МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ
Федеральное государственное автономное образовательное учреждение
высшего образования
Дальневосточный федеральный университет
(ДВФУ)

ШКОЛА БИОМЕДИЦИНЫ

«СОГЛАСОВАНО»

Руководитель ОП

_____ Каленик Т.К.
(подпись) (Ф.И.О. рук. ОП)

«12» июля 2018 г.

«УТВЕРЖДАЮ»

Директор Департамента
пищевых наук и технологий

_____ Ю.В. Приходько
(подпись) (Ф.И.О.)

«12» июля 2018 г.

УЧЕБНО-МЕТОДИЧЕСКИЙ КОМПЛЕКС ДИСЦИПЛИНЫ

«Analytical studies of objects in biotechnology / Аналитические исследования объектов в биотехнологии»

Направление подготовки 19.04.01 Биотехнология
Образовательная программа «Agri-Food Biotechnology»
Форма подготовки очная

Школа биомедицины
Департамент пищевых наук и технологий
Курс _1, семестр 2 __
Лекции –_18__ час.
Практические занятия –_36__ час.
Лабораторные работы –_-_ час.
Самостоятельная работа – _18_ час.
Всего часов –_108 час.
Всего часов аудиторной нагрузки – _54__ час.
Контрольные работы – не предусмотрены
Зачет – _-_ семестр
Экзамен – _2_ семестр

Учебно-методический комплекс составлен в соответствии с требованиями образовательного стандарта, самостоятельно устанавливаемого ДВФУ, утвержденного приказом ректора от 07.07.2015 № 12-13-1282.

УМКД обсужден на заседании Департамента пищевых наук и технологий Школы биомедицины ДВФУ протокол № 1 от «11» июля 2018 г.

Директор Департамента пищевых наук и технологий Ю.В. Приходько
Составитель: Е.В. Добрынина, к.т.н., доцент

ANNOTATION
of the educational complex of discipline
"Biotechnology of plants and animals"
Direction of preparation: 19.04.01 Biotechnology
Educational program: "Agri-Food Biotechnology"

The educational-methodical complex of the discipline "Biotechnology of plants and animals / Biotechnology of plants and animals" was developed for students of the _1_ course in the direction 19.04.01 "Biotechnology" master's program "Agri-Food Biotechnology" in accordance with the requirements of OS HE in this area and the regulation on educational complexes of disciplines of educational programs of higher professional education (approved by order of the acting rector of the FEFU from 04.17.2012 No. 12-13-87).

The discipline "Biotechnology of plants and animals / Biotechnology of plants and animals" is included in the variable part of the curriculum.

The total complexity of mastering the discipline is __108__ hours. The curriculum includes lecture classes (__18__ hours), practical classes (_36_ hours), independent work of the student (__18__ hours). The discipline is implemented on the _1__ course in the __2_ semester.

The content of the discipline covers the following range of issues:

- Objects and raw materials base of biotechnology;
- Technology of fermentation processes and enzyme technology;
- Biotechnology in the food industry and agriculture;
- Advances in modern biotechnology and genetic engineering.

The discipline “Biotechnology of plants and animals” is logically and meaningfully connected with such courses as “Fundamentals of food biotechnology”, “Microbiology”, “Enzymatic and microbial conversion”, “Chemistry”.

The discipline is aimed at the formation of professional competencies.

Educational complex includes:

- the work program of the discipline;
- educational and methodological support of students' independent work

(Appendix 1);

- appraisal fund (appendix 2)

Директор Департамента
пищевых наук и технологий  Ю.В. Приходько

МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ
Федеральное государственное автономное образовательное учреждение высшего образования
«Дальневосточный федеральный университет»
(ДВФУ)

ШКОЛА БИОМЕДИЦИНЫ

«СОГЛАСОВАНО»
Руководитель ОП
_____ Каленик Т.К.
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«УТВЕРЖДАЮ»
Директор Департамента
пищевых наук и технологий
_____ Ю.В. Приходько
(подпись) (Ф.И.О.)

«12» июля 2018 г.

РАБОЧАЯ ПРОГРАММА УЧЕБНОЙ ДИСЦИПЛИНЫ
«Analytical studies of objects in biotechnology / Аналитические исследования объектов в биотехнологии»
Направление подготовки 19.04.01 Биотехнология
магистерская программа «Agri-Food Biotechnology»
Форма подготовки очная

курс 1 семестр 2
лекции 18 час.
практические занятия 36 час.
лабораторные работы - час.
в том числе с использованием МАО лек. 4 /пр. 8 /лаб. - час.
в том числе в электронной форме лек. - /пр. - /лаб. - час.
всего часов аудиторной нагрузки 54 час.
в том числе с использованием МАО 12 час.
в том числе в электронной форме - час.
самостоятельная работа 18 час.
в том числе на подготовку к экзамену 36 час.
контрольные работы (-)
курсовая работа / курсовой проект 2 семестр
зачет - семестр
экзамен 2 семестр

Рабочая программа составлена в соответствии с требованиями образовательного стандарта, самостоятельно устанавливаемого ДВФУ, утвержденного приказом ректора от 07.07.2015 № 12-13-1282

Рабочая программа обсуждена на заседании Департамента пищевых наук и технологий, протокол № 1 от «11» июля 2018 г.
Директор Департамента ___ Приходько Ю.В.___
Составитель (ли): к.т.н., доцент Добрынина Е.В.

Оборотная сторона титульного листа РПУД

I. Рабочая программа пересмотрена на заседании Департамента:

Протокол от «_____» _____ 20___ г. № _____

Директор Департамента _____ _Ю.В. Приходько___
(подпись) (И.О. Фамилия)

II. Рабочая программа пересмотрена на заседании Департамента:

Протокол от «_____» _____ 20___ г. № _____

Директор Департамента _____ __ Ю.В. Приходько __
(подпись) (И.О. Фамилия)

ABSTRACT

Master's degree in 19.04.01 «Biotechnology»

Master's Program «Agri-Food Biotechnology**»**

Course title: «Analytical studies of objects in biotechnology / Аналитические исследования объектов в биотехнологии»

Variable part of Block, 3 credits

At the beginning of the course a student should be able to:

– the ability to use modern methods and technologies (including information) in professional activities;

– hold the basic methods and techniques of experimental research in the professional field; ability to carry out standard and certification tests of raw materials, finished products and production processes;

– possession of experimental design, processing and presentation of the results;

– the ability to participate in the development of technological projects in the group of authors;

– the ability to develop and implement normative documents on standardization, certification of food products.

Learning outcomes:

PC-11 ability to provide the technological discipline, hygienic conditions of the enterprise, the maintenance of process equipment in good technical condition;

PC-14 ability to use the model and to develop new methods of engineering calculation of process parameters and production of biotechnological equipment;

PC-17 readiness for carry out the pilot development of the technology and zooming processes;

PC-18 ability to develop and scientific substantiation of the optimum complex schemes of certification of biotech products;

PC-19 ability to analyze the performance of the process for compliance of the original scientific research.

Course description: Contents cover a range of issues related to the study of chemical, biotechnological and biological processes, biotechnological equipment, the problems of saving and rational use of resources, the latest achievements in the field of biological food production technologies, get acquainted with the basics of biological engineering, areas for improvement of structures and operation of biotechnological equipment. Implementation of this program involves extensive use of students' knowledge gained in the study of previous disciplines.

Main course literature:

1. Biotechnology of combined food products based on dairy and microbiological raw materials: method. directions to the lab. works for students special. 240902 "Food Biotechnology" of all forms of training / comp. N.V. Situn, E.S. Fishchenko. Dairy Biotechnology, Vladivostok: Publishing House of the Pacific University of Economics, 2009. - 96 p. (8 copies). http://lib.dvfu.ru:8080/lib/item?id=chamo:357087&theme=FEFU

2. Visual biotechnology and genetic engineering / R. Schmid; per. with him. A.A. Vinogradova, A.A. Sinyushina. Moscow: BINOM. Laboratory of Knowledge, 2014. - 324 p. (10 copies) http://lib.dvfu.ru:8080/lib/item?id=chamo:797469&theme=FEFU

3. Basic principles of processing raw materials of plant, animal, microbiological origin and fish: method. directions for special students 240902 "Food Biotechnology" of all forms of training / comp. E.V. Makarova, Vladivostok: Publishing House of the Pacific University of Economics, 2009. - 80 p. (10 copies) http://lib.dvfu.ru:8080/lib/item?id=chamo:356130&theme=FEFU

Form of final knowledge control: exam.

ANNOTATION

The discipline "Biotechnology of plants and animals" is included in the variable part of the professional (special) section cycle of the compulsory discipline of the training direction 19.04.01 "Biotechnology" master's program "Agri-Food Biotechnology".

The total complexity of mastering the discipline is 3 credits, 108 hours.

The content of the discipline covers a range of issues related to the study of chemical, biotechnological and biological processes, biotechnological equipment, problems of economy and rational use of resources, modern achievements in the field of biological technology of food products, familiarization with the basics of biological engineering, directions for improving designs, operation and operation of biotechnological equipment. The implementation of this program involves the widespread use of students' knowledge gained in the study of previous disciplines.

The discipline "Biotechnology of plants and animals / Logically and meaningfully connected with such courses as" Chemistry "," Biology ". Mastering the discipline is closely related to the study of disciplines: "Fundamentals of food biotechnology", "Microbiology", "Enzymatic and microbial conversion."

The purpose of mastering the discipline "Biotechnology of plants and animals / Biotechnology of plants and animals" is the development of an integrated approach to the organization of biotechnological production, a detailed study of biotechnological processes in agriculture, technological production based on plant and animal raw materials.

Objectives of the discipline are:

- study of scientific and technical information, domestic and foreign experience in the field of biotechnological production, technology of functional food products;
- the development of concepts for the implementation of biotechnological processes, the study of the stages of processes, their scientific foundations.

To successfully study the discipline "Biotechnology of plants and animals / Biotechnology of plants and animals" the following preliminary competencies should be formed in students:

- the ability to use modern methods and technologies (including information) in professional activities;
- possession of the basic methods and techniques for conducting experimental research in their professional field; the ability to conduct standard and certification tests of raw materials, finished products and processes;
- ownership of experimental design, processing and presentation of the results;
- the ability to participate in the development of technological projects as part of the team of authors;
- the ability to develop and implement regulatory documents for standardization, certification of food products.

As a result of studying this discipline, the following professional competencies (elements of competencies) are formed in students.

Code and wording of competency	**Competency Stages**	
PK-11 with the ability to provide technological discipline, sanitary and hygienic operation of the enterprise, the maintenance of technological equipment in proper technical condition	Knows	this technological discipline, sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition
	Is able	provide this technological discipline, sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition
	Owns	Skills to ensure this technological discipline, sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition
PK-14 with the ability to use standard and develop new methods of engineering calculations of technological parameters and equipment of biotechnological industries	Knows	standard and new methods of engineering calculations of technological parameters and equipment of biotechnological industries
	Is able	use standard and develop new methods of engineering calculations of technological parameters and equipment of biotechnological industries
	Owns	the skills of using standard and developing new methods of engineering calculations of technological parameters and equipment of biotechnological industries

PK-17 readiness for experimental development of technology and process scaling	Knows	pilot development of technology and process scaling
	Is able	to carry out pilot industrial testing of technology and scaling of processes
	Owns	skills for pilot development of technology and scaling processes
PK-18 with the ability to develop and scientifically substantiate schemes for the optimal integrated certification of biotechnological products	Knows	optimal integrated certification schemes for biotechnological products
	Is able	to develop and scientifically substantiate schemes for the optimal integrated certification of biotechnological products
	Owns	skills of development and scientific substantiation of schemes for the optimal integrated certification of biotechnological products
PK-19 with the ability to analyze technological process indicators for compliance with initial scientific developments	Knows	analysis of technological process indicators for compliance with initial scientific developments
	Is able	analyze the performance of the technological process for compliance with the original scientific developments
	Owns	skills in analyzing technological process indicators for compliance with initial scientific developments

For the formation of the above competencies within the discipline "Biotechnology of plants and animals" the following methods of active / interactive training are used: lecture-discussion, round table, business game.

I. STRUCTURE AND CONTENT OF THE THEORETICAL PART OF THE COURSE

Section I. Agricultural Biotechnology (6 hours)

Topic 1. Biochemical processes in biotechnology (2 hours)

Biochemical characteristics of the genome of prokaryotic and eukaryotic cells. Biotechnological processes in nitrogen and protein metabolism in plants. Protein biosynthesis. Biochemical regulation of crop production quality.

Topic 2. Lecture-discussion: “Cellular and tissue biotechnology in breeding and plant growing” (2 hours)

During the lecture-discussion, the teacher gives individual examples in the form of situations or briefly formulated problems, respectively, students analyze and discuss specific situations and material. The teacher, when presenting the

lecture material, uses students' answers to their questions and organizes a free exchange of views in the intervals between logical sections.

Questions of the lecture: biology of the cultured cell; cell and tissue culture; hormone-independent plant tissue; culture of isolated cells and tissues in plant breeding; achievements of cell biotechnology in crop production.

Topic 3. Biotechnology in animal husbandry (2 hours)

Biotechnological control of the reproduction of farm animals. Cell biotechnology in animal husbandry.

Section II. Biotechnology of raw materials of animal origin (6 hours)

Topic 1. Lecture-discussion: “Nutritional aspects of biotechnology. Getting food protein "(2 hours)

During the lecture-discussion, the teacher gives individual examples in the form of situations or briefly formulated problems, respectively, students analyze and discuss specific situations and material. The teacher, when presenting the lecture material, uses students' answers to their questions and organizes a free exchange of views in the intervals between logical sections.

Questions of the lecture: modern areas of food biotechnology; obtaining biomass of microorganisms as a source of protein.

Topic 2. Biotechnology of products from raw materials of animal origin. Getting dairy products. (2 hours)

Biotechnology of dairy products. Biotechnological processes in the production of dairy products.

Topic 3. Biotechnological processes in the production of meat products (2 hours)

Biotechnology of meat and fish products. Biotechnological processes in the production of meat and fish products

Section III. Biotechnology of raw materials of plant origin (6 hours)

Topic 1. Biotechnology of products from raw materials of plant origin. Biotechnological processes of baking. (2 hours)

Biotechnology of bread. Biochemical processes in the production of bakery products.

Topic 2. Biotechnological processes in conservation (2 hours)

Biotechnology of canned vegetables and other products. Biochemical processes in the production of canned vegetables and other products.

Topic 3. Biotechnological processes of fermentation plants (2 hours)

Biotechnology in fermentation plants. Biochemical processes in winemaking, brewing and the production of alcohol products.

II. STRUCTURE AND CONTENT OF THE PRACTICAL PART OF THE COURSE

Practical exercises (36 hours)

Lesson 1. Seminar on the topic: "Biosafety of the production, distribution and consumption of genetically modified plants" (2 hours)

1. Directions for using the culture of isolated cells and plant tissues in biotechnology.
2. Cellular biotechnology in crop production.
3. Cell selection.

Lesson 2. Seminar on the topic: "Organic and mineral components of plant materials" (2 hours)

1. Grain components characterizing its ash content.
2. Convertible component of grain.
3. The process of lignification of plant materials.
4. Methods for the microbial use of mineral elements in the bioconversion of plant materials.

Lesson 3. Seminar on the topic: "Biochemical and biotechnological processes in nitrogen and protein metabolism in plants" (2 hours)

1. The biosynthesis of amino acids.
2. Elements of biochemical genetics of nitrogen fixation.

3. Biochemical and molecular analyzes of plant functions.

Lesson 4. Seminar on the topic: “Biotechnology in animal husbandry: cell biotechnology, genetic engineering” (2 hours)

1. Transplantation of embryos.

2. Intraspecific transplantation of embryos, obtaining chimeric animals.

3. Transgenic animals.

Lesson 5. Round table (MAO) on the topic: “Genetic Engineering Enzymes” (2 hours)

To participate in the discussion of the topic of the round table, students should be acquainted with the basics of the production of genetically modified products, concepts and terminology in this area.

The round table is aimed at consolidating the knowledge gained by students, as well as the ability to conduct a discussion.

Points for discussion:

1. DNA polymerase, DNA ligase, nuclease, restrictase.

2. The purpose of these enzymes, mode of action, enzymatic activity.

Lesson 6. Seminar on the topic: “The effect of different sterilization modes on the death of microorganisms” (2 hours)

1. Providing conditions for obtaining pure crops in the laboratory, sowing machines, chambers.

2. Sterilization, sealing equipment and communications.

3. Special techniques for the introduction of additives, seeding, sampling.

4. Sterilization of defoamers, culture media, air.

5. Processes that contribute to the achievement and maintenance of aseptic conditions of material flow, equipment, communication.

Lesson 7. "The study of the effectiveness of air filtration" (2 hours)

1. Description of methods for determining microbial contamination of air and formulas for their calculation.

2. Scheme of a laboratory installation for air purification through an air filter and determining the leakage coefficient; a brief description of the experiment conducted on it.

3. Formulas for calculation, calculation of the thickness of the filter layer.

4. Construction of a graphical dependence Кп = f (Vв).

Lesson 8. Seminar on the topic: “Preparation of culture media for the cultivation of microorganisms” (2 hours)

1. The principle of compilation of nutrient media.

2. The influence of the composition of the medium on the composition of the cellular substance of microorganisms.

3. Methods of disinfection of culture media.

Lesson 9. "The influence of the composition of the nutrient medium on the accumulation of amylase during solid-phase cultivation of myxomycetes" (2 hours)

1. The technology of solid-phase cultivation of enzyme producers.

2. The stages of preparation of the nutrient medium.

3. The study of the influence of the composition and humidity of the nutrient medium on the level of amylolytic enzyme accumulation in the process of growing a culture of the microscopic fungus Aspergillus oryzae on a solid granular medium.

4. The mode of extraction and clarification of the hood.

5. The essence of the method for determining amylolytic ability.

6. Graphing the dependencies of amylolytic ability: AC = f (starch content), AC = f (W,%).

Lesson 10. "The study of the kinetics of yeast growth during deep fermentation" (2 hours)

1. Diagram of a laboratory setup for growing yeast and a description of the principle of its operation.

2. Description of the methods used in the work for analyzing the concentration of yeast biomass, carbon-containing substrate, assimilated nitrogen, and formulas for their calculation.

3. The construction of a graphical dependence of the concentration of yeast cell biomass over time, the change in the concentration of sugar and digestible nitrogen.

Lesson 11. Business game on the topic: "Methods of isolation, concentration and drying of microorganisms and products of microbial synthesis" (2 hours)

Students are invited to formulate the main areas of development and biotechnology methods that can be applied to solve this problem.

To conduct a business game, students should be familiar with the basic concepts of biotechnology, the essence of fermentation processes, the characteristics of the growth and development of microorganisms, the use of enzymes in the technology for the production of various substances, as well as the standards and norms for the quality of processed products, regulatory documents in the field of use genetically modified products.

Points for discussion:

1. Isolation and concentration of microorganisms and products of microbial synthesis.

2. Membrane separation methods.

3. Drying of microorganisms and products of microbial synthesis.

Lesson 12. Seminar on the topic: "The study of the concentration of yeast by the method of foam flotation" (2 hours)

1. The essence of the flotation process.

2. The benefits of using flotation to concentrate yeast.

3. Factors of influence on flotation efficiency.

4. Flotation coefficient.

5. The principle of operation of the installation for studying the pressure flotation process.

6. Methods used to determine cell biomass concentration.

7. Setting the time for settling foam.

Lesson 13. Seminar on the topic: “Technique of introduction into in vitro culture and cultivation of isolated cells and tissues of plants” (2 hours)

1. The cultivation of isolated cells, sterilization of the original plant material, the composition of nutrient media.

2. Cultivation conditions.

Lesson 14. Round table (MAO) on the topic: “Microorganisms in food technology” (2 hours)

To participate in the discussion of the topic of the round table, students should be familiar with the basics of biotechnological production, the concepts and terminology of this field.

The round table is aimed at consolidating the knowledge gained by students, as well as the ability to conduct a discussion.

Points for discussion:

1. Growing cell culture.

2. The processes of cultivation of microorganisms.

3. Features of the cultivation of plant cells.

4. Products of microbial fermentation and metabolism.

Lesson 15. Seminar on the topic: “Biochemical processes in the dairy industry” (2 hours)

1. The basic principles of milk processing.

2. Milk sugar fermentation.

3. Methods for coagulation of milk proteins.

Lesson 16. Seminar on the topic: “Biochemical fundamentals of the technology of meat products” (2 hours)

1. The composition and properties of meat.

2. Change in the composition, properties and structure of meat under the influence of biochemical processes.

Lesson 17. Seminar on the topic: “Biochemical fundamentals of technology of plant products” (2 hours)

1. The chemical composition and properties of raw materials of plant origin.

2. Food biotechnology of products from raw materials of plant origin

Lesson 18. Round table (MAO) on the topic: "Technology of biologically active compounds" (2 hours)

To participate in the discussion of the topic of the round table, students should be familiar with the basics of biologically active compounds, the concepts and terminology of this field.

The round table is aimed at consolidating the knowledge gained by students, as well as the ability to conduct a discussion.

Points for discussion:

1. Biologically active substances of fish and mammals.

2. Plant biologically active substances.

3. Polyenic fatty acids. Glucosamine. Enzyme preparations.

4. Biologically active substances of invertebrates..

III. TRAINING AND METHODOLOGICAL SUPPORT OF STUDENTS'S INDEPENDENT WORK

Educational and methodological support for students' independent work in the discipline "Biotechnology of plants and animals" is presented in Appendix 1 and includes:

a schedule of independent work on the discipline, including approximate norms of time to complete each task;

characteristics of tasks for independent work of students and guidelines for their implementation;

requirements for the presentation and presentation of the results of independent work;

criteria for evaluating the performance of independent work.

IV. CONTROL OF ACHIEVING COURSE OBJECTIVES

№	Supervised sections / topics of discipline	Codes and stages of formation of competencies		Evaluation Tools	
				current control	intermediate certification
1	Section I. Agricultural Biotechnology	PK-17	knows the essence of pilot development of technology and scaling processes	UO-1 - interview, UO-2 - colloquium, PR-4 – abstract	Exam Questions 1-27 Pr-1 - final test
			able to conduct pilot industrial development of technology and process scaling		
			owns the skills of pilot development of technology and scaling processes		
2	Section II. Biotechnology of animal feed	PK-11; PK-18	knows this technological discipline, sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition; optimal integrated certification schemes for biotechnological products	UO-1 - interview, UO-2 - colloquium, PR-4 – abstract	Exam Questions 77-104 Pr-1 - final test
			able to provide this technological discipline, sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition; to develop and scientifically substantiate schemes for the optimal integrated certification of biotechnological products		
			owns the skills to ensure this technological discipline, the sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition; skills of development and		

			scientific substantiation of schemes for the optimal integrated certification of biotechnological products		
3	Section III. Biotechnology of raw materials of plant origin	PK-14; PK-19	knows standard and new methods of engineering calculations of technological parameters and equipment of biotechnological industries; analysis of technological process indicators for compliance with initial scientific developments	UO-1 - interview, UO-2 - colloquium, PR-4 – abstract	Exam Questions 28-76 Pr-1 - final test
			able to use standard and develop new methods of engineering calculations of technological parameters and equipment of biotechnological industries; analyze the performance of the technological process for compliance with the original scientific developments		
			owns the skills of using standard and developing new methods of engineering calculations of technological parameters and equipment of biotechnological industries; skills in analyzing technological process indicators for compliance with initial scientific developments		

Typical control tasks, methodological materials that determine the procedures for assessing knowledge, skills and (or) experience, as well as criteria and indicators necessary for assessing knowledge, skills, and characterizing the stages of formation of competencies in the process of mastering an educational program are presented in the Appendix 2.

V. LIST OF TRAINING LITERATURE AND INFORMATION AND METHODOLOGICAL SUPPORT OF DISCIPLINE

Main literature

(electronic and print editions)

1. Biotechnology of combined foods based on dairy and microbiological raw materials: method. directions to the lab. works for students special. 240902 "Food biotechnology" of all forms of education / comp. N.V. Xitun, E.S. Fishchenko. Biotechnology of dairy production, Vladivostok: Publishing house of the Pacific Economic University, 2009. - 96 p. (8 copies). http://lib.dvfu.ru:8080/lib/item?id=chamo:357087&theme=FEFU

2. Visual biotechnology and genetic engineering / R. Schmid; trans. with him. A. A. Vinogradova, A. A. Sinyushina. Moscow: BINOM. Laboratory of Knowledge, 2014 .-- 324 p. (10 copies) http://lib.dvfu.ru:8080/lib/item?id=chamo:797469&theme=FEFU

3. The basic principles of processing raw materials of plant, animal, microbiological origin and fish: method. directions for students special. 240902 "Food biotechnology" of all forms of education / comp. E.V. Makarova, Vladivostok: Publishing House of the Pacific Economic University, 2009. - 80 p. (10 copies) http://lib.dvfu.ru:8080/lib/item?id=chamo:356130&theme=FEFU

Additional literature

(electronic and print editions)

1. Golubtsova, Yu.V. Biotechnology of food raw materials and food [Electronic resource]: study guide / Yu.V. Golubtsova, O.V. Krieger, A.Yu. Prosekov. - The electron. Dan. - Kemerovo: KemSU, 2017 .-- 111 p. - Access Mode: https://e.lanbook.com/book/103935

2. Evstigneeva, T.N. Biotechnological basis for the processing of food raw materials [Electronic resource]: teaching aid / T.N. Evstigneeva, E.P. Suchkova. -

The electron. Dan. - St. Petersburg: NRU ITMO, 2017 .-- 57 p. - Access Mode: https://e.lanbook.com/book/110436

3. Kim, I.N. Food safety of aquatic biological resources and products of their processing [Electronic resource]: study guide / I.N. Kim, A.A. Kushniruk, G.N. Kim under the editorship of Kim I.N .. - Electron. Dan. - St. Petersburg: Doe, 2017 .-- 752 p. - Access Mode: https://e.lanbook.com/book/93693

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VI. METHODOLOGICAL INSTRUCTIONS FOR THE DEVELOPMENT OF THE DISCIPLINE

The theoretical part of the discipline "Biotechnology of plants and animals" is revealed at the lecture classes, as a lecture is the main form of training, where the teacher gives the basic concepts of the discipline.

The sequence of presentation of the material at the lecture classes is aimed at forming an indicative basis for students for the subsequent assimilation of the material during independent work.

In practical exercises during discussions at seminars and in discussing essays, students learn to analyze and predict the development of biotechnology in various applications as a science, and reveal its scientific and social problems.

Practical classes of the course are held in all sections of the curriculum. Practical work is aimed at developing students' independent research work skills. During practical classes, the student performs a set of tasks that allows you to consolidate lecture material on the topic under study, to obtain basic skills in various fields of biotechnology. The active consolidation of theoretical knowledge is facilitated by the discussion of the problematic aspects of the discipline in the form of a seminar and practical exercises. At the same time, the skills of independent research activity are developed in the process of working with scientific literature, periodicals, the formation of the ability to defend one's point of view reasonably, listen to others, answer questions, and lead a discussion.

When writing essays, it is recommended that you independently find the literature for it. The abstract reveals the content of the investigated problem. Work on the essay helps to deepen understanding of individual issues of the course, to form and defend your point of view, to acquire and improve independent creative work skills, to conduct active cognitive work.

The main types of independent work of undergraduates is work with literary sources and guidelines for the study of agricultural and food biotechnology, Internet resources for a deeper familiarization with individual problems of biotechnology. The results of the work are drawn up in the form of abstracts or

reports with subsequent discussion. Topics of essays correspond to the main sections of the course.

To conduct ongoing monitoring and intermediate certification, several oral interviews and test-control works are carried out.

VII. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE

Logistical support for the implementation of the discipline includes classrooms for lectures and practical exercises, equipped with multimedia equipment, and corresponding to sanitary and fire safety standards.

Logistics discipline

Name of equipped premises	List of main equipment
Laboratory of General Food Biotechnology Vladivostok, Russian Island, 10 Ajax, Building 25.1, aud. M 311. The classroom for lectures, practical and laboratory classes, group and individual consultations, ongoing monitoring and interim certification.	Training furniture for 25 jobs. Teacher's place (table, chair). Analytical and technological equipment (M311): Milk centrifuge with heating ЦЛМ 1-12; Liquid thermostat LOIP Lt-208a, volume 8l, 120x150 / 200mm; Analyzer of milk quality Lactan 1-4 mod. 230; PH-millivolmeter with tripod pH-150MI; VSP 1.5-2-3T scales; Refrigerator "Ocean-RFD-325B"; Drying cabinet, stainless steel chamber. steel, 58l; electric stove 111CH 101-226589; PE-6110 magnetic stirrer with heating; VNZh-0,3-KhS3 viscometer (d-1.41) glass capillary; Tripod PE-2710 lab. for burettes. Multimedia equipment: Monoblock Lenovo C360G-i34164G500UDK; Screen with electric 236 * 147 cm Trim Screen Line; DLP projector, 3000 ANSI Lm, WXGA 1280x800, 2000: 1 EW330U Mitsubishi; Subsystem of specialized hardware mounts CORSA-2007 Tuarex; Video Switching Subsystem: DVI DXP 44 DVI Pro Extron matrix switcher; Extender DVI over twisted pair DVI 201 Tx / Rx; Subsystem of audio switching and sound reinforcement; ceiling mount speaker SI 3CT LP Extron; Sennheiser EW 122 G3 UHF Microphone Lavalier Radio System with a wireless microphone and receiver; DMP 44 LC Extron digital audio processor; Extron IPL T S4 Network Management Controller; Wireless LANs for students are provided with a system based on 802.11a / b / g / n 2x2 MIMO (2SS) access points.
Ecobiotechnology Laboratory Vladivostok, Russian Island, 10 Ajax, Building 25.1, aud. M120, M122. The classroom for practical and laboratory studies of group and individual	Ecobiotechnology Laboratory M120: Total Organic Carbon Analyzer, model TOC-L Manufacturer 'Shimadzu'; Gas Chromatoss Spectrometer GCMS-QP2010 Ultra; LC-20 Prominece High Performance Liquid Chromatography Module; Monoblock Lenovo C360G-i34164G500UDK; HP Pro 6200 SFF i3 2120 / 2Gb / 500Gb PC, Viewsonic 20 Monitor. Laboratory of Ecobiotechnology M122: Voltammetric Analyzer TA-Labk - set; Monoblock MSI AE1920-093 Atorm D525 / 2G / 250GB; Fume hood LK-1200 ШВП; Centrifuge 5810 R, with accessories (rotor-buckets) for the deposition of fine substances; Drying cabinet

consultations, current monitoring and intermediate certification.	IIIC-80-01; Rotary evaporator, model EV311-V; Vertical electrophoresis chamber CriterionCell, 13.3x8.7 cm 1-2 gels, Bio-R; Thermostat 20L, up to 60 C, TS-1/20.
Independent work	
Computer class Vladivostok, Russian Island, 10 Ajax, Building 25.1, aud. M621. The classroom for lectures, practical classes, group and individual consultations, ongoing monitoring and interim certification.	Computer class. Training furniture for 17 jobs. Teacher's place (table, chair). Monoblock Lenovo C360G-i34164G500UDK 19.5 "Intel Core i3-4160T 4GB DDR3-1600 SODIMM (1x4GB) 500GB Windows Seven Enterprise - 17 pcs; Wired LAN - Cisco 800 series; Wireless LAN for students with a system based on 802.11a / b access points / g / n 2x2 MIMO (2SS).
Reading rooms of the FEFU Scientific Library with open access to the fund (building A - level 10)	Reading room equipment of the FEFU Scientific Library: HP All-in-One 400 All-in-One Monoblock 400 All-in-One 19.5 (1600x900), Core i3-4150T, 4GB DDR3-1600 (1x4GB), 1TB HDD 7200 SATA, DVD +/- RW, GigEth, Wi- Fi, BT, usb kbd / mse, Win7Pro (64-bit) + Win8.1Pro (64-bit), 1-1-1 Wty Internet access speed of 500 Mbps. Workplaces for people with disabilities are equipped with braille displays and printers; equipped with: portable devices for reading flat-printed texts, scanning and reading machines with a video enlarger with the ability to control color spectra; magnifying electronic magnifiers and ultrasonic markers

Приложение 1

МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ
Федеральное государственное автономное образовательное учреждение высшего образования
«Дальневосточный федеральный университет»
(ДВФУ)

ШКОЛА БИОМЕДИЦИНЫ

УЧЕБНО-МЕТОДИЧЕСКОЕ ОБЕСПЕЧЕНИЕ САМОСТОЯТЕЛЬНОЙ РАБОТЫ ОБУЧАЮЩИХСЯ

по дисциплине «Analytical studies of objects in biotechnology / Аналитические исследования объектов в биотехнологии»

Направление подготовки 19.04.01 Биотехнология

магистерская программа «Agri-Food Biotechnology»

Форма подготовки очная

Владивосток
2021

Schedule of independent work on the discipline

№	Date / Deadline	Type of independent work	Estimated time to complete	Form of control
1	12.04.2019 17.05.2019	Preparation of essays	3	Essay, an interview on the subject of the essay
2	24.05.2019	Presentation preparation	2	Presentation, interview on the topic of presentation
3	01.03.2019 29.03.2019	Preparation for the test	3	Test
4	Every week of the semester	Preparation for practical work	10	Practice Report

Students' independent work consists of preparing for practical classes, working on recommended literature, writing reports on the topic of a seminar, preparing presentations, and abstracts.

The teacher offers each student individual and differentiated tasks. Some of them can be carried out in a group (for example, several students can do the preparation of a report and presentation on the same topic, sharing their responsibilities - one prepares the scientific and theoretical part, and the second carries out an analysis of the practice).

Tasks for self-fulfillment

1. On a given topic of a business game, an analysis of the literature on the discipline under study should be carried out. Based on the developed material, a business game should be prepared and presented for discussion.

2. Writing an essay on a topic proposed by the teacher or independently selected by the student and agreed with the teacher.

3. Preparation of presentations using multimedia equipment.

Methodological instructions for the abstract

The goals and objectives of the essay

The essay (from lat. Referto - report, report) is a summary of the problems of a practical or theoretical nature with the formulation of certain conclusions on the subject. A student-selected problem is studied and analyzed based on one or more sources. In contrast to the course project, which is a comprehensive study of the problem, the essay is aimed at analyzing one or more scientific papers.

The objectives of writing an abstract are:

development of students' skills in finding relevant problems of modern legislation;

• development of skills to summarize the material with highlighting only the most significant points necessary to reveal the essence of the problem;

• development of skills to analyze the material studied and formulate their own conclusions on the selected issue in writing, in a scientific, competent language.

The tasks of writing an essay are*:*

- teach the student to convey the opinions of the authors as faithfully as possible, on the basis of which the student writes his essay;
- teach the student to correctly state their position on the problem analyzed in the abstract;
- prepare the student for further participation in scientific - practical conferences, seminars and competitions;
- help the student to determine the topic of interest to him, the further disclosure of which is possible when writing a term paper or diploma;
- to clarify for themselves and state the reasons for their consent (disagreement) with the opinion of one or another author on this issue.

The basic requirements for the content of the essay

The student should use only those materials (scientific articles, monographs, manuals) that are directly related to their chosen topic. Remote reasoning not related to the problem being analyzed is not allowed. The content of the essay

should be specific, only one problem should be investigated (several are allowed, only if they are interconnected). The student must strictly adhere to the logic of presentation (start with the definition and analysis of concepts, go to the problem statement, analyze the ways to solve it and draw the appropriate conclusions). The abstract should end with a conclusion on the topic.

The structure of the essay consists of:

1. The title page;

2. Introduction, where the student formulates the problem to be analyzed and investigated;

3. The main text, which consistently reveals the selected topic. Unlike term paper, the main text of the essay involves a division into 2-3 paragraphs without highlighting the chapters. If necessary, the text of the abstract can be supplemented by illustrations, tables, graphs, but they should not "overload" the text;

4. Conclusions, where the student formulates conclusions made on the basis of the main text.

5. The list of used literature. This list refers to those sources that the student refers to in preparing the essay, as well as others that were studied by him during the preparation of the essay.

The essay is 10-15 pages of typewritten text, but in any case should not exceed 15 pages. Interval - 1.5, font size - 14, margins: left - 3 cm, right - 1.5 cm, upper and lower - 1.5 cm. Pages must be numbered. The indent from the beginning of the line is 1.25 cm.

The order of delivery of the essay and its assessment

Essays are written by students during the semester in the terms set by the teacher in a particular discipline, reported by the student and submitted for discussion. The printed version is given to the teacher, leading the discipline.

Based on the results of the check, the student is given a certain number of points, which is included in the total number of student points scored by him during the semester. When evaluating the essay, the correspondence of the content to the chosen topic, the clarity of the work structure, the ability to work with

scientific literature, the ability to pose a problem and analyze it, the ability to think logically, knowledge of professional terminology, and literacy are taken into account.

Recommended topics and list of essays

1. The scientific basis of biotechnology. Elements that make up biotechnology.

2. Biological agents (cells, microbial monocultures and associations, enzymes, cell and tissue cultures, hybridomas, transgenic organisms).

3. Equipment for the implementation of biotechnological processes and obtaining the final product.

4. Types of fermentation apparatus used in anaerobic and aerobic fermentation processes (surface cultivation, deep, homogeneous flow and periodic).

5. Equipment for the final stage of biotechnological production and obtaining the finished product.

6. A set of methods for monitoring and managing biotechnological processes. Modeling and optimization of processes for obtaining target products.

7. Criteria for assessing the effectiveness of biotechnological processes: producer growth rate, product yield, economic coefficient and unproductive energy costs, energy costs and waste disposal costs.

8. Technological factors affecting the productivity and economics of biotechnological processes.

9. Industrial biosynthesis of protein substances. Features of the industry, current status and development prospects.

10. Substrates of the 1st generation to obtain protein-vitamin concentrates. 2nd generation substrates: hydrocarbons. Substrates of the third generation: features of obtaining unicellular protein on alcohols and natural gas.

11. Microbiological preparation of target products. Amino acids. Substrates and producers.

12. Features of fermentation and control of the process of obtaining amino acids. The technique of isolation and purification of amino acids.

13. Enzyme preparations, especially the preparation, use.

14. Producers and environments. Types of fermentation processes / solid-phase surface and deep. Equipment.

15. The technological cycle and staged process of production of enzymes. Methods of isolation and purification. Application.

16. Immobilized enzymes. Methods of immobilization of enzymes. Adsorption, incorporation into gels, chemical crosslinking and addition.

17. The technique of immobilization. Properties of immobilized enzymes.

18. Features of processes based on immobilized enzymes. Types of reaction apparatus.

19. Processes for obtaining target products based on immobilized enzymes.

20. Biological microdevices. Types of enzyme electrodes. Bioluminescent microanalysis.

Приложение 2

МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ РОССИЙСКОЙ ФЕДЕРАЦИИ
Федеральное государственное автономное образовательное учреждение высшего образования
«Дальневосточный федеральный университет»
(ДВФУ)

ШКОЛА БИОМЕДИЦИНЫ

ФОНД ОЦЕНОЧНЫХ СРЕДСТВ

по дисциплине «Analytical studies of objects in biotechnology / Аналитические исследования объектов в биотехнологии»
Направление подготовки 19.04.01 Биотехнология
магистерская программа «Agri-Food Biotechnology»
Форма подготовки очная

Владивосток
2021

FOS passport

in the discipline "Biotechnology of plants and animals"

Code and wording of competency	Competency Stages	
PK-11 with the ability to provide technological discipline, sanitary and hygienic operation of the enterprise, the maintenance of technological equipment in proper technical condition	Knows	this technological discipline, sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition
	Is able	provide this technological discipline, sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition
	Owns	Skills to ensure this technological discipline, sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition
PK-14 with the ability to use standard and develop new methods of engineering calculations of technological parameters and equipment of biotechnological industries	Knows	standard and new methods of engineering calculations of technological parameters and equipment of biotechnological industries
	Is able	use standard and develop new methods of engineering calculations of technological parameters and equipment of biotechnological industries
	Owns	the skills of using standard and developing new methods of engineering calculations of technological parameters and equipment of biotechnological industries
PK-17 readiness for experimental development of technology and process scaling	Knows	pilot development of technology and process scaling
	Is able	to carry out pilot industrial testing of technology and scaling of processes
	Owns	skills for pilot development of technology and scaling processes
PK-18 with the ability to develop and scientifically substantiate schemes for the optimal integrated certification of biotechnological products	Knows	optimal integrated certification schemes for biotechnological products
	Is able	to develop and scientifically substantiate schemes for the optimal integrated certification of biotechnological products
	Owns	skills of development and scientific substantiation of schemes for the optimal integrated certification of biotechnological products
PK-19 with the ability to analyze technological process indicators for compliance with initial scientific developments	Knows	analysis of technological process indicators for compliance with initial scientific developments
	Is able	analyze the performance of the technological process for compliance with the original scientific developments
	Owns	skills in analyzing technological process indicators for compliance with initial scientific developments

№	Supervised sections / topics of discipline	Codes and stages of formation of competencies		Evaluation Tools	
				current control	intermediate certification
1	Section I. Agricultural Biotechnology	PK-17	knows the essence of pilot development of technology and scaling processes	UO-1 - interview, UO-2 - colloquium, PR-4 – abstract	Exam Questions 1-27 Pr-1 - final test
			able to conduct pilot industrial development of technology and process scaling		
			owns the skills of pilot development of technology and scaling processes		
2	Section II. Biotechnology of animal feed	PK-11; PK-18	knows this technological discipline, sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition; optimal integrated certification schemes for biotechnological products	UO-1 - interview, UO-2 - colloquium, PR-4 – abstract	Exam Questions 77-104 Pr-1 - final test
			able to provide this technological discipline, sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition; to develop and scientifically substantiate schemes for the optimal integrated certification of biotechnological products		
			owns the skills to ensure this technological discipline, the sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition; skills of development and scientific substantiation of		

			schemes for the optimal integrated certification of biotechnological products		
3	Section III. Biotechnology of raw materials of plant origin	PK-14; PK-19	knows standard and new methods of engineering calculations of technological parameters and equipment of biotechnological industries; analysis of technological process indicators for compliance with initial scientific developments	UO-1 - interview, UO-2 - colloquium, PR-4 – abstract	Exam Questions 28-76 Pr-1 - final test
			able to use standard and develop new methods of engineering calculations of technological parameters and equipment of biotechnological industries; analyze the performance of the technological process for compliance with the original scientific developments		
			owns the skills of using standard and developing new methods of engineering calculations of technological parameters and equipment of biotechnological industries; skills in analyzing technological process indicators for compliance with initial scientific developments		

Scale for assessing the level of formation of competencies in the discipline "Biotechnology of plants and animals"

Code and wording of competency	Competency Stages		Criteria	Indicators	Points
PK-11 with the ability to provide technological discipline, sanitary and hygienic operation of the enterprise, the maintenance of technological equipment in proper technical condition	knows (threshold level)	technological discipline, sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition	Knowledge of the basics of the sanitary-hygienic mode of operation of the enterprise, the maintenance of technological equipment in proper technical condition	the ability to give definitions of basic concepts in the organizational and production field; the ability to list and disclose the essence of the norms and rules of the organizational and production area	45-64
	able (advanced)	observe the sanitary-hygienic mode of operation of the enterprise, taking into account the technological features of production, keep the technological equipment in proper technical condition	the ability to comply with the sanitary-hygienic mode of operation of the enterprise, to maintain technological equipment in proper technical condition	the ability to apply the terminological apparatus of the organizational and production field, regulatory documents	65-84
	owns (high)	methods of compliance with the sanitary-hygienic regime of the enterprise	tools, methods and techniques for determining sanitary and hygienic indicators at the enterprise	the ability to use technological equipment on their own, to ensure technological discipline, the sanitary-hygienic regime of the enterprise	85-100
PK-14 with the ability to use standard and develop new methods of engineering calculations of technological parameters and equipment of biotechnological industries	knows (threshold level)	features of standard and new methods of engineering calculations of technological parameters and equipment of biotechnological industries	knowledge of the basic concepts and terminology of methods of engineering calculations of technological parameters and equipment of biotechnological industries	the ability to uncover the essence of methods of engineering calculations of technological parameters and equipment of biotechnological industries	45-64
	able (advanced)	use standard methods of engineering calculations of technological parameters and equipment of biotechnological industries	ability to work with reference books and engineering calculations of technological parameters and equipment of biotechnological industries	the ability to justify and apply the results of engineering calculations of technological parameters and equipment at biotechnological enterprises	65-84
	owns (high)	methods of using standard and new	the ability to understand the	the ability to conduct independently	85-100

		methods of engineering calculations of technological parameters and equipment of biotechnological industries	requirements for the content and sequence of development of methods of engineering calculations of technological parameters and equipment of biotechnological industries	engineering calculations of technological parameters and equipment of biotechnological industries	
PK-17 readiness for experimental development of technology and process scaling	knows (threshold level)	the basics of pilot development of technology and process scaling	knowledge of the basics of industrial technology development and process scaling	the ability to give definitions of basic concepts in the field of pilot development of technology and process scaling; list and disclose the essence of research methods	45-64
	able (advanced)	to carry out pilot industrial development of technology and process scaling	the ability to conduct pilot industrial testing of technology and scaling processes	the ability to apply the terminological apparatus of the biotechnological field and explain the essence of methods in verbal answers to questions and in written works	65-84
	owns (high)	methods of pilot development of technology and process scaling	possession of tools, methods and techniques for pilot development of technology and scaling processes	the ability to work with data on pilot industrial testing of technology and process scaling, conduct independent research and present their results	85-100
PK-18 with the ability to develop and scientifically substantiate schemes for the optimal integrated certification of biotechnological products	knows (threshold level)	the basics of developing schemes for the optimal integrated certification of biotechnological products	knowledge of the basic principles for developing schemes for the optimal integrated certification of biotechnological products	the ability to reveal the essence of the development of schemes for the optimal integrated certification of biotechnological products	45-64
	able (advanced)	draw up and scientifically substantiate schemes for the optimal integrated certification of biotechnological products	the ability to work with library catalogs, the ability to compile and scientifically substantiate schemes for the optimal integrated certification of biotechnological products	ability to formulate tasks in the field of integrated certification of biotechnological products	65-84
	owns (high)	methods and techniques for developing schemes for the optimal integrated certification of	possession of the ability to develop and scientifically substantiate schemes for the optimal integrated	the ability to justify and apply optimal integrated certification schemes for biotechnological products	85-100

		biotechnological products	certification of biotechnological products		
PK-19 with the ability to analyze technological process indicators for compliance with initial scientific developments	knows (threshold level)	features of the analysis of process indicators	knowledge of the basic concepts and terminology of technological process methods	the ability to reveal the essence of the methods of analysis of technological process indicators	45-64
	able (advanced)	analyze the performance of the technological process for compliance with the original scientific developments	the ability to work with tables and reference materials, the ability to apply methods of analysis of technological process indicators and implement them in biotechnological enterprises	the ability to justify and apply the results of the analysis of technological process indicators at enterprises of biotechnological production	65-84
	owns (high)	research methods of technological process indicators for compliance with initial scientific developments	mastery of methods for analyzing technological process indicators for compliance with initial scientific developments	the ability to independently analyze the indicators of the technological process for compliance with the original scientific developments and present their results for discussion	85-100

I. Evaluation tools for intermediate certification

Interim certification includes the student's answer to the questions for the exam and passing the final test.

Student Examination Criteria

Points (rating)	Credit/exam mark (Standart)	Requirements for formed competencies
100-85	Credit / excellent	The student is rated as “excellent” if he has deeply and firmly grasped the program material, sets out comprehensively, consistently, clearly and logically in harmony with him, knows how to closely relate theory to practice, freely copes with tasks, questions and other types of application of knowledge, and does not the answer when modifying tasks, uses monographic material in the answer literature, correctly substantiates the decision, owns versatile skills and techniques for performing practical tasks.
84-75	"Credit" / "good"	The student is rated “good” if he knows the material well, correctly and essentially sets out it, avoiding significant inaccuracies in answering the question, correctly applies theoretical principles when solving practical questions and tasks, and has the necessary skills and techniques for their implementation
74-61	"Credit" / "satisfactory"	A student is rated “satisfactory” if he has knowledge of only the basic material, but has not learned its details, admits inaccuracies,

		insufficiently correct wording, violations of the logical sequence in the presentation of program material, has difficulty in performing practical work.
60-0	“Not credited” / “unsatisfactory”	Grade "unsatisfactory" is given to a student who does not know a significant part of the program material, makes significant mistakes, hesitates, with great difficulty performs practical work. Typically, grades are given to students who cannot continue their studies without additional classes in the relevant discipline.

Questions for the exam

1. Achievements of cell biotechnology in crop production.
2. Directions for using the culture of isolated cells and plant tissues in biotechnology.
3. Components of the main types of culture media used in biotechnology.
4. The main stages in the history of the development of the method of culture of isolated cells and tissues of plants.
5. Obtaining and using a culture of cell suspensions.
6. Cell selection and its capabilities.
7. Biotechnological methods that accelerate the selection process.
8. Characterization of the main stages of clonal micropropagation of plants.
9. Methods that allow for interspecific hybridization of plants.
10. Hormones and their role in the reproductive function of animals.
11. Transgenosis, its main stages and features when receiving various types of transgenic animals.
12. Methods for detecting the integration of a foreign gene into a DNA molecule. Features of its inheritance in transgenic animals.
13. Limitations on the use of recombinant microorganisms and lines of genetically engineered animal cells in obtaining valuable biologically active substances for medical and technological purposes.
14. Advantages of transgenic animals compared with recombinant microorganisms and mammalian cell lines in obtaining pharmacologically valuable substances.
15. Participation and use of biochemical processes in biotechnology.

16. Differences between the gene of prokaryotic and eukaryotic cells.
17. Classification of amino acids and their activation.
18. Protein biosynthesis and its regulation at the genetic level.
19. Methods of immobilization of enzymes. Why are enzymes immobilized?
20. Mechanisms of intracellular regulation of metabolism.
21. The essence of the concept of gene regulation of biochemical reactions.
22. The essence of biochemical regulation of the formation of crop production quality.
23. Application of genetic engineering methods to improve the nutritional value of plant proteins.
24. The practical importance of biochemical and genetic engineering.
25. The practical use of enzymes in production and medicine.
26. The producers of enzymes. Purpose, directions of use, examples.
27. The essence of the deep and surface methods of cultivation of microorganisms.
28. The main types of plant materials, its classification.
29. Biochemical processes that occur in plant materials during storage.
30. Factors of influence on the quality of juicy plant materials during its storage.
31. Morphological and chemical composition of parts of grain crops.
32. Physico-chemical indicators of the quality of flour.
33. Methods of water treatment. Characteristic. Destination
34. Substances related to enzymes. Definition, purpose.
35. Classification of enzymes by type of catalyzed reaction.
36. The main features of enzymes. Examples characterizing the role of enzymes in the production and storage of food products.
37. Factors of influence on the speed of biochemical processes.
38. The essence of various types of energy metabolism of microorganisms.
39. Factors of regulation of the metabolism of microorganisms.
40. The role of microorganisms in food technology.
41. Factors affecting the process of soaking grain. Add grain.
42. Changes in barley grain during germination.

43. Processes that occur when drying malt.

44. Obtaining potato starch.

45. Modified starches. Views. Characteristic. Application.

46. The essence of various methods of hydrolysis of starch. Characteristic. Features

47. Types of molasses. Receiving.

48. Glucose-fructose syrups. Receiving.

49. Raw materials used in the production of beer. Characteristic.

50. Properties of hops and hop products in beer production.

51. The role of enzyme preparations in the production of beer.

52. Biochemical processes in the raw material during mashing.

53. The difference between the processes of fermentation of beer must and beer fermentation.

54. Indicators of differences in beers. Characteristic.

55. Description of the raw materials used in the production of kvass.

56. Quality indicators of kvass. Characteristic.

57. The difference between fermentation kvass and carbonated kvass.

58. Preparation of starchy raw materials for processing in the production of ethyl alcohol. The essence of the process.

59. Processes for the cooking of starch-containing raw materials. Their essence.

60. 3. The essence of the process of fermentation of wort in the production of alcohol.

61. Barda. Concept, characteristic, use.

62. Stages of development of baker's yeast. Their characteristic.

63. Factors affecting the vital activity of yeast.

64. The components that make up the nutrient medium for growing yeast.

65. Methods for the production of yeast. The main stages of the technological process of production of yeast.

66. Stages of cultivation of seed yeast. Their characteristic.

67. Cultivation of marketable yeast. Equipment used for growing.

68. Factors affecting the safety of dried yeast.

69. Features of drying of yeast in dryers of various designs.

70. Raw materials used in the production of bread. Characteristic.

71. The essence of ripening flour. The processes that occur during ripening.

72. Processes during the fermentation of the dough. Their influence on the quality of bread.

73. Processes that occur when baking bread.

74. Quality indicators of bread. Their characteristic.

75. Microorganisms used in the production of citric and lactic acids. Characteristic.

76. The main operations of the technological process for the production of citric acid.

77. Characterization of milk proteins (structure, functions, properties).

78. The structure and structure of the natural shell of the fat ball.

79. Factors affecting the stability of the shells of fat globules of milk.

80. Characteristics of milk carbohydrates (structure, functions, properties).

81. Characterization of the mineral composition of milk. The role of minerals of milk in the stability of the colloidal system of milk.

82. The role of milk enzymes in the production of dairy products.

83. The essence of the buffering properties of milk.

84. The bactericidal properties of milk. Factors of dependence of the duration of the bactericidal phase.

85. Defects of milk. Classification, essence, characteristic.

86. Causes of spoilage of milk. Measures to prevent the appearance of defects in milk.

87. Modes of intermediate storage of milk. Methods for cleaning milk from mechanical and microbiological impurities.

88. Bactofuging as a way of cleaning milk from microbiological contaminants. Process characteristic.

89. Factors affecting the effectiveness of the separation of milk fat from milk by separation.

90. Pasteurization of milk and dairy products. The essence of the process, parameters, characteristics.

91. Modes of pasteurization of raw milk in the production of various dairy products. Their rationale.

92. Comparative characteristics of various methods of sterilization of milk raw materials.

93. Product research for compliance with industrial sterility requirements.

94. Changes in the components of milk during its heat treatment.

95. Physical and chemical methods of inactivation of microflora in milk raw materials.

96. Characterization of various types of milk sugar fermentation.

97. The essence of acid coagulation of milk proteins.

98. The essence of rennet coagulation of milk proteins.

99. Properties of protein clots obtained by various methods of coagulation.

100. Characterization of various meat tissues. Distinctive features of their structure, composition, properties.

101. Basic physical and chemical properties of meat.

102. The process of ripening meat. Essence, characteristic.

103. Changes in meat during its maturation.

104. Characterization of offal and endocrine-enzyme raw materials.

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Final test

VARIANT 1

1. What science is associated with the development of genetic engineering?

a) molecular biology;

b) physics;

c) biotechnology.

2. The result of alcoholic fermentation is formed:

a) butanol;

b) ethanol;

c) acetone.

3. What microorganisms cause acetobutyl fermentation?

a) spore-forming bacteria clostridium;

b) yeast;

c) mycelial fungi.

4. What enzyme helps bond the adhered sticky ends of fragments of different DNA?

a) DNA ligase;

b) restrictase;

c) polymerase.

5. Where is the hybridization of the studied nucleic acid with a DNA probe?

a) in solution;

b) in a gel;

c) on nitrocellulose.

6. What is the name of the DNA doubling process?

a) replication;

b) denaturation;

c) duplication.

7. What method is used to increase the frequency of DNA penetration into cells, which consists in a brief exposure of cells in an intense electric field?

a) a method for closing a DNA fragment of interest;

b) copying DNA fragments;

c) electroporation method.

8. What is the main advantage of enzymatic bioconversion of steroids over chemical transformation?

a) in the selectivity of exposure to certain functional groups of the steroid;

b) to reduce the time of the process;

c) in obtaining fundamentally new compounds.

9. What is limited to the immobilization of individual enzymes?

a) high lability of the enzyme;

b) the presence of an enzyme coenzyme;

c) affiliation of the enzyme to hydrolases.

10. Immobilization of producer cells is advisable if the target product:

a) soluble in water;

b) localized within the cells;

c) it is the biomass of cells.

11. Alcoholic fermentation is caused by:

a) yeast;

b) bacteria;

c) yeast and bacteria.

VARIANT 2

1. What kind of fermentation is caused by bacteria of the Lactobacteriaceae family?

a) alcohol fermentation;

b) butyric acid fermentation;

c) lactic acid fermentation.

2. What is the name of a DNA molecule that can transfer foreign DNA of any origin into a cell and ensure its reproduction there?

a) vector;

b) a plasmid;

c) DNA of viruses.

3. What enzyme inactivates and destroys foreign DNA that has fallen into cells in nature?

a) ligase;

b) methylase;

c) restriction enzyme.

4. What elements are monomers of nucleic acid molecules?

a) only nucleotides;

b) only nitrogenous bases;

c) nitrogenous bases and phosphoric acids.

5. What is achieved by increasing the yield of the target product during biotransformation of the steroid?

a) with increasing temperature of fermentation;

b) with increasing intensity of mixing;

c) with an increase in the concentration of steroid substrate in the fermentation medium.

6. The desired protein product is localized within the immobilized cell. To achieve its selection, without violating the system, you can:

a) attaching to the protein a leader sequence from an external protein;

b) increasing the rate of protein synthesis;

c) weakening the barrier functions of the membrane.

7. How should a column bioreactor for immobilizing whole cells differ from a reactor for immobilizing enzymes?

a) the form of particles of an insoluble carrier;

b) faster movement of the solvent;

c) the removal of gases.

8. Why is ligase enzyme used in genetic engineering?

a) it fastens the vector with the membrane of the host cell;

b) catalyzes the incorporation of a vector into the chromosome of host cells;

c) catalyzes the covalent binding of the carbohydrate - phosphorus chain of a DNA gene to vector DNA.

9. What method is used as the main method of genomics?

a) microscopy;

b) sequencing;

c) spectral analysis.

10. What is the name of the cells in which the vector carries the gene sewn into it?

a) donors;

b) recipients;

c) target cells.

11. In what year was the birth of genetic engineering?

a) 1971;

b) 1972;

c) 1973.

VARIANT 3

1. DNA in a eukaryotic cell contains:

a) only the core;

b) only the core and chromoplasts;

c) the nucleus of mitochondria, chloroplasts.

2. What test is used to ensure that cells of grown colonies on tetracycline medium do contain recombinant DNA molecules?

a) "spot test";

b) “test-test”;

c) “in vitro test”.

3. What are the restriction enzyme substrates used by the genetic engineer?

a) homopolysaccharides;

b) proteins;

c) nucleic acids.

4. What is the reason for the economic advantage of biotechnological production, based on immobilized biological objects, over traditional?

a) cheaper raw materials;

b) repeated use of the biological object;

c) acceleration of the production process.

5. What method achieves controlled fermentation during biosynthesis?

a) periodic;

b) continuous;

c) semi-periodic.

6. One of the advantages of microorganisms as bioobjects is:

a) small size;

b) the "simplicity" of the organization of the genome;

c) high prevalence.

7. What are the components of nucleic acids?

a) nucleotides;

b) nitrogenous bases;

c) peptosis.

8. What are transgenic plants?

a) hybrids;

b) plants that “transplanted” the genes of other organisms;

c) hybrids with a modified set of genes.

9. What explains the search for new restriction enzymes for use in genetic engineering?

a) differences in catalytic activity;

b) the specificity of the species;

c) different places of influence on the substrate.

10. RNA in a eukaryotic cell contains:

a) only the core;

b) only ribosomes;

c) ribosomes and nucleus.

11. What is the treatment of vector DNA restriction in order to reduce the frequency of spontaneous formation of ring molecules of vector DNA?

a) phosphotase;

b) galactosidase;

c) ligase.

VARIANT 4

1. For what purposes is a "marker gene" in genetic engineering necessary?

a) to increase the stability of the vector;

b) for the selection of colonies formed by cells into which the vector has penetrated;

c) to incorporate the vector into the host cells.

2. Retroinhibition of the final product in the biosynthesis of biologically active substances is the suppression of:

a) all enzymes in the metabolic chain;

b) the last enzyme of the metabolic chain;

c) the initial enzyme in the metabolic chain.

3. What complex does the term "multienzyme complex" mean?

a) enzymes that catalyze the synthesis of a primary or secondary metabolite;

b) exo- and endoproteases;

c) enzymes of cell membranes.

4. Microorganisms that tolerate cold are called:

a) mesophiles;

b) thermophiles;

c) psychrophiles.

5. What is the raw material for ethanol production in Russia?

a) rice;

b) reed molasses;

c) beet molasses.

6. What is the most important function of RNA?

a) participation in the process of protein synthesis;

b) determination of specificity and transfer of units of heredity;

c) transport.

7. What is cloning?

a) the exact reproduction of an object;

b) a method for producing several identical organisms by asexual (including vegetative) reproduction;

c) the technology used to obtain a genetic copy of an adult animal.

8. What plants are the creatures of the "third wave" of genetically modified plants?

a) plants resistant to viruses;

b) oilseeds with a high content and a changed composition of oils, fruits, vegetables with a high content of vitamins, more nutritious cereals;

c) plants - vaccines, plants - bioreactors, plants - drug factories.

9. What is a feature of peptide tissue growth factors?

a) tissue specificity;

b) species specificity;

c) transformational activity.

10. What explains the search for new restriction enzymes for use in genetic engineering?

a) differences in catalytic activity;

b) different places of influence on the substrate;

c) high cost.

11. What molecule is assembled by polyketide synthesis?

a) tetracycline;

b) streptomycin;

c) cyclosporin.

VARIANT 5

1. What is the complex component of the nutrient medium that dramatically increases the productivity of fermentation in the case of penicillin?

a) cotton flour;

b) soy flour;

c) corn extract.

2. What method can be used to monitor the formation of protoplasts from microbial cells?

a) colorimetry;

b) phase contrast microscopy;

c) spectral analysis.

3. Why is sprouted grain (malt) added to starch raw materials?

a) for the hydrolytic breakdown of starch to glucose;

b) to improve palatability;

c) for the purity of the product.

4. What is the most important function of DNA?

a) ribosomal (forms ribosomes, collects proteins);

b) informational;

c) determination of specificity and transfer of units of heredity.

5. What bacterium is associated with the birth and formation of genetic engineering of plants?

a) a bacterium isolated from a tumor of grapes in 1897 - Agrobacterium tumefaciens (Pseudomonadaceae);

b) E. coli E. coli;

c) the ground bacteria Bacillus thuringiensis.

6. What is the reason for using ligase enzyme in genetic engineering?

a) this enzyme fastens the vector with the membrane of the host cell;

b) it catalyzes the incorporation of a vector into the chromosome of the host cells;

c) it catalyzes the covalent binding of the carbohydrate-phosphorus chain of a DNA gene to vector DNA.

7. What allows you to control the design of the necessary genes by genetic and cellular engineering methods?

a) the structure of the genome;

b) the heredity and vital activity of plants, animals, microorganisms;

c) the mechanism of expression of the genome.

8. What explains the successes of genetic engineering in creating recombinant proteins over recombinant antibiotics?

a) a simpler structure of proteins;

b) the difficulty of selecting host cells for the biosynthesis of antibiotics;

c) a large number of structural genes included in the biosynthesis of antibiotics.

9. The precursor of penicillin, which dramatically increased its yield when added to the medium:

a) phenylacetic acid;

b) beta-dimethylcysteine;

c) valine.

10. When is the precursor added during penicillin biosynthesis?

a) every day during the 5-day process;

b) at the beginning of fermentation;

c) on the second - third day after the start of fermentation.

11. Compared to plant and animal cells, microorganisms:

a) reproduce faster;

b) reproduce more slowly;

c) the breeding rate is average.

VARIANT 6

1. Under what conditions is it possible to combine the genomes of cells of different species and genera during somatic hybridization?

a) only in natural conditions;

b) only in artificial conditions;

c) with the development of the pathological process.

2. What is the name of the total chromosome material?

a) genetic material;

b) chromosome material;

c) chromatin.

3. Where is the vast majority of DNA concentrated?

a) in the core;

b) in the cytoplasm;

c) in mitochondria.

4. With what is direct transfer of foreign DNA into protoplasts possible?

a) microinjection;

b) transformation;

c) packaging in liposomes.

5. What is the reason for using ligase enzyme in genetic engineering?

a) fastens the vector with the membrane of the host cell;

b) catalyzes the closure of peptide bridges in the peptidoglycan of the cell wall;

c) catalyzes the covalent binding of the carbohydrate-phosphorus chain of a DNA gene to a DNA vector.

6. The advantage of plant materials obtained by growing cell cultures over raw materials obtained from plantation or wild plants is:

a) standard;

b) a large concentration of the target product;

c) easier extraction of the target product.

7. Auxins - a term under which specific growth stimulants are combined:

a) plant tissue;

b) acinomycetes;

c) animal tissues.

8. Lighter adaptability to the environment have:

a) plant cells;

b) animal cells;

c) microbes.

9. What contributes to the polyethylene glycol (PEG) introduced into the suspension of protoplasts?

a) prevents their merger;

b) contributes to their merger;

c) increases the stability of the suspension.

10. In which phase are suspension cultures most suitable for protoplasty?

a) in the logarithmic phase;

b) in the phase of accelerated growth;

c) in the phase of slow growth.

11. What is the name of the central thread of which each chromosome consists?

a) chromoneme;

b) chromomeres;

c) chromatin.

VARIANT 7

1. What is the name of the additional small DNA rings, the presence of which is not necessary?

a) chromatide;

b) plasmids;

c) nucleotide.

2. What enzyme is used for “violent” conversion of molecules with “sticky” ends?

a) transferase;

b) isomerase;

c) ligase.

3. What function do transferases perform?

a) catalysis of redox reactions;

b) catalysis of reactions of addition by double bonds;

c) catalysis of reactions of the transfer of functional groups to a substrate.

4. What is signal transduction?

a) initiation of protein synthesis;

b) isolation of lytic enzymes;

c) signal transmission from the cell membrane to the genome.

5. What elements are targets for physical and chemical mutagens in the cell of a biological object?

a) DNA;

b) a ribosome;

c) informational RNA.

6. What elements are units of heredity in living organisms?

a) genes;

b) DNA;

c) chromosomes.

7. What element is the foreign gene introduced into when generating transgenic organisms?

a) in the sperm;

b) into the egg;

c) into a somatic cell.

8. Which bacterium was the first to be genetically engineered?

a) E. coli;

b) S. cerevisiae;

c) B. subtilis.

9. The constant presence of strains of destructors in aeration tanks is ineffective; periodic introduction of their commercial preparations is caused by:

a) a weak rate of their reproduction;

b) the loss of plasmids, where the genes of oxidative enzymes are localized;

c) safety issues.

10. What makes a plasmid-based vector preferable to a phage DNA-based vector?

a) the absence of lysis of the host cell;

b) less toxicity;

c) a higher switching frequency.

11. What is a target?

a) a functional group of a macromolecule;

b) an intermediate target inside the cell;

c) the final intracellular target.

VARIANT 8

1. Which scientist discovered microorganisms and introduced the concept of a bioobject?

a) D. Watson;

b) F. Senger;

c) L. Pasteur.

2. What is a “gene marker" for?

a) incorporating the vector into host cells;

b) selection of colonies formed by cells into which the vector penetrates;

c) increasing the competence of the cell.

3. What explains the search for new restriction enzymes for use in genetic engineering?

a) differences in catalytic activity;

b) lability;

c) different places of influence on the substrate.

4. What restriction enzymes are used to produce DNA fragments?

a) restrictase;

b) nucleases;

c) polymerase.

5. What makes a plasmid-based vector preferable to a phage DNA-based vector?

a) large size;

b) less toxicity;

c) the absence of lysis of the host cell.

6. What is the principle of crosslinking of DNA ends with the restrictase ligase method?

a) dumb - dumb;

b) dull - sticky;

c) sticky - sticky.

7. What elements are pre-treated with bacterial cells, with the aim of competent perception of recombinant DNA?

a) potassium or silver ions;

b) calcium or rubidium ions;

c) sodium or cobalt ions.

8. At what stages of the process is the isolation and purification of biosynthesis and organic synthesis products have fundamental differences?

a) at first;

b) on the final;

c) at all.

9. Why is it necessary to activate an insoluble carrier in case of enzyme immobilization?

a) to increase the activity of the enzyme;

b) to enhance the inclusion of the enzyme in the gel;

c) for the formation of covalent bonds.

10. What period of development of biotechnology refers to the use of alcoholic fermentation in the production of beer and wine?

a) pre-paster;

b) new and latest biotechnology;

c) controlled biosynthesis.

11. In what year was the first recombinant DNA obtained?

a) in 1953 F. Sengerm;

b) in 1972 by P. Berg;

c) in 1963 by M. Nirenberg.

II. Evaluation tools for ongoing certification

Evaluation Criteria

- 100-86 points are awarded to the student if the student expressed his opinion on the formulated problem, argued for it, accurately determining its content and components. The data of domestic and foreign literature, statistical information, and regulatory information are presented. The student knows and possesses the skill of independent research work on the topic of research; methods and techniques of analysis of theoretical and / or practical aspects of the study area. There are no factual errors related to understanding the problem; graphically, the work is framed correctly

- 85-76 - points - the work is characterized by semantic integrity, coherence and sequence of presentation; no more than 1 mistake was made in explaining the meaning or content of the problem. For argumentation, data from domestic and foreign authors are given. Demonstrated research skills. There are no actual errors related to understanding the problem. One or two errors in the design of the work

- 75-61 points - the student conducts a fairly independent analysis of the main stages and semantic components of the problem; understands the basic foundations and theoretical justification of the chosen topic. The main sources on this topic were brought. No more than 2 errors were made in the meaning or content of the problem, the design of the work

- 60-50 points - if the work is a retransmitted or completely rewritten source text without any comments, analysis. The structure and theoretical component of the topic is not disclosed. Three or more than three errors were made in the semantic content of the problem being revealed and in the design of the work.

Questions for colloquiums, interviews
in the discipline "Biotechnology of plants and animals**"**

Section I. "Agricultural Biotechnology"

1. Biochemical processes in biotechnology.

2. Cellular and tissue biotechnology in breeding and crop production.

3. Biotechnology in animal husbandry.

Section II. "Biotechnology of raw materials of animal origin"

1. Nutritional aspects of biotechnology. Getting food protein.

2. Biotechnology of products from raw materials of animal origin. Getting dairy products.

3. Biotechnological processes in the production of meat products.

Section III. "Biotechnology of raw materials of plant origin"

1. Biotechnology of products from raw materials of plant origin. Biotechnological processes of baking.

2. Biotechnological processes in canning.

3. Biotechnological processes of fermentation plants.

Evaluation Criteria

- 100-86 points are awarded to the student, if the student knows and is fluent in the material, expressed his opinion on the formulated problem, argued for it. For preparation, the student uses not only lecture material, but also additional domestic and foreign literature.

- 85-76 - points - the work is characterized by semantic integrity, coherence and sequence of presentation. There are no actual errors related to understanding the problem.

- 75-61 points - the student understands the basic foundations and theoretical justification of the topic. The main sources on this topic were brought.

- 60-50 points - if the answer is a retransmitted source text, without any comments, analysis. Three or more than three errors were made in the semantic content of the topic.