Odesa I. I. Mechnikov National University
Faculty of Biology
Department of Microbiology, Virology and Biotechnology

Syllabus of the Discipline

PHYSICAL AND CHEMICAL METHODS OF RESEARCH OF BIOLOGICAL OBJECTS

Volume	Credits – 4.5, hours – 135, content modules – 4
Semester, year	Full-time: 1 year, 1 semester
Days, time, place	According to the schedule, Faculty of Biology
Working place	Faculty of Biology, Department of Microbiology, Virology and Biotechnology
Consultations	The consultation schedule is provided by the instructor duri lecture.

COMMUNICATIONS

Communication in the classroom is conducted according to the schedule. Outside class hours, students may ask questions during consultations (the schedule is provided by the instructor during the first class).

Other forms of communication include offline and online Zoom consultations.

COURSE ANNOTATION

Subject of the Course **-** basic physicochemical methods used in modern biotechnology and in conducting omics research.

Course prerequisites: the discipline is based on the knowledge, skills and abilities obtained in the process of studying the disciplines “General and Inorganic Chemistry”, “Organic Chemistry”, “Physics”, “Genetics and Molecular Biology”, “Biochemistry”, “Bioorganic Chemistry”.

Postrequisites: knowledge, skills and abilities obtained in the process of studying the discipline can be applied in the study and understanding of the following disciplines: “Immunobiotechnology”, “Biofilms”, “Biologically active Peptides in Medicine”, “Biologically Active Compounds from the Merine Enviroment”, “Qualification Work: Preparation and Defense”.

Aim of the Discipline: is to familiarize students with the basic physicochemical methods used in modern biotechnology and in conducting omics research.

Tasks*:*

- To provide knowledge about the principles of the most modern optical research methods and the spectrum of their application in conducting a variety of biotechnological research.
- To familiarize students with the basic principles of genomics, transcriptomics, proteomics and metabolomics, their role in systems biology and with basic methods used in conducting omics research.
- To provide students with in-depth knowledge of the principles of chromatography and practical skills in its implementation.
- To familiarize students with the basic theoretical principles of metabolomics, methods of

chromatography-mass spectrometry and NMR spectroscopy, as well as with the practical application of metabolomics approaches in conducting biotechnological research.

- Provide practical skills in analyzing metabolomic experiment data and identifying substances of biotechnologically valuable microorganisms
- Provide in-depth knowledge of the principles of basic molecular biological research methods and practical skills in their use.
- Provide students with knowledge of the most modern research methods in microbiology and ways to solve the problem of "uncultivable" microorganisms.
- Introduce the principles of planning biotechnological research at the most modern level, selection of materials, reagents, devices and equipment for specific research tasks.

Expected results:

As a result of the discipline study a student has to

know:

- Basic principles of modern physical and chemical research methods used in biotechnology;
- range of applications of the most modern physical and chemical methods in biotechnological research;
- basic concepts of systems biology, as well as basic principles and methods of genomics, transcriptomics, proteomics and metabolomics;
- the most modern methods of cultivating microorganisms.

Be able:

- select research methods for a specific task when conducting biotechnological experiments;
- select materials, reagents, devices and equipment;
- use modern chromatographic and molecular biological research methods;
- analyze metabolomic experiment data.

COURSE DESCRIPTION

Forms and Methods of Education

The course will be taught in the form of lectures (22 hours) and laboratory classes (22 hours), independent work of students (91 hours).

The main training of students is carried out in lectures and laboratory classes, and also relies largely on independent study of the discipline. When teaching the discipline, the following teaching methods are used: lectures, explanations, conversations, instructions, discussions, discussion of problem situations, illustrations (including multimedia presentations), demonstrations; test exercises; individual performance of laboratory work.

Content of the Discipline

CONTENT MODULE 1.
MODERN OPTICAL METHODS FOR STUDYING BIOLOGICAL OBJECTS

TOPIC 1. Modern methods for visualizing microobjects
TOPIC 2. Modern methods of optical-spectral analysis

CONTENT MODULE 2.
METHODS AND BASIC PRINCIPLES OF METABOLOMICS

TOPIC 3. Modern methods of chromatography and mass spectrometry
TOPIC 4. Metabolomics and its role in systems biology
TOPIC 5. Applied metabolomics

CONTENT MODULE 3.
MODERN REACTION METHODS FOR STUDYING BIOLOGICAL OBJECTS

TOPIC 6. Modern biochemical research methods
TOPIC 7. Molecular biological research methods. Polymerase chain reaction
TOPIC 8. Modern methods of sequencing nucleic acids and proteins

CONTENT MODULE 4.
MODERN METHODS OF CULTIVATING MICROORGANISMS

TOPIC 9. The problem of "unculturable" microorganisms and microchip technology
TOPIC 10. Biofilm chips and other methods for studying biofilms

ASSESSMENT

1. Current control:
   - performance and defense of laboratory work;
   - oral asking questions;
   - independent work of the applicant with a note, recommended literature in preparation for lectures and laboratory classes;

2. Periodic control:

Control work on the content module is carried out in the form of testing after completing the study of the educational material of each content module. Control works include test questions, each of which has four answer options and only one of them is correct. For each correct answer to one question, a student receives 0.5 points. There are 20 questions in the control works.

3. Final control - exam. The final grade is the sum of points for current, periodic and final control, which is an exam. The exam is conducted in written form. Control and evaluation of educational activities in the discipline is carried out on a 100-point scale.

Grading Scale (National and ECTS)

Score	ECTS	National grade
90–100	A	Passed
85–89	B	Passed
75–84	C	Passed
70–74	D	Passed
60–69	E	Passed
35–59	FX	Retake allowed
0–34	F	Failed – mandatory repetition

COURSE POLICY

Policy on deadlines and retakes*:* retakes or violation of deadlines are possible only if there are valid reasons (medical reasons). In case of absence from a test, it can be retaken during a scheduled consultation. The list of questions for control is contained in the work program of the discipline, which is posted on Google Class and on the website of the Faculty of Biology biologywiki.onu.edu.ua

Policy on academic integrity: The applicant for higher education and the lecturer must adhere to academic integrity according to the Code of Academic Integrity of Participants in the Educational Process of Odesa I. I. Mechnikov National University http://onu.edu.ua/pub/bank/userfiles/files/documents/acad-dobrochesnost.pdf

Policy on attendance: attendance at practical classes is mandatory, points for attending lecture classes are not awarded. A valid reason for absence from classes is considered to be illness, confirmed by a doctor's (hospital) certificate.

Mobile devices: it is allowed to use a smartphone, tablet or other device with access to the Internet during a lecture or laboratory classes in cases of working with information sources and discussing them (determined by the lecturer).

Behavior in the classroom: according to the "Rules of Internal Procedure of the ONU" (http://onu.edu.ua/pub/bank/userfiles/files/documents/kd_2020_dodatok4.pdf), higher education students must: follow the rules of internal procedure, treat university property (inventory, textbooks, devices, etc.) with care and accuracy; be disciplined and neat; maintain proper cleanliness and order in all educational premises; follow safety instructions.