

**OPEN INTERNATIONAL UNIVERSITY OF
HUMAN DEVELOPMENT "UKRAINE"**

INSTITUTE OF BIOMEDICAL TECHNOLOGIES

**DEPARTMENT OF MICROBIOLOGY, MODERN BIOTECHNOLOGIES,
IMMUNOLOGY**

APPROVE

Vice-rector

on educational work

_____ Oksana Kolyada

« _____ » _____ 2020

WORKING PROGRAM TRAINING COURSE

Research Methodology with the Basics of Modern Experimental
Biology

(code and name of the discipline)

educational program of the second level of higher education "master" in the specialty 091 "Biology" in the field of knowledge 91 "Biology", qualification "master of biology"

(the name of the educational program)

educational level _____ Master of Biology _____
(name of educational level)

branch of knowledge _____ 09 Biology _____
(code and name of the field of knowledge)

Specialty _____ 091 Biology _____
(code and name of the specialty)

Qualification _____ Microbiologist, immunologist _____
(name of specialization)

Institute _____ Biomedical technologies _____
(the name of the educational unit)

The volume of credits: 5

Form of final control: exam

Kyiv 2020

Work program Research methodology with the basics of modern experimental biology

(name of the discipline)

for students / graduate students in the field of knowledge _____09 Biology _____, specialty _____091 Biology _____.

« _____ » _____ 2020.

Developers: Tetyana Tugay (Doctor of Biological Sciences, Senior Researcher, Head of the Department of Microbiology, Modern Biotechnology and Immunology), Andriy Tugay (Philosophy Doctor of sciences).

Teachers: Tetyana Tugay (Doctor of Biological Sciences, Senior Researcher, Head of the Department of Microbiology, Modern Biotechnology and Immunology), Andriy Tugay (philosophy doctor of sciences).

The work program was considered and approved at the meeting of the Department of Microbiology, Modern Biotechnology and Immunology

Protocol from « _____ » _____ 20__ No _____

Head of the Department of Microbiology, Modern Biotechnology and Immunology

(signature)

(Tetyana Tugay)

(surname and initials)

« _____ » _____ 2020 year

The work program is agreed with the guarantor of the educational professional program of the second (master's) level of higher education in the specialty 091 Biology, the branch of knowledge 09 Biology, qualification: "**microbiologist, immunologist**".

_____. 2020 year.

Guarantor of educational (professional / scientific) program (project team leader)

(signature)

(Tetyana Tugay)

(surname and initials)

PROLONGATION OF WORKING PROGRAM

Academic year	20___/20___	20___/20___	20___/20___	20___/20___
Date of the meeting of the department / cycle commission				
№ protocol				
Signature of the head of the department / chairman of the cycle commission				

Materials for the course are posted on the website of the Internet support of the educational process at the address: <https://vo.uu.edu.ua/enrol/index.php?id=13920>

(specify the address)

The work program is checked

_____ 2020 year.

Director of the Institute of Biomedical Technologies

(signature)

(Valentina Movchan)

(surname and initials)

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1. DESCRIPTION OF THE COURSE

Name of indicators	Field of knowledge, specialty, specialization, educational degree / educational qualification level	Characteristics of the discipline	
		<i>full-time education</i>	<i>external form of education</i>
Total loans – 5	Branch of knowledge _____09 Biology _____	Type of discipline <u>Required</u>	
	Specialty _____091 Biology _____	Cycle of preparations <u>и professional</u>	
Modules – 2	Qualification Microbiologist, Immunologist	Рік підготовки:	
Content modules – 2		1	1
Individual research task abstract	Language of teaching, learning and assessment: <u>Ukrainian</u>	Semester	
Total hours –150		1	1
Weekly hours for full-time study: classroom – 3 independent work of the student – 7	Educational degree / educational qualification level: <u>Master</u>	Lectures	
		30 hours	6 hours
		Practical, seminar	
		16 hours	4 hours
		Laboratory	
		0	0
		Individual work	
104 hours	130 hours		
Individual tasks: 10 hours.			
Type of semester control: <u>exam</u>			

Note.

The ratio of the number of hours of classroom classes to independent and individual work is:

for full-time education - 44%

for distance learning - 7%

2. GOAL AND TASKS OF THE COURSE

Goal: The objectives of the discipline "Methodology of scientific research with the basics of modern experimental biology" are the formation of research methodology, the formation of ideas, knowledge and skills of knowledge and skills that create the necessary methodological basis for professional research, its presentation to the scientific community; to consider the main forms and mechanisms of commercialization of the results of intellectual activity, applied principles of disposal of intellectual property rights, methods of their accounting and evaluation.

Acquaintance of students with modern methods of biological research by methods of control of contamination by microorganisms of premises, air, water, the person, preparation of experts who are capable to solve problems of a certain specialized complexity, presentation of the received knowledge to scientific community, application of the received skills in practical problems in biology. , and in research and innovation activities in certain areas of the economy and health care.

Task:

- provide knowledge about methods, types and main stages of research related to the study of biological properties of pathogenic and non-pathogenic microorganisms, to acquaint students with the patterns of their interaction with the macroorganism, human population and the environment;
- to form students' ability to use the latest achievements in various fields of biology in their professional activities;
- to form skills in the use of world scientific information and communication technologies in the international context;
- to form the ability on the basis of obtaining comprehensive up-to-date information to form their own ideas in solving research problems in the field of experimental microbiology;
- to form students' ability to conduct experimental research using a set of different biological methods to solve problems related to the identification, isolation and

diagnosis of certain groups of microorganisms and recommendations for specific disease prevention;

- to form in students understanding of stages of preparation for carrying out research work on a certain subject, creation of model systems for carrying out researches, mastering of the conceptual device,
- to form the ability to statistical assessment of the obtained data and their discussion using the data of world research in this direction;
- to form in students an algorithm of presentation of the received data at scientific conferences of domestic and world levels, to activate skills of the correct form of conducting scientific discussion taking into account ethical considerations, academic integrity.

According to the requirements of the Standard of Higher Education of Ukraine (second (master's)) level of higher education (eighth level of NQF of Ukraine), branch of knowledge 09 "Biology", specialty 091 "Biology") the discipline provides students with the following competencies:

integral:

Ability to solve complex problems and problems in the field of biology in the implementation of professional activities or in the learning process, which involves research and / or innovation and is characterized by uncertainty of conditions and requirements.

general:

GC 2 Ability to use information and communication technologies.

GC 3 Ability to generate new ideas (creativity).

GC 4 Ability to act on the basis of ethical considerations (motives).

GC 5 Ability to develop and manage projects.

GC 6 Ability to conduct research at the appropriate level.

special (professional, subject):

SC 1 Ability to use the latest advances in biology necessary for professional, research and / or innovation.

SC 2 Ability to formulate modeling problems, create models of objects and processes on the example of different levels of organization of living things using mathematical methods and information technology.

SC 4 Ability to analyze and summarize the results of research at different levels of organization of living, biological phenomena and processes.

SC 5 Ability to plan and perform experimental work using modern methods and equipment.

SC 6 Ability to predict the direction of development of modern biology on the basis of a general analysis of the development of science and technology

SC 7 Ability to diagnose the state of biological systems based on the results of studies of organisms at different levels of the organization

SC 8 Ability to present and discuss the results of scientific and applied research, prepare scientific publications, participate in scientific conferences and other events.

SC 9 Ability to apply copyright law for practical purposes.

SC 12 Ability to adequately apply existing and develop new methods for solving scientific-theoretical and applied problems of biology.

3. LEARNING RESULTS BY DISCIPLINE, COMPLIANCE OF SOFTWARE COMPETENCIES AND LEARNING RESULTS TO THE COMPONENTS OF THE EDUCATIONAL PROGRAM

As a result of studying the discipline the student must

know:

- Features of the development of science, the scientific picture of the world, the historical features of the study of pathogenic microorganisms and the first attempts at their taxonomy;

- The concept of a set of scientific methods: imperial, theoretical, general scientific, used in the study of taxonomy, structure, morphological features, physiology and ecology, biodiversity, succession processes in microorganisms;

- Basic principles of scientific information retrieval, use of modern information technologies and analysis of information in the field of biology and at the boundaries of subject areas, in particular, the latest data on the main groups of gram-negative bacteria and gram-positive bacteria the main groups of tortuous bacteria, mycoplasmas, representatives of human and animal diseases;

- Basic principles of methodical and methodological construction of scientific research related to the identification, control of contamination of various substrates by microorganisms, checking the quality of the impact of hygienic and medicinal products on the human microbiota.

- know the safety standards and methods of work in the microbiological laboratory, the technique of research of microorganisms, methods of cultivation of microorganisms, obtaining pure cultures;

be able:

- Use innovative approaches to solve complex problems in biology in general and in microbiology under uncertain conditions and requirements, use the main taxonomic categories in the classification of microorganisms; use the Bergi determinant;

- Plan research, choose effective research methods and their material support. have direct and indirect methods of quantitative and qualitative

analysis; prepare and sterilize nutrient media; prepare preparations of live and fixed microorganisms and microscopy them;

- Analyze and summarize the results of research at different levels of organization of living things, biological phenomena and processes, to draw conclusions about the affiliation of microorganisms to pro- and eukaryotic organisms; draw conclusions about the ecological role of a particular group of microorganisms;

- Plan and perform experimental work using modern methods and equipment to determine the contamination of a particular environment, to assess the role of a particular group of microorganisms in the pathogenesis; estimate the number of certain groups of microorganisms depending on their properties;

- Carry out statistical processing, analysis and generalization of the obtained experimental data using software and modern information technologies.

- Present the results of scientific work in writing (in the form of a report, scientific publications) and orally (in the form of reports and report defense) using modern technology, argue their position in the scientific discussion.

- Adhere to the basic rules of biological ethics, biosafety, biosecurity, assess the risks of using the latest biological, biotechnological and biomedical methods and technologies, identify potentially dangerous organisms or production processes that may pose a threat of emergencies.

- Adhere to the norms of academic integrity in the study and conduct of scientific activities, know the basic legal norms for the protection of intellectual property.

have:

- The latest methods for conducting research at the global level, the ability to create model systems, to have a methodology of scientific research aimed at the selection of microbiological samples depending on the direction of further research and their preparation.

- Skills of conducting research at different levels of biological organization, as well as the use of special modern research methods. Methods of studying living cells, methods of culturing microorganisms; methods of microscopy, preparation of samples for microscopy, PCR, SEM.

- Use the results of scientific research of their own and known in the world in practice, formulate guidelines.

- Know the state and foreign languages at a level sufficient for communication on professional issues and presentation of the results of their own research.

Discipline line in the "Matrix of correspondence of general program competencies to the components of the educational program"

	GC1	GC2	GC3	GC4	GC5	GC6	GC7	GC8	GC9	GC10	GC11	GC12
RC 1.3	+	+	+	+	+	+						

Discipline line in the "Matrix of correspondence of special (professional) program competencies to the components of the educational program"

	SC 1	SC 2	SC 3	SC 4	SC 5	SC 6	SC 7	SC 8	SC 9	SC 10	SC 11	SC 12	SC 13	SC 14	SC 15
RC 1.3	+	+		+	+	+	+	+	+			+			

Discipline line in the "Matrix of providing program learning outcomes (PLO) with the relevant components of the educational program"

	PLO 1	PLO 2	PLO 3	PLO 4	PLO 5	PLO 6	PLO 7	PLO 8	PLO 9	PLO 10	PLO 11	PLO 12	PLO 13	PLO 14	PLO 15	PLO 16	PLO 17	PLO 18
RC 1.3		+		+	+			+	+	+			+	+				

4. THE SUBJECT SYLLABUS

4.1. Discipline Abstract

Content module 1. Fundamentals of research methodology in biology

Topic 1. Features of the development of biological sciences. Multidimensionality of the concept of science. The process of scientific knowledge.

Topic 2. The concept of a set of scientific methods: imperial, theoretical, general scientific, used in the study of biological objects. Methodology of scientific knowledge.

Topic 3. Basic concepts of modern biology. Methodological foundations of the concept of biological evolution in nonclassical biology: a synthetic theory of evolution.

Topic 4. Basic principles of searching for scientific information, use modern information technologies and analyze information in the field of biology and at the boundaries of subject areas. use the latest taxonomic categories in the classification of microorganisms, using molecular and bioinformative research methods.

Topic 5. Basic principles of methodical and methodological construction of scientific research related to the study of the effects of drugs on humans and animals, the relationship of GC their structure and function.

Topic 6. Research planning, selection of effective research methods and their material support. Safety standards and methods of work in the microbiological laboratory, techniques for the study of microorganisms. Modern methods of culturing microorganisms, obtaining pure cultures.

Content module 2. Experimental biology with evaluation of research results

Topic 1. Detailed, step-by-step planning of experimental work using modern methods on the example of the equipment of the educational and scientific laboratory of the University "Ukraine" and the Institute of Microbiology for the determination of microbial air contamination of a number of university premises.

Topic 2. Features of the ability to work in a group in the development of the methodological part of the program and conducting biological research and analysis of the data.

Topic 3. Formation of the algorithm of statistical estimation of the received data concerning qualitative and quantitative characteristics and their discussion with use of data of world researches in this direction.

Topic 4. Forms of presentation of results of scientific work with use of modern technologies. Presentation of results in the form of a report, comparative analysis with literature data, argue their position in the scientific discussion.

Topic 5. Planning and conducting research to detect microbial contamination of the outer coverings and mucous membranes and evaluate the results.

Topic 6. Formation of creative ideas to study the impact of certain drugs and hygiene products on their own microbiome, creating an algorithm for research, analysis of results and concepts for guidelines for the tools used.

Disciplines, the study of which necessarily precedes this discipline: Biology, microbiology, cytology, radiobiology, biology and taxonomy of certain groups of bacteria, biochemistry, pharmacy.

Interdisciplinary links: Microbiology, aquatic microbiology, mycology, biology and taxonomy of certain groups of bacteria, occupational safety in the production of microorganisms, radiobiology, cytology of microorganisms, biogeochemical activity of microorganisms and others.

4.2. The Structure of the Discipline

4.2.1. Thematic Plan

Names of content modules and topics	Distribution of hours between types of work														Forms and methods of knowledge control
	Full-time							external form							
	Total	classroom					independent work	Total	classroom					independent work	
		including							including						
		L.	seminar	practical	lab	ind			L.	seminar	practical	lab	ind		
2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
Content module 1. Fundamentals of research methodology in microbiology															
Topic 1. Features of the development of biological sciences. Multidimensionality of the concept of science. The process of scientific knowledge.	11	2		2			7	10						10	CW: IW: PW:
Topic 2. The concept of a set of scientific methods: imperial, theoretical, general scientific, used in the study of biological objects. Methodology of scientific knowledge.	10	2					8	12						12	CW: IW:
Topic 3. Basic concepts of modern biology. Methodological foundations of the concept of biological evolution in nonclassical biology: a synthetic theory of evolution	12	2		2			8	13			1			12	CW: IW: PW:
Topic 4. Basic principles of searching for scientific information, use modern information technologies and analyze information in the field of biology and at the boundaries of subject areas. use the latest taxonomic categories in the classification of microorganisms, using molecular and bioinformative research methods.	12	4					8	11			1			10	CW: IW:
Topic 5. Basic principles of methodical and methodological	12	2		2			8	11	1					10	CW: IW: PW:

construction of scientific research related to the study of the action of antibiotics, the relationship of their structure and function.															
Topic 6. Research planning, selection of effective research methods and their material support. Safety standards and methods of work in the microbiological laboratory, techniques for the study of microorganisms. Modern methods of culturing microorganisms, obtaining pure cultures;	13	3		2			8	11	1					10	CW: IW: PW:
Modular control															Test work
Together on the content module 1	70	15		8			47	68	2			2		64	
Content module 2. Experimental biology with evaluation of research results															
Topic 1. Detailed, step-by-step planning of experimental work using modern methods on the example of the equipment of the educational and scientific laboratory of the University "Ukraine" and the Institute of Microbiology for the determination of microbial air contamination of a number of university premises.	11	2		2			7	11				1		10	CW: IW: PW:
Topic 2. Features of the ability to work in a group in the development of the methodological part of the program and conducting biological research and analysis of the data.	10	2					8	11				1		10	CW: IW:
Topic 3. Formation of the algorithm of statistical estimation of the received data concerning qualitative and quantitative characteristics and their discussion with use of	14	4		2			8	13	1					12	CW: IW: PW:

data of world researches in this direction.														
Topic 4. Forms of presentation of results of scientific work with use of modern technologies. Presentation of results in the form of a report, comparative analysis with literature data, argue their position in the scientific discussion.	10	2				8	11	1					10	CW: IW:
Topic 5. Planning and conducting research to detect microbial contamination of the outer coverings and mucous membranes and evaluate the results.	13	3		2		8	13	1					12	CW: IW: PW:
Topic 6. Formation of creative ideas to study the impact of certain drugs and hygiene products on their own microbiome, creating an algorithm for research, analysis of results and concepts for guidelines for the tools used.	12	2		2		8	13	1					12	CW: IW: PW:
Modular control														Test work
Together on the content module 2	60	15		8		47	72	4		2			66	
IERT	10					10	10						10	IERT
Total hours	150	30		16		104	150	6		4			140	

4.2.2. Educational and Methodical Card of the Discipline

Methodology of scientific research with the basics of modern experimental biology

Together: 150 hours., lectures – 30 hours., practical classes – 16 hours, individual task – 10 hours., independent work – 94 hours., final control – 1 hours

Module name	<i>Module title 1 Fundamentals of research methodology in microbiology</i>					
Number of points per module	50 points					
Lectures	1	2	3	4	5	6
Lecture topics	<i>Features of development of biological sciences. Multidimensionality of the concept of science. The process of scientific knowledge.</i>	<i>The concept of a set of scientific methods: imperial, theoretical, general scientific, used in the study of biological objects. Methodology of scientific knowledge.</i>	<i>Basic concepts of modern biology. Methodological foundations of the concept of biological evolution in nonclassical biology: a synthetic theory of research evolution.</i>	<i>Basic principles of searching for scientific information, use modern information technologies and analyze information in the field of biology and on the borders of subject areas. use the latest taxonomic categories in the classification of microorganisms, using molecular and bioinformative research methods.</i>	<i>Basic principles of methodological and methodological construction of scientific research related to the study of the action of antibiotics, the relationship of their structure and function.</i>	<i>Research planning, selection of effective research methods and their material support. Safety standards and methods of work in the microbiological laboratory, techniques for the study of microorganisms. Modern methods of culturing microorganisms, obtaining pure cultures;</i>
Topics of practical classes	<i>Methods, selection of certain samples for microbiological control, technique and methodology of their preparation for further research</i>		<i>Methods of preparation of testing laboratories for a certain type of research sterilization of nutrient media, utensils, premises.</i>		<i>Methodological, ideological and aesthetic components of modern biological research.</i>	<i>Peculiarities of formulation of the topic of biological research. Formulation of the purpose, tasks of research, definition of object and subject of research.</i>
Independent work	5 points	5 points	5 points	5 points	5 points	5 points
Types of current control	Modular test (20 points)					

Module name	<i>Module title 2 Experimental microbiology with evaluation of research results</i>					
Number of points per module	42 points					
Lectures	1	2	3	4	5	6
Lecture topics	<i>Detailed, step-by-step planning of experimental work using modern methods on the example of equipment of the educational and scientific laboratory of the University "Ukraine" and the Institute of Microbiology for the determination of microbial air contamination of a number of university premises.</i>	<i>Features of the ability to work in a group in developing the methodological part of the program and conducting biological research and analysis of the data.</i>	<i>Formation of algorithm of statistical estimation of the received data concerning qualitative and quantitative characteristics and their discussion with use of data of world researches in this direction.</i>	<i>Forms of presentation of results of scientific work with use of modern technologies. Presentation of results in the form of a report, comparative analysis with literature data, argue their position in the scientific discussion.</i>	<i>Planning and conducting research to detect microbial contamination of the outer coverings and mucous membranes and evaluate the results.</i>	<i>Formation of creative ideas to study the impact of certain drugs and hygiene products on their own microbiome, creating an algorithm for research, analysis of results and concepts for guidelines for the tools used.</i>
Topics of practical classes	<i>Basic rules of scientific publication. Presentation of scientific results ..</i>		<i>Methods of research of living cells of microorganisms. Methods of culturing microorganisms The latest methods of identification</i>		<i>Methods of research of biological systems in field and laboratory-field experiments</i>	<i>The latest technologies and their application in field research of biological systems</i>
Independent work	5 points	5 points	5 points	5 points	5 points	5 points
IERT	10 points					
Types of current control	Modular test (10 points)					
Final control	Exam (20 points)					

4.3. Forms of Organization of Classes

4.3.1. Topics of Practical Classes

№	Name topics	Number hours
1	Methods, selection of certain samples for microbiological control, technique and methodology of their preparation for further research	2
2	Methods of preparation of testing laboratories for a certain type of research sterilization of nutrient media, utensils, premises.	2
3	Methodological, ideological and aesthetic components of modern biological research.	2
4	Features of the formulation of the topic of biological research. Formulation of the purpose, tasks of research, definition of object and subject of research.	2
5	Basic rules of scientific publication. Presentation of scientific results	2
6	Methods of research of living cells of microorganisms. Methods of culturing microorganisms The latest methods of identification	2
7	Methods of research of biological systems in field and laboratory-field experiments	2
8	The latest technologies and their application in field research of biological systems	2

4.3.2. Individual Research Work (educational project)

Individual educational and research work (IERW) is a type of extracurricular individual activity of the student, the results of which are used in the process of studying the program material of the discipline. The implementation of IERW students by public defense of the educational project is coming to an end.

The individual educational and research task (IERT) of the course is a type of research work of the student, which contains the results of the research search, reflects a certain level of his educational competence..

The purpose of IERT: independent study of part of the program material, systematization, generalization, consolidation and practical application of

knowledge from the training course, improvement of skills of independent educational and cognitive activity.

Content of IERT: completed theoretical or practical work within the curriculum of the course, which is performed on the basis of knowledge, skills and abilities acquired during lectures, seminars, practical and laboratory classes and covers several topics or the entire content of the course.

Types of IERT, requirements and evaluation:

- ✓ synopsis on the topic (module) according to the given plan (**2 points**);
- ✓ synopsis on the topic (module) according to the plan developed by the student independently (**3 points**);
- ✓ annotation of the read additional literature from the course, bibliographic description, thematic explorations (**3 points**);
- ✓ report of topics recommended by the teacher (**2 points**);
- ✓ reports on the topic (without the teacher's recommendation): modern discoveries on the topic, information analysis, independent research (3 points);
- ✓ research of various issues on the subject of the discipline in the form of an essay (**5 points**).
- ✓ research on the subject of the discipline in the form of an abstract (covers the entire content of the course) - **15 points**.

Approximate structure of IERT - scientific and pedagogical research in the form of an abstract: introduction, main part, conclusions, appendices (if any), list of sources used.

Topics of IERT

1. Family Spirochaetaceae, the main pathogenic species.
2. Family Leptospiraceae, the main pathogenic species.
3. Family Spirillaceae, the main pathogenic species. (special attention to the genera *Vampirovibrio*, *Bdellovibrio*)
4. Family Pseudomonaceae, the main pathogenic species.
5. Species of the genus *Neisseria*, the main pathogenic species.

6. Family Enterobacteriaceae, the main pathogenic species. (genus Escherichia, Salmonella)
7. Family Enterobacteriaceae, the main pathogenic species. (genus Klebsiella, Shigella)
8. Rickettsiae, pathogenesis.
9. Chlamydia, pathogenesis.
10. Family Micrococcaceae, the main pathogenic species.
11. Family Streptococcaceae, the main pathogenic species.
12. Family Peptococcaceae, the main pathogenic species.
13. Genus Clostridium, the main pathogenic species.
14. Genus Bacillus, the main pathogenic species.
15. Family Lactobacillaceae, biological role.
16. Coryneform bacteria, the main pathogenic species.
17. Actinomycetes, the main pathogenic species.
18. Mycoplasmas - Mollicutes, the main pathogenic species.

Recommendations for writing an abstract

Precis - a type of independent research work of the student. This is a written statement of the concepts available in the scientific literature; the content of scientific work; content of literature on a given topic. The student must reveal the essence of the research problem. The presentation of the material should be problem-thematic.

Stages of work on the precis

- selection and study of the main sources, based on the proposed list of literature (15 - 25 sources). It is possible to write on one source (monograph).
- Bibliography;
- information processing and systematization;
- development of an abstract plan;
- writing an abstract.

The structure of the precis

- Title page;
- Contents in which the points of the plan are stated with the indication of the page from which the point begins.
- Precis consists of three parts: introduction, main part and conclusion. The introduction substantiates the relevance of the topic, formulates the essence of the problem, purpose and objectives of the work, gives a brief description of the literature used, the volume of 12-20 pages.
- In the main part of the abstract the tasks of research are realized: according to the plan consistently and evidentially. Tables, diagrams and graphs can be presented in the main part.
- In the final part, the author draws conclusions based on the purpose and objectives of the work.

Requirements for the precis.

Volume of work - 12-20 printed pages. Presentation style - analytical (analysis of sources, comparison and comparison of leading positions, generalizations), the style should be literary. Mandatory line references to the used literature. The list of literature according to the rules of bibliographic description should complete the work.

Criteria for evaluating the precis.

- Correspondence of the content to the topic and the content.
- Depth of material processing.
- Logic of presentation.
- Complete use of sources.
- Availability of references to sources.
- Culture of written speech.

The evaluation criteria and evaluation scale are given in the tables below, respectively.

**Criteria for evaluation of IERT
(research in the form of an precis)**

№	Performance evaluation criteria	The maximum number of points for each criterion
1.	Substantiation of relevance, formulation of goals, objectives and definition of research methods	4 points
2.	scheduling essay	2 points
3.	Critical analysis of the essence and content of primary sources. Presentation of facts, ideas, research results in a logical sequence. Analysis of the current state of research of the problem, consideration of trends in the further development of this issue	10 points
4.	Adherence to the rules of abstracting scientific publications	4 points
5.	Evidence of conclusions, validity of one's own position, proposals for solving the problem, determining the prospects of the study	6 points
6.	Compliance with the requirements for the technical design of structural elements of the work (title page, plan, introduction, main part, conclusions, appendices (if any), list of sources used, links	4 points
Together		30 points

**Assessment by IERT in the Form of Course Work: National and ECTS
Assessment Scale**

Score on a 100-point system		Score on a national scale	Assessment on the ECTS scale	
24 - 30 and more	perfectly	5	A	perfectly
16 - 23	good	4	BC	good
8 – 15	satisfactorily	3	DE	satisfactorily
0 – 7	unsatisfactorily	2	FX	unsatisfactory with the possibility of re-execution

4.3.3. Topics of Independent Work of Students

№	Name topics	Number hours
1	Organization of science in Ukraine. Scientific and pedagogical staff. The contribution of domestic scientists to the development of microbiology	8
2	Search and use of information databases, Internet resources, libraries to obtain the necessary information	8
3	Comparison of the system of organization of science in different countries.	8
4	Practical use of biochemical activity of microorganisms in medical microbiology	10
5	Basic rules of biological ethics, biosafety, biosecurity, basic approaches to risk assessment using the latest biological, biotechnological and biomedical methods and technologies	10
6	Development of algorithms of research processes, creation of a model scheme, choice of methods, hardware	10
7	Present the results of scientific work in writing (in the form of a report, scientific publications, etc.) and orally (in the form of reports and report defense) using modern technologies, correctly conduct a discussion.	10
8	Plagiarism in scientific research. How to avoid it?	10
9	The main requirements of current legislation of Ukraine on the use of biological resources. To use normative legal acts and normative-technical documentation in the sphere of scientific activity.	10
10	Regularities of individual and historical development of biological systems at different levels of organization, the role of systemic processes in their formation, functioning and plasticity, features of their cooperative interaction, as well as the systemic organization of living things.	10

STUDENT'S INDEPENDENT WORK CARD

Content module and course topics	Academic control	points	Term execution (weeks)
CONTENT MODULE I.			
Fundamentals of research methodology in microbiology			
Topic 1. Organization of science in Ukraine. Scientific and pedagogical staff. The contribution of domestic scientists to the development of microbiology (8 hours)	Independent work	5	I-II
Topic 2. Search and use of information databases, Internet resources, libraries to	Independent work	5	II-III

obtain the necessary information (8 hours)			
Topic 3. Comparison of the system of organization of science in different countries. (8 hours)	Independent work	5	III- IV
Topic 4. Practical use of biochemical activity of microorganisms in medical microbiology (10 hours)	Independent work	5	IV-V
Topic 5. Basic rules of biological ethics, biosafety, biosecurity, basic approaches to risk assessment using the latest biological, biotechnological and biomedical methods and technologies (10 hours)	Independent work	5	V- VI
<i>Total: 44 hours</i>	<i>Total: 25 points</i>		
CONTENT MODULE II.			
Experimental microbiology with evaluation of research results			
Topic 1. Development of algorithms of research processes, creation of a model scheme, choice of methods, hardware. (10 hours)	Independent work	5	VIII
Topic 2. To present the results of scientific work in writing (in the form of a report, scientific publications, etc.) and orally (in the form of reports and report defense) using modern technologies, to conduct a correct discussion. (10 hours)	Independent work	5	VIII
Topic 3. Plagiarism in research. How to avoid it? (10 hours)	Independent work	5	IX
Topic 4. The main requirements of current legislation of Ukraine on the use of biological resources. To use normative legal acts and normative-technical documentation in the sphere of scientific activity. (10 hours)	Independent work	5	IX
Topic 5. Regularities of individual and historical development of biological systems at different levels of organization, the role of systemic processes in their formation, functioning and plasticity, features of their cooperative interaction, as well as the systemic organization of living things. (10 hours)	Independent work	5	X
<i>Total: 50 hours</i>	<i>Total: 25 points</i>		
<i>Together: 94 hours</i>	<i>Together: 50 points</i>		

5. TEACHING METHODS

5.1. Methods of Organization and Implementation of Educational and Cognitive Activities

1. According to the source of information:

- *verbal*: lecture (traditional, problematic, etc.) with the use of computer information technology (PowerPoint presentation), seminars, explanations, story, conversation;
- *visual*: observation, illustration, demonstration;
- *practical*: exercises.

2. By the logic of transmission and perception of educational information: inductive, deductive, analytical, synthetic.

3. According to the degree of independence of thinking: reproductive, exploratory, research.

4. By the degree of management of educational activities: under the guidance of a teacher; independent work of students with a book; implementation of individual educational projects.

5.2. Methods of Stimulating Interest in Learning and Motivation of Educational and Cognitive Activities

Methods of stimulating interest in learning: educational discussions; creating a situation of cognitive novelty; creation of situations of interest (method of interesting analogies, etc.), involvement in practical work; organization of extracurricular meetings with scientists and specialists in microbiology and soil microbiology working in various fields of science and industry.

5.3. Inclusive Teaching Methods

1. Methods of forming consciousness: conversation, debate, lecture, example, explanation, persuasion.
2. The method of organizing activities and the formation of social behavior of the individual: exercises, training, educational situations, example.
3. Methods of motivation and stimulation: demand, public opinion. We believe that it is unacceptable to use methods of emotional stimulation in inclusive education - competition, encouragement, persuasion.
4. Method of self-education: self-knowledge, self-evaluation, self-regulation.
5. Methods of social and psychological assistance: psychological counseling, self-training, stimulation games.
6. Special methods: patronage, support, training, mediation.
7. Special methods of pedagogical correction that should be used to purposefully correct behavior or other disorders caused by a common cause. Special methods of corrective work include: subjective-pragmatic method, method of substitution, method of "explosion", method of natural consequences and labor method.

6. SYSTEM OF EVALUATION OF EDUCATIONAL ACHIEVEMENTS OF HIGHER EDUCATION STUDENTS

The discipline is evaluated according to the modular rating system. It consists of 2 modules.

The results of students' academic activity are evaluated on a 100-point scale in each semester separately.

Based on the results of the current, modular and semester tests, a final grade is set on a 100-point scale, a national scale and an ECTS scale.

Modular control: the number of points required to obtain an appropriate grade for each content module during the semester.

Semester (final) control: setting a semester grade for students who have worked on theoretical topics, practically mastered them and have positive results, scored the required number of points.

The general criteria for assessing the performance of students who received a 4-point scale of "excellent", "good", "satisfactory", "unsatisfactory" are given in the table below.

Each module includes points for the current work of the student in seminars, practical, laboratory classes, independent work, individual work, modular control work.

Modular tests are performed in the mode of computer diagnostics or with the use of printed tasks.

Precis and essays performed by the student on a specific topic are discussed and defended in seminars.

Modular control of students' knowledge is carried out after completing the study material of the module.

Assessment tools and methods for demonstrating learning outcomes are:

- test;
- standardized tests;
- control works;
- precis, essays;
- presentation of the results of completed tasks and research;
- student presentations and speeches at scientific events;
- other types of individual and group tasks.

6.1. General Criteria for Assessing Student Achievement

Rating	Evaluation criteria
<i>"excellent"</i>	It is considered for full and strong knowledge of a material in the set volume, ability to carry out freely the practical tasks provided by the curriculum; for knowledge of basic and additional literature; for showing creativity in understanding and creative use of acquired knowledge and skills.
<i>"good"</i>	The student is required to show complete, systematic knowledge of the discipline, successful completion of practical tasks, mastering the basic and additional literature, the ability to independently replenish and update knowledge. But there are minor errors in the student's answer.
<i>"satisfactorily"</i>	It is considered a manifestation of knowledge of the basic educational material in the volume sufficient for further training and future professional activity, superficial acquaintance with the basic and additional literature provided by the curriculum. There may be significant errors in performing practical tasks, but the student is able to eliminate them with the help of the teacher.
<i>"unsatisfactorily"</i>	It is presented to the student, the answer of which during the reproduction of the main program material is superficial, fragmentary, which is determined by the initial ideas about the subject of study. Thus, the grade "unsatisfactory" is given to a student who is unable to study or perform professional activities after graduation from higher education without re-education in the program of the discipline.

6.2. System for Evaluating the Work of Students / Graduate Students during the Semester

Type of activity of a student / graduate student	Maximum number of points per unit	Module 1		Module 2		Module 3	
		number of units	maximum number of points	number of units	maximum number of points	number of units	maximum number of points
I. Required							
1.1. Attending lectures	1	6	6	6	6	4	4
1.2. Work on seminars and practical classes	5	3	15	3	15	2	10
1.3. Laboratory work (including admission, execution, protection)	5	3	15	3	15	2	10
1.4. Performing tasks for independent work	2-5	6	30	6	12	4	8
1.5. Execution of modular work	25	1	20	1	15	1	15
1.6. Execution of individual tasks (IERT)	30	-	-	-	-	-	-
Together		-	50	-	50	-	50
Maximum number of points for required types of work: 50							
II. Selective							
Performing tasks for self-study							
2.1. Compilation of situational tasks on different topics of the course	5	-		-		-	-
2.2. Review of literature on specific topics	5	-		-		-	-
2.3. Composing a business game with specific practical material on any topic of the course	5	-		-		-	-
2.4. Preparation of a scientific article on any topic of the course	10	-	5	-	5	-	5
2.5. Participation in a scientific student conference	5	-	5	-	5	-	5
2.6. Research of Ukrainian or foreign experience	5	-		-		-	-
Together		-	10	-	10	-	10
Maximum number of points for selected types of work: 10							
Total points for theoretical and practical course: 60							

The number of points for working with theoretical material, in practical classes, during the implementation of independent and individual educational and research work depends on compliance with the following requirements:

- ✓ timeliness of educational tasks;
- ✓ the full scope of their implementation;
- ✓ quality of educational tasks;

- ✓ independence of execution;
- ✓ creative approach to tasks;
- ✓ initiative in educational activities.

6.3. Assessment for Theoretical and Practical Course: National and ECTS Assessment Scale

Score on a 100-point system		Score on a national scale	Assessment on the ECTS scale	
54 - 60 and more	<i>excellent</i>	5	A	<i>excellent</i>
45 – 53	<i>good</i>	4	BC	<i>good</i>
36 – 44	<i>satisfactorily</i>	3	DE	<i>satisfactorily</i>
21 – 35	<i>unsatisfactorily</i>	2	FX	<i>unsatisfactory with the possibility of re-possession</i>
1 – 20		2	F	<i>unsatisfactory with mandatory re-study of the discipline</i>

6.3.1. Exam Score: National and ECTS Grading Scale

Score on a 100-point system		Score on a national scale	Assessment on the ECTS scale	
36 - 40 and more	<i>excellent</i>	5	A	<i>excellent</i>
30 – 35	<i>good</i>	4	BC	<i>good</i>
24 – 29	<i>satisfactorily</i>	3	DE	<i>satisfactorily</i>
14 – 23	<i>unsatisfactorily</i>	2	FX	<i>unsatisfactory with the possibility of re-possession</i>
1 – 13		2	F	<i>unsatisfactory with mandatory re-study of the discipline</i>

6.4. General Assessment of the Course: National Assessment Scale and ECTS

Score on a 100-point system		Score on a national scale		Assessment on the ECTS scale	
		exam	grading test		
90 – 100	<i>excellent</i>	5	<i>credited</i>	A	<i>excellent</i>
82 – 89	<i>good</i>	4		B	<i>good (very good)</i>
75 – 81	<i>good</i>	4		C	<i>good</i>
64 – 74	<i>satisfactorily</i>	3		D	<i>satisfactorily</i>
60 – 63	<i>satisfactorily</i>	3		E	<i>satisfactorily (enough)</i>
35 – 59	<i>unsatisfactorily</i>	2	<i>not credited</i>	FX	<i>unsatisfactory with the possibility of re-possession</i>
1 – 34	<i>unsatisfactorily</i>	2		F	<i>unsatisfactory with mandatory re-study of the discipline</i>

6.5. Distribution of Points received by Students

Example for grading test

Current testing and independent work												Together	Credit	Sum
Content module №1						Content module № 2								
T1	T2	T3	T4	T5	T6	T1	T2	T3	T4	T5	T6			
5	5	5	5	5	5	5	5	5	5	5	5	not more than 60	not more than 40	not more than 100

Example for the exam

Current testing and independent work												Final test (exam)	Sum
Content module №1						Content module № 2							
T1	T2	T3	T4	T5	T6	T1	T2	T3	T4	T5	T6		
5	5	5	5	5	5	5	5	5	5	5	5	not more than 40	not more than 100

Example for the implementation of a course project (work)

Literature review	The experimental part	Work protection	Sum
to 2	to 5	to 3	not more than 10

6.6. INDICATIVE LIST OF QUESTIONS FOR THE EXAM (TEST)

1. Research methodology.
2. Science as research.
3. Methods and methodology of scientific research.
4. Methodological problems of nonlinear natural science as a phenomenon of post-classical science.
5. Methodology and methods of scientific research.
6. The essence of scientific research. Types of research.
7. Methodological, philosophical and aesthetic SC of modern biological research.
8. Methodological SCladova mental operations.
9. Organization and conduct of biological research
10. Methodological and methodical parts of scientific research. Features of the organization and conduct of a biological experiment
11. Organization of science in Ukraine. Scientific and pedagogical staff.
12. Features of formulation of a theme of scientific researches of a biological direction. Formulation of the purpose, tasks of research, definition of object and subject of research.
13. Search for scientific information. Scientometric databases and basic scientific electronic resources.
14. Basic rules of registration of a scientific publication. Presentation of scientific results.
15. Comparison of the system of organization of science in different countries
16. Work with electronic scientometric databases and scientific libraries.
17. Features of experimental work on animals. Preclinical studies.
18. Requirements for clinical trials.
19. Fundamentals of intellectual property
20. The concept of intellectual property
21. Copyright and related rights

22. rights and obligations of owners of intellectual property rights and other participants in copyright relations. Rules for concluding agreements on intellectual property.
23. The value of the study of intellectual property for students of non-legal specialties
24. Plagiarism in scientific research. How to avoid it?
25. Modern methods of research of biological objects of different levels of organization
26. Basic principles of biological research methods
27. The latest technologies and their application in the practice of biological research
28. Methods of research of biological macromolecules, cells and non-cellular life forms
29. The latest technologies and their application in the study of biological macromolecules, cells and non-cellular life forms
30. Methods of studying the functioning of organisms
31. The latest technologies and their application in studies of the functioning of organisms
32. Methods of field research of biological systems
33. The latest technologies and their application in field research of biological systems

EXAMINATION TICKETS

Open International University of Human Development "Ukraine"

DEPARTMENT / CYCLE COMMISSION

Educational degree / educational qualification level: _____

All specialties / specialty _____

Semester: autumn / spring (underline)

Academic course: _____

EXAMINATION TICKET № _____

1. _____
2. _____
3. _____

Approved at the meeting of the department / cycle commission _____

Protocol No__ from "___" _____ 20__.

Head of the department / chairman of the cycle commission

 (signature) (SNSc.N)

Examiner _____
 (signature) (position, SNSc.N)

7. METHODOLOGICAL SUPPORT

List	Availability (+/-)
Educational and methodical complex of studying the discipline in distance form;	+
Reference notes of lectures	+
Test tasks	+
Presentations for lectures	+
Methodical recommendations for independent work of students	+
Exam questions	+
<p>Tutorials:</p> <p>1. Vorobyova G. Research Activities. Patent. Intellectual Property : Tutorial for students non-legal professions / by G. Vorobyova [etc.] – Kyiv : Caravela, 2020. – 116 p. – ISBN 978-966-2229-80-6. Medical Microbiology, Virology and Immunology = Медична мікробіологія, вірусологія та імунологія : a textbook for English-speaking students of higher medical schools : translation from Ukr. / by T.V. Andrianova, by V.V. Bobyr, by V.V. Danyleichenko [etc.]; Ed. by V.P.Shyrobokov. – Vinnytsia : Nova Knyha, 2019. –744 p.</p> <p>2. Research Methodology in the Medical and Biological Sciences</p> <p>Editors: Petter Laake, Haakon Breien Benestad, Bjorn R. Olsen</p> <p>https://books.google.com.ua/books?id=jJ8734qdiuoC&prints=ec=frontcover&dq=methodology+of+research+biology&hl=ru&sa=X&ved=2ahUKEwjPw9Xcic7uAhXnh4sKHbRTB0YQ6AEwAHoECAQQAg#v=onepage&q=methodology%20of%20research%20biology&f=false</p>	+
<p>Scientific Research Methodologies and Techniques Unit 1: Introduction Luis M. Camarinha-Matos</p> <p>https://www.geophysik.uni-muenchen.de/~valerian/Scientific_Working/SRMTunit1.pdf</p>	+

The Experimental Method https://www.colby.edu/biology/BI17x/expt_method.html	
Writing a Scientific Research Article http://www.columbia.edu/cu/biology/ug/research/paper.html	
The Scientific Method: Steps, Terms and Examples https://www.youtube.com/watch?v=BVfI1wat2y8	

7.1. Educational and Methodical Audio and Video Materials, including for Students with Disabilities

For inclusive education:

- methods of differentiated approach to the process of teaching and assessing the knowledge, skills and abilities of students with disabilities;
- distance learning programs for students with hearing problems and musculoskeletal disorders.
- computer programs for teaching people with disabilities;
- availability of audiovisual teaching aids in electronic and audiovisual formats;
- didactic materials and teaching aids for distance and open forms of learning.

7.2. Glossary (Terminology)

Abstraction – a method of thinking, which involves the reflection in the human consciousness of objects and phenomena of objective reality, mental separation from their secondary properties and relationships and the selection of a common feature that characterizes the class of objects.

Academician – an academic title of full members of the NAS and branch academies of Ukraine: the highest academic title held by persons elected to the Academies of Sciences.

Actuality of theme – modernity, topicality, the importance of anything at the moment and in this situation to solve this problem.

Algorithm – a system of rules for solving a certain type of problem.

Altruism – an ethical principle, which is a selfless desire to act for the benefit of others as opposed to selfishness.

Analogy – considerations in which from the similarity of two objects on separate signs the conclusion on their similarity and on other signs is made. Used in making hypotheses, gives impetus to speculation.

Analysis – a division of the whole into constituent parts (parties, signs, properties, relations) for the purpose of their detailed study.

Annotation – a brief information about the book, article, monograph.

Aporia – a contradiction in reasoning that seems insurmountable

Aspect – the point of view from which the object of research is considered.

Aspectation – a search for the optimal type of scientific work.

Avtoreferat – a scientific publication in the form of a brochure containing the author's version of the precis presentation of his research.

Axiom – statements, provisions adopted without proof.

Alphabetical catalog – a system of cards with a description of the publication, arranged in alphabetical order by the name of the authors and the titles of the publication, regardless of their content.

Deduction – a form of reliable inference from the general to the partial position, in which the conclusion about individual cases of the plural is made on the basis of knowledge of the general properties of the whole set.

Definition – a brief definition of the meaning of a concept.

Determination – a logical action by which an object must be distinguished from others by establishing its specific and typical features or such disclosure of the

meaning of the term that denotes the object and replaces the description of its properties.

Determination (definition) – a concise scientific definition of the meaning of a concept.

Digest – a publication that consists of separate works by different authors, devoted to one area, but from different branches.

Display – a general property of matter, which is that under certain conditions of interaction one material system reproduces in a specific form certain aspects of another system that interacts with it.

Epistemology – a doctrine of the essence and patterns of knowledge.

Experiment – an approbation of the studied phenomena in controlled, artificially created conditions.

Information industry – a set of documented or publicly announced information about relatively independent spheres of life and activity.

Genesis – a process of creation and formation of any natural or social phenomenon.

Hypothesis – a scientific prediction, assumption, the truth of which is not defined, put forward to explain any phenomena, processes, causes that determine this consequence.

Idea – a product of human thinking, a form of spiritual and cognitive reflection of reality, aimed at its transformation. It reflects not only the object of study, but also realizes the purpose and its practical implementation. By mastering the masses of people, the idea is able to become a great transforming material force.

Idealization – constructing objects that do not exist in reality or that have not been realized in practice, endowing objects with properties that correspond to the ideal.

Induction – a research method and method of reasoning, in which the overall conclusion is based on partial references.

Intuition – the ability to directly understand the truth. The results of intuitive cognition are logically proved over time and tested in practice.

Measurement – an operation based on the comparison of objects by certain similar properties or features using quantitative characteristics.

Questionnaire – one of the types of written survey of a significant number of respondents according to the full scheme of the questionnaire or questionnaire.

Reference and information fund – a set of organized primary documents and reference and search apparatus designed to meet information needs.

Science Tools – methods of thinking, empirical research, and technical means.

Sensation-reflection – properties of objects of objective reality that affect the senses; as a reflection of the objective properties of things, sensation is a means of knowing reality.

Statute – a philosophical category that reflects the essential, general, necessary, stable, recurring relations of dependence between objects and phenomena of objective reality, arising from their essence.

Scientific task – a theoretical problem that requires the establishment of a previously unknown pattern, property or phenomenon.

Truth – a true, adequate reflection of objects and phenomena of reality, their reproduction as they exist outside our consciousness. Truth is objective in content, but subjective in form, as a result of human thinking.

Validity – a criteria for assessing the quality of the text.

Verification – a verification, empirical confirmation of theoretical positions of science by comparing them with the object of study, the data of sensation and experiment, is the repeatability of the research result.

7.3 Recommended Books

Basic

3. Vorobyova G. Research Activities. Patent. Intellectual Property : Tutorial for students non-legal professions / by G. Vorobyova [etc.] – Kyiv : Caravela, 2020. – 116 p. – ISBN 978-966-2229-80-6.

4. Medical Microbiology, Virology and Immunology = Медична мікробіологія, вірусологія та імунологія : a textbook for English-speaking students of higher medical schools : translation from Ukr. / by T.V. Andrianova, by V.V. Bobyr, by V.V. Danyleichenko [etc.]; Ed. by V.P.Shyrobokov. – Vinnytsia : Nova Knyha, 2019. –744 p.

5. Research Methodology in the Medical and Biological Sciences
 Editors: Petter Laake, Haakon Breien Benestad, Bjorn R. Olsen
<https://books.google.com.ua/books?id=jJ8734qdiuoC&printsec=frontcover&dq=methodology+of+research+biology&hl=ru&sa=X&ved=2ahUKEwjPw9Xcic7uAhXnh4sKHbRTB0YQ6AEwAHoECAQQAg#v=onepage&q=methodology%20of%20research%20biology&f=false>

6. Correlative Microscopy in Biology: Instrumentation and Methods
 Editors: M.A. (Eric) Hayat
<https://books.google.com.ua/books?id=YdiCk1mQ6aYC&printsec=frontcover&dq=methodology+of+research+biology&hl=ru&sa=X&ved=2ahUKEwjPw9Xcic7uAhXnh4sKHbRTB0YQ6AEwA3oECAyQAg#v=onepage&q=methodology%20of%20research%20biology&f=false>

7. Research in Medical and Biological Sciences: from Planning and Preparation
 Authors: Petter Laake, Haakon Breien Benestad
<https://books.google.com.ua/books?id=p9icBAAAQBAJ&printsec=frontcover&dq=methodology+of+research+biology&hl=ru&sa=X&ved=2ahUKEwjPw9Xcic7uAhXnh4sKHbRTB0YQ6AEwBnoECAkQAg#v=onepage&q=methodology%20of%20research%20biology&f=false>

7.4. Information Resources

Research Methodology: A Step-by-Step Guide for Beginners

Authors: Ranjit Kuma

<https://books.google.com.ua/books?id=a3PwLukoFIMC&printsec=frontcover&dq=methodology+of+research&hl=ru&sa=X&ved=2ahUKEwihnjUiM7uAhUIxYsKHRIbDGoQ6AEwAHoECAyQAg#v=onepage&q&f=false>

Research Methodology: Methods and Techniques

Authors: C. R. Kothari

<https://books.google.com.ua/books?id=hZ9wSHysQDYC&printsec=frontcover&dq=methodology+of+research&hl=ru&sa=X&ved=2ahUKEwihnjUiM7uAhUIxYsKHRIbDGoQ6AEwAnoECAAQAg#v=onepage&q&f=false>

Research Methodology in the Medical and Biological Sciences

редактор(ы): Petter Laake, Haakon Breien Benestad, Bjorn R. Olsen

<https://books.google.com.ua/books?id=jJ8734qdiuoC&printsec=frontcover&dq=methodology+of+research+biology&hl=ru&sa=X&ved=2ahUKEwjPw9Xcic7uAhXnh4sKHbRTB0YQ6AEwAHoECAQQAg#v=onepage&q=methodology%20of%20research%20biology&f=false>

Correlative Microscopy In Biology: Instrumentation and Methods редактор(ы):

M.A. (Eric) Hayat

<https://books.google.com.ua/books?id=YdiCk1mQ6aYC&printsec=frontcover&dq=methodology+of+research+biology&hl=ru&sa=X&ved=2ahUKEwjPw9Xcic7uAhXnh4sKHbRTB0YQ6AEwA3oECAyQAg#v=onepage&q=methodology%20of%20research%20biology&f=false>

Research in Medical and Biological Sciences: From Planning and Preparation ...

Authors: Petter Laake, Haakon Breien Benestad

<https://books.google.com.ua/books?id=p9icBAAAQBAJ&printsec=frontcover&dq=methodology+of+research+biology&hl=ru&sa=X&ved=2ahUKEwjPw9Xcic7uAhXnh4sKHbRTB0YQ6AEwBnoECAkQAg#v=onepage&q=methodology%20of%20research%20biology&f=false>

The Scientific Method: Steps, Terms and Examples

<https://www.youtube.com/watch?v=BVfI1wat2y8>

8. MATERIAL AND TECHNICAL SUPPORT OF THE DISCIPLINE

Forms of employment	Available logistics	Necessary logistics
Lecture	own or departmental laptop	projector, interactive whiteboard, felt-tip pens to it, premises with Internet access
Practice session		laboratory premises № _____, consumables