



**SYLLABUS OF THE ACADEMIC DISCIPLINE**  
**«MODERN PROBLEMS OF MOLECULAR BIOLOGY»**

<b>1. General Information</b>	
<b>Faculty</b>	Faculty of Foreign Students
<b>Education Programme</b>	22 Healthcare 222 Medicine 2nd (master's) degree of Higher Education, full-time
<b>Academic year</b>	2023-2024
<b>Discipline, code</b>	Modern problems of molecular biology, code ББ 1.28 e-mail: <a href="mailto:Kaf_medicalbiology@meduniv.lviv.ua">Kaf_medicalbiology@meduniv.lviv.ua</a>
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<b>Studying year</b>	I course
<b>Semester</b>	I
<b>Type of discipline</b> (obligatory / selective)	selective
<b>Educators</b>	1. Solomiya Paryzhak – Ph.D., Assoc. Prof. <a href="mailto:sola.paryzhak@gmail.com">sola.paryzhak@gmail.com</a> ; 2. Olena Onufrovysh – Ph.D., Assoc. Prof. <a href="mailto:onufrovyshok@ukr.net">onufrovyshok@ukr.net</a>
<b>Erasmus yes/no</b>	No
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<b>Quantity of ECTS credits</b>	3
<b>Quantity of hours</b> (lectures/ practical classes/ individual work)	Total – 90 h Lectures – 12 h; Practical classes – 18 h; Individual student's work – 60 h
<b>Language of instruction</b>	English
<b>Information about consultations</b>	According to the schedule

## 2. Course overview

«Modern problems of molecular biology» (selective course) as a discipline is studied by the I year students. It is based on «General biology» subject, which the students are supposed to know from their previous secondary school learning and is integrated with «Medical biology, parasitology and genetics» discipline. The Working Program contains such chapters: «Molecular basis of heredity», «Molecular basis of hereditary diseases», «Modern issues of genetic technologies». The discipline «Modern problems of molecular biology», is fundamental for the next block of disciplines, which ensure a range of subjects providing both natural-science (NS unit) and professional-practical (PP unit) preparation of Higher Medical Institution graduates and are based on the essence of system theoretical knowledge, practical skills necessary for doctors.

## 3. Aim and goals of the course

**The aim** of the course is to form knowledge and practical aptitude for further students' mastering the block of relevant disciplines, which provide natural-science (NS unit) and professional-practical (PP unit) preparation for understanding modern problems as well as achievements of molecular medicine.

### **The ultimate goals**

1. To explain the the patterns of human organism vital functions manifestation at the molecular-biological and cellular levels.
2. To identify the manifestations of general biological laws during human ontogenesis.
3. To understand the molecular-genetic basis for the development of hereditary and multifactorial diseases, prospects for the application of advances in molecular biology in practical medicine.
4. To explain the nature and mechanisms of inherited human diseases phenotypic manifestation.

### **Competencies and studying process results**

**Integral competence.** The ability to solve complex problems, including research and innovation in medicine. The ability to continue learning with a high degree of autonomy.

### **General (3K):**

- 3K 1. The ability for abstract thinking, analysis and synthesis.
- 3K 2. The ability to learn and acquire advanced knowledge.
- 3K 3. The ability to apply knowledge in practical situations;
- 3K 4. Knowledge and understanding of the subject area and understanding of professional activity.
- 3K 5. The ability to adapt and act in a new situation.
- 3K 6. The ability to make responsible decisions.
- 3K 7. The ability to work as a team member.
- 3K 8. Skills of interpersonal interaction.
- 3K 9. The ability to communicate in the foreign language.
- 3K 10. The ability to apply information and communication technologies.
- 3K 11. The ability to search, process and analyze information from various sources.
- 3K 12. To be determined and insistent in according to tasks and responsibilities.
- 3K 13. Awareness of equal opportunities and gender issues.
- 3K 14. The ability to realize the own rights and responsibilities as a member of society, to recognize the values of civil (free democratic) society and the need for its sustainable development, the rule of law, human and civil rights and freedoms in Ukraine.
- 3K 15. The ability to preserve and multiply the moral, cultural, scientific values and achievements of society based on understanding the history and patterns of development of the subject area, its place in the general system of knowledge about nature and society and in the development of society, techniques and technologies, to use different types and forms of motor skills for recreation and a healthy lifestyle.

**Special (professional) (ФК):**

ФК 2. The ability to determine the necessary list of laboratory and instrumental studies and evaluate their results.

ФК 13. The ability to carry out sanitary and hygienic and preventive measures.

ФК 17. The ability to evaluate the impact of the environmental, socio-economic and biological determinants on the individual, family and population health.

ФК 21. To convey one's own knowledge clearly and nonambiguous, conclusions and arguments on health care problems and related issues to specialists and non-specialists, in particular to people who are studying.

ФК 24. Compliance with ethical principles when working with patients and laboratory animals.

ФК 25. Adherence to the values of professional and academic integrity, to be responsible for the reliability of the obtained scientific results.

**Program learning outcomes in accordance with the standards of higher education:**

ППН 1. To have thorough knowledge of the professional activity structure. To be able to carry out professional activities that require updating and integration of knowledge. To be responsible for professional development, the ability for further professional training with a high level of autonomy.

ППН 2. Understanding and knowledge of basic and clinical biomedical sciences, at a level sufficient for solving professional tasks in the field of health care.

ППН 19. To plan and to implement a system of anti-epidemic and preventive measures regarding the occurrence and spread of diseases among the population.

ППН 21. To collect information the necessary information in the professional literature and databases of other sources, to analyze, to evaluate and to apply this information.

ППН 23. To evaluate the environmental impact on human health in order to assess the morbidity of the population.

ППН 25. To convey one's own knowledge, conclusions and arguments on health care problems and related issues to specialists and non-specialists clearly and nonambiguous.

ППН 27. To communicate freely in the state language and in English, both orally and in writing to discuss professional activities, research and projects.

**4. Preliminary requirements**

For successful learning and gaining necessary competencies in the discipline being studied, fundamental knowledge of biology (such subjects as "General Biology", "Human Biology",) in accordance with State standard for basic general secondary education is advisable.

**5. Program learning results****List of the learning results**

<b>Code of education results</b>	<b>Essence of education results</b>	<b>Matrix of competencies</b>
ЗН – knowledge УМ – skills АВ – independence and responsibility К – competencies		ППН – program learning outcomes
<i>3Н-1</i>	To know the role of nucleic acids in the storage and realization of hereditary information.	<i>ППН- 1,</i>

3H-2	To know the importance of replication, recombination and repair of DNA processes in the human body in norm and in pathology.	<i>PPH -2,</i> <i>PPH- 21,</i> <i>PPH- 23,</i> <i>PPH-25</i>
3H-3	To know the molecular mechanisms of genetic information realization in a cell, as well as its regulation in pro- and eukaryotes.	
3H-4	To know the peculiarities of human genome organization.	
3H-5	To know the molecular mechanisms of mutagenic factors action and methods of mutagenic activity studying.	
3H-6	To know modern methods of the human genome study.	
3H-7	To know the basic mechanisms of apoptosis.	
3H-8	To know the nucleic acid methods investigation, DNA diagnostics, genetic engineering.	
YM-1	Be able to explain the relationship between the molecular structure of a gene and its expression.	
YM-2	Be able to classify the forms of variability, to distinguish between gene, chromosomal and genome mutations.	
YM-3	Be able to explain the importance of mutagenic factors of different nature for the formation of molecular and chromosomal human diseases.	
YM-4	Be able to explain the importance of the cloning method for biology and medicine.	
YM-5	Be able to solve situational problems, to identify the primary structure of the protein, the number of amino acids, the molecular weight of the polypeptide according to the gene structure encoding it	
K-1	To apply knowledge of molecular and cytological basis of heredity in practical activity of a doctor.	
K-2	To interpret the importance of molecular-genetic methods for the diagnosis of hereditary and infectious diseases in forensic medicine.	
K-3	To apply knowledge of modern advances in molecular biology in practical medicine.	
K-4	To use the own professional activities for the environmental protection.	
AB-1	Be responsible for mastering the relevant knowledge and content.	
AB-2	Be responsible for the measures that preserve the environment within its own competence.	
<b>6. Course format and content</b>		
<b>Course format</b>	Full-time Course	
Classes	Hours	Groups

lectures		12		
practical		18		
individual		60		
<b>7. Topics and content of the Course</b>				
<b>Code of the classes type</b>	<b>Topic</b>	<b>Content</b>	<b>Code of the learning outcomes</b>	<b>Educator</b>
Л – lecture П – practical class СРС – individual student's work				
Л-1	Subject and tasks of molecular biology. The main stages of development. Prospects for the application of modern advances in molecular biology in clinical medicine.	To acquaint students with the subject and tasks of molecular biology; stages of development; achievements; the possibility of application in clinical medicine.	ЗН-1, ЗН-8, К-1, К-2, К-3, АВ-1	Assoc. Prof. Paryzhak S.Ya., Assoc. Prof. Onufrovych O.K.
Л-2	Nucleic acids and their role in the storage of hereditary information.	Chemical composition of DNA, RNA; macromolecular organization. Types of DNA helices. Types of RNA and their biological functions. Molecular mechanisms of DNA recombination, replication and repair. DNA replication as a prerequisite for the transmission of genetic information to offspring. Characteristics of the process of replication, reparation.	ЗН-1, ЗН-2, К-1, АВ-1	Assoc. Prof. Paryzhak S.Ya., Assoc. Prof. Onufrovych O.K.
Л-3	Genomic organization in non-cellular and cellular organisms. Regulation of	To consider the structure and functions of viral genomes, the Lac operon of <i>E. coli</i> and the exon-intron organization of the eukaryotic genome. Control of gene expression in pro- and eukaryotes. Regulation at the	ЗН-3, ЗН-4 АВ-1	Assoc. Prof. Paryzhak S.Ya., Assoc. Prof. Onufrovych O.K.

	gene expression.	level of translation and post-translation processes.		
Л-4	Cell cycle. Genetic mechanisms of carcinogenesis. Regulation of the cell cycle.	To consider the mitotic cycle, its regulation. The role of cyclins and cyclin-dependent kinases. Principles of mitotic signal transmission. The role of growth factors, integrins and cadherins. Characteristics of genes involved in carcinogenesis: viral oncogenes, protooncogenes, tumor suppressor genes, mutator genes. Carcinogenic factors.	ЗН-5, ЗН-7, АВ-1, АВ-2	Assoc. Prof. Paryzhak S.Ya., Assoc. Prof. Onufrovych O.K.
Л-5	Genetic engineering. Transgenic organisms. Gene therapy: prospects for application in medicine.	Recombinant DNA, principles of their construction. Cloning of nucleic acid fragments <i>in vivo</i> . Definition of the concept of vector in biology. Vectors: plasmids, bacteriophages, cosmids, artificial chromosomes. Principles of construction of transgenic organisms. Transgenic bacteria, plants, animals. Principles of gene therapy. Ex vivo and in vivo gene therapy. Viral and non-viral vectors in chemotherapy. Prospects and limitations of gene therapy.	ЗН-6, ЗН-8, К-2, К-3, АВ-1, АВ-2	Assoc. Prof. Paryzhak S.Ya., Assoc. Prof. Onufrovych O.K.
Л-6	Cell engineering. Cloning of organisms. Biological and ethical problems of cloning.	The concept of cloning. Natural and artificial clones. History of organisms cloning. Biological and ethical problems of cloning. Therapeutic cloning and its prospects in medicine.	ЗН-6, ЗН-8, К-2, К-3, АВ-1, АВ-2	Assoc. Prof. Paryzhak S.Ya., Assoc. Prof. Onufrovych O.K.
П-1	Molecular mechanisms of DNA replication.	Characteristics of the DNA replication process. Events occurring in the replication fork. Replication error correction system.	ЗН-2, УМ-5, К-1, АВ-1	Assoc. Prof. Paryzhak S.Ya., Assoc. Prof. Onufrovych O.K.
П-2	DNA repair. Mechanisms of damaged DNA repair. Hereditary diseases with defects in DNA repair.	To consider the types and molecular mechanisms of DNA repair. Excisional, non-excisive, recombinant reparation. The concept of DNA repair diseases	ЗН-2, УМ-3, К-1, АВ-1	Assoc. Prof. Paryzhak S.Ya., Assoc. Prof. Onufrovych O.K.

II-3	Genome structure and molecular mechanisms of gene expression in viruses.	Organization of the viral genomes. The concept of the lysogenic and lytic cycles of viruses. Peculiarities of the retroviruses genome and life cycle.	3H-3, УМ-1, K-1, AB-1	Assoc. Prof. Paryzhak S. Ya., Assoc.Prof. Onufrovyh O.K.
II-4	Genome structure and molecular mechanisms of gene expression in pro- and eukaryotes.	Current state of pro- and eukaryotic genomes study. Regulation of gene expression in prokaryotes. Catabolic and anabolic operons of bacteria. Control of gene expression in eukaryotes. Regulation of gene expression at the structural organization level, at the level of transcription and translation.	3H-3, УМ-1, K-1, K-2, AB-1	Assoc. Prof. Paryzhak S. Ya., Assoc.Prof. Onufrovyh O.K.
II-5	Human genome organization.	«Human Genome» Project. Nuclear and mitochondrial genome. Features of the human genome. The main ways of the human genome research: structural, functional, comparative, informative. Knowledge of the human genome opens new perspectives in the diagnosis and treatment of inherited human diseases.	3H-4, 3H-6, УМ-1, K-1, K-2, AB-1	Assoc. Prof. Paryzhak S. Ya., Assoc.Prof. Onufrovyh O.K.
II-6	Molecular mechanisms of mutations.	Classification of gene mutations. The concept of monogenic hereditary diseases. Molecular and cytological mechanisms of chromosomal mutations. Classification of mutations. Generative and somatic mutations. Mutagenic factors, methods for determining the mutagenic activity of substances. Antimutagenesis.	3H-5, УМ-2, УМ-3, K-2, K-3, AB-1	Assoc. Prof. Paryzhak S. Ya., Assoc.Prof. Onufrovyh O.K.
II-7	Regulation of the cell cycle. Molecular basis of oncogenetics.	To consider the mitotic cycle, its regulation. The role of cyclins and cyclin-dependent kinases in changing the phases of the mitotic cycle. Mitogenic signaling pathways. Characteristics of genes involved in carcinogenesis: viral oncogenes, protooncogenes, tumor suppressor genes, mutator genes. Carcinogenic factors.	3H-5, 3H-7, УМ-3, K-2, AB-1, AB-2	Assoc. Prof. Paryzhak S. Ya., Assoc.Prof. Onufrovyh O.K.
II-8	Gene therapy. Transgenic organisms.	Principles of gene therapy. Ex vivo and in vivo gene therapy. Viral and non-viral vectors in gene therapy. Prospects and limitations of gene therapy.	3H-8, УМ-4, K-2, K-3, K-4, AB-1,	Assoc. Prof. Paryzhak S. Ya., Assoc.Prof. Onufrovyh O.K.

		Principles of construction of transgenic organisms. Transgenic bacteria: the main areas of application in the national economy and medicine. Transgenic plants, their use. Transgenic animals as disease models and bioreactors. Environmental safety issues.	AB-2	
II-9	Cloning of organisms and cells. Therapeutic cloning and its prospects in medicine.	The concept of cloning. Natural and artificial clones. History of cloning of organisms. Biological and ethical problems of cloning. Therapeutic cloning and its prospects in medicine.	3H-8, УМ-4, K-2, K-3, K-4, AB-1, AB-2	Assoc. Prof. Paryzhak S.Ya., Assoc.Prof. Onufrovych O.K.
CPC-1	Proteins, their role in providing of biological specificity. The concept of proteomics. Prion diseases.	The role of proteins in providing of biological specificity. Formation of a polypeptide chain. The structure of protein molecules. Classification of proteins according to biological functions. Carrier proteins, signaling, protective, structural, receptor, regulatory, enzymes. The concept of proteomics and prion diseases.	3H-1, K-1, K-4, AB-1	Assoc. Prof. Paryzhak S.Ya., Assoc.Prof. Onufrovych O.K.
CPC-2	Mobile genetic elements. Molecular mechanisms of general genetic recombination.	Mobile genetic elements of the human genome (MGE): transposons, retrotransposons. Structure, distribution and functional role. Chromosomal and gene localization of MGE. The role of MGE in genome function, participation in recombination processes, regulation of gene activity and in the formation of new genes.	3H-2, K-1, AB-1	Assoc. Prof. Paryzhak S.Ya., Assoc.Prof. Onufrovych O.K.
CPC-3	Nucleic acid research methods. Methods of DNA diagnostics. Molecular genetic research methods in forensic medicine.	Methods of DNA isolation from plant and animal tissues. Characteristics of enzymes used for genetic engineering research. Indications for DNA diagnostics. Direct and indirect methods. DNA chips. Genetic identification of a person in forensic examination.	3H-8, K-2, AB-1	Assoc. Prof. Paryzhak S.Ya., Assoc.Prof. Onufrovych O.K.
CPC-4	Modern methods of human	Human karyotype. Obtaining samples of mitotic chromosomes, their differential staining. Molecular	3H-4, 3H-8, K-2,	Assoc. Prof. Paryzhak S.Ya.,



	karyotype study.	cytogenetic methods: FISH-method, comparative genome hybridization, spectroscopic analysis of chromosomes.	K-3, AB-1	Assoc.Prof. Onufrovych O.K.
CPC-5	Molecular mechanisms of cell aging.	Telomeric regions of chromosomes, their functions. Replication of telomeric regions of DNA. Telomerase, its activity in germ and stem cells. Participation of telomerases in the processes of cell aging and cancer therapy.	3H-7, K-2, K-3, AB-1	Assoc. Prof. Paryzhak S.Ya., Assoc.Prof. Onufrovych O.K.
CPC-6	Molecular mechanisms of intercellular signaling and transmembrane transport	To consider the molecular organization and functions of biological membranes; surface receptors of cell membranes. To draw students' attention to the mechanisms of transmembrane signaling. To consider the types of substances transport.	3H-7, AB-1	Assoc. Prof. Paryzhak S.Ya., Assoc.Prof. Onufrovych O.K.
CPC-7	Extranuclear heredity. Mitochondrial genome.	Extranuclear heredity: DNA of mitochondria and plastids. Mitochondrial genome, structure peculiarities. Mitochondrial diseases. Using mtDNA analysis to study maternal lineage, human evolution, population migration, human identification.	3H-4, K-2, K-3, AB-1	Assoc. Prof. Paryzhak S.Ya., Assoc.Prof. Onufrovych O.K.
CPC-8	Apoptosis: molecular mechanisms. Ways to realize the apoptosis program.	Apoptosis as a physiological process of cellular suicide. Morphological manifestations of apoptosis. Molecular mechanisms of apoptosis. Ways to realise the apoptosis program: the role of physiological inducers of mitochondrial proteins, endoplasmic reticulum, granzyme B cytotoxic T-lymphocytes, RGD-peptides. Regulation of apoptosis by external factors and autonomous mechanisms.	3H-7, K-1, K-3, K-4, AB-1	Assoc. Prof. Paryzhak S.Ya., Assoc.Prof. Onufrovych O.K.
CPC-9	Mutagenic factors. Methods for substances mutagenic activity determination.	Mutagenic factors, their classification. Spontaneous and induced mutations. Causes of spontaneous mutations. Chemical mutagens. Methods for determining the genotoxicity of substances: analysis of gene mutations, analysis of chromosomal and genome mutations, analysis of the DNA effect. Antimutagenesis.	3H-5, 3H-8, K-3, AB-1, AB-2	Assoc. Prof. Paryzhak S.Ya., Assoc.Prof. Onufrovych O.K.
CPC-10	Genetic mechanisms of carcinogenesis.	Carcinogenic factors, their classification. Carcinogens of direct and indirect action. Characteristics	3H-5, K-3, AB-1,	Assoc. Prof. Paryzhak S.Ya.,

		of genes involved in carcinogenesis: viral oncogenes, protooncogenes, tumor suppressor genes, mutator genes.	AB-2	Assoc.Prof. Onufrovyh O.K.
CPC-11	Gene therapy. Viral and non-viral vectors in gene therapy. Gene vaccines.	Principles of gene therapy. <i>Ex vivo</i> and <i>in vivo</i> gene therapy. Viral and non-viral vectors in gene therapy. Prospects and limitations of gene therapy. DNA vaccines: method of production; advantages and limitations.	3H-5, 3H-8, K-3, AB-1, AB-2	Assoc. Prof. Paryzhak S.Ya., Assoc.Prof. Onufrovyh O.K.
CPC-12	Transgenic organisms. Recombinant drugs.	Basic methods and principles of construction of transgenic organisms. Methods used to produce transgenic bacteria. Application of transgenic organisms in the national economy and medicine.	3H-5, 3H-8, K-3, AB-1, AB-2	Assoc. Prof. Paryzhak S.Ya., Assoc.Prof. Onufrovyh O.K.
<b>System of classes organization</b>				
- <b>according to information sources:</b> verbal and auditory perception methods of learning information (lecture, conversation, explanation, discussion); methods of presenting information and visual methods (illustration, demonstration of slides, tables, figures, review of literature; visual sources of information); methods of practical application of the information (practical assignment, practical tasks solving, mastering of practical skills).				
- <b>according to individual work:</b> by means of problems, partial-searching, research (situational tasks solving, preparing scientific reports)				
<b>Interactive methods</b>				
-problem-oriental method				
-method of individual educational-research and practical tasks				
- method of competing groups				
- method of training technologies				
- «business game» method				
- «brainstorming method»				
<b>8. Verification of results</b>				
<b>Current control</b> Scoring system <i>Students are being tested and scored at each and every single class.</i> Criteria of evaluation:				
Learning outcome code	Code of classes type	The method of learning outcomes verification	Criteria of evaluation	
		<b>Methods of control</b>		
		Types of educational activities of students are: a) lectures b) practical classes c) individual work of student (ISW)	<b>Excellent ("5")</b> – the student perfectly mastered the theoretical material of the topic, demonstrates deep and comprehensive knowledge of the topic,	

<p>3H-1, 3H-2, 3H-3, YM-1, YM-2, YM-3, K-1, K-2, K-3, AB-1, AB-2</p>	<p>Л-1, Л-2, Л-3, Л-4, Л-5, Л-6</p>	<p>Thematic plans of lectures, practical classes, ISW ensure the implementation in the educational process of all topics according to the program.</p> <p><b>The lecture course</b> consists of 6 lectures. The topics of the lecture course reveal the problematic issues of the relevant chapters of Genetics. During lectures, students develop theoretical basic knowledge, provides a motivational component and a general-indicative stage of mastering scientific knowledge during individual work. The lecture course makes maximum use of various didactic tools - multimedia presentations, educational films, slides.</p>	<p>the main concepts of scientific sources and recommended literature, thinks logically and answers thoroughly, freely uses the acquired theoretical knowledge in analyzing of practical material, expresses his attitude to certain problems, demonstrates high level of practical skills acquisition.</p> <p><b>Good ("4")</b> – the student has well mastered the theoretical material of the lesson, knows the basic aspects of primary sources and recommended literature; possess practical skills, expresses his views on certain issues, but assumes certain inaccuracies and errors in the logic of the presentation of theoretical content or in the implementation of practical skills.</p>
<p>3H-1, 3H-2, 3H-3, 3H-4, 3H-5, 3H-6, 3H-7, 3H-8, YM-1, YM-2, YM-3, YM-4, YM-5, K-1, K-2, K-3, K-4, AB-1, AB-2</p>	<p>П-1, П-2, П-3, П-4, П-5, П-6, П-7, П-8, П-9</p>	<p><b>Practical classes</b> aim at control of theory, the formation of practical skills and ability to analyze and apply their knowledge to solve practical problems.</p> <p>Each lesson begins with a test to assess the initial level of knowledge and determine degree of readiness of students for classes. The teacher determines the purpose of the lesson and creates a positive cognitive motivation; answers questions from students that arose during the ISW on the topic of the lesson.</p> <p>The main stage of the lesson is to perform practical work. Students consider microslides and macropreparations, solve typical situational problems, problems in molecular biology, genetics and medical genetics, make an album.</p> <p>At the final stage of the lesson in order to assess the student's mastery of the topic he is asked to answer the situational tasks.</p> <p>The teacher summarizes the lesson, gives students tasks for <b>individual work</b>, points out the main issues of the next topic and offers a list of recommended reading.</p> <p>The duration of the practical lesson is 2 academic hours</p>	<p><b>Outstanding ("3")</b> – the student has mainly mastered the theoretical knowledge of the subject, is guided by primary sources and recommended literature, but answers unconvincingly, confuses concepts, additional questions cause the student uncertainty or lack of stable knowledge; answering questions of apractical nature, reveals inaccuracies in knowledge, is unable to assess facts and phenomena, relate them to future activities, makes mistakes in the</p>

		implementation of practical skills.  <b>Poor ("2")</b> – the student has not mastered the study material of the topic, does not know the scientific facts, definitions, almost does not navigate in the original sources and recommended literature, there is no scientific thinking, practical skills are not formed.
<b>Current educational activity</b>		
<p><b>Current control</b> is performed during the studying classes and is aimed at checking the mastering by students the learning material. The forms of current control are:</p> <p>a) tests with a choice of one correct answer (multiple choice questions), the definition of the correct sequence of actions, definition of correspondency, the definition of specific areas in a picture or diagram («recognition»). Control can be performed using the Misa distance learning platform.</p> <p>b) individual oral examination, interview;</p> <p>c) solving of typical situational problems.</p> <p>During the estimation of mastering of each topic for current educational activity student is graded in 4-point (traditional) scale according with the approved assessment criteria for the appropriate discipline. This takes into account all types of work, provided by the program of the discipline. The traditional scores from discipline are converted to the points.</p> <p><b>Individual work of students</b> is estimated during current control topics at the proper lesson and is a part of the final grade of student.</p>		
<b>Final control</b>		
General evaluation system	Is performed after the discipline completion in the form of a credit on a 200-point scale	
Grading scales	traditional 4-point scale, multi-point (200-point) scale, ECTS rating scale	
Requirements for final control access	The student attended all practical classes and received at least 72 points for current performance	
Type of final control	Credit	Criteria for crediting «pass» or «fail» (Credit/No Credit)
<p><b>Maximum quantity of points</b>, which student can collect for the current educational activity for admission to the credit (differentiated credit) makes 200 points.</p>		

**Minimum quantity of points**, which student can collect for the current educational activity for admission to the credit (differentiated credit) makes 120 points.

**The calculation of the number of points** is made on the basis of the collected student's marks on the traditional scale during the discipline study, by calculating the arithmetic mean (AM or average), rounded to two decimal places. The obtained value is converted into points according to the scoring scale as follows:

$$x = \frac{CA \times 200}{5}$$

The assessment of the discipline, the form of final control of which is credit, is based on the results of the assessment of current educational activities and is marked on a two-point scale: "pass" or "fail". To pass the discipline, the student must collect for the current educational activity not less than 60% of the maximum amount of points (for a 200-point scale - not less than 120 points). Scores and grades ("pass" or "fail") the teacher puts in the examination sheet and in the student's record book (except for a failing grade). The scores from discipline are converted to the ECTS scale. Grade F (failing grade). Grade F (unsatisfactory with obligate repeat of the course) is awarded to students who have attended all classes in the discipline, but did not collect the minimum number of points for the current academic activity. Such students receive a grade "fail" and are not allowed to take the exam session.

The scores from discipline are converted to the ECTS scale and to the 4-point scale independently.

„A”, „B”, „C”, „D”, „E” ranking is made for students studying at one of the specialty and who have successfully completed study course.

Discipline points for students who have successfully completed the program are converted into traditional 4-point scale by absolute criteria, which are listed in the following table:

<b>Points from discipline</b>	<b>Estimation on 4-point scale</b>
From 170 to 200 points	5
From 140 to 169 points	4
From 139 points to minimal quantity of points, which student must collect	3
Less than minimal quantity of points, which student must collect	2

Estimation of ECTS and traditional scale is not converted because the ECTS scale and 4-point scale are independent.

Objective evaluation of educational activities of students is tested by statistical methods (the correlation coefficient between ECTS score and score in a national scale).

### **9. Course policy**

The policy of the course is determined by the system of requirements for the student in the study of the discipline "Modern problems of molecular biology" and is based on the principles of academic integrity. Students are explained the value of acquiring new knowledge, the need for independent performance of all types of work and tasks provided by the work program of this discipline. Lack of references to used sources, fabrication of sources, writing off, interference in the work of other students are examples of possible academic dishonesty. Detection of signs of academic dishonesty in the student's work is the basis for its non-enrollment by the teacher,

regardless of the extent of plagiarism or deception. Literature resources may be provided by the teacher exclusively for educational purposes without the right to transfer to third parties. Students are encouraged to use other literature resources which are not provided by the recommended list.

## 10. Recommended literature

### Basic:

1. Paryzhak S.Ya., Vorobets Z.D. Medical Biology. Textbook – Lviv: Qvart, 2020. – 426 p.
2. Bazhora Y.I., Bulyk R.Ye., Chesnokova M.M., Shevelenkova A.V., Smetyuk O.O., Lomakina Yu.V. Medical Biology: textbook. – Vinnytsia: Nova Knyha, 2018. – 448 p.: il.
3. Paryzhak S.Ya., Odnorih L.O. Medical biology and parasitology. Manual for the first-year students of the English department, the faculties of medicine and dentistry. – Lviv: Danylo Halytsky Lviv National Medical University, 2021. – 306 p.
4. Step 1. Lecture notes 2018 Biochemistry and Medical genetics. New York. Kaplan, Inc. – 2018 – 403 c.

### Additional:

1. Kratz R.F. Molecular & Cell Biology For Dummies, 2nd Edition. – New Jersey: John Wiley & Sons Inc, 2020, 400 p.
2. Kaplan Medical's USMLE STEP 1. Biochemistry and Medical Genetics. Lecture notes. – 2018. – 432 p.
3. Pap E., Falus A., László V., Oberfrank F., Szalai C., Tóth S. Medical Genetics and Genomics. Edited by Typotex Kiadó. – Budapest University of Technology and Economics, 2016. – 206 p.
4. Rautenstrauss B.W., Liehr T. FISH technology. – Berlin: Springer, 2012, 494 p.

### Informational resources:

1. Testing center – database of license tests Krok – 1 <http://testcentr.org.ua/>
2. OMIM (Online Mendelian Inheritance in Man) – An Online Catalog of Human Genes and Genetic Disorders <http://omim.org/>
3. NCBI databases <http://www.ncbi.nlm.nih.gov>
4. Encyclopedia of DNA elements <http://genome.ucse.edu/ENCODE/>

## 11. Equipment, hardware and software resources of the discipline/ course

### Methodological support

- Working program from the discipline;
- Lecture thesis from the discipline;
- Methodical recommendations for teachers;
- Methodical recommendations for practical classes for students;
- Distance learning platform MISA;
- Methodical manual for students independent work;
- Tests and control tasks for practical classes;
- Questions and tasks for final control.

## 12. Additional information

Responsible for the educational process at the department – Associate Professor Oksana Pershyn. There is a scientific students' association at the department. Meetings take place in the auditorium №1.

Practical classes are held in the classrooms of the department at the address: 3a Shimzeriv street, Theoretical building, 2nd floor.

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Ph.D., Associate Professor

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Lydmyla SERHIYENKO

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Zinoviy VOROBETS