Federal State Autonomous Educational Institution of Higher Education "Moscow Institute of Physics and Technology (National Research University)"

APPROVED
Head of the Phystech School of Biological and Medical Physics
D.V. Kuzmin

Work program of the course (training module)

course:	Microbiology/Микробиология
major:	Biotechnology
specialization:	Biomedical Engineering/Биомедицинская инженерия
	Phystech School of Biological and Medical Physics
	Center for educational programs in bioinformatics
term:	4
qualification:	Bachelor

Semester, form of interim assessment: 8 (spring) - Exam

Academic hours: 60 AH in total, including:
lectures: 0 AH.
seminars: 60 AH.
laboratory practical: 0 AH.

Independent work: 90 AH.

Exam preparation: 30 AH.

In total: 180 AH, credits in total: 4

Authors of the program:

A.S. Kuznetsov, teacher
A.S. Dukh, senior professor

The program was discussed at the Center for educational programs in bioinformatics 04.06.2020

Annotation

The aim of this discipline is to master the principles of the work of prokaryotic cells in the framework of summer biological practice. After completing the course, the student will understand the principles of the work of prokaryotic cells, the basic methods of working with primary cell cultures. The main topics that will be covered in the course: The structure of the prokaryotic cell, The structure of the nucleoid, Inclusions, Flagella and drank, Protein secretion systems, Ribosomes - structure and function.

1. Study objective

Purpose of the course

Mastering the principles of the work of prokaryotic cells in the framework of summer biological practice.

Tasks of the course

Gaining knowledge about the principles of work of prokaryotic cells.

Mastering the methods of direct and indirect observation on the example of the issued object.

Obtaining the skills of working with a given object in nature and in experiment.

2. List of the planned results of the course (training module), correlated with the planned results of the mastering the educational program

Mastering the discipline is aimed at the formation of the following competencies:

Code and the name of the competence	Competency indicators
UC-1 Search and identify, critically assess, and synthesize information, apply a systematic approach to problem-solving	UC-1.1 Analyze problems, highlight the stages of their solution, plan the actions required to solve them
	UC-1.2 Find, critically assess, and select information required for the task in hand
	UC-1.3 Consider various options for solving a problem, assess the advantages and disadvantages of each option
	UC-1.4 Make competent judgments and estimates supported by logic and reasoning
	UC-1.5 Identify and evaluate practical consequences of possible solutions to a problem
Gen.Pro.C-1 Apply knowledge of mathematical, physical, chemical, biological laws, patterns, and interrelation to study, analyze, and utilize biological objects and processes	Gen.Pro.C-1.1 Analyze the task in hand, outline the ways to complete it
	Gen.Pro.C-1.2 Build mathematical models, make quantitative measurements and estimates
	Gen.Pro.C-1.3 Determine the applicability limits of the obtained results
Gen.Pro.C-6 Operate technological equipment, manage biotechnological processes, design technical and technological systems, technical facilities, biotechnological production processes by applying basic engineering and technological knowledge	Gen.Pro.C-6.1 Professionally operate modern experimental scientific research (measuring and analytical, technological) equipment in biotechnological research
	Gen.Pro.C-6.2 Evaluate, analyze, and interpret biotechnological data
	Gen.Pro.C-6.3 Possession of the skills to design new technological solutions for the scientific, technical, biotechnological task at hand

3. List of the planned results of the course (training module)

As a result of studying the course the student should:

know:

How prokaryotic cells work.

Basic methods of working with primary cell cultures.

be able to:

Carry out sampling.
Isolate primary cell cultures.
Carries out the simplest manipulations and solving primary problems associated with primary cell cultures.

master:

Methods for the isolation of primary cultures of prokaryotic cells.
Methods for working with cultures of prokaryotic cells.
Methods of preparation of cell cultures of prokaryotic cells.

4. Content of the course (training module), structured by topics (sections), indicating the number of allocated academic hours and types of training sessions

4.1. The sections of the course (training module) and the complexity of the types of training sessions

№	Topic (section) of the course	Types of training sessions, including independent work			
		Lectures	Seminars	Laboratory practical	Independent work
1	The structure of the prokaryotic cell		10		14
2	Nucleoid structure		10		14
3	Inclusions		10		16
4	Flagella and drank		10		16
5	Protein secretion systems		10		14
6	Ribosomes - structure and function		10		16
AH in total			60		90
Exam preparation		30 AH.			
Total complexity		180 AH., credits in total 4			

4.2. Content of the course (training module), structured by topics (sections)

Semester: 8 (Spring)

1. The structure of the prokaryotic cell

An overview of the forms characteristic of prokaryotic cells. Determination mechanisms of the prokaryotic cell shape. The structure and synthesis of peptidoglycan. Growth of the peptidoglycan layer in length and thickness?

2. Nucleoid structure

Bacterial chromosomes. DNA-binding proteins.

3. Inclusions

Types and forms. Structure and function.

4. Flagella and drank

Structure. Functions. Education.

5. Protein secretion systems

Transfer from the cytoplasm to the outer membrane of proteins, lipopolysaccharides, lipoproteins. Withdrawal of plasmids from the cytoplasm into the external environment.

6. Ribosomes - structure and function

Ribosome composition. Translation mechanism. History of ribosome research.

5. Description of the material and technical facilities that are necessary for the implementation of the educational process of the course (training module)

Equipment needed for lectures and seminars: computer and multimedia equipment (projector, sound system)

6. List of the main and additional literature, that is necessary for the course (training module) mastering

Main literature

Provided at the base department

1. Gusev M. V., Mineeva L. A. Microbiology. M., 2003.
2. Egorov PS Fundamentals of the doctrine of antibiotics. M., 2004.
3. Emtsev VT, Mishustin EP Microbiology. M., 2005.
4. Zavarzin GA, Kolotilova PP Introduction to natural history microbiology. M., 2001.
5. Medical Microbiology / Ed. V. I. Pokrovsky, O. K. Pozdeeva. M., 1998.
6. Industrial microbiology / Ed. N. S. Egorova. M., 1989.

Additional literature

Provided at the base department

1. Dmitrieva VA, Dmitriev VV Russian – English dictionary of terms in microbiology. M., 1991.
2. Krasilnikov AP, Romanovskaya TR Microbiological dictionary-reference book. Minsk, 1999.
3. Reimers PF Popular biological dictionary. M., 1991.
4. Steinier R., Edelberg E., Ingram J. The world of microbes. M., 1979.
5. Frobisher M. Fundamentals of Microbiology. M., 1965.
6. Schlegel G. General microbiology. M., 1987.
7. Schlegel G. History of Microbiology. M., 2002.

7. List of web resources that are necessary for the course (training module) mastering

Not used

8. List of information technologies used for implementation of the educational process, including a list of software and information reference systems (if necessary)

Internet access. For some of the lessons, you need Zoom. Google Drive to access course materials. The presence of smartphones / laptops during classes is encouraged to participate in interactive exercises.

9. Guidelines for students to master the course

A student who studies discipline must, on the one hand, master a general conceptual apparatus, and on the other hand, must learn to apply theoretical knowledge in practice.

As a result of studying the discipline, the student should know the basic definitions of the discipline, be able to apply this knowledge to solve various problems.

Successful learning requires:

- visits to all classes provided by the curriculum for the discipline;
- conducting the abstract of occupations;
- intense independent work of the student.

Independent work includes:
- reading recommended literature;
- study of educational material, preparation of answers to questions intended for self-study;
- solving problems offered to students in the classroom;
- preparation for performance of tasks of the current and intermediate certification.

An indicator of possession of the material is the ability to answer questions on discipline topics without an outline.

It is important to achieve an understanding of the material being studied, and not its mechanical memorization. If it is difficult to study individual
topics, questions, you should seek advice from the teacher.

Intermediate control of students' knowledge in the form of problem solving in accordance with the subject of classes is possible

SUPPLEMENT

Assessment funds for course (training module)

major:	Biotechnology
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1. Competencies formed during the process of studying the course

Code and the name of the competence	Competency indicators
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2. Competency assessment indicators

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Methods for working with cultures of prokaryotic cells.
Methods of preparation of cell cultures of prokaryotic cells.

3. List of typical control tasks used to evaluate knowledge and skills

During the current control, the student should be able to answer the following questions:

1. Describe the genus Azotobacter
2. By appearance, recognize the demonstrated representative of the flora. Explain the differences with closely related species.
3. Excursion around the island. Describe the encountered ecotope (littoral, marching meadow, puddle6, meromictic lake).
4. Sulfur cycle and its implementation in a given ecotope

During the class, interactive discussions can take place in the course chats, which will be homework. It is possible to perform patent search as an independent task. Successful completion of all tasks in the course and the completion of control slices of knowledge gives an advantage in the differential credit.

4. Evaluation criteria

1. Block of questions on the history of microbiology
2. Block of questions on microbial cytology, molecular biology and biochemistry
3. A block of questions on the systematics of microorganisms
4. Block of questions on microbial ecology
5. Block of questions on methods of working with microbial cultures and studying the physiology of microorganisms
6. Block of questions on microbial biotechnology
7. Block of questions on medical microbiology, bacterial multidrug resistance, microbiome research

Examples of tickets

Ticket 1

1. Give examples of processes leading to the recombination of genetic material between two prokaryotic cells and describe them
2. What is the reason for the incomplete oxidation of the organic substrate by microorganisms?

Ticket 2

1. Is it possible for microbial communities to exist on Earth without more highly organized forms of life, and why? If possible, what is the structure of such communities?
2. Why is there a change in the dominant population of microorganisms in fermented vegetables?

Ticket 3

1. What can happen to pathogenic microorganisms that enter the gastrointestinal tract in normal and pathological conditions?
2. List potential approaches to the treatment of infections caused by antibiotic-resistant bacteria.

The mark is excellent (10 points) - it is given to a student who has shown comprehensive, systematic, deep knowledge of the curriculum of the discipline, who has an interest in this subject area, has demonstrated the ability to confidently and creatively put them into practice in solving specific problems, and a free and proper substantiation of decisions.

The mark is excellent (9 points) - it is given to a student who has shown comprehensive, systematic, in-depth knowledge of the curriculum of the discipline and the ability to confidently put them into practice in solving specific problems, free and proper substantiation of the decisions made.

The mark is excellent (8 points) - given to a student who has shown comprehensive, systematic, in-depth knowledge of the curriculum of the discipline and the ability to confidently apply them in practice in solving specific problems, correct justification of decisions made, with some shortcomings.

A mark is good (7 points) - it is put up for a student, if he knows the material firmly, sets it up competently and in essence, knows how to apply the knowledge gained in practice, but does not competently substantiate the results obtained.

Evaluation is good (6 points) - it is put up to a student, if he knows the material firmly, sets it up correctly and in essence, knows how to apply this knowledge in practice, but admits some inaccuracies in the answer or in solving problems.

A mark is good (5 points) - it is given to a student, if he basically knows the material, correctly and essentially sets it out, knows how to apply this knowledge in practice, but allows a sufficiently large number of inaccuracies to answer or solve problems.

Grade satisfactorily (4 points) is given to a student who has shown the fragmented, fragmented nature of knowledge, insufficiently correct formulations of basic concepts, violations of the logical sequence in the presentation of program material, but at the same time he has mastered the main sections of the curriculum necessary for further education and can apply knowledge is modeled in a standard situation.

Grade satisfactorily (3 points) - given to a student who showed the fragmented, scattered nature of knowledge, making mistakes in formulating basic concepts, disrupting the logical sequence in presenting program material, poorly masters the main sections of the curriculum required for further education and even applies the knowledge gained in a standard situation.

The rating is unsatisfactory (2 points) - is given to a student who does not know most of the main content of the curriculum of the discipline, makes gross mistakes in the wording of the basic principles and does not know how to use this knowledge when solving typical tasks.

Unsatisfactory mark (1 point) - is given to a student who does not know the main content of the discipline's curriculum, makes gross errors in the wording of the basic concepts of the discipline and does not have any skills to solve typical practical problems.

5. Methodological materials defining the procedures for the assessment of knowledge, skills, abilities and/or experience

The student is given 30 minutes to prepare. The oral examination should not exceed one astronomical hour.