МИНИСТЕРСТВО НАУКИ И ВЫСШЕГО ОБРАЗОВАНИЯ
РОССИЙСКОЙФЕДЕРАЦИИ
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

«Information research in biotechnology / Информационные исследования в биотехнологии»
Направление подготовки 19.04.01 «Биотехнология»
Магистерская программа «Agri-Food Biotechnology»
Форма подготовки очная

Школа биомедицины
Департамент пищевых наук и технологий
Курс 2, семестр 4
Лекции –_9__ час.
Практические занятия –_18__ час.
Лабораторные работы –___ час.
Самостоятельная работа – _45__ час.
Всего часов –_108__ час.
Всего часов аудиторной нагрузки – __45__ час.
Контрольные работы – __-
Зачет – __ семестр
Экзамен – _4_ семестр

Учебно-методический комплекс составлен в соответствии с требованиями образовательного стандарта, самостоятельно устанавливаемого «ДВФУ» по направлению подготовки 19.04.01 «Биотехнология», принятый решением Ученого совета ДВФУ, протокол № 06-15 от 04.06.2015, и введенный в действие приказом ректора ДВФУ от 07.07.2015 № 12-13-1282 (с изменениями утвержденными приказом ректора ДВФУ от 06.09.2016 № 12-13-1594).

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

Директор Департамента пищевых наук и технологий Ю.В. Приходько
Составитель: Ким Е.М.

ANNOTATION
of the educational complex of discipline
«Information research in biotechnology / Информационные исследования в биотехнологии»
Direction of preparation: 19.04.01 Biotechnology
Educational program: "Agri-Food Biotechnology"

The educational-methodical complex of the discipline «Information research in biotechnology / Информационные исследования в биотехнологии» was developed for 2nd year students in the direction 19.04.01 "Biotechnology" master's program "Agri-Food Biotechnology" in accordance with the requirements of the Federal Educational Standards in this area and the regulation on educational-methodical complexes of the disciplines of educational programs of higher professional education (approved by order of the acting rector of the FEFU dated 04/17/2012 No. 12-13-87).

The discipline «Information research in biotechnology / Информационные исследования в биотехнологии» is included in the basic part of the curriculum.

The total complexity of mastering the discipline is 108 hours. The curriculum includes lecture classes (9 hours), laboratory classes (0 hours), practical classes (18 hours), independent work of the student (45 hours). The discipline is implemented in the 2nd year in the 4th semester.

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

- methods of bioinformatics to solve the problems of molecular biology, molecular genetics, cell biology, biomedicine, pharmacology, ecology;
- databanks of primary sequences and structures of biological macromolecules;
- bibliographic databases;
- bioinformation programs for the analysis of biological data;
- algorithms for computer analysis of genomics and proteomics;
- programs predicting the spatial structure of biopolymers.

The discipline «Information research in biotechnology / Информационные исследования в биотехнологии» is logically and meaningfully connected with

such courses as "Research Methods in Biotechnology", "Methodology of Scientific Research in Biotechnology", "Modern Trends in the Development of Biotechnology".

The discipline is aimed at the formation of cultural and 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
РОССИЙСКОЙФЕДЕРАЦИИ
Федеральное государственное автономное образовательное учреждение высшего образования
«Дальневосточный федеральный университет»
(ДВФУ)

ШКОЛА БИОМЕДИЦИНЫ

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«12» июля 2018 г.

«УТВЕРЖДАЮ»
Директор Департамента
пищевых наук и технологий
_____ Ю.В. Приходько
(подпись) (Ф.И.О.)
«12» июля 2018 г.

РАБОЧАЯ ПРОГРАММА УЧЕБНОЙ ДИСЦИПЛИНЫ
«Information research in biotechnology / Информационные исследования в биотехнологии»
Направление подготовки 19.04.01 Биотехнология
Магистерская программа «Agri-Food Biotechnology»
Форма подготовки очная

курс 2____ семестр __4_____
лекции __9_ час.
практические занятия__18_____час.
лабораторные работы_____час.
в том числе с использованием МАО лек.__4___/пр._8___/лаб._____ час.
всего часов аудиторной нагрузки___45___ час.
в том числе с использованием МАО __12___ час.
самостоятельная работа ____63_____ час.
в том числе на подготовку к экзамену ___27___ час.
контрольные работы (количество)
курсовая работа / курсовой проект ___-_____ семестр
зачет _____ семестр
экзамен___4_____семестр

Рабочая программа составлена в соответствии с требованиями образовательного стандарта, самостоятельно устанавливаемого ДВФУ, утвержденного приказом ректора от18.02.2016 №12-13-235. Рабочая программа обсуждена на заседании кафедры биотехнологии и функционального питания, протокол № 1 от «11» июля 2018 г.

Директор департамента д.т.н., профессор Ю.В. Приходько
Составитель (ли): Ким Е.М.

Оборотная сторона титульного листа РПУД

I. Рабочая программа пересмотрена на заседании кафедры:

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

Заведующий кафедрой _____ Т.К. Каленик
(подпись) (И.О. Фамилия)

II. Рабочая программа пересмотрена на заседании кафедры:

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

Заведующий кафедрой _____ Т.К. Каленик
(подпись) (И.О. Фамилия)

ABSTRACT

Master's degree in 19.04.01 Biotechnology

Master's Program «Agrofood biotechnology».

Course title: «Information research in biotechnology / Информационные исследования в биотехнологии»

Basic part of Block B1, 3 credits

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

- the ability to use modern information methods and computer technologies in professional activities;
- possession of modern scientific achievements in the field of molecular biology, proteomics and genomics;
- mastering the practical skills of using computer technology to process experimental data on the structure of biological macromolecules in order to obtain biologically important information;
- ability to use knowledge and representations of biochemistry, molecular biology, genetics, methods of applied mathematics, statistics and informatics in agro biotechnological research;
- the ability to apply experimental and calculated data of physical-chemical biology, genomics and proteomics in professional activities.

Learning outcomes:

GC-8 -ability to abstract thinking, analysis, synthesis;

GPC-4-readiness to use methods of mathematical modeling of materials and technological processes, readiness for theoretical analysis and experimental testing of hypotheses;

GPC-5- the ability to use modern information technologies for the collection, processing and dissemination of scientific information in the field of biotechnology and related industries, the ability to use databases, software products and resources of the information and telecommunications network "Internet" (the "Internet" network) for solving problems;

Course description: The subject of bioinformatics. The purpose, objectives and methods of bioinformatics. Infrastructure of bioinformatics. Database. Methods of bioinformatics data analysis. Sequence comparison. Methods for determining the spatial structure of biopolymers. Actual problems of bioinformatics. Bioinformatics and biotechnology.

Main course literature:

1. Lesk A. Introduction to bioinformatics. A. Lesk; trans. with English. - M .: BINOM. Laboratory knowledge, 2015. - 318 pp.
http://lib.dvfu.ru:8080/search/query?term_1=%D0%9B%D0%B5%D1%81%D0

%BA+%D0%92%D0%B2%D0%B5%D0%B4%D0%B5%D0%BD%D0%B8%D0%B5+%D0%B2+%D0%B1%D0%B8%D0%BE%D0%B8%D0%BD%D1%84%D0%BE%D1%80%D0%BC%D0%B0%D1%82%D0%B8%D0%BA%D1%83&theme=FEFU

2. Bioorganic chemistry: study guide / D. G. Knorre, T. S. Godovikova, S. D. Myzina [and others]; Novosibirsk National Research State University, Faculty of Natural Sciences. Novosibirsk: Due to Novosibirsk University, 2011. - 480 p. (5 copies) http://lib.dvfu.ru:8080/lib/item?id=chamo:679690&theme=FEFU

Form of final knowledge control: *exam*

Annotation to the wor k program of the discipline

«Information research in biotechnology / Информационные исследования в биотехнологии»

The course «Information research in biotechnology / Информационные исследования в биотехнологии» is included in block B1.B.1. and relates to its basic part of the direction of preparation 19.04.01 "Biotechnology" of the master's program "Agri-Food Biotechnology". Discipline is one of the main in the fundamental training of masters in this field and is logically and meaningfully connected with such courses as “Research Methods in Biotechnology”, “Methodology of Scientific Research in Biotechnology”, “Modern Trends in the Development of Biotechnology”. The total complexity of 108 hours, contact work 45 hours, including lectures 9 hours, practical classes 18 hours, control of independent work 18 hours; independent work 36 hours, preparation for the exam 27 hours

The purpose of the discipline is to provide students with basic information about the content and capabilities of bioinformatics - a science aimed at analyzing, using appropriate computational methodologies, the results of numerous experimental studies in molecular biology, biochemistry, genetics, virology, etc., and application of information biology methods to solving fundamental and applied problems. agri-food biotechnology.

Objectives of the discipline are**:**

- To form knowledge systems about the content and possibilities of bioinformatics, the possibilities of applying bioinformatics methods to solving fundamental and applied problems of molecular biology, molecular genetics, cell biology, biomedicine, pharmacology, ecology and the problems that arise at the junction of these sciences with mathematics and computer science;
- Get skills in working with data banks of primary sequences and structures of biological macromolecules, actively use bibliographic databases, navigate in bioinformation programs for biological data analysis;
- To study algorithms for computer analysis of genomics and proteomics data, programs that allow to predict the spatial structure of biopolymers;
- To study the existing methodological techniques and approaches used when working with biological databases,
- To master the skills of predicting the basic physicochemical and biological properties of the analyzed nucleotide sequences and the products determined by them, and also to predict their potential functions.

To successfully master the discipline “Bioinformatics”, the following preliminary competencies should be formed in students:

• the ability to use modern information methods and computer technology in professional activities;

• knowledge of modern scientific achievements in the field of molecular biology, proteomics and genomics;

• possession of practical skills in using computer technology to process experimental data on the structure of biological macromolecules in order to obtain biologically important information;

• the ability to use the knowledge and ideas of biochemistry, molecular biology, genetics, methods of applied mathematics, statistics and computer science in agrobiotechnological research;

• the ability to apply experimental and calculated data of physical and chemical biology, genomics and proteomics in professional activities.

As a result of studying this discipline, students form the following general cultural / general professional / professional competencies (elements of competencies).

Code and wording of competency	**Competency Stages**	
OK -8 ability to abstract thinking, analysis, synthesis	Knows	Goals and objectives of bioinformatics, bioinformation analysis methods, computer data analysis algorithms
	Is able	-Select and organize information on the spatial structure of the sequences of macromolecules of biopolymers - Avoid the automatic application of standard techniques in solving theoretical and practical problems - Analyze solutions to research and practical problems and evaluate the implementation of these options - Predict the physicochemical and biological properties of the analyzed nucleotide sequences.
	Owns	- Skills in the collection, processing, analysis and systematization of information on the structure of biopolymers - Skills in the selection of methods and means of solving problems in the field of molecular biology, genomics and proteomics.

OPK-4 readiness to use methods of mathematical modeling of materials and technological processes, readiness for theoretical analysis and experimental testing of hypotheses	Knows	-Modern methods of mathematical modeling technological processes -Modern principles and approaches to modeling biological materials -Methodic techniques and approaches used when working with biological databases
	Is able	-Apply the knowledge and ideas of biochemistry, molecular biology, genetics, methods of applied mathematics, statistics and computer science for the analysis and experimental testing of hypotheses -Use the methods of mathematical modeling to create new biological materials for the development of biotechnological processes
	Owns	-Modern scientific achievements in the field of molecular biology, proteomics and genetics, - The skills of using computer technology to process experimental data in order to obtain biological information
OPK -5 the ability to use modern information technologies for the collection, processing and dissemination of scientific information in the field of biotechnology and related industries, the ability to use databases, software products and resources of the information and telecommunication network "Internet" (hereinafter referred to as the "Internet" network) for solving problems	Knows	-Modern information technologies for the collection, processing of scientific information -Database -Program products and Internet resources for solving scientific and production problems
	Is able	-Use computer technology to collect, process and disseminate scientific information in the field of biotechnology and related industries -Work with software products of the Internet -Use databases for scientific work, for predicting the functions of biopolymer macromolecules

	Owns	-Modern information technologies for the collection, processing and dissemination of scientific information in the field of biotechnology, - Skills when working with databases of primary sequences and structures of macromolecules - Skills in organizing the collection, processing and storage of scientific information in related fields of biotechnology
PK -16 the ability to carry out the effective work of means of control, automation and automated production management, chemical-technical, biochemical and microbiological control	Knows	rules for the implementation of the effective operation of controls, automation and automated production management, chemical-technical, biochemical and microbiological control
	Is able	to carry out the effective work of controls, automation and automated production management, chemical-technical, biochemical and microbiological control
	Owns	the principles and practice of implementing the effective operation of controls, automation and automated production management, chemical-technical, biochemical and microbiological control

For the formation of the above competencies within the framework of the Bioinformatics discipline, interactive forms of training are used, which are _12_ hours and include: a lecture-conference, problem lectures, discussion, creative tasks, and the small group method.

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

Section 1. Topic: The subject of bioinformatics (2 hours).

Lecture 1. Goals, objectives and methods of bioinformatics, main applications (2 hours)

Lecture plan:

1. Define bioinformatics.

2. What date can be considered the date of the release of bioinformatics in a separate scientific field?

3. What are the specific features of bioinformation data?

4. What is sequencing and what role does sequencing play in bioinformatics?

5. Where are bioinformation data stored?

6. What are the three components of the subject of bioinformatics?

7. What are the goals of bioinformatics?

8. What are the challenges facing bioinformatics?

9. In what types of activities is the subject of bioinformatics implemented?

10. What role does the analysis of homologous sequences play in decoding biological information?

11. Actual problems of bioinformatics.

Section 2. Bioinformatics infrastructure (2 hours).

Lecture 1. Topic: Databases (2 hours).

Lecture plan:

1.Internet for bioinformatics.

2. Methods for presenting sequence information.

3. Fundamentals of database structures: records, fields, objects.

4. Recording formats FASTA, BLAST, GenBank, PDB.

5. Classification of databases: archival, automatic, curated.

6. Main databases: GenBank, EMBL, SwissProt, PIR, TrEMBL, PDB, banks of protein families, genetic banks, metabolic databases, specialized databases.

7. Search for homologous sequences in databases.

Section 3. Methods of bioinformation analysis (4 hours).

Lecture 1. Topic: Comparison of sequences (3 hours).

Conference lecture

Students' presentations on the following topics:

1. Genomic information.

2. Genetic maps and genome mapping.

3. The main types of DNA markers used in genome mapping.

4. Determination of nucleotide sequences, DNA sequencing.

5. Determination of the sequence of the clone.

6. Use of EST sequences.

7. Methods of analysis of multiple gene expression.

8. Sequencing of proteins.

9. Analysis of protein expression by two-dimensional phoresis in a polyacrylamide gel.

10. Global sequence alignment.

11. Local alignment of sequences.

12. Multiple sequence alignment.

13. A measure of the similarity of biological sequences.

14. Distances of Hamming and Levenstein.

15. Editing operations.

16. The weight of editing operations.

17. Types of fines for deletions.

Lecture 2. Methods for determining the spatial structure of biopolymers (1 h).

Discussion - discussion of the following issues:

1. PDB record structure

2. Analysis of structural features

3. Modeling

4. Prediction of the secondary and tertiary structure of proteins by homology

5. Prediction of DNA helix parameters

6. Dynamic programming and dynamic RNA models

7. Search for RNA with a given structure

8. Genes of prokaryotes and eukaryotes. What is the difference between the organization of the prokaryotic genome compared to eukaryotes?

Section 4. Actual problems of bioinformatics (2 hours).

Lecture 1. Bioinformatics / Bioinformatics and biotechnology (1 h).

Lecture Plan:

1. Genome annotations, gene search, search for replication sites in the human genome.

2. Prediction of the structure, function and cellular localization of proteins.

2. Medical and chemo informatics.

3. Pharmacoinformatics.

4. Computer toxicology and immunoinformatics.

II. STRUCTURE AND CONTENT OF THE PRACTICAL PART OF THE COURSE (18 H)

PRACTICAL WORK №1 MEANS OF WORK WITH DATA BANKS I (ENTREZ) (2 H)

PRACTICAL WORK №2 MEANS OF WORK WITH DATA BANKS II (SRS) (2 H)

PRACTICAL WORK №3 GENEBEE SERVICE. SWISSPROT MAIN RECORDING FIELDS (2 HOURS)

PRACTICAL WORK №4 SEARCH FOR HOMOLOGUES (INTERPRETATION OF RESULTS, COMPARISON OF ALGORITHMS, DEPENDENCE ON PARAMETERS) (2 H)

PRACTICAL WORK №5 CONSTRUCTION OF ALIGNMENTS, RECONSTRUCTION OF PHYLOGENETIC TREES (COMPARISON OF LOCAL AND GLOBAL ALIGNMENTS, THE DEPENDENCE OF ALIGNMENT ON PARAMETERS, ESTIMATION OF STATISTICAL SIGNIFICANCE) (2 HOURS).

PRACTICAL WORK №6 WORK WITH THE BANK OF SPATIAL STRUCTURES PDB (2 HOURS)

PRACTICAL WORK №7 STRUCTURES OF PROTEINS (RASMOL, SWISSPDBVIEWER). WORK WITH THE RASMOL I MACROMOLECULE VISUALIZATION PROGRAM (2 HOURS).

PRACTICAL WORK №8 ANNOTATION OF THE SEQUENCE (SEARCH FOR PROTEIN-CODING REGIONS, SEARCH FOR FUNCTIONAL SITES) (2 HOURS)

PRACTICAL WORK № 9 SECONDARY STRUCTURES OF RNA (2 H)

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

Educational and methodological support for students' independent work in the discipline «Information research in biotechnology / Информационные исследования в биотехнологии» 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 1. The subject of bioinformatics.	OK-8; OPK-4; PK-16	Knows the goals, objectives and methods of bioinformatics	seminar, survey,	Exam Questions 1-5 Final test app 2
			Able to use bioinformatics methods to solve scientific and applied problems of agri-food biotechnology	creative assignment, test	
			Possesses actual problems of bioinformatics	seminar, practical assignment, abstract	
2	Section 2. Bioinformatics infrastructure.	OK-8; OPK-5; PK-16	Knows databases of GenBank, EMBL, SwissProt, PIR, TrEMBL, PDB	homework, seminar,	Exam Questions 6-12 Final test Appendix 2
			Able to use recording formats FASTA, BLAST, GenBank, PDB.	control work, abstract	
			Owns ways to provide sequence information	seminar, practical task	
3	Section 3. Methods of bioinformation analysis.	OK-8; OPK-4; OPK-5; PK-16	Knows methods of bioinformation analysis	test items seminar	Credit Questions 13-33 Final test app 2
			Able to predict the structure,	interview, test tasks	

			function and cellular localization of proteins		
			has skills in applying bioinformation analysis methods	creative task, essay	
4.	Section 4. Actual problems of bioinformatics.	OK-8; OPK-4; PK-16	Knows the actual problems of bioinformatics	seminar, report	Exam Questions 33-46 Final test app 2
			Able to identify and systematize the main problems of bioinformatics	seminar, report	
			has skills in identifying and solving bioinformatics problems	discussion, homework	

Typical control and 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 Appendix 2.

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

Main literature

(electronic and print editions)

1. Lesk A. Introduction to bioinformatics. / A. Lesk; trans. from English - M .: BINOMIAL. Laboratory knowledge, 2015 .-- 318 p. (10 copies) http://lib.dvfu.ru:8080/search/query?term_1=%D0%9B%D0%B5%D1%81%D0 %BA+%D0%92%D0%B2%D0% B5% D0% B4% D0% B5% D0% BD% D0% B8% D0% B5 +% D0% B2 +% D0% B1% D0% B8% D0% BE% D0% B8% D0% BD% D1% 84% D0% BE% D1% 80% D0% BC% D0% B0% D1% 82%

D0% B8% D0% BA% D1% 83 & theme = FEFU

2. Bioorganic chemistry: a training manual / D. G. Knorre, T. S. Godovikova, S. D. Myzina [et al.]; Novosibirsk National Research State University, Faculty of Natural Sciences. Novosibirsk: University of Novosibirsk, 2011 .-- 480 p. (5 copies) http://lib.dvfu.ru:8080/lib/item?id=chamo:679690&theme=FEFU

Additional literature

(electronic and print editions)

1. Glick B., Pasternak J. Molecular biology. Principles and application: Per. from English / ed. N.K. Yankovsky. - M .: World. 2002 .-- 589 p.

2. Borinskaya S.A., Yankovsky N.K. The structure of prokaryotic genomes. / S.A. Borinskaya, N.K. Yankovsky // Molecular Biology.- 1999.V. 33. No. 6.

3. Gelfand M.S. Computer DNA sequence analysis. / M.S. Gelfand // Molecular Biology. - 1998.V. 32.P.-103-120.

4. Sverdlov E.D. Microcosm of the genome./E.D. Sverdlov // Molecular Biology. - 1999.V. 33. No. 6.

5.Frolova L.L. Databases of nucleotide sequences Genbank / EMBL / DDBJ. Abstract arcA gene E. coli K12: Textbook for the course "Bioinformatics / Bioinformatics" / L. L. Frolova, A. Ya. Khidiyatullina, A.S. Kuzmin; Kazan. state un-t - Kazan: Kazan publishing house. state Univ., 2007. -45 p.

6. Kuznetsov, Vl.V. Molecular genetic and biochemical methods in modern plant biology [Electronic resource] / Vl. V. Kuznetsov, V.V. Kuznetsov, G.A. Romanov. - M.: BINOM, Laboratory of Knowledge. 2012 .-- 487 p. http://e.Ianbook.com/view/book/8803/page425/ EB "Doe"

7.Lashin S.A. Electronic lecture course "Information Technologies and Programming Languages"

http://kib.nsu.ru/?page_id=2837

8.Kolchanov N.A., Lashin S.A. Electronic lecture course "Introduction to Information Biology"

http://kib.nsu.ru/?page_id=2837

9.Ogurtsov A.N. The basics of bioinformatics. Kharkov: NTU "KhPI", 2013. 400 p. 10.Ogurtsov A.N. Alignment of protein sequences. Kharkov: NTU "KhPI", 2015. 80 pp .: [Electronic document] https://sites.google.com/site/anogurtsov/lectures/bi).

11.Nefedova L.N. The use of molecular research methods in genetics: Textbook / L. N. Nefedova. - M.: SIC Infra-M, 2012 .-- 104 p. http://znanium.com/bookread.php?book=302262 EBS "Znanium"

12.Kudinov Yu.I., Pashchenko F.F. Fundamentals of modern computer science: Textbook. 2nd ed., Rev. [Electronic resource] St. Petersburg: Publishing House "Lan", 2011. - 256 p.

The list of resources of the information and telecommunication network "Internet"

1. http://www.bibliotech.ru/ Electronic library system BiblioTech.
2. http://book.ru Electronic-library system BOOK.ru
3. http://elibrary.ru Scientific electronic library eLIBRARY.RU
4. http://www.scholar.ru/ Scientific electronic library - dissertations, abstracts and scientific articles.
5. http://www.ict.edu.ru/lib/ ICT portal. Information and communication technologies in education.
6. http://bio-x.ru/ Internet portal for biotechnology
7. http://www.biotechnolog.ru/ Biotechnology website
8. NSU. Digital Library http://libra.nsu.ru/catalogue/;
9. NSU. Scientific Electronic Library http://libra.nsu.ru/scientificres/
10. The electronic library system "Doe" http://e.lanbook.com/ http://e.lanbook.com/view/book/2024/page1/ EB "Lan"

List of information technology and software

1.http: //www.ncbi.nlm.nih.gov/BLAST
2.http: //www.genome.jp/tools/clustalw/
3.http: //www.ncbi.nlm.nih.gov/Entrez
4. http://www.expasy.org/ Expasy
5. http://www.drive5.com/muscle/
6.http: //evolution.genetics.washington.edu/phylip.html
7. Entrez cross-database search page - http://www.ncbi.nlm.nih.gov
8. Bioinformation resources for genomics and proteomics - http://www.expasy.org
9. Biological banks and databases -
10. http://www.nsu.ru/education/i4biol/noframes/reviewdb.html
11. Programs for the analysis of polynucleotide and polypeptide sequences - http://blast.ncbi.nlm.nih.gov
12. Multiple alignment programs - www.genome.jp/tools/clustalw/
13. Forum on molecular biology - http://molecularstation.com/
14. Unipro UGENE: [Electronic document] (http://ugene.unipro.ru/ru).

15. Institute of Bioinformatics: [Electronic document] (http://bioinformaticsinstitute.ru/).
16. Handbook of bioinformatics
http://www.cellbiol.ru/book/bioinformatika

VI. METHODOLOGICAL INSTRUCTIONS FOR THE DEVELOPMENT OF THE DISCIPLINE

The presentation of theoretical material is made in the format of lectures. The theoretical information obtained in this way is fixed in practical classes, when discussing the theoretical topic proposed by the teacher. At the beginning of each lecture, 15 minutes are allocated to check the assimilation of the material of the previous lesson and answers to students' questions. After the presentation of new material, another 15 minutes are devoted to questions on a new topic studied, tasks for independent work are sorted out. To consult on training material and assignments, email is intensively used. Mandatory independent work with literature, a regular review of publications and materials on the discipline in the periodical press and on the Internet are provided. Current control consists in testing the student's knowledge based on the results of practical classes. To verify the mastery of theoretical material, colloquiums and tests are provided. As an intermediate control at the end of the semester of the study of the discipline, the curriculum provides an exam, which is carried out orally. The exam student must answer two questions of the exam ticket on subjects of the discipline and answer additional questions of the teacher.

Independent work is carried out in order to deepen knowledge of the discipline and provides for: - reading by students of the recommended literature and assimilation of the theoretical material of the discipline; - preparation for practical exercises, oral interviews and tests; - work with Internet sources; - preparation for passing practical work, passing the exam. It is best for students to plan the time for independent work necessary to study this discipline for the whole semester, while ensuring regular repetition of the material covered. The material outlined in the lectures should be regularly supplemented with information from literary sources presented in the work program of the discipline “Bioinformatics”. For each of the topics for self-study, given in the work program of the discipline, you should first read the recommended literature and, if necessary, draw up a brief summary of the main provisions, terms, and information requiring memorization and which are fundamental in this topic and for the development of the subsequent sections of the course. Work with lecture notes - review the notes immediately after class, note the lecture notes, which cause difficulties for understanding. Try to find answers to difficult questions using recommended literature. If you yourself could not understand the material, formulate questions and seek help from a teacher at a consultation or the next lecture. Regularly take time to repeat the material covered, checking your knowledge, abilities and skills on control questions.

VII. MATERIAL AND TECHNICAL SUPPORT OF DISCIPLINE

В данном разделе приводятся сведения о материально-техническом обеспечении дисциплины (с указанием наименования приборов и оборудования, компьютеров, учебно-наглядных пособий, аудиовизуальных средств; аудиторий, специальных помещений), необходимом для осуществления образовательного процесса по дисциплине.

Лаборатория общей биотехнологии пищевых продуктов: г. Владивосток, о. Русский п. Аякс д.10, Корпус 25.1, ауд. М 311. Учебная аудитория для проведения занятий лекционного типа, практических и лабораторных занятий, групповых и индивидуальных консультаций, текущего контроля и промежуточной аттестации.

Учебная мебель на 25 рабочих мест, Место преподавателя (стол, стул),

Аналитическое и технологическое оборудование (М311): Центрифуга молочная с нагревом ЦЛМ 1-12; Термостат жидкостный LOIP Lt-208a, объем 8л, 120х150/200мм; 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.

Computer class: Vladivostok, about. Russian Ajax d.10, Building 25.1, aud. M612. The classroom for lectures, practical classes, group and individual consultations, ongoing monitoring and interim certification. Training furniture for 22 workplaces, Teacher's place (table, chair), Monoblock HP ProOne 400 G1 AiO 19.5 "Intel Core i3-4160T 4GB DDR3-1600 SODIMM (1x4GB) 500GB Windows Seven Enterprise - 22 pieces; Wired LAN - Cisco 800 series; Wireless LAN for students is provided with a system based on 802.11a / b / g / n 2x2 MIMO (2SS) access points.

For independent work of students are used:

computer class Vladivostok, about. Russian p. Ajax 10, Building 25.1, aud. M621. The classroom for lectures, practical classes, group and individual consultations, ongoing monitoring and interim certification. Training furniture for 17 workplaces, 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.

Licensed software installed on PC

Name of the software package	Version	Purpose
Microsoft Office 2010 Professional Plus	14.0.6029.1000	Office package
7-Zip	9.20.00.0	Educational software package
Abbyy FineReader 11	11.0.460	Educational software package
Adobe Acrobat XI Pro	11.0.00	Educational software package

Приложение 1

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

ШКОЛА БИОМЕДИЦИНЫ

УЧЕБНО-МЕТОДИЧЕСКОЕ ОБЕСПЕЧЕНИЕ САМОСТОЯТЕЛЬНОЙ РАБОТЫ ОБУЧАЮЩИХСЯ

по дисциплине «Bioinformatics

Направление подготовки

19.04.01 Биотехнология

профиль «Agri-Food Biotechnology»

Форма подготовки очная

Владивосток
2021

Schedule of independent work on the discipline

№	Type of independent work	Date / Deadline	Estimated time to complete	Form of control
1	Issue of essays	24th week	15	Exam
2	Предоставление плана (оглавление)	25th week		Exam
3	Составление библиографии по заданной теме	26th week		Exam
4	Подготовка доклада	27-28th week	6	Exam
5	Подготовка к контрольной работе	29th week	4	Exam
6	Конспектирование монографий	30th week	2	Exam
7	Тестирование	31st-32nd week	5	Exam
8	Защита рефератов	33rd week	4	Exam

Recommendations for independent work of students

The review of educational and scientific literature involves an in-depth study of individual scientific works, which should ensure the development of the necessary skills for working on a book. All this will contribute to expanding the scientific horizons, increasing their theoretical training, the formation of scientific competence.

For abstracting, textbooks, individual monographic studies and articles on issues provided for in the curriculum are offered. When selecting literature on the selected issue, it is necessary to cover the most important areas of development of this science at the present stage. Particular attention should be paid to those literary sources that (directly or indirectly) can assist a specialist in his practical activities. However, this section also includes works and individual studies on issues that go beyond the studied discipline. This literature is recommended to be used if you want to expand your knowledge in any branch of science.

Along with the literature on general issues for undergraduates, literature is supposed to be taken into account independently of the profile of their professional activity. Not all of the proposed literature is equivalent in content and volume, so a different approach to its study is possible. In one case, this may be a general review of several literary sources of various authors devoted to the consideration of the same issue, in the other case, a detailed study and review of one of the recommended works or even its individual sections, depending on the degree of

complexity of the issue (issue). In order to decide what to do in each case, you should consult with the teacher.

The choice of a specific work for abstracting should be preceded by a detailed familiarization with the list of all literature given in the curriculum of the discipline. It is recommended that you first familiarize yourself with the selected work by looking at the subheadings, selected texts, diagrams, tables, general conclusions. Then it is necessary to carefully and thoughtfully (delving into the ideas and methods of the author) read it, making notes along the way on a separate sheet of paper about the main points and key issues. After reading, you should consider the content of the article or a separate chapter, paragraph (if it is a monograph) and write it down briefly. Literally, only strict definitions, formulations of laws should be written out. It is sometimes useful to include one or two examples in a record to illustrate. In the event that there are strange places, it is recommended to read the subsequent statement, as it can help to understand the previous material, and then return again to understanding the previous statement.

The result of work on literary sources is an abstract.

An essay (from Latin refer to - to report, to report) - a statement of the essence of any issue. An abstract (or public report) is usually called a report on a given topic from certain sources; a detailed retelling of the contents of the book or of a number of sources for information on new literature. Although the semantic meaning of the word "abstract" is intertwined with the word "report", the abstract is a higher form of creative work of the student. Preparation for the essay requires a deep knowledge of the methodological and scientific and practical aspects of the studied problem and question, the ability to analyze them in detail.

In preparing the essay, it is necessary to highlight the most important theoretical points and justify them independently, paying attention not only to the result, but also to the methodology used in studying the problem. Reading non-fiction should be critical. Therefore, we must strive not only to master the main content, but also the method of proof, to reveal the features of different points of view on the same issue, to evaluate the practical and theoretical significance of the results of the abstracted work. A very desirable element of the essay is the expression by the listener of his own attitude to the ideas and conclusions of the author, supported by certain arguments (personal experience, statements of other researchers, etc.).

Essays of monographs, journal articles of a research nature must certainly contain, as already mentioned above, a definition of the problem and specific tasks

of the study, a description of the methods used by the author, as well as those conclusions that he came to as a result of the study. The proposed abstracting literature is constantly updated.

Recommended topics and list of essays

1. Generation and reception of information.
2. Features of genetic information.
3. Bioinformation data, networks and bases.
4. NCBI and services
5. Recording formats Fasta, Genbank, PDB
6. EMBL
7. Swiss-PDBviewer
8. Design of primers for PCR.
9. The human genome and post-genomic projects.
10. Genomic fingerprinting.
11. Blasting of nucleic acid and protein sequences.
12. The use of domains to predict the structure and function of proteins.
13. Methods for predicting 3 D protein structure.
14. Molecular phylogeny as a means of studying the evolutionary relationships between species.
15. Microerrey as a means of mass analysis of gene expression.
16. The evolution of molecules and organisms.
17. Phylogenetic tree as a mathematical object
18. Evolution models
19. Algorithms for constructing phylogenetic trees.
20. Algorithmic problems of finding the optimal tree, bootstrapping, matching trees
21. Evolution at the genome level.
22. Analysis of population data.
23. DNA sequence statistics
24. DNA statistics as a characteristic of the genome
25. Computational genomics
26. Metabolic reconstruction
27. Positional analysis
28. The evolution of regulatory interactions
29. The evolution of protein families, their share in the genome

Guidelines for preparing for the seminar, practical exercises, individual lessons

The seminar (translated from Latin as "nursery") is one of the forms of classes in any subject. If a lecture lays the foundation for scientific knowledge, gives the student the opportunity to assimilate it in a generalized form, then seminars and laboratory and practical classes deepen, concretize and expand this knowledge, help to master it at a higher level of reproduction and transformation. These forms of the educational process contribute to the consolidation of skills and independent work. The workshop is a group lesson. Its purpose is in-depth study of a particular discipline. It develops students' creative independence, strengthens their interest in science, research, helps to connect scientific and theoretical positions with life, contributing to the development of practical work skills. At the same time, seminars are also a means of monitoring the results of independent work of students, a kind of collective form of summarizing its results. Participation in group classes expands the general, professional and cultural horizons of students. Seminars are a popular form of organizing the educational process, however, preparing for them is the most difficult type of independent work for students. Each seminar lesson is the result of a large purposeful independent work of students on the instructions of the teacher. The reports and speeches of future specialists summarize the results of independent observations and the work carried out by them on educational and additional literature. The great educational and developmental significance of seminars is that they teach students to operate freely on acquired knowledge, to prove the points put forward in their reports and speeches, to polemicize with friends, to theoretically explain life phenomena. According to the content, the seminars are divided into three main groups: - in one case, their goal is an in-depth study of individual, most important, issues of a particular topic; - in another - the whole topic, if its material does not present great difficulties; - in the third - a generalization of all the material studied on large topics or even sections of the curriculum.

Forms of the workshop. 1. Repeat-generalizing: - generalization and systematization of knowledge and skills on the topic; - discussion; - detailed conversation; - reports; - essays; - a business, situational game. 2. Seminar - the study of new material: - the study of new material, if it is available for independent study by students; - Messages: collective reading of sources; - workshop; - consultations. 3. Workshop - a combination of generalization with the study of new material: - the study of new material based on existing knowledge of the subject, using intersubject communications; - messages; - reports; - essays; - integrated workshop; - consultation.

It should be noted that the seminars are characterized, first of all, by two interconnected features: - independent study by students of program material; - discussion of the results of their subsequent activities. At them, students learn to make independent messages, discuss, defend their judgments. Seminars contribute to the development of cognitive skills, increase the culture of communication. The effectiveness of seminars is determined not only by their skillful choice of topics, but also by the methods of conducting. In the practice of training, seminars were distributed: - solving situational problems; - detailed conversations; - reports; - essays; - commented reading; - a dispute. The seminar is held with the whole group of students. The teacher determines the topic, purpose, objectives of the seminar in advance, plans to conduct it, formulates the main and additional questions on the topic, distributes tasks taking into account the individual capabilities of students and their desires, selects literature, conducts individual and group consultations, checks notes, formulates topics for reports and abstracts . Along with the seminars listed above, where the material is distributed among individual students, it is advisable to conduct those in which special speakers are not allocated. In this case, the right to speak with messages is granted at the request of or upon the call of the teacher. Another construction of the seminars is possible: all students prepare according to a single plan and study the common volume of material for everyone, but some receive additional individual tasks that deepen the content of the questions provided for by the seminar program. Preparing students for group classes requires a lot of work. Therefore, a detailed plan for each seminar should be announced and explained to the students in advance: approximately two to three weeks before it. The theme of the seminar and its plan largely determine the focus of the lesson, the form of its conduct, goals and objectives. It all depends on how they orient students towards independent judgments, raising questions, and finding answers to them. The seminar does not make any sense if students' presentations are reduced to simply retelling textbooks without proper analysis and generalization of the material studied. Reports and presentations at seminars should raise questions, a desire to make a supplement or refutation. The course of discussion of messages at the seminar is directed by the teacher, so that students' attention is not distracted from the main that is determined by his topic. But this in no way precludes the need in some cases to consider at the seminar the acute and exciting issues that arose during the discussion. They have great cognitive and educational significance, although they are not provided for in the lesson plan.

The tasks of the teacher in the preparation and conduct of the seminar: to draw up and explain to the students his plan, to direct their independent work in preparation for the seminar (conducting consultations, checking prepared reports and messages), directing the discussion of the issues raised, and making a

conclusion. Its purpose is to once again emphasize the conditional questions of the topic, to provide comprehensive answers to the questions raised by students, and if they were resolved during the discussion, confirm the solution found. With this construction of each seminar, it will differ in completeness of content. Sample seminars The seminar opens the introductory word of the teacher, which formulates the goals and main tasks of the lesson, gives a brief description of the topic, emphasizes its practical significance. An important role is played by the emotional mood of the teacher. After the opening remarks, those who wish are invited to speak or highlight the first question of the plan. To ensure a collective discussion of the problem raised, it is useful for the group to ask questions: "What additions should be made and why?", "What do you disagree with in the messages of your comrades and why?" etc.

The seminar ends with the teacher's closing remarks, which is an example of analysis and generalization. It is intended to summarize the work of the seminar, clearly formulate the main assessments, indicate the shortcomings, as well as what the speakers did not take into account and what should be paid attention to. To facilitate independent work in preparation for the seminar, the teacher should introduce students to the technique and culture of academic work and prepare methodological developments to help students. Conducting seminars can be an integral part of the lecture-seminar training system, expanding the scope of their application. Any kind of seminar only reaches its goal when the students are carefully prepared. Having ascertained the topic of the seminar, having familiarized with the recommended literature and tasks, the student begins his work in preparation for the seminar: 1) work planning: the volume of literature, the methodology for preparing for the seminar, the deadlines are determined; 2) reading of literature: begins with the main sources (textbook, lecture) and ends with work on additional literature; 3) extracts: are made for each item of the plan, notes of lectures are worked out; 4) a speech plan is drawn up, quotes and abstracts are prepared. The plan helps the student organize his work on the topic, makes his answers more focused, logical, consistent, evidence-based. As noted above, the seminars hear reports and essays. On behalf of the teacher (or desire), students are prepared in advance to act as speakers (co-rapporteurs) on specific issues of the topic. The report identifies three main parts: - introductory, which defines the topic, its methodological essence, structure and content, shows how it is reflected in the writings of scientists; - the main part contains an account of the topic being studied (preferably in a problematic way); - generalizing - conclusion.

The seminar also uses such forms as a dispute, discussion. The meaning of the word "dispute" (lat. Disputare - to reason, disassemble, argue) suggests a high

mental activity of its participants. The debate seminar instills in students the ability to debate, ponder the material discussed, and defend their views and beliefs; express their thoughts concisely and figuratively, learn to deal with erroneous, false views, analyze concepts and arguments, and discover their weakness.

The list of practical work

PRACTICAL WORK №1 MEANS OF WORK WITH DATA BANKS I (ENTREZ) (2 H)

PRACTICAL WORK №2 MEANS OF WORK WITH DATA BANKS II (SRS) (2 H)

PRACTICAL WORK №3 GENEBEE SERVICE. SWISSPROT MAIN RECORDING FIELDS (2 HOURS)

PRACTICAL WORK №4 SEARCH FOR HOMOLOGUES (INTERPRETATION OF RESULTS, COMPARISON OF ALGORITHMS, DEPENDENCE ON PARAMETERS) (2 H)

PRACTICAL WORK №5 CONSTRUCTION OF ALIGNMENTS, RECONSTRUCTION OF PHYLOGENETIC TREES (COMPARISON OF LOCAL AND GLOBAL ALIGNMENTS, THE DEPENDENCE OF ALIGNMENT ON PARAMETERS, ESTIMATION OF STATISTICAL SIGNIFICANCE) (2 HOURS).

PRACTICAL WORK №6 WORK WITH THE BANK OF SPATIAL STRUCTURES PDB (2 HOURS)

PRACTICAL WORK №7 STRUCTURES OF PROTEINS (RASMOL, SWISSPDBVIEWER). WORK WITH THE RASMOL I MACROMOLECULE VISUALIZATION PROGRAM (2 HOURS).

PRACTICAL WORK №8 ANNOTATION OF THE SEQUENCE (SEARCH FOR PROTEIN-CODING REGIONS, SEARCH FOR FUNCTIONAL SITES) (2 HOURS)

PRACTICAL WORK № 9 SECONDARY STRUCTURES OF RNA (2 H)

Recommendations on the implementation of control work

Examination - an independent student work, which contributes to an in-depth study of the material passed. The purpose of the work: - to independently master the material of the discipline, which will be studied in the new semester; - gain special knowledge on a selected topic; - gain skills in working with educational and scientific literature. The main tasks of the work performed:

1) consolidation of previously obtained theoretical knowledge;

2) development of independent work skills;

3) clarification of the student's preparedness for future practical work;

The preparation of the test work should begin with the repetition of the corresponding section of the textbook, study guides on this topic and the lecture notes given earlier. It is not necessary to start work without studying the basic provisions and concepts of science, since in this case the student, as a rule, is poorly oriented in the material, cannot delimit related issues and focus on the main, primary problems of the topic under consideration.

After choosing a topic, it is necessary to carefully study the guidelines for the preparation of the test work, to draw up a work plan, which should include the main issues that cover the whole topic being worked out.

In preparing the work should use the following scientific literature:

- monographs (books devoted to the study of the most significant problematic issues for theoretical and legal science);
- Articles in scientific journals;
- articles and collections of scientific papers;
- articles in collections of abstracts at scientific conferences;
- abstracts and manuscripts of dissertations;
- annotations of monographs of foreign authors in abstract collections.

To search for general scientific and specialized technical literature, you should use:

- subject and systematic catalogs of libraries;
- bibliographic indexes;
- abstract journals;
- indexes published in journals of articles and materials (these indexes are usually placed in the last issue of the journal over the past year).

It is recommended to pay attention to the following scientific journals:

- "Mathematical Biology and Bioinformatics / Bioinformatics"
-"Biotechnology";
- "Computer research and modeling";
-- "Mathematical modeling";
- "Mathematical modeling and numerical methods";
- “Proceedings of the Moscow Institute of Physics and Technology”;
- “International Journal of Experimental Education”;
- “European Journal of Molecular”;
- "Biotechnology";
- "Biotechnologia Acta"

It should also be borne in mind that special “Bibliographies” have been published in this branch of science, which already contain a systematic list of works published over a certain period of time.

Information on such collections can be obtained from bibliographers in educational and scientific funds of libraries.

In addition, it is necessary to use the literature indicated by the authors of scientific works in footnotes on the pages of books (magazines) or in the notes and lists of literature placed at the end of the book (article).

In addition, you can use the resources of the telecommunication network INTERNET.

For all questions a student should seek the advice of a teacher. The deadline for completing the test is determined by the teacher, and it must be passed no later than a week before the exam. Based on the results of the audit, the control work is estimated at 2-5 points. In the case of a negative assessment, the student should familiarize himself with the comments and, having eliminated the shortcomings, re-submit the work for verification.

Test work

1. Define bioinformatics.

2. What date can be considered the date of the release of bioinformatics in a separate scientific field?

3. What are the specific features of bioinformation data?

4. What is sequencing and what role does sequencing play in bioinformatics?

5. Where are bioinformation data stored?

6. What are the three components of the subject of bioinformatics?

7. What are the goals of bioinformatics?

8. What are the challenges facing bioinformatics?

9. In what types of activities is the subject of bioinformatics implemented?

10. What role does the analysis of homologous sequences play in decoding biological information?

METHODOLOGICAL INSTRUCTIONS FOR THE PREPARATION OF THE REPORT

To increase the level of students' independence, to activate cognitive activity, to stimulate a creative approach to solving professional problems. The preparation of reports within the framework of this module is mandatory and involves individual or group work.

Stages of the report:

1. Definition of the topic of the report.

2. The formulation of the problem, setting goals and objectives.

3. Active and independent work on the report; teacher advice; registration of materials.

5. Preparation for the submission of the report.

1 week is allotted for the implementation of the report (training time within the module). The amount of work performed must be at least 5 pages.

The report is considered fully implemented if

1. Providing the full amount of training materials on a pre-approved topic, fully disclosing the stated topic;

2. Providing materials on electronic media and in print.

The completed report must be submitted in electronic and printed form. The work should be arranged accordingly:

- introduction;

- main part;

- conclusion;

- bibliographic list, links to internet resources;

The text is printed on one side of the standard a4 format after one interval, times new roman, 14 pt, red line - 1.25 cm, alignment in width. The size of the left margin is 30 mm, the right margin is 10 mm, the upper and lower margins are 20 mm each. Page numbering begins with the title page, but its page number is not indicated. All other pages are numbered in order, placing the number in the middle of the upper or lower field.

Preparation for defense consists in preparing an electronic and printed version of the report, as well as preparing a speech reflecting the goals and objectives of the work, the main content of the topic of the speech, and the strengths of the work performed. The duration of the performance is no more than 10 minutes.

Speaking with a report involves a student of the group, in front of students and the teacher. After each speech, the participants present at the defense ask questions to clarify some points, to find out how deeply the research topic has been worked out and how effectively. Each work is evaluated: at the same time, each member of the group receives an assessment of their work, the performance on defense is taken into account, and finally, the whole work is evaluated.

Subjects of lectures for the conference lecture

Topic: Sequence Comparison.

1. Genomic information.
2. Genetic maps and genome mapping.
3. The main types of DNA markers used in genome mapping.
4. Determination of nucleotide sequences, DNA sequencing.
5. Determination of the sequence of the clone.
6. Use of EST sequences.
7. Methods of analysis of multiple gene expression.
8. Sequencing of proteins.
9. Analysis of protein expression by two-dimensional phoresis in a polyacrylamide gel.
10. Global sequence alignment.
11. Local alignment of sequences.
12. Multiple sequence alignment.
13. A measure of the similarity of biological sequences.
14. Distances of Hamming and Levenstein.
15. Editing operations.
16. The weight of editing operations.
17. Types of fines for deletions.

Subjects of reports for independent work:

1. Modern methods for studying the primary structure of proteins (determination of N-, C-, terminal amino acids, sequencing).
2. Proteomics: opportunities and prospects.
3. Processing and folding of the synthesized protein, the biological significance of these processes.
4. Proteomics-the leader of science of the XXI century.
5. Phylogenetic trees.
6. Genomics and medicine.
7. The hypothesis of the "molecular clock"
8. Metabolomics and the problem of antibiotic resistance.
9. Genomics and human health.
10. Metagenomics - Extensive genomic information from the environment.

Exam preparation:

This form of SIW can be very diverse in nature, since the offset itself can be different. It is usually held on the basis of the results of the semester before the session in written or oral form, and the teacher can include questions of lectures, practical classes, and questions on independent work. The main difference between an exam and a test is almost always a five-point grading system. Thus, the first one - to pass the exam, it is necessary, first of all, to fulfill all the requirements of the teacher, which requires knowledge of these requirements. The second - you need to find out as early as possible what issues you have to prepare and what are the rules of the procedure itself (is attendance taken into account, do you need to work out missed classes, and if necessary, how, etc.). Practice shows that a good attendance of classes is almost a full guarantee of getting an exam, since then you can be aware of all the requirements of a teacher. Conversely, a large number of passes can complicate the life of even a strong student. In addition, it should be borne in mind that problems can arise with the student's widespread approach to practical exercises, when many work the first months half-heartedly, accumulating arrears in completing essays, practical assignments, abstracts, etc., and before the session they try to do it all in one week. Try to distribute the forces evenly throughout the entire semester distance, and then the test week before the session will not be the most stressful.

Приложение 2

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

ШКОЛА БИОМЕДИЦИНЫ

ФОНД ОЦЕНОЧНЫХ СРЕДСТВ

по дисциплине «Bioinformatics

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

Владивосток
2021

Passport FOS

In the discipline «Information research in biotechnology / Информационные исследования в биотехнологии»

Code and wording of competency	**Competency Stages**	
OK -8 ability to abstract thinking, analysis, synthesis	Knows	Goals and objectives of bioinformatics, bioinformation analysis methods, computer data analysis algorithms
	Is able	-Select and organize information on the spatial structure of the sequences of macromolecules of biopolymers - Avoid the automatic application of standard techniques in solving theoretical and practical problems - Analyze solutions to research and practical problems and evaluate the implementation of these options - Predict the physicochemical and biological properties of the analyzed nucleotide sequences.
	Owns	- Skills in the collection, processing, analysis and systematization of information on the structure of biopolymers - Skills in the selection of methods and means of solving problems in the field of molecular biology, genomics and proteomics.
OPK-4 readiness to use methods of mathematical modeling of materials and technological processes, readiness for theoretical analysis and experimental testing of hypotheses	Knows	-Modern methods of mathematical modeling technological processes -Modern principles and approaches to modeling biological materials -Methodic techniques and approaches used when working with biological databases
	Is able	-Apply the knowledge and ideas of biochemistry, molecular biology, genetics, methods of applied

		mathematics, statistics and computer science for the analysis and experimental testing of hypotheses -Use the methods of mathematical modeling to create new biological materials for the development of biotechnological processes
	Owns	-Modern scientific achievements in the field of molecular biology, proteomics and genetics, - The skills of using computer technology to process experimental data in order to obtain biological information
OPK -5 the ability to use modern information technologies for the collection, processing and dissemination of scientific information in the field of biotechnology and related industries, the ability to use databases, software products and resources of the information and telecommunication network "Internet" (hereinafter referred to as the "Internet" network) for solving problems	Knows	-Modern information technologies for the collection, processing of scientific information -Database -Program products and Internet resources for solving scientific and production problems
	Is able	-Use computer technology to collect, process and disseminate scientific information in the field of biotechnology and related industries -Work with software products of the Internet -Use databases for scientific work, for predicting the functions of biopolymer macromolecules
	Owns	-Modern information technologies for the collection, processing and dissemination of scientific information in the field of biotechnology, - Skills when working with databases of primary sequences and structures of macromolecules - Skills in organizing the collection, processing and storage of scientific information in related fields of biotechnology

PK -16 the ability to carry out the effective work of means of control, automation and automated production management, chemical-technical, biochemical and microbiological control	Knows	rules for the implementation of the effective operation of controls, automation and automated production management, chemical-technical, biochemical and microbiological control
	Is able	to carry out the effective work of controls, automation and automated production management, chemical-technical, biochemical and microbiological control
	Owns	the principles and practice of implementing the effective operation of controls, automation and automated production management, chemical-technical, biochemical and microbiological control

№	Supervised sections / topics of discipline	Codes and stages of formation of competencies		Evaluation Tools	
				current control	intermediate certification
1	Section 1. The subject of bioinformatics.	OK-8; OPK-4; PK-16	Knows the goals, objectives and methods of bioinformatics	seminar, survey,	Exam Questions 1-5 Final test app 2
			Able to use bioinformatics methods to solve scientific and applied problems of agri-food biotechnology	creative assignment, test	
			Possesses actual problems of bioinformatics	seminar, practical assignment, abstract	
2	Section 2. Bioinformatics infrastructure.	OK-8; OPK-5; PK-16	Knows databases of GenBank, EMBL, SwissProt, PIR, TrEMBL, PDB	homework, seminar,	Exam Questions 6-12 Final test Appendix 2
			Able to use recording	control work, abstract	

			formats FASTA, BLAST, GenBank, PDB.		
			Owns ways to provide sequence information	seminar, practical task	
3	Section 3. Methods of bioinformation analysis.	OK-8; OPK-4; OPK-5; PK-16	Knows methods of bioinformation analysis	test items seminar	Credit Questions 13-33 Final test app 2
			Able to predict the structure, function and cellular localization of proteins	interview, test tasks	
			has skills in applying bioinformation analysis methods	creative task, essay	
4.	Section 4. Actual problems of bioinformatics.	OK-8; OPK-4; PK-16	Knows the actual problems of bioinformatics	seminar, report	Exam Questions 33-46 Final test app 2
			Able to identify and systematize the main problems of bioinformatics	seminar, report	
			has skills in identifying and solving bioinformatics problems	discussion, homework	

Scale for assessing the level of competency formation in the discipline «Information research in biotechnology / Информационные исследования в биотехнологии»

Code and wording of competency	Competency Stages		Criteria	Indicators	Points
OK -8 ability to abstract thinking, analysis, synthesis	knows (threshold level)	modern approaches to the creation of technology for new products; -modern principles and approaches to the substantiation of schemes for the optimal integrated certification of biotechnological products -creation of competitive biotechnological products;	-knowledge of the fundamental concepts of bioinformatics;	the ability to define basic concepts and concepts of bioinformatics	61-75
			-knowledge of the main tasks that are solved within bioinformatics; -knowledge of modern information technologies that are used in solving bioinformatics problems.	- the ability to apply information technology in solving specific research problems; -new technologies for creating biotechnological products of a new generation, which were studied and mastered by a graduate student; -the ability to list sources of information on bioinformatics methods;	
	able (advanced)	-scientific justify the scheme of the optimal integrated certification of biotechnological products;	-seek and analyze specialized literature. including using specialized bioinformation data from PubMed and Medline; - be able to conduct a computer analysis of biologically active substances using the results of experimental studies accumulated in databases	- the ability to logically true, reasoned and clearly build your speech - the ability to apply bioinformatics methods for non-standard solution of tasks	75-85

	owns (high)	- basic techniques bioinformation analysis using computer technology for certification of biotechnologic al products methodology of scientific creativity	- mastery of the terminology of bioinformatics; -owning the ability to apply the knowledge of bioinformation analysis for the certification of biotechnological products; - Possession of methods for obtaining, organizing and analyzing data;	- the ability to fluently and accurately apply the terminological apparatus in answering questions and in written works, - the ability to apply knowledge for the analysis and certification of biotechnological products; -the ability to conduct independent research on the creation of technologies for biotechnological products; -represent the results when creating technology for new generation products using local computer data processing tools.	85-100
OPK-4 readiness to use methods of mathematical modeling of materials and technological processes, readiness for theoretical analysis and experimental testing of hypotheses	knows (threshol d level)	technological processes in biotechnology; - indicators of the technological process; -modern directions in biotechnology;	-knowledge of the methods of analysis of the technological process for compliance with the original scientific developments; - knowledge of software for obtaining the results of the analysis of the technological process;	-the ability to navigate in the directions of development of bioinformation analysis; -the ability to list the main goals, tasks of bioinformation analysis for organizing databases of biological sequences and technological processes;	61-75

	able (advanced)	-Evaluate the process in biotechnology on its compliance with the original scientific development; - lead a scientific discussion on the problems of agri-food biotechnology; - navigate in directions biotechnology development; -create a data bank on technological processes and their parameters;	- the ability to evaluate the effectiveness of the process; - ability to apply bioinformation analysis methods; ability to navigate in the areas of biotechnology development; -the ability to create a data bank;	the ability to evaluate the technological process for compliance with the initial scientific developments; -The ability to manage the process; -the ability to organize the process; -the ability to organize a scientific discussion;	75-85
	owns (high)	-modern methods of analysis of technological process indicators; - skills in process control; - the skills of the organization of technological control;	knowledge of modern methods of analysis; skills to draw conclusions and predictions on new technological processes; knowledge of technological control organization skills;	-the ability to apply methods for the analysis of the process; -the ability to apply process control skills; - the ability to apply the skills of organizing technological control;	85-100
OPK -5 the ability to use modern information technologies for the collection, processing and dissemination of scientific information in the field of biotechnology and related	knows (threshold level)	-modern information technologies for the collection, processing of scientific information -Database -program products and Internet resources for	-knowledge of modern information technologies for the collection and processing of scientific information; -know modern databases on the structures of biopolymers;	-the ability to apply information technology to collect and process scientific processing; -the ability to use databases of biopolymers to predict their properties and structure;	61-75

industries, the ability to use databases, software products and resources of the information and telecommunication network "Internet" (hereinafter referred to as the "Internet" network) for solving problems		solving scientific and production problems			
	able (advanced)	-use computer technology to collect, process and disseminate scientific information in the field of biotechnology and related industries -Work with software products of the Internet -Use databases for scientific work, for predicting the functions of biopolymer macromolecules	-the ability to use computer technology to collect and process scientific information; -the ability to work with programs of the Internet; - knows how to predict the functions of macromolecules of biopolymers using computer programs;	-Works with software products of the Internet; - solves the problems of professional activity with the help of computer programs; - Processes scientific data using computer programs.	75-85
	owns (high)	-modern information technologies for the collection, processing and dissemination of scientific information in the field of biotechnology, - skills when working with databases of primary sequences and	- owns information technology in the field of biotechnology; - possesses skills when working with databases of primary sequences and structures of protein, DNA, RNA - owns the skills of collecting, preserving	-Able to quickly organize the collection, processing and storage of scientific information in related branches of biotechnology; -Able to quickly disseminate scientific information from the field of biotechnology; -Able to solve professional	85-100

		structures of macromolecules - the skills of organizing the collection, processing and storage of scientific information in related fields of biotechnology	scientific information	problems at a high scientific level, using software products of the Internet;	
PK -16 the ability to carry out the effective work of means of control, automation and automated production management, chemical-technical, biochemical and microbiological control	knows (threshold level)	rules for the implementation of the effective operation of controls, automation and automated production management, chemical-technical, biochemical and microbiological control	-knowledge of modern information technologies for the collection and processing of scientific information; -know modern databases on the structures of biopolymers;	-the ability to apply information technology to collect and process scientific processing; -the ability to use databases of biopolymers to predict their properties and structure;	61-75
	able (advanced)	to carry out the effective work of controls, automation and automated production management, chemical-technical, biochemical and microbiological control	-the ability to use computer technology to collect and process scientific information; -the ability to work with programs of the Internet; - knows how to predict the functions of macromolecules of biopolymers using computer programs;	-Works with software products of the Internet; - solves the problems of professional activity with the help of computer programs; - Processes scientific data using computer programs.	75-85

	owns (high)	the principles and practice of implementing the effective operation of controls, automation and automated production management, chemical-technical, biochemical and microbiological control	- owns information technology in the field of biotechnology; - possesses skills when working with databases of primary sequences and structures of protein, DNA, RNA - owns the skills of collecting, preserving scientific information	-Able to quickly organize the collection, processing and storage of scientific information in related branches of biotechnology; -Able to quickly disseminate scientific information from the field of biotechnology; -Able to solve professional problems at a high scientific level, using software products of the Internet;	85-100

Guidelines that determine the procedures for assessing the results of mastering the discipline

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 required to evaluate the final test	Credit score	Requirements for completed competencies in the student's oral response
100-85	"excellent"	Grade «Excellent» exhibited to a student who has knowledge of the methods of critical analysis and evaluation of modern scientific achievements, the ability to use modern methods and computational tools to study the structure of biomolecules, knows computer technology for collecting, storing, processing and transmitting chemical information, knows how to use fundamental and applied knowledge sections of disciplines, databases, software packages, choose methods for solving a scientific problem, application of scientific planning skills.
85-75	"good"	formed knowledge, but containing separate gaps in the use of modern methods, and computing tools for studying the structure of biomolecules, computer technologies for collecting, storing, processing and transmitting chemical information, gaps in the use of knowledge of fundamental and applied sections of disciplines, databases, software packages
75-61	"satisfactorily"	general, but not structured knowledge, not the systematic use of modern methods and computing tools, not the full use of computer technology
61-0	"Unsatisfactory"	The assessment is unsatisfactory for a student who has fragmented knowledge of information and computer technologies, modern methods and computational tools for studying the structure of biomolecules, the use of computer technology in the collection, storage, processing, analysis and transfer of chemical information, does not know a significant part of the program material, makes significant mistakes, uncertainly carries out practical work with great difficulties and cannot continue training without additional classes in the relevant discipline.

QUESTIONS FOR THE EXAM

1. Bioinformatics: emergence, goals, objectives, methods.
2. Give the characteristics of the human genome.
3. Name the information technology used in bioinformatics.
4. The main objectives of bioinformatics
5. Information flows in biological self-reproducing systems
6. Databases: classification, fundamentals of structures.
7. Databases of protein sequences.
8. Database of nucleic acid sequences.
9. Databanks of metabolic pathways.
10. Databases containing the results of global experiments on the analysis of expression, proteomics, etc.
11. The main bibliographic databases.
12. NCBI, ENTREZ and BLAST - appointment, tools, tasks
13. Methods of comparison of the primary structures of biopolymer molecules
14. Alignment of two sequences, point matrices.
15. Global and local alignment, weight alignment, matrix of amino acid substitutions.
16. Local alignment, tasks, examples.
17. The dynamic programming algorithm. Optimal sequence alignment. Search Optimization Methods - FASTA, BLAST
18. Dependence of alignment on parameters, statistical significance of alignments
19. Methods of recognition of functional sites in nucleotide sequences
20. Multiple alignment.
21. Programs for the search for multiple alignment. PSI-BLAST.
22. Hidden Markov Models (HMM).
23. Alignment and phylogenetic relationships.
24. Problems of phylogeny of genomic sequences.
25. Clusterization approach to the task of phylogenetic relations
26. Cladistic methods.
27. Tertiary structure of the protein. Folding.
28. Prediction of the tertiary structure of the protein. Modeling homologues. Methods, software, services.
29. Experimental determination of protein structure. Quality assessment of the resulting structure.
30. Prediction of DNA helix parameters.
31. Dynamic RNA models.

32. Search for RNA with a given structure (tRNA, etc., regulatory regions of mRNA).

33. Molecular docking: goal, objectives, approaches, application.

34. Bioinformatics / Bioinformatics and phylogenesis. Molecular watch. Treasure, OTU, branch, leaf, root. Ultrametric and non-parametric tree.

35. Orthologists, paralogs, homologues, xenologists.

36. Horizontal gene transfer and its role in the evolution of genomes.

37. Algorithms for constructing phylogenetic trees

38. Prediction of gene functions.

39. Comparison of genomes

40. Methods for predicting the spatial structures of proteins

41. Methods of modeling the chains of metabolic reactions

42. Algorithms for assembling genomic sequences from fragments

43. Selection of primers for PCR and probes for hybridization. Selection of probes for microchips

44. Genetic data processing algorithm, implementation schemes.

45. Medical genomics, gene diagnostics and gene therapy. Pharmacoinformatics.

46. Computer toxicology and immunoinformatics.

а) ДНК → РНК → белок
б) ДНК ↔ РНК → белок
в) ДНК → РНК ↔ белок
г) РНК → ДНК → белок

FINAL TEST

1. A mutation in which a single base change leaves the amino acid sequence unchanged is called

a) nonsense mutation
b) reverse replacement
c) “silent” mutation
d) misense mutation

2. The basic postulate (central dogma) of molecular biology

a) DNA → RNA → protein
b) DNA ↔ RNA → protein
c) DNA → RNA ↔ protein
d) RNA → DNA → protein

3. The degeneracy of the genetic code is

a) coding with one triplet of only one amino acid

b) coding with one triplet of one or several amino acids
c) coding of one amino acid with several triplets
d) coding with one triplet of different amino acids

4. The universality of the genetic code is
a) coding with one triplet of one or several amino acids
b) coding of one amino acid with several triplets
c) coding of one amino acid with one triplet
d) the presence of a single code for all creatures on Earth

5. For finding conservative regions in a sequence set, it is mainly used
a) multiple alignment
b) local alignment
c) global alignment
d) structural alignment

6. Alignment is:
a) comparison of nucleotide sequences with “sticky ends”
b) comparison of amino acid sequences of proteins along the length
c) comparison of nucleotide sequences in length
d) comparison of sequences in the search for identical series of characters

7. Levenstein distance or “editorial distance” between two lines
a) the minimum number of "editing operations" in order to turn one line into another
b) the maximum number of "editing operations" in order to turn one line into another
c) the minimum number of substitutions of positions in a line in order to turn one line into another
d) the minimum number of inserts in order to turn one row into another

8. PSI-BLAST is a program that
a) allows the analysis of population genetic data
b) carries out phylogenetic analysis using the parsimony method
c) selects data for sequences similar to those requested
d) conducts multiple alignment of nucleotide and amino acid sequences

9. In the hierarchy of protein structures, domains are located ...
a) after the quaternary structure
b) between the secondary and tertiary structures of the monomer
c) there is no such level
d) between the primary and secondary structures of the monomer

10. Which of the following does not apply to the main types of genetic maps
a) genetic linkage maps of genes

b) "band" chromosome schemes
c) DNA sequences
d) contig

11. Contig is
a) a set of overlapping DNA fragments, which together constitute a consensus region of DNA
b) loci with varying numbers of tandem repeats
c) polymorphism of short tandem repeats
d) a short, sequenced portion of DNA localized in a strictly defined region of the genome

12. The process of spontaneous folding of a polypeptide chain into a unique native spatial structure is called
a) splicing
b) broadcast
c) folding
d) processing

13. The main tool of bioinformatics is
a) sequence alignment
b) sequencing
c) programming
d) genome mapping

14. The dot matrix is
a) complementary, written in reverse order
b) sequence palindroma
c) matrices for calculating weights for substitutions in amino acid sequences
d) the simplest image, which gives an idea of the similarity between the two sequences

15. A method for studying a substance by determining the ratio of mass to charge and the number of charged particles formed during a particular process of exposure to a substance
a) NMR spectroscopy
b) mass spectrometry
c) IR spectroscopy
d) electrophoresis

16. The method is not used to annotate the protein structure.
a) a method for identifying homology in sequences
b) fold recognition method
c) experimental determination of the structure
d) Smith-Waterman method

17. At what value of the percentage of identical residues in optimal alignment, two proteins are likely to have a similar folding pattern

a) more than 25%

b) more than 45%

c) 18%

d) 10%

18. Paralogous genes are:

a) homologous genes of phylogenetically related organisms

b) genes that occurred as a result of intragenomic duplication in the genome of a given species

c) homologous genes of phylogenetically related organisms dispersed in the process of speciation

d) homologous genes of microorganisms formed in the process of horizontal transfer

19. Transmembrane segments consist almost exclusively of hydrophobic amino acid residues. How many residues is the length of transmembrane spirals

a) 100 residues

b) 150 residues

c) 2-5 residues

d) 15-30 residues

20. Which of the following programs is used for multiple alignment of DNA and protein sequences?

a) ClustalW

b) BLAST

c) DALI

d) CASP

21. A model for assessing the evolutionary distance by nucleotide (or amino acid) substitutions in the sequence

a) Tamura-Ney model

b) the Jux-Cantor model

c) Markov model

d) hidden Markov model

22. The main problem of the postgenomic era:

a) - prediction of the primary structure of the protein by DNA sequence

b) - prediction of the secondary structure of the protein by DNA sequence

c) - prediction of the tertiary structure of a protein by DNA sequence

d) - prediction of the quaternary structure of the protein by DNA sequence

23. Homologous nucleotide (or amino acid) sequences are called paralogous if ...

a) they appeared as a result of speciation
b) they appeared as a result of duplication
c) they are at the beginning of the gene
d) they are unique

24. Phylogenetic tree (evolutionary tree, tree of life) - a tree that reflects the evolutionary relationships between different species or other entities that have a common ancestor. The vertices of the phylogenetic tree are divided into three classes (note incorrect):
a) leaves
b) trunks
c) nodes
d) root

25. Which of the following alignments applies to "similar" sequences of approximately the same length and clearly shows the difference between these sequences
a) local
b) multiple
c) global
d) structural

26. The alignment of the nucleotide or amino acid sequences with the highest weight is called
a) optimal
b) multiple
c) global
d) structural

27. Methods for predicting the structure of proteins by amino acid sequence include (note incorrect)
a) homology modeling
b) recognition of the styling method
c) prediction of new folds
d) screening of degenerate targets

Tasks with the choice of one correct answer.

The task takes 45 minutes to complete.

The number of tasks in each option is 4. The number of answers is 1.

Evaluation tools for ongoing certification

Evaluation Criteria

- 100-85 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

- 85-75 - points - the work is characterized by semantic integrity, coherence and consistency 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

- 61-50 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.

Homework Assessment Criteria

Evaluation of homework is carried out in the process of ongoing certification of students using a point-rating system of assessment.

The maximum number of points is 100-85. When completing homework assignments, the maximum score is assigned to the student if he performed the work by one or a group of students who completed the homework assignment most fully and accurately in accordance with the goals, using relevant information and the presence of illustrative material, links to regulatory sources, specialized literature and scientific and scientific and practical publications (monographs, articles in scientific journals, abstracts of dissertations). Fluency in the conceptual apparatus on the topic of the assignment. When performing creative tasks with elements of economic calculations, 100-86 points are rewarded for a correct

calculations and a clear explanation by students of the algorithm and the purpose of their implementation.

A score of 85-75 points is provided for the performance of home creative assignment in accordance with the goals set, clear wording of technological terms and concepts used in disclosing the topic and purpose of the task, correct conclusions, the presence of links to reliable sources of information, some inaccuracies in the implementation of illustrative text support (tables, charts, graphs, etc.) When performing creative tasks with elements of economic calculations, an assessment of 85-75 points provides for the presence of certain inaccuracies in the calculation x, the ability of students to independently determine them and make corrections, students' understanding of the calculation algorithm.

Evaluation of 75-61 points provides for homework in accordance with the goals. At the same time, students can observe difficulties with generalizing information, structuring research materials, and incomplete (inaccurate) formulations of economic terms and concepts are allowed. Students have difficulty answering instructor questions. When performing creative tasks with elements of economic calculations, a score of 75-61 points implies the presence of inaccuracies in the calculations, the inability of students with the participation of the teacher to make corrections, and students' misunderstanding of the calculation algorithm.

60-50 points - if the results of the study do not match the objectives of the assignment, as well as if there are fuzzy, incorrect definitions of technological terms and concepts, the use of irrelevant scientific information, the lack of logic in the presentation of the material and the formulation of conclusions based on the results of the work performed, the homework assignment is considered not completed and not deserves a positive assessment.