. 5. Чемерис, А.В. Секвенирование ДНК / А.В. Чемерис, Э.Д. Ахунов, В.А. Вахитов. М.: Наука, 1999.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, preparation of abstracts
13	The form of current certification	Credit

1	Course title	Special practical "Electrophysiological methods of studying the nervous system"
2	Course of Study	3
3	Academic semester	5
4	Amount of credits	2,5
5	Full Name of the lecturers	PhD in Biological Sciences, Associate Professor Rutkevich Svetlana A.
6	Study subject purpose	Skills training and practicing electrophysiological methods used in modern physiology to study the functional systems of human and animals body.
7	Prerequisites	"Human Anatomy", "Human and Animal Physiology", "Methodology and Methods of Physiological Experiment", "Physiology of the Autonomic Nervous System".
8	Contents of the subject	Electrophysiological methods of studying the nervous system (making electrodes, training skills in the preparation of vertebrate animals, recording and analysis of electrical potentials of excitable tissues of vertebrates, human, recording and analysis of pulse waves by rheovasography).
9	Recommended literature	1. Workshop on Physiology: Textbook. Allowance for stud. supreme. training. institutions / Ed. A. A. Vladimirov. - M. 2000. 2. Nikolaev S.G. Workshop on clinical electromyography / S.G. Nikolaev. - Ivanovo, 2001. 3. Zapadnyuk I.P. Laboratory animals / I.P. Zapadnyuk, V.I. Zapadnyuk, E.A. Zakhariya - Kiev, 1983.
10	Teaching Methods	Technical devices of training to demonstrate video materials teaching the skills of preparation, the implementation of injections, types of anesthesia, electrophysiological hardware and software complexes. In practice, the acquired skills of experimental activity are worked out and theoretical knowledge, acquired in previous courses of disciplines by specialty, is applied.
11	Teaching language	Russian
12	Conditions (requirements), current control	Protection of individual assignments, the protection of abstracts, written and oral surveys
13	Form of current certification	Credit

1	Name of disciplines	Special Practical Course "Methods of studying of homeostasis and systemic physiological functions"
2	Course of Study	3
3	Semester of training	6
4	Amount of credits	2,5
5	FULL NAME lecturer	Alla Molchanova
6	Objectives of studying the discipline	To provide students with practical idea of what is physiological and pathophysiological experiment, give them the opportunity to gain skills in working with experimental animals. To familiarize students with modern methods of assessment of physiological functions and processes, as well as mechanisms for their regulation.
7	Prerequisites	Human and Animal Physiology
8	Contents of the discipline	Bioethics and safety requirements for work with experimental animals. Preparation of animals for experiment. Types of injections. Principles of dosing of pharmacological substances. Methods for nociception assessment. Methods of studying behavioral reactions of animals. Thermometry. Modeling of experimental fever. Experimental data processing. Anesthesia, its types and stages. Fundamentals of vivisection. Necropsy. Methods for assessing the effectiveness of dermatotropic drugs. Acquaintance with electrophysiological methods <i>in vivo</i> and <i>ex vivo</i>
9		<ul style="list-style-type: none"> <li>• Guide for the Care and Use of Laboratory Animals: Eighth Edition. Washington (DC): <u>National Academies Press (US)</u>; 2011. 248 p.</li> <li>• A large practical workshop on human and animal physiology. In 2 volumes: a textbook/ edited by. A. D. Nozdrachev. - M. : Publishing Center "Academy", 2007.- 608 p.</li> <li>• Chereshnev VA Experimental models in pathology: a textbook / B.A. Chereshnev. Yu.I. Shilov, M.V. Chereshneva. 2011. - Perm.– Gos. University. - 267 p.</li> </ul>
10	Teaching Methods	Verbal, practical, visual, problematic, research.
11	Language of instruction	Russian
12	Conditions (requirements), current control	Tests, tasks for dosing, laboratory work
13	Form of current certification	credit

1	Name of disciplines	Specialized practice "Biochemical methods of studying physiological functions"
2	Course of Study	4
3	Semester of training	7
4	Amount of credits	3
5	FULL NAME lecturer	Tatyana O. Suhan
6	Objectives of studying the discipline	To give an idea about the modern level of knowledge in physiology, biological science, which studies the general and particular mechanisms of the functioning of a healthy organism and its structural elements (organs, tissues, cells) in various conditions of life.
7	Prerequisites	Physiology of humans and animals, biochemistry
8	Contents of the discipline	Determination of protein concentration by biuret method and direct spectrophotometric method. Construction of a calibration curve. Determination of the activity of lactate dehydrogenase and glutathione-S-transferase in the intracellular extract of the eukaryotic cells. Isolation of leukocytes from whole blood. Determination of the viability / metabolic activity of eukaryotic human cells using the MTT test and Preso-Blue-Test.
9		1. Freshni R. Culture of animal cells. Practical guidance / Binom, 2014. 2. Glantz S. Medico-biological statistics. Practical guidance / "Practice", 1999. 3. Rokitsky P.F. Biological Statistics / M: Higher School, 1973.
10	Teaching Methods	Verbal, practical, visual, heuristic, problematic, research
11	Language of instruction	Russian
12	Conditions (requirements), current control	Written control
13	Form of current certification	credit

1	Name of the course	Special practice Plant physiology
2	Year of education	3, 4
3	Semester	6; 7; 8
4	Credits	2,5; 5; 2
5	Full name of the lecturer	Oksana Yakovets, Viera Mackievic, Darya Shyrvel, Darya Przhevalskaya
6	Objectives of the course	students introduction to the possibility of using plants in biotechnological processes
7	Prerequisites	Biology (Biotechnology)
8	Course content	Cultivation of intact plants, tissues and cells <i>in vitro</i> . Isolation of biologically active substances and enzymes from intact plants and callus cultures. Practical use of plant cells in biotechnology and analysis of the state of the environment.
9	Recommended reading	<p>1. Бидей С. П. Иммуобилизованные клетки и ферменты. Методы / Бидей С. П., Броделиус П., Кабрал И. М. и др. МИР, 1988.</p> <p>2. Биологический контроль окружающей среды: Биоиндикация и биотестирование: Учеб. пособие / Под ред. О.П. Мелеховой, Е.И. Егоровой. М.: Академия наук, 2007.</p> <p>3. Егорова Т.А. Основы биотехнологии: Учеб. пособие / Егорова Т.А., Клунова С.М., Живухина Е.А. М Изд. центр «Академия». 2003</p> <p>4. Методы биохимического исследования растений / Под ред. Ермакова. Л.: Колос. 1972.</p> <p>Современные проблемы биохимии. Методы исследований / У.В. Барковский [и др.]; под ред. проф. А.А. Чиркина. Минск: Выш. шк., 2013.</p> <p>5. Лутова Л.А. Биотехнология высших растений. Спб.: Изд-во С.-Петербур. ун-та, 2003.</p> <p>6. Оценка избирательности действия пестицидов на растения (электрофизиологический метод) [Электронный ресурс]: методические указания для студентов биологического факультета / В.М. Юрин [и др.]. – Минск: БГУ, 2011. – Режим доступа: <a href="http://elib.bsu.by">http://elib.bsu.by</a>, ограниченный. – ISBN 978-985-518-383-3. – Деп. в БелИСА 28.02.2011, № Д20115.</p>
10	Teaching methods	Interactive, problematic, visual
11	Language	Russian
12	Conditions (requirements), current control	<ul style="list-style-type: none"> <li>- individual tasks while performing laboratory work;</li> <li>- essay prepared by the student;</li> <li>- oral surveys;</li> <li>- written tests on specific topics of the course</li> </ul>
13	Form of current attestation	credit

1	Name of discipline	Special practice microbiological and biochemical methods. Features of transport of carbohydrates to bacterial cells <i>Escherichia coli</i>
2	Course	3
3	Semester	6
4	ECTS (credits)	2,5
5	Lecturer	Assistant professor GOROVIK Yuri Nikolaevich
6	Goal	Teaching students modern methods of microbiological and molecular biological studies. Assimilation by students principles of laboratory practice and forming skills application of common molecular biological techniques.
7	Prerequisites	Biochemistry, Microbiology, Genetics
8	Content	Preparation and sterilization of nutrient media and solutions. Isolation of microorganisms from the natural environment and their physiological and biochemistry characterization. Construction of the growth curve of bacterial culture. A study of the ability of bacteria to utilize carbohydrates. Detection of the effect of diauxia in the bacteria <i>E. coli</i> . Measuring activity of $\beta$ -galactosidase. Quantitative determination of protein.
9	Literature (in Russian)	1. Досон Р. Справочник биохимика / Р. Досон, Д. Эллиот, У. Эллиот, К. Джонс. М.: Мир, 1991. 543с. 2. Методы общей бактериологии: В 3 т. / Под ред. Герхардта Ф. и др. М.:Мир, 1984. 3. Миллер Дж. Эксперименты в молекулярной генетике / Дж. Миллер. М.: Мир, 1976. 436 с. Петербург: Издательство СПбГТУ, 2002.
10	Teaching methods	Comparative, problem, dialog-heuristic, visual
11	Language of education	Russian
12	Requirements, current control	-
13	Form of students reporting	Credit

1	Name of discipline	Special practice Methods of DNA studying
2	Course	4
3	Semester	7
4	ECTS (credits)	5
5	Lecturer	Candidate of biological sciences, associated professor GALINOUSKI Dmitri Valentinovich
6	Goal	Teaching students modern methods of microbiological and molecular biological studies. Assimilation by students principles of laboratory practice and forming skills application of common molecular biological techniques.
7	Prerequisites	Biochemistry, Microbiology, Genetics
8	Content	Chromosomal and plasmid DNA preparation from bacterial cells. DNA agarose gel electrophoresis. Restriction, ligation. Calcium transformation of bacteria. Polymerase chain reaction. Cloning of PCR-products in <i>Escherichia coli</i> . DNA sequencing.
9	Literature (in Russian)	<p>1. Досон Р. Справочник биохимика / Р. Досон, Д. Эллиот, У. Эллиот, К. Джонс. М.: Мир, 1991. 543с.</p> <p>2. Маниатис Т. Молекулярное клонирование / Т. Маниатис, Э. Фрич, Дж. Сэмбрук. М.: Мир, 1984.</p> <p>3. Методы общей бактериологии: В 3 т. / Под ред. Герхардта Ф. и др. М.: Мир, 1984.</p> <p>4. Миллер Дж. Эксперименты в молекулярной генетике / Дж. Миллер. М.: Мир, 1976. 436 с. Петербург: Издательство СПбГУ, 2002.</p>
10	Teaching methods	Comparative, problem, dialog-heuristic, visual
11	Language of education	Russian
12	Requirements, current control	-
13	Form of students reporting	Credit



1	Name of discipline	Methods of working with proteins (biology, biotechnology direction) (special practice)
2	Course	4
3	Semester	8
4	ECTS (Credits)	3,5
5	Lecturer(-s)	Candidate of biological sciences, associated professor KACHAN Alexandr Vjacheslavovich
6	Goal	Mastering students with modern methods of microbiological and molecular biological research, mastering the principles of laboratory practice and developing stable skills in using basic molecular biological techniques.
7	Prerequisites	Molecular biology, microbiology
8	Content	Electrophoresis of proteins in the Laemmli system. Fractionation of proteins, methods of protein precipitation and concentration. Dialysis of protein solutions. Determination of protein concentration in solution. Obtaining zymograms of enzymes.
9	Literature (in Russian)	1. Досон Р. Справочник биохимика / Р. Досон, Д. Эллиот, У. Эллиот, К. Джонс. М.: Мир, 1991. 543с. 2. Остерман Л.А. Методы исследования белков и нуклеиновых кислот. Электрофорез и ультрацентрифугирование / Л.А. Остерман. М.: Наука. 1981. 3. Скоупс Р. Методы очистки белков / Р. Скоупс. М.: Мир. 1985.Петербург: Издательство СПбГТУ, 2002. 3. Щелкунов С.Н. Генетическая инженерия / С.Н. Щелкунов. Новосибирск: Сибирское университетское издательство, 2004.
10	Teaching methods	Comparative, problematic, dialog-heuristic, visual
11	Language	Russian
12	Requirements, current control	Oral questioning
13	Form of students reporting	Credit

1	Name of disciplines	Special Practice Botany
2	Course of Study	3-4
3	Semester of training	5-7
4	Amount of credits	8
5	FULL NAME lecturer	PhD, Associated Professor Sautkina T.A., PhD, Associated Professor Juice M.A., PhD, Associated Professor Tikhomirov V.N., PhD, Associated Professor Chernik V.V., assistants Stadnichenko M.A., Dzuban O.V.
6	Objectives of studying the discipline	To form stable practical skills of students in the field of modern botany and mycology
7	Prerequisites	Botany (systematics of higher plants), algology, mycology, phytopathology, genetics, molecular biology
8	Contents of the discipline	Taxonomic diversity of vascular plants of the flora of Belarus. Department Lycopodiophyta, Equisetophyta, Polypodiophyta, Gymnosperms, Angiosperms. Woody introducents in the flora of the republic. Diversity of the main taxonomic groups of phytopathogenic fungi and mushroom-like organisms of Belarus. General rules and methods of cultivation of fungi. DNA markers in botanical research. Methods for DNA isolation, polymerase chain reaction and analysis of the results
9	Recommended literature	<ol style="list-style-type: none"> <li>1. Определитель высших растений Беларуси. Мн., 1999.</li> <li>2. Флора Европейской части СССР. Т. 1–10. Л., 1974–2001.</li> <li>3. Деревья и кустарники СССР. Т. I–VI. М.-Л., 1949–1962.</li> <li>4. Доброзракова Т.Л. Определитель болезней растений / Т.Л. Доброзракова, М.Ф. Легова, К.М. Степанова, М.К. Хохряков. Спб., 2003.</li> <li>5. Методы экспериментальной микологии (справочник). Киев, 1989.</li> <li>6. Методические указания к занятиям спецпрактикума по разделу «Микология. Методы экспериментального изучения микроскопических грибов» для студентов 4 курса дневного отделения специальности «G 31 01 01 – Биология» / Авт.-сост. В.Д. Поликсенова, А.К. Храмцов, С.Г. Пискун. – Мн.: БГУ, 2004.</li> <li>7. Краткое руководство по определению родов пресноводных водорослей: метод. указания / Сост. А.К. Храмцов. – Минск: БГУ, 2004.</li> </ol>
10	Teaching Methods	Наглядный, системный, групповой, экспериментальный, технологии модульно-рейтингового обучения
11	Language of instruction	Русский
12	Conditions (requirements), current control	– защита индивидуальных заданий; – устный опрос.
13	Form of current certification	credit

1	The name of the discipline	Special practice Zoology «Kingdom Protista. Kingdom Animalia. Phylum Porifera. Phylum Cnidaria. Phylum Ctenophora. Phylum Platyhelminthes. Group of Phyla Nematelminthes. Phylum Annelida. Phylum Mollusca»
2	The course of the study	3
3	Semester of training	5
4	The amount of credits	2,5
5	Full name of the lecturer	Doctor of Biological Sciences E. I. Anisimova; PhD, Associate Professor S.M. Degtyarik; Senior Lecturer A.V. Balash.
6	The objectives of the discipline studying	The special practical training (specialization workshop) is provided by curricula of biological specialties of classical universities in parallel with special courses of specialization and aims to further enhance the knowledge and skills of trainees.
7	The prerequisites	Zoology
8	Contents of the discipline	Kingdom Protista. Kingdom Animalia. Phylum Porifera. Phylum Cnidaria. Phylum Ctenophora. Phylum Platyhelminthes. Group of Phyla Nematelminthes. Phylum Annelida. Phylum Mollusca
9	Literature recommended (in Russian)	1. Иванов А.В. Большой практикум по зоологии беспозвоночных. М.: Высшая школа, 1981. Т. 1–2. 2. Лукин Е.И. Пиявки: Пиявки пресных и солоноватых водоемов. Л.: Наука, 1976. 3. Тихомиров И.А. Малый практикум по зоологии беспозвоночных. М.; Л.: Товарищество научных изданий КМК, 2005. Ч. 1. 4. Хаусман К. Протозоология. М.: Мир, 1988. 5. Шалапенок Е.С. Зоология беспозвоночных: методические указания. Минск: БГУ, 2005. 6. Шалапенок Е.С. Краткий определитель водных беспозвоночных животных. Минск: БГУ, 2005.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, oral survey, preparation of abstracts, drawing albums
13	The form of current certification	Credit

1	The name of the discipline	Special practice «Phylum Arthropoda, Phylum Chordata: Subphylum Tunicata, Subphylum Acrania (Cephalochordata), Subphylum Vertebrata (Gnathostomata and Agnatha). Tetrapoda: Class Amphibia»
2	The course of the study	3
3	Semester of training	6
4	The amount of credits	2,5
5	Full name of the lecturer	PhD, Associate Professor J.Ye. Meleshko; PhD, Associate Professor O.Yu. Kruglova; PhD, Associate Professor V.I. Khvir; Senior Lecturer A.V. Balash.
6	The objectives of the discipline studying	The special practical training (specialization workshop) is provided by curricula of biological specialties of classical universities in parallel with special courses of specialization and aims to further enhance the knowledge and skills of trainees.
7	The prerequisites	Zoology
8	Contents of the discipline	Phylum Arthropoda, Phylum Chordata: Subphylum Tunicata, Subphylum Acrania (Cephalochordata), Subphylum Vertebrata (Gnathostomata and Agnatha). Tetrapoda: Class Amphibia
9	Literature recommended (in Russian)	<ol style="list-style-type: none"> <li>1. Бурко Л.Д. Позвоночные животные Беларуси. Минск: БГУ, 2004.</li> <li>2. Гуртовой Н.Н. Практическая зоотомия позвоночных Низшие хордовые. Бесчелюстные. Рыбы. М.: Высшая школа, 1976.</li> <li>3. Гуртовой Н.Н. Практическая зоотомия позвоночных. Амфибии. Рептилии. М.: Высшая школа, 1978.</li> <li>4. Захваткин Ю.А. Курс общей энтомологии. М.: Колос, 2001.</li> <li>5. Руководство по зоологии /под ред. Л.А. Зенкевича. М.; Л.: Биомедгиз, 1937–1951. Т. 1–3.</li> <li>6. Тихомиров И.А. Малый практикум по зоологии беспозвоночных. М.; Л.: Товарищество научных изданий КМК, 2005. Ч. 1.</li> <li>7. Шалапенок Е.С. Зоология беспозвоночных: методические указания. Минск: БГУ, 2005.</li> <li>8. Шалапенок Е.С. Краткий определитель водных беспозвоночных животных. Минск: БГУ, 2005.</li> </ol>
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, oral survey, preparation of abstracts, drawing albums
13	The form of current certification	Credit

1	The name of the discipline	Special practice «Phylum Arthropoda. Phylum Chordata: Tetrapoda: Class Reptilia, Class Aves, Class Mammalia»
2	The course of the study	4
3	Semester of training	7
4	The amount of credits	3
5	Full name of the lecturer	Senior Lecturer A.V. Balash
6	The objectives of the discipline studying	The special practical training (specialization workshop) is provided by curricula of biological specialties of classical universities in parallel with special courses of specialization and aims to further enhance the knowledge and skills of trainees.
7	The prerequisites	Zoology
8	Contents of the discipline	Phylum Arthropoda. Phylum Chordata: Tetrapoda: Class Reptilia, Class Aves, Class Mammalia
9	Literature recommended (in Russian)	<ol style="list-style-type: none"> <li>1. Бурко Л.Д. Позвоночные животные Беларуси. Минск: БГУ, 2004.</li> <li>2. Гуртовой Н.Н. Практическая зоотомия позвоночных. Практическая зоотомия позвоночных. Низшие хордовые. Бесчелюстные. Рыбы. М.: Высшая школа, 1976.</li> <li>3. Гуртовой Н.Н. Практическая зоотомия позвоночных. Амфибии. Рептилии. М.: Высшая школа, 1978.</li> <li>4. Гуртовой Н.Н. Практическая зоотомия позвоночных. Птицы. Млекопитающие. М.: Высшая школа, 1992.</li> <li>5. Захваткин Ю.А. Курс общей энтомологии. М.: Колос, 2001.</li> <li>6. Иванов А.В. Большой практикум по зоологии беспозвоночных. М.: Высшая школа, 1981–1983. Т. 1–2.</li> <li>7. Птушкі Еўропы. Палявы вызначальнік / пад рэд. М. Нікіфарава. Варшава: Навуковае выдавецтва ПВН, 2000.</li> <li>8. Руководство по зоологии /под ред. Л.А. Зенкевича. М.; Л.: Биомедгиз, 1937–1951. Т. 1–3.</li> <li>9. Сидорович В.Е. Атлас-определитель следов деятельности охотничьих животных. Минск, 2006.</li> <li>10. Шалапенок Е.С. Зоология беспозвоночных: методические указания. Минск: БГУ, 2005.</li> <li>11. Шалапенок Е.С. Краткий определитель водных беспозвоночных животных. Минск: БГУ, 2005.</li> </ol>
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, oral survey, preparation of abstracts, drawing albums
13	The form of current certification	Credit

1	Course Title	Special Practice Applied Microbiology 1 Isolation and identification of auxotrophic mutants of bacteria 2 Transposon mutagenesis of bacteria <i>Pectobacterium carotovorum</i> JN42 using the transposon mini-Tn5xylE
2	Year	3 4 4
3	Academic Semester	6 7 8
4	Number of credits	9,5
5	Lecturer	Alena Ihnatsenka
6	Goal	To obtain a systematic knowledge of the basic microbiological, physiological-biochemical and molecular genetic methods of microorganism research with their subsequent use for solving problems of applied and fundamental nature
7	Prerequisites	Structural organization of microorganism cells, Physiology of microorganisms, Biochemistry, Molecular bacteriology, Systematics of microorganisms
8	Course Description from Program Guide	1 Isolation and identification of auxotrophic mutants of bacteria 1. Determination of the rate of growth and the time of entry of the bacterial culture into a logarithmic growth phase. 2. Study of the dependence of the survival of bacteria on the concentration of mutagen. Treatment of bacterial cultures of <i>Escherichia coli</i> with a mutagen for obtaining auxotrophic mutants. 3. Selection of auxotrophic mutants and determination of their growth factor requirements. 2 Transposon mutagenesis of bacteria <i>Pectobacterium carotovorum</i> JN42 using the mini-Tn5xylE transposon 1. Preparation and implementation of crossing, plating the transconjugants. 2. Selection of transconjugants that retain the transposon marker (Kmr), but lost the plasmid marker (Apr). 3. Phenotypic characterization of the obtained mutants: auxotrophy; expression of major virulence factors; expression of the xylE reporter gene.
9	Recommended Textbooks (in Russian)	1. <i>Нетрусов, А. И.</i> Практикум по микробиологии / М.: Изд. Центр Академия, 2005. 2. <i>Маниатис, Т.</i> Методы генетической инженерии. Молекулярное клонирование / Т. Маниатис. М.: Мир, 1984. 3. <i>Рыбчин, В. Н.</i> Основы генетической инженерии / В. Н. Рыбчин. СПб.: Изд-во ГТУ, 1999.
10	Methods	Active, interactive, verbal, problematic, visual
11	Language	Russian
12	Student evaluation	Preparation of abstracts
13	Final examination	Credit

1	Name of discipline	Special practice microbiological and biochemical methods. Features of transport of carbohydrates to bacterial cells <i>Escherichia coli</i>
2	Course	3
3	Semester	5
4	ECTS (credits)	2,5
5	Lecturer	Assistant professor GOROVIK Yuri Nikolaevich
6	Goal	Teaching students modern methods of microbiological and molecular biological studies. Assimilation by students principles of laboratory practice and forming skills application of common molecular biological techniques.
7	Prerequisites	Biochemistry, Microbiology, Genetics
8	Content	Preparation and sterilization of nutrient media and solutions. Isolation of microorganisms from the natural environment and their physiological and biochemistry characterization. Construction of the growth curve of bacterial culture. A study of the ability of bacteria to utilize carbohydrates. Detection of the effect of diauxia in the bacteria <i>E. coli</i> . Measuring activity of $\beta$ -galactosidase. Quantitative determination of protein.
9	Literature (in Russian)	1. Досон Р. Справочник биохимика / Р. Досон, Д. Эллиот, У. Эллиот, К. Джонс. М.: Мир, 1991. 543с. 2. Методы общей бактериологии: В 3 т. / Под ред. Герхардта Ф. и др. М.:Мир, 1984. 3. Миллер Дж. Эксперименты в молекулярной генетике / Дж. Миллер. М.: Мир, 1976. 436 с. Петербург: Издательство СПбГТУ, 2002.
10	Teaching methods	Comparative, problem, dialog-heuristic, visual
11	Language of education	Russian
12	Requirements, current control	-
13	Form of students reporting	Credit

1	Name of discipline	Special practice Methods of DNA studying
2	Course	3
3	Semester	6
4	ECTS (credits)	2,5
5	Lecturer	Candidate of biological sciences, associated professor GALINOUSKI Dmitri Valentinovich
6	Goal	Teaching students modern methods of microbiological and molecular biological studies. Assimilation by students principles of laboratory practice and forming skills application of common molecular biological techniques.
7	Prerequisites	Biochemistry, Microbiology, Genetics
8	Content	Chromosomal and plasmid DNA preparation from bacterial cells. DNA agarose gel electrophoresis. Restriction, ligation. Calcium transformation of bacteria. Polymerase chain reaction. Cloning of PCR-products in <i>Escherichia coli</i> . DNA sequencing.
9	Literature (in Russian)	1. Досон Р. Справочник биохимика / Р. Досон, Д. Эллиот, У. Эллиот, К. Джонс. М.: Мир, 1991. 543с. 2. Маниатис Т. Молекулярное клонирование / Т. Маниатис, Э. Фрич, Дж. Сэмбрук. М.: Мир, 1984. 3. Методы общей бактериологии: В 3 т. / Под ред. Герхардта Ф. и др. М.: Мир, 1984. 4. Миллер Дж. Эксперименты в молекулярной генетике / Дж. Миллер. М.: Мир, 1976. 436 с. Петербург: Издательство СПбГУ, 2002.
10	Teaching methods	Comparative, problem, dialog-heuristic, visual
11	Language of education	Russian
12	Requirements, current control	-
13	Form of students reporting	Credit



1	Name of discipline	Methods of working with DNA. Methods of working with proteins (biology, molecular biology direction) (special practice)
2	Course	4
3	Semester	7
4	ECTS (Credits)	3
5	Lecturer(-s)	Candidate of biological sciences, associated professor KACHAN Alexandr Vjacheslavovich
6	Goal	Mastering students with modern methods of microbiological and molecular biological research, mastering the principles of laboratory practice and developing stable skills in using basic molecular biological techniques.
7	Prerequisites	Molecular biology, microbiology
8	Content	Isolation of chromosomal and plasmid DNA from bacterial cells. Electrophoresis of DNA in agarose gel. Polymerase chain reaction. Cloning of amplification products in E. coli cells. DNA sequencing. Electrophoresis of proteins in the Laemmli system. Fractionation of proteins, methods of protein precipitation and concentration. Dialysis of protein solutions. Determination of protein concentration in solution. Obtaining zymograms of enzymes.
9	Literature (in Russian)	1. Досон Р. Справочник биохимика / Р. Досон, Д. Эллиот, У. Эллиот, К. Джонс. М.: Мир, 1991. 543с. 2. Остерман Л.А. Методы исследования белков и нуклеиновых кислот. Электрофорез и ультрацентрифугирование / Л.А. Остерман. М.: Наука. 1981. 3. Маниатис Т. Молекулярное клонирование / Т. Маниатис, Э. Фрич, Дж. Сэмбрук. М.: Мир, 1984.
10	Teaching methods	Comparative, problematic, dialog-heuristic, visual
11	Language	Russian
12	Requirements, current control	Oral questioning
13	Form of students reporting	Credit

1	The discipline	Specially Protected Natural Territories
2	Year of study	3
3	Semester	6
4	Number of credits	1
5	Name of lecturer	PhD, associate professor Nesterova Oxana Lvovna
6	Learning objectives	Formation of the idea of specially protected natural areas (PAs), to study the peculiarities of the organization (network) of the PAs of different ranks of the Republic of Belarus and its role in the light of modern nature protection measures
7	Prerequisites	General ecology, Ecological problems of Belarus, Plant and animal resources, Rational use, protection, Landscape ecology
8	Contents of the discipline	Fundamentals of nature protection. The concept of specially protected areas. Global networks of specially protected natural areas. Characteristics of certain categories and types of PAs. Reserve. National parks. The reserve. Monuments of nature. Other types of PAs. Protected areas in Belarus. Berezinsky nature reserve. NP "Belovezhskaya Pushcha", "Pripyatsky", "Braslav Lakes", "Narochansky". Reserves of Belarus. Monuments of nature of Belarus. Red book of the Republic of Belarus. Structure and concepts used. Vulnerability categories
9	Recommended literature	1. Bobrov R.V. All about national parks / RV Bobrov. - M.: Young Guard, 1987. 2. Borisov V.L. etc. Protected natural areas of the world: national parks, reserves, reserves. Reference book / V.L. Borisov, L.S. Belousova, A.A. Vinokourov. - Moscow: Agropromizdat, 1985. 3. Galay E.I. Use of natural resources and nature protection / E.I. Galay. - Mn.: Amalfee, 2008. 4. Ivanov AI, Chizhova VP Protected natural territories / A.I. Ivanov, V.P. Chizhov. - Moscow: Moscow State University, 2003. 5. Reimers NF, Shtilmark F.R. Specially Protected Natural Territories / N.F. Reimers, FR Stilmark. - M.: Thought, 1978. 6. Romanov VS, Kharitonova N.Z. Nature Protection / V.S. Romanov, N.Z.
10	Teaching Methods	Problematic, dialog-heuristic, visual
11	Language learning	Russian
12	Conditions (requirements), current control	Writing and protecting essays, tests
13	Form of current certification	credit

1	The name of the discipline	Sports Biochemistry
2	The course of the study	3
3	Semester of training	6
4	The amount of credits	1
5	Full name of the lecturer	GILEP Irina Leonardovna PhD
6	The objectives of the discipline studying	Formation of biochemists 'students' system of ideas about biochemical changes in the body of athletes when performing work of varying power and duration and regularities of recovery after a load.
7	The prerequisites	biochemistry
8	Contents of the discipline	Integration and regulation of metabolism is the biochemical basis of adaptation processes. Biochemistry of muscle contraction. Bioenergetics of muscular activity. Biochemical changes in the body when performing work of varying power and duration. Molecular mechanisms of fatigue. Characteristics of anticipation, chronic fatigue and overwork. Biochemical regularities of recovery after a load. Biochemical characteristics of the basic motor qualities. Regularities of biochemical and physiological adaptation to muscular work. The influence of special environmental conditions on the human body. Biochemical basis of rational nutrition. Biochemical substantiation of the use of pharmacological agents to increase the body's adaptation to stresses. Biochemical and anti-doping control in sports.
9	Literature recommended	1. Biochemistry of muscular activity: Textbook for high schools phys. upbringing and sports / N.I. Volkov [and others]; under the Society. Ed. N.I. Volkova. - Kiev: Olympic literature, 2000. - 503 p. 2. Biochemistry: A Textbook for IFC / V.V. Menshikov [and others]; Ed. V.V. Menshikova. - Moscow: FiS, 1986. - 384 p. 3. Mikhailov, S.S. Sports biochemistry: Textbook for high schools and secondary schools / SS. Mikhailov. - Moscow: Soviet Sport, 2004. - 219 p. 4. Basulko, A.S. Biochemical bases of sports muscular activity: Textbook for high schools / A.C. Basulco. - Minsk: BSUFK, 2006. - 85 p. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- oral and written interviews in laboratory classes; - execution of tasks in the test form; - checking the conduct of laboratory journals; - protection of the student's prepared essay.
13	The form of current certification	credit

1	Name of the discipline	Structural and functional organization of pro- and eukaryotic genomes
2	Course of Study	4
3	Semester of training	8
4	Amount of credits	2
5	lecturer FULL NAME	Candidate of Biological Sciences, Associate Professor LAGONENKO Alexander Leonidovich
6	Objectives of studying the discipline	Studying methods of genomic research, rapidly developing in recent years, and the consequences of genomics development for all branches of biology.
7	Prerequisites	Genetics, molecular biology
8	Contents of the discipline	History of the development of genomic research. Modern approaches to DNA sequencing, their advantages and disadvantages. Functional genomics and proteomics. Molecular databases. Evolution of genomes. Mechanisms of genomic rearrangements, increase and decrease in the size of genomes. Families of homologous genes. Molecular phylogeny. Synthetic genomics. Organization of genomes of pro and eukaryotes. Organization of the genomes of mitochondria and plastids.
9	Recommended literature	1. Попов В.В. Геномика с молекулярно-генетическими основами. / В.В. Попов.- М.: Книжный дом “ЛИБРОКОМ”. 2009 2. Леск А. Введение в биоинформатику. / А. Леск; пер. с англ. – М.: БИНОМ. Лабораторные знания. 2009 3. Льюин Б. Гены / Б. Льюин. М.: БИНОМ, 2011.
10	Teaching Methods	Comparative, problematic, dialog-heuristic, visual
11	Language of instruction	Russian
12	Conditions (requirements), current control	- Preparation of essays; - preparation of the report on the genomic sequence annotation
13	Form of current certification	exam

1	The name of the discipline	Structural Biochemistry
2	The course of the study	2
3	Semester of training	3
4	The amount of credits	2,5
5	Full name of the lecturer	NOVIKOV Dmitry Alekseevich PhD, assistant professor
6	The objectives of the discipline studying	Form the students an integral system of knowledge about the chemical composition of living organisms, the physico-chemical and biological properties of natural compounds.
7	The prerequisites	Organic chemistry. Analytical chemistry
8	Contents of the discipline	Structurally functional characteristics of amino acids, peptides, proteins, enzymes, nucleosides, nucleotides, nucleic acids, carbohydrates, lipids, hormones, vitamins.
9	Literature recommended	1. Gubich O.I. Structural Biochemistry: Textbook. allowance / Mn .: BSU, 2012, 311 p. 2. Berezov TT Biological Chemistry / T.T. Berezov, B.F. Korovkin. M .: Medicine, 1990. 3. Biochemistry: Textbook for high schools / Ed. E.S. Severin. Moscow: GEOTAR-Media, 2006. 4. Komov V. P., Shvedova V.N. Biochemistry / V.P. Komov, V.N. Shvedova. M .: Drofa, 2004. 5. Filippovich Yu.B. Fundamentals of biochemistry / Yu.B. Filippovich. M., 1999. (in Russian)
10	Teaching methods	Explanatory-illustrative, research, problem, dialog-heuristic
11	Language of instruction	Russian
12	Conditions (requirements), routine control	- the preparation of abstracts, - 2 tests, - the preparation of a report on the results of the workshop
13	The form of current certification	credit

1	Name of the discipline	Structural organization of cells of microorganisms
2	Course	2
3	Semester of training	3
4	Amount of credits	3
5	Full name of the lecturer	Candidate of Biological Sciences, Associate Professor Miamin Vladislav Evgen'evich
6	Objectives of the study of the discipline	Formation of students' ideas about macromolecular organization and molecular mechanisms of functioning of the most important bacterial structures
7	Prerequisites	"Microbiology", "Biochemistry", "Molecular Biology", "Genetics"
8	Contents of the discipline	The main differences of prokaryotic cells from eukaryotic cells. Development of ideas about the structure of bacteria. The chemical and anatomical complexity of the surface structures of a bacterial cell. The structure of murein, lytic enzymes that destroy the structure of murein. The structure of the cell walls of Gram-positive and Gram-negative bacteria. External structures of the bacterial cell: capsules and mucous layers, villi and pili. Protoplasts, spheroplasts, L-forms. Chemical structure and basic functions of the cytoplasmic membrane of bacteria. Derivatives of the cytoplasmic membrane. Features of the structure of cytoplasmic membranes archaea. Macromolecular organization of nucleoids. Bacterial inclusions, surrounded by a membrane, inclusion of reserve substances. Bacterial flagella as locomotor organelles of a bacterial cell. Structure, biosynthesis and assembly of flagellum components. Principal organization and mechanism of the flagellar motor functioning. The structure of the organelles of the spirochete movement. The bacterial toxins. Bacterial endospores. Characteristics of endospores, cytology and biochemistry of sporulation process. Types of vegetative cell cycles in bacteria - monomorphic, dimorphic, polymorphic.
9	Recommended literature	1. Громов Б.В. Строение бактерий / Б. В. Громов. – Л.: Из-во ЛГУ, 1985. 2. Современная микробиология: Прокариоты / Под ред. Й. Ленгелера, Г. Дрекса, Г. Шлегеля. М.: Мир: т.1-2, 2005. 3. Гусев М. В. Микробиология / М. В. Гусев, Л. А. Минеева. – М.: Академия, 2010.
10	Teaching Methods	Active, interactive, dialog-heuristic verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), current control	-preparation of abstracts; -testing
13	Form of current certification	exam

1	The name of the discipline	Systematization of microorganisms
2	Course	3
3	Semester of training	5
4	Amount of credits	3,5
5	Full Name lecturer	Candidate of Biological Sciences, Associate Professor Lysak Vladimir Vasilevich Candidate of Biological Sciences, Associate Professor Fomina Olga Valentinovna
6	Objectives of studying the discipline	Formation of students' ideas about the features of vital activity and organization of prokaryotic and eukaryotic microorganisms and their position in the general system of the organic world; consideration of the principles and approaches used in the modern classification of microorganisms; acquaintance with the general characteristic of the main higher taxa and modern ideas about the taxonomy and nomenclature of microorganisms.
7	Prerequisites	Physiology of microorganisms; Genetics of microorganisms; Structural organization of microorganism cells; Structural biochemistry, Metabolic biochemistry; Fundamentals of botany
8	Contents of the discipline	The most important groups of microorganisms. Traditional and modern classifications of microorganisms. Principles of taxonomy. Phylogenetic (natural) and phenotypic (artificial) classification. Criteria of systematics. The main groups of prokaryotic microorganisms are phototrophic bacteria, chemolithotrophic bacteria, nitrogen-fixing bacteria, gram-positive bacteria that forming endospores, lactic acid bacteria, coryneform bacteria, propionic bacteria, actinomycetes, mycoplasmas, arhebacteria, etc. The most important groups of eukaryotic microorganisms: heterotrophic protists, microscopic algae, mushroom-like organisms, fungi.
9	Recommended literature	1. <i>Гарибова, Л. В.</i> Основы микологии: морфология и систематика грибов и грибоподобных организмов / Л. В. Гарибова, С. Н. Лекомцева. М. : Товарищество научных изданий КМК, 2005. 2. Современная микробиология / под ред. Й. Ленгелера, Г. Дрекса, Г. Шлегеля. М. : Мир, 2005. Т. 1–2. 3. <i>Bergey's Manual of Systematic Bacteriology</i> / Editor-in-Chief G. M. Garrity. New York: Springer, 2001–2003, V.1–5.
10	Training Methods	Active, interactive, verbal, problematic, visual
11	Language of training	Russian
12	Conditions (requirements), operating control	-preparation of abstracts; -written tests; -computer testing
13	Form of current certification	Exam

1	Discipline	The English Language
2	Year of Study	1,2
3	Term of Study	I, II, III
4	Number of Credits	7
5	Tutors	T. Karlovich, N. Ringel, A. Mikhailenko, V. Kornakova, I. Krivosheya, D. Borovkov.
6	Study Objectives	On completion of the course students will have greatly increased the knowledge of the subject studied (biology) as well as their professional and sociocultural communicative confidence in the English language
7	Prerequisites	A2 (pre-intermediate level)
8	Course Content	Curriculum includes three modules: professional communication module, sociocultural communication module and assessment module. Professional communication module is focused on studying: "Origin of Life", "Cell", "Human Body", "Brain", "Nervous System", "Blood", "Viruses", "Protista", "Botany", "Zoology". Sociocultural module is aimed at studying: "Belarus", "Great Britain", "BSU", "Biology Faculty", "About Myself and My Family", "My Speciality". Assessment module provides current, intermediate and final assessment of students' knowledge and is carried out by testing, writing essays and making reports
9	Literature Recommended	"English for Biology Students", "Grammar for Biology Students", "Zoology", "Biological Sciences"
10	Methods of Teaching	Communicative method, student-centered approach, project technology, teamwork approach
11	Language of Teaching	English
12	Requirements, Current Assessment	Essays, students' reports and projects
13	Form of Current Assessment	Exam



1	Course Title	The main groups of producers in modern biotechnology (special course)
2	Year	4
3	Academic Semester	7
4	Number of credits	2,5
5	Lecturer	RUS Olga Borisovna, associate professor
6	Goal	To expand of idea of the main achievements, modern genetic designs for an expression of genes in different pro- and the eukaryotic systems and the fields of use of microorganisms, cages of plants, animal and other objects of biotechnology.
7	Prerequisites	Biochemistry, Molecular biology, Bases of biotechnology
8	Course Description from Program Guide	Screening of industrial microorganisms. Ways of increase in efficiency of industrial facilities. Concept of metabolic engineering. Main methodical methods of metabolic engineering. The factors influencing process of an expression at the level of DNA, RNA, protein. Systems of an expression of bacteria Escherichia coli, Pseudomonas, Bacillus, lactic bacteria, korinebacteria, actinomycetes, yeast, filamentous fungi, baculovirus. Ways of introduction of recombinant DNA to cages grampositive and gramnegative bacteria, yeast, filamentous mushrooms. Use of cells of the highest eucariots for superproduction of biologically active agents.
9	Recommended Textbooks (in Russian)	1. Глик Б. Молекулярная биотехнология. Принципы и применение / Б. Глик, Дж. Пастернак. М.: Мир, 2002. 2. Щелкунов С.Н. Генетическая инженерия / С.Н. Щелкунов. Новосибирск, Сибирское университетское издательство, 2008. 3. Рыбчин В.Н. Основы генетической инженерии / В.Н. Рыбчин. Санкт-Петербург: Изд-во СПбГТУ, 2002. 4. Патрушев Л.И. Искусственные генетические системы. Т. 1. Генная и белковая инженерия / В.И. Патрушев. М.: Наука, 2004.
10	Methods	Research, practical, evident, method of formation of the personal importance of knowledge
11	Language	Russian
12	Student evaluation	testing
13	Final examination	credit

1	Discipline	The physiology of the endocrine system
2	Year of Study	3
3	Term of Study	6
4	Number of Credits	1
5	Tutors	Liuzina KM
6	Study Objectives	The goal - on the basis of a systematic scientific approach to form the students' basic ideas about the hormone mechanisms of maintaining homeostasis in various conditions of the organism's existence
7	Prerequisites	Human Anatomy, Cytology and Histology, Human and Animal Physiology
8	Course Content	Principles of the organization of the endocrine system. Endocrine System vs. Nervous System Function. Hormone Properties. Hormonal Regulation. Classes of Hormones
9	Literature Recommended	<ol style="list-style-type: none"> <li>1. Physiology of the endocrine system / under. Ed. G. Griffin and S. Ojeda; trans. with the English-M .: BINOM. Laboratory of Knowledge, 2008.</li> <li>2. The beginning of physiology: Textbook / ed. acad. HELL. Nozdracheva. - SPb .: Publishing house "Lan", 2005.</li> <li>3. Nichols D. From the neuron to the brain / Nichols D., Martin R., Wallas B., Fuks PM: Editorial URSS, 2003.</li> <li>4. Human physiology: a textbook / ed. V.M. Smirnov. - Moscow: Medicine, 2007.</li> <li>5. Physiology. Fundamentals and functional systems: Course of lectures / ed. K.S. Sudakov. - M .: Medicine, 2008.</li> </ol>
10	Methods of Teaching	Problem, dialogue-heuristic, visual, search-research, reproductive (in the part of laboratory exercises).
11	Language of Teaching	Russian
12	Requirements, Current Assessment	Methods of oral, written and laboratory-practical control, abstracts, testing
13	Form of Current Assessment	credit

1	Name of the discipline	Theory of evolution
2	Course of study	4
3	Semester	7
4	Number of credits	4
5	Name of the Lecturer	Candidate of biological sciences, associate professor RAMANOUSKAYA Tatsiana Uladzimirauna
6	Objectives of studying the discipline	To form a systemic view of natural factors, driving forces and patterns of biological evolution, on the problems and methods of modern evolutionary biology.
7	Prerequisites	Genetics, zoology, botany, ecology
8	Contents of the discipline	Key issues and main sections of evolutionary biology. Theoretical concepts developed within the framework of evolutionary biology in past eras and at the present stage of the development of science. Methods used to study biological evolution. Driving forces and the basic laws of biological evolution. The fundamental and practical importance of evolutionary biology.
9	Recommended literature	1. Дарвин Ч. Происхождение видов путем естественного отбора. Соч. в 9 томах / Ч. Дарвин. – М.-Л., 1939. Т.3, 539 с. 2. Яблоков А. В. Эволюционное учение. Учебн. пособие. 6-е изд., переработано и дополнено / А. В. Яблоков, А. Г. Юсуфов. М.: Высш. шк., 2006, 310 с. 3. Иорданский Н. И. Эволюция жизни / Н. И. Иорданский. – М.: «Академия», 2005, 425 с.
10	Teaching methods	Lectures, problem discussions, solving tasks
11	Language	Russian
12	Conditions (requirements), control	Attending seminars, writing essays, reading and analysis of scientific articles, holding written tests.
13	Форма текущей аттестации	Exam

1	Course Title	Transgenic eukaryotic organisms
2	Year	4
3	Academic Semester	8
4	Number of credits	2
5	Lecturer	Candidate of biological sciences, associate professor Pesnyakevich Alexander Georgievich
6	Goal	The course is intended for students of biological faculties, and aims to give listeners an idea about the methods of obtaining transgenic eukaryotic organisms, the peculiarities of their use in science and production, the problems associated with their implementation in practice.
7	Prerequisites	Biochemistry; Microbiology, Virology, Molecular Biology, Genetics
8	Course Description from Program Guide	The course examines the features of the natural transformation of plant organisms during their colonization of <i>Agrobacterium tumefaciens</i> , characterizes Ti plasmids and T-DNA, describes the vector systems created on their basis to introduce genetic information into the plant genome. Specific examples give an idea of the selection of genes for the production of transgenic plants and their modifications necessary for optimal functioning of the introduced genetic information. The course includes information on the features of the genetic transformation of unicellular fungi, the main vector systems developed to produce transgenic yeast, the advantages and disadvantages of using yeast in the microbiological industry. Data on the potential for the production of transgenic animals and the vector systems and methods used for this purpose are given. Genetic engineering systems for editing genomes and their application are considered. Economic and social problems that have arisen in society as a result of introduction of transgenic eukaryotes into practice are discussed.
9	Recommended Textbooks (in Russian)	1. Молекулярная биотехнология. Принципы и применение / Б.Глик, Дж. Пастернак. М.: Мир, 2002. 2. Ермишин А.П.. Генетически модифицированные организмы и биобезопасность Минск: Беларуская навука, 2013. – 171 с. 3. Биотехнология Биобезопасность Биэтика Под ред. А.П. Ермишина / Мн.: Техналогія, 2005.
10	Methods	Comparative, problematic, visual methods, heuristic dialogue, method of forming the personal significance of knowledge
11	Language	Russian
12	Student evaluation	Lectures Laboratory classes (compulsory attendance)
13	Final examination	Exam

1	Name of the discipline	Vector Systems
2	Course	3
3	Semester of training	5
4	Amount of credits	2,5
5	Full name lecturer	Doctor of Biological Sciences, Professor Titok Marina Alekseevna
6	Objectives of studying the discipline	Review the principles of organization of vector systems used for molecular cloning of foreign genetic material in pro and eukaryotic organisms.
7	Prerequisites	Genetics, Microbiology, Biotechnology
8	Contents of the discipline	Introduction. Principles of the construction of genetically modified organisms. Technology of recombinant DNA. Enzymes of genetic engineering (restrictases, ligases, polymerases, reverse transcriptases, nuclease, phosphotases, etc.). Methods of isolation and analysis of genes of pro- and eukaryotes (cloning, PCR, chemical synthesis, sequencing). Types of vector systems. Vector systems of bacteria based on plasmids, phages and their hybrids. Vector systems for cloning in yeast, plant and animal cells. Methods of introducing vectors.
9	Literature	1. <i>Rybchin V.N. Principles of genetic engineering / SPbSTU Publishers, St. Petersburg, 2002.</i> 2. <i>Juravleva G.A. Genetic engineering in biotechnology / S.G. Inge-Vechtomov, editor / Eco-Vector Publishers, St. Petersburg, 2016.</i> 3. <i>Titok M.A. Plasmids of Gram-positive bacteria / J.K. Fomichev, editor / BSU Publishers, Minsk, 2004.</i>
10	Teaching Methods	Problematic, dialog-heuristic, visual.
11	Language of instruction	Russian
12	Conditions (requirements), current control	-testing -writing essays
13	Form of current certification	exam

1	Course Title	Veterinary microbiology
2	Year	5
3	Academic Semester	9
4	Number of credits	2,5
5	Lecturer	Candidate of Agricultural Sciences Arkhipov Ivan Nikolaevich
6	Goal	The purpose of the discipline is to form ideas about the theoretical and practical foundations for diagnosing infectious diseases of animals and birds and the principles of disease prevention, as well as ensuring veterinary and sanitary quality of products subject to veterinary control.
7	Prerequisites	Physiology of microorganisms, Systematics of microorganisms, Mechanisms of biosynthesis of antibiotics and their effect on cells of microorganisms
8	Course Description from Program Guide	Types of relationships between macro and microorganisms, the general theory of infection. The setup of a veterinary laboratory. Obligatory minimum of studies conducted in the diagnosis of infectious diseases. The rules of selection, conservation and transfer of material to the laboratory. Storage of material in the laboratory, preparing it for research. Formulation of a preliminary diagnosis by a microscopic method of investigation. The diagnosis based on the results of bacteriological and serological research methods. Biological method of research. Veterinary-sanitary bacteriological evaluation of products of animal origin and feed. Disinfection and quality control of disinfection. Production of biological agents for immunoprophylaxis of animal diseases
9	Recommended Textbooks (in Russian)	<i>Радчук, Н.А.</i> Ветеринарная микробиология и иммунология / Н.А. Радчук, Г.В. Дунаев, Н.М. Колычев и [др.]; под редакцией Н.А. Радчука. – М.: Агропромиздат, 1991. – 383 с. <i>Солонко, А.А.</i> Практикум по общей микробиологии: учебное пособие / А.А. Солонко, А.А. Гласкович, В.Н. Алешкевич и [др.]; под редакцией А.А. Гласкович. – Мн.: «Ураджай». 2000. – 280 с. <i>Солонко, А.А.</i> Практикум по частной микробиологии: учебное пособие / А.А. Солонко, А.А. Гласкович, В.Н. Алешкевич и [др.]; под редакцией А.А. Гласкович. – Мн.: Ураджай», 2000. – 250 с.
10	Methods	active, interactive, verbal, visual, problematic
11	Language	Russian
12	Student evaluation	- written tests on specific topics of the course; - protection of the essay prepared by the student; - oral polls
13	Final examination	credit

1	Course Title	Virology
2	Year	3
3	Academic Semester	6
4	Number of credits	2,5
5	Lecturer	Doctor of biological sciences, professor, the head of the department of molecular biology Evtushenkov A.N.
6	Goal	To acquaint students with the basic groups of viruses of bacteria, animals and plants, to consider peculiarities of their organization and reproduction, to give an idea about the most interesting representatives, to display the basic directions and perspectives of viral science development
7	Prerequisites	Biochemistry, microbiology, genetics
8	Course Description from Program Guide	Introduction. The general virology. Principles of virus classification. Basic families of animal and human viruses. Special methods of isolation and studying viruses. The structure of virus substances. Organization of viral genomes. Basic hypothesis of virus origins and their confirming facts. Possible ways of virus evolution. Bacteriophages. Viruses and host cell interaction. The general scheme of virus replication (cycle of phage single development, viral infection biochemistry). Virus infections. The ways of transmission of animal and human viruses. Latent virus infections. Novel and rising virus infections. Plant virus infections. Noncanonical viruses: prions and viroids and their mechanisms of reproduction. Description of viral separate families pathogenic to human and animals. Antiviral therapy.
9	Recommended Textbooks (in Russian)	1. Зинченко А. И. Основы молекулярной биологии вирусов и антивирусной терапии/ А. И. Зинченко, Д. А. Паруль. Минск: «Высшая школа», 2005. 2. Медицинская микробиология/ под ред. В. И. Покровского, О. К. Поздеева.- Гэотар Медицина, М., 1999. С. 657-848 (Общая вирусология. Частная вирусология). 3. Общая и частная вирусология / под ред. В. М. Жданова, С. Я. Гайдамовича. М.: Медицина, 1982.
10	Methods	Comparative, problematic, visual methods, heuristic dialogue, method of forming the personal significance of knowledge
11	Language	Russian
12	Student evaluation	-labs report. -writing tests;
13	Final examination	exam

1	The name of the discipline	Zoogeography
2	The course of the study	3
3	Semester of training	5
4	The amount of credits	1,5
5	Full name of the lecturer	PhD, Associate Professor J.Ye. Meleshko
6	The objectives of the discipline studying	The purpose of the special course «Zoogeography» is the formation of a holistic view of the Earth's fauna and it's structure. The objectives of the course include introducing students to environmental and basics of zoogeography, the study of the range and its dynamics, fauna and zoogeographical zoning, anthropic influence on biomes and biota in different geographic conditions.
7	The prerequisites	Zoology
8	Contents of the discipline	The history of zoogeography. Ecological basis of zoogeography. The doctrine of the range. The doctrine of the fauna. The origin and evolution of the fauna of the earth (historical biogeography). Systematic zoogeography
9	Literature recommended (in Russian)	1. Лопатин И.К. Зоогеография. Минск: Высшая школа, 1989. 2. Воронов А.Г. Биогеография мира / А.Г. Воронов, Н.Н. Дроздов, Е.Г. Мяло. М.: Высшая школа, 1985. 3. Биогеография с основами экологии / А.Г. Воронов [и др.]. М.: Высшая школа, 1999. 4. Воронов А.Т. Биогеография с основами экологии. М., 1987. 5. Крыжановский О.Л. Состав и распространение энтомофаун земного шара. М.: Товарищество научных изданий КМК, 2002.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, preparation of abstracts
13	The form of current certification	Credit



1	The name of the discipline	Zoology
2	The course of the study	1
3	Semester of training	1–2
4	The amount of credits	10
5	Full name of the lecturer	PhD, Associate Professor J.Ye. Meleshko; PhD, Associate Professor V.V. Sakhvon
6	The objectives of the discipline studying	The course «Zoology» is one of the fundamental courses in the system of university biological education. The aim is to familiarize students with the diversity of animal organisms, the patterns of their distribution, as well as the specific features of the morpho-physiological organization of representatives of various systematic groups.
7	The prerequisites	Zoology
8	Contents of the discipline	Kingdom Protista. Kingdom Animalia. Subkingdom Parazoa. Subkingdom Phagocytellozoa. Subkingdom Eumetazoa. Phylum Platyhelminthes. Group of Phyla Nematelminthes. Phylum Annelida. Phylum Arthropoda. Phylum Onychophora. Phylum Mollusca. Phylum Tentaculata. Phylum Echinodermata. Phylum Hemichordata. Phylum Chordata.
9	Literature recommended (in Russian)	1. Догель В.А. Зоология беспозвоночных. М.: Высшая школа, изд. 6-ое, 1975; изд. 7-ое, 1981. 2. Шарова И.Х. Зоология беспозвоночных. М.: Владос, 1999. 3. Лопатин И.К. Зоология беспозвоночных / И.К. Лопатин, Ж.Е. Мелешко. Минск: БГУ, 2009. 4. Шалапенок Е.С. Практикум по зоологии беспозвоночных / Е.С. Шалапенок, С.В. Буга. Минск: Новое знание, 2002. 5. Методическое пособие по систематике и словарь систематических групп по курсу «Зоология беспозвоночных животных» / И.К. Лопатин [и др.]. Минск: БГУ, 2008. 6. Лопатин И.К. Функциональная зоология. Минск: Высшейшая школа, 2002. 7. Наумов Н.П. Зоология позвоночных / Н.П. Наумов, Н.Н. Карташов. М.: Высшая школа, 1979. Ч. 1, Ч. 2. 8. Ромер А. Анатомия позвоночных / А. Ромер, Т. Парсонс. М.: Мир, 1992. Т. 1, Т. 2.
10	Teaching methods	Active, interactive, verbal, problematic, visual
11	Language of instruction	Russian
12	Conditions (requirements), routine control	Testing, oral survey, preparation of abstracts, drawing albums
13	The form of current certification	Exam