

MINISTRY OF HEALTH OF UKRAINE
KHARKIV NATIONAL MEDICAL UNIVERSITY
Department of Medical biology

Academic year 2024-2025

SYLLABUS OF THE ACADEMIC DISCIPLINE
«Medical Biology»

Normative or optional educational component Normative
Form of obtaining education full-time
(full-time; part-time; remote)
Field of science 22 «Health»
Specialty 221 "Dentistry"
Educational program for education of specialists of the second (master's)
level of higher education course
Course 1

Syllabus was approved at the meeting of
the department of medical biology

Approved by the KhNMU Methodological
Commission on Problems of General and
Natural-science Trainin


Meeting protocol
" 30 " of August, 2024 № 1

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Acting Head of the Department

Head of the Commission


Iryna MESHCHERIAKOVA
(signature) (initials, surname)


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Developers of the syllabus:

1. ass. professor, candidate of medical science Meshchseriakova I.P.

(surname, first name and patronymic, position, academic title, academic degree)

**INFORMATION ABOUT THE TEACHERS WHO DELIVER
THE EDUCATIONAL COMPONENT**

Surname, First Name, Patronymic	Position, Academic Title, Scientific Degree Professional Interests, Links to the Lecturer's Profile, Corporate Email
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In-person and online consultations by prior arrangement.

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Department of Medical Biology, Building A, 2nd floor.

INTRODUCTION

The syllabus of the educational component “Medical Biology” has been developed in accordance with the Educational and Professional Program (EPP) “Dentistry” and the Standard of Higher Education of Ukraine for the second (master’s) level, field of knowledge 22 “Health Care”, specialty 221 “Dentistry.”

Description of the educational component (annotation). The program of the educational component includes the following sections: “Molecular and Cytological Foundations of Human Life Activity,” “The Organismal Level of Life Organization. Fundamentals of Human Genetics,” and “Population–Species, Biogeocenotic, and Biospheric Levels of Life Organization.” These sections ensure a high level of general biological training. Medical biology lays the foundation for the further acquisition by students of knowledge and skills in specialized theoretical and clinical professional disciplines.

The subject of study of the educational component is the **biological foundations of human life activity.**

Interdisciplinary connections: histology, cytology and embryology; biological and bioorganic chemistry; microbiology; physiology; pathophysiology; medical genetics; obstetrics and gynecology; epidemiology; pathomorphology; pediatrics.

Prerequisites: general biology, human biology, animal biology, plant biology.

Postrequisites: medical chemistry; biological and bioorganic chemistry; histology, cytology and embryology; human anatomy; physiology; pathomorphology; pathophysiology; medical and biological physics; medical informatics; microbiology, virology and immunology; pharmacology; medical genetics; clinical pharmacology; clinical immunology and allergology; social medicine and public health; hygiene and ecology; epidemiology and principles of evidence-based medicine; the entire set of professional training disciplines.

Link to the educational component page in MOODLE:

<https://distance.knmu.edu.ua/course/view.php?id=4977>

1. OBJECTIVES AND TASKS OF THE EDUCATIONAL COMPONENT

1.1. The purpose of studying the educational component is to form knowledge and practical skills in human biology for the further acquisition by students of a block of disciplines that ensure natural science and professional-practical training.

1.2. The main tasks of studying the educational component are:

- To explain the patterns of manifestation of the vital activity of the human organism at the molecular-biological and cellular levels.
- To identify the manifestations of general biological laws during human ontogenesis.
- To determine the biological essence and mechanisms of development of diseases arising as a result of anthropogenic changes in the environment.
- To explain the essence and mechanisms of manifestation of hereditary human diseases in the phenotype.
- To make a preliminary conclusion about the presence of parasitic invasions in humans and determine measures for disease prevention.

1.3. Competencies and learning outcomes, the formation of which is facilitated by the educational component

(interrelation with the normative content of training of higher education applicants formulated in terms of learning outcomes in the EPP and the Standard).

1.3.1. According to the requirements of the Standard, the educational component ensures that master's students acquire the following competencies:

Integral competence:

The ability to solve complex tasks and problems in the field of health care within the specialty “Dentistry” in professional activity or during the learning process, which involves conducting research and/or implementing innovations and is characterized by uncertainty of conditions and requirements.

General competencies:

- GC 1. Ability for abstract thinking, analysis, and synthesis.
- GC 2. Knowledge and understanding of the subject area and professional activity.
- GC 3. Ability to apply knowledge in practical activity.
- GC 6. Skills in the use of information and communication technologies.
- GC 7. Ability to search, process, and analyze information from various sources.
- GC 8. Ability to adapt and act in new situations.
- GC 9. Ability to identify, formulate, and solve problems.
- GC 11. Ability to work in a team.
- GC 12. Commitment to environmental preservation.

Professional (special) competencies:

- PC 1. Ability to collect medical information about a patient and analyze clinical data.
- PC 2. Ability to interpret the results of laboratory and instrumental studies.
- PC 4. Ability to plan and implement preventive measures for diseases of the organs and tissues of the oral cavity and the maxillofacial region.
- PC 13. Ability to assess the impact of environmental factors on the health of the population (individual, family, and population levels).

1.3.2. The study of the educational component ensures that students acquire the following program learning outcomes (PLOs):

- PLO 1. To identify and recognize the leading clinical symptoms and syndromes (according to List 1); using standard methods and based on preliminary patient history data, patient examination data, and knowledge about the human body, its organs and systems, to establish a probable nosological or syndromic preliminary clinical diagnosis of a dental disease (according to List 2).
- PLO 2. To collect information about the general condition of the patient, assess the psychomotor and physical development of the patient, the condition of the organs of the maxillofacial region, and based on the results of laboratory and instrumental examinations, evaluate information relevant to the diagnosis (according to List 5).
- PLO 3. To prescribe and analyze additional (mandatory and optional) examination methods (laboratory, radiological, functional, and/or instrumental) according to List 5 for patients with diseases of the organs and tissues of the oral cavity and maxillofacial region in order to perform differential diagnosis (according to List 2).
- PLO 6. To plan and implement preventive measures for dental diseases among the population in order to prevent the spread of dental diseases.
- PLO 7. To analyze the epidemiological situation and carry out measures of mass and individual, general and local, pharmacological and non-pharmacological prevention of dental diseases.
- PLO 15. To assess the impact of environmental factors on the health status of the population in a medical institution using standard methods.
- PLO 17. To maintain a healthy lifestyle and apply methods of self-regulation and self-control.
- PLO 19. To comply with the principles of ethics, bioethics, and deontology in professional activity.

1.3.3. The study of the educational component ensures that students acquire the following social skills (soft skills):

- communication with patients
- ethics and respect

- time management
- teamwork
- stress resistance
- adaptability
- activity management.

2. Information about educational course

Name of indices	Branch of knowledge, direction of training, educational-qualification level	Characteristics of the course	
		Day tuition	
Number of credits — 6,0	Direction of training 22 «Health Protection»	mandatory	
Total number of hours — 180	Specialty 221 «Dentistry»	Year of study:	
		1rd	
		Term	
		1th	2th
Number of hours for day tuition: Classroom classes — 100, Independent work — 80	Educational-qualification level: «second (master's) level»	Lectures	
		20 hours	10 hours
		Practical classes	
		36 hours	34 hours
		Laboratory classes	
		-	
		Independent work	
		39 hours	41 hours
Individual tasks: 10 hours			
Type of control: Exam			

2.1 Description of the discipline

2.2.1 Lectures

№	Topics	Number of hours	Types of lectures
1	Introduction to the Course of Medical Biology. Structural and Functional Organization of the Cell	2	Thematic
2	Reproduction at the Cellular Level	2	Thematic
3	Molecular Basis of Heredity. Expression of Genetic Information	2	Thematic
4	Organismal Level of Organization of Genetic Information. Gene Interaction	2	Thematic
5	Chromosomal Theory of Heredity. Genetics of Sex	2	Thematic
6	Variability in Humans as a Property of Life and a Genetic Phenomenon	2	Thematic
7	Fundamentals of Human Genetics. Gene Diseases. Methods of Human Genetics	2	Thematic
8	Human Chromosomal Diseases. Methods of Human Genetics	2	Thematic

9	Molecular-Genetic Mechanisms of Ontogenesis. Developmental Disorders and Their Role in Human Pathology	2	Thematic
10	Modern Aspects of Regeneration and Transplantation. Biological Mechanisms of Maintaining Organism Homeostasis	2	Thematic
11	Medical and Biological Foundations of Parasitism. Protozoa — Human Parasites	2	Thematic
12	Medical Helminthology. Helminths — Human Parasites	2	Thematic
13	Medical Arachnoentomology. Arthropods as Pathogens and Vectors of Infectious and Invasive Diseases	2	Thematic
14	The Biosphere as a System Ensuring Human Existence. Human Ecology	2	Thematic
15	Fundamentals of Biomedicine and Biostatistics	2	Thematic
Total for lectures		30	

2.2.3 Practical classes

No	The practical lesson topic	Hours	Education methods	Methods of control
1	Forms of Life. Structure and Functions of Cell Membranes	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
2	Cell Morphology. Structural Components of the Cytoplasm and Nucleus	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
3	Chromosome Morphology. Human Karyotype	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
4	Cell Cycle. Cell Division: Mitosis and Meiosis	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
5	Characteristics of Nucleic Acids. DNA Replication and Repair	2	Practical lesson with e-learning elements	oral interview; test control

			demonstration, presentation, videos	
6	Organization of Prokaryotic and Eukaryotic Genomes. Gene Expression and Its Regulation	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
7	Lab Practical Exam 1: Molecular and Cellular Features of Human Vital Activity	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
8	Features of human genetics. Manifestation of Mendelian laws of inheritance on the example of human traits (mono-, di- and polyhybrid crosses). Multiple alleles. Phenomenon of pleiotropy	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
9	Interaction of allelic genes. Genetics of blood groups	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
10	Interaction of non-allelic genes.	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
11	Linked inheritance	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
12	The genetics of sex in human beings. Sex-linked inheritance	2	Practical lesson with e-learning elements demonstration,	oral interview; test control

			presentation, videos	
13	Human variability, its forms and manifestations. Genealogical and twin methods of studying human genetics	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
14	Gene diseases, the methods of their diagnostics	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
15	Chromosome diseases, the methods of their diagnostics	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
16	Medical genetic counseling. Population statistical method	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
17	Biological features of human reproduction.	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
18	Lab Practical Exam 2	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
19	Introduction to Medical Parasitology. Medical Protozoology. Subkingdom Protozoa. Phylum Sarcomastigophora. Class Lobosea	2	Practical lesson with e-learning elements demonstration, presentation,	oral interview; test control

			videos	
20	Phylum Sarcomastigophora. Class Zoomastigophora (Flagellata): causative agents of human diseases	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
21	Phylum Sarcomastigophora. Class Zoomastigophora (Flagellata): causative agents of human diseases	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
22	Phylum Apicomplexa. Class Sporozoa: pathogenic agents of human diseases. Phylum Ciliophora. Class Litostomatea.	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
23	Lab Practical Exam 3. Medical Protozoology	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
24	Medical Helminthology. Phylum Flatworms (Plathelminthes). Class Flukes I (Trematoda): causative agents of human diseases	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
25	Class Flukes II (Trematoda): causative agents of human diseases	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
26	Phylum Flatworms (Plathelminthes). Class Tapeworms (Cestoidea): causative agents of human diseases I	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control

27	Phylum Flatworms (Plathelminthes). Class Tapeworms (Cestoidea): causative agents of human diseases II	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
28	Phylum Roundworms (Nemathelminthes). Class True Roundworms (Nematoda): causative agents of human diseases	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
29	Phylum Roundworms (Nemathelminthes). Class Nematoda. Biohelminthes	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
30	Laboratory diagnosis of helminthic infection	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
31	Lab Practical Exam 4. Medical Helminthology	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
32	Phylum Arthropoda. Subphylum Branchiata. Class Crustacea. Subphylum Chelicerata. Class Arachnoidea	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
33	Phylum Arthropoda. Subphylum Tracheata. Class Insecta	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
34	The biosphere as a system that provides	2	Practical	oral

	existence of human being. Human Ecology		lesson with e-learning elements demonstration, presentation, videos	interview; test control
35	Lab Practical Exam 5. Medical Arachnoentomology	2	Practical lesson with e-learning elements demonstration, presentation, videos	oral interview; test control
Total for Practical classes		70		

2.2.5. Independent work of students

No	The independent work topic	Hours	Education methods	Methods of control
1	Learning theoretical foundation for practical classes and developing practical skills	30	processing of educational and scientific literature	oral interview; test control
2	Work on the topics which are not enlisted in the class curriculum			
2.1	Methods of biological researches	2	processing of educational and scientific literature	oral interview; test control;
2.2	Cell life out of the organism. Cell cloning	1	processing of educational and scientific literature	speech on a given topic
2.3	Genetic maps. Methods of human chromosome mapping. Modern state of human genome researches	1	processing of educational and scientific literature	oral interview; test control;
2.4	Genetic threat of the habitat contamination. Concept of antimutagenes and comutagenes	1	processing of educational and scientific literature	speech on a given topic
2.5	Gene engineering. Biotechnology. Concepts of gene therapy.	1	processing of educational and scientific literature	oral interview; test control;
2.6	Genetic polymorphism of mankind	1	processing of educational and scientific literature	speech on a given topic
2.7	Methods of human genetics: dermatoglyphic, immunologic,	1	processing of educational	oral interview;

	hybridization of somatic cells		and scientific literature	test control;
2.8	Genetic load and its biological essence	1	processing of educational and scientific literature	speech on a given topic
2.9	Genetic structure of populations and inherited pathology load	2	processing of educational and scientific literature	oral interview; test control;
2.10	Congenital disorders of development. Critical periods of development	1	processing of educational and scientific literature	speech on a given topic
2.11	Stages of human embryonic development. Differentiation in the molecular and genetic, cellular and tissue levels	1	processing of educational and scientific literature	oral interview; test control;
2.12	Molecular and genetic mechanisms of ontogenesis	1	processing of educational and scientific literature	speech on a given topic
2.13	Ageing as a final stage of human ontogenesis. Theories of ageing	1	processing of educational and scientific literature	oral interview; test control;
2.14	Basic regularities of the organs systems phylogenesis	2	processing of educational and scientific literature	speech on a given topic
2.15	Famous scientists-parasitologists	1	processing of educational and scientific literature	oral interview; test control;
2.16	Methods of laboratory diagnostics for diseases caused by Protozoa	1	processing of educational and scientific literature	speech on a given topic
2.17	<i>Blood</i> Trematoda –vectors of parasitic human diseases, vectors of metagonimosis and nanophyctiasis	1	processing of educational and scientific literature	oral interview; test control;
2.18	Guinea worm and filaria – vectors of human diseases	1	processing of educational and scientific literature	speech on a given topic
2.19	Mites as inhabitants of people’s dwelling , their medical characteristics	2	processing of educational and scientific literature	oral interview; test control;

2.20	Characteristics of mosquitos, midges, sandflies as intermediary helminths hosts and human diseases vectors	2	processing of educational and scientific literature	speech on a given topic
2.21	Origin of a man. Human races as reflection of adaptive patterns of development	2	processing of educational and scientific literature	oral interview; test control;
2.22	Structure and functions of the biosphere	2	processing of educational and scientific literature	speech on a given topic
2.23	Biological variation in humans caused by biogeographical features of the environment. Formation of adaptive ecotypes.	2	processing of educational and scientific literature	oral interview; test control;
2.24	Human ecology	2	processing of educational and scientific literature	speech on a given topic
2.25	Characteristics of mosquitos, midges, sandflies as intermediary helminths hosts and human diseases vectors	2	processing of educational and scientific literature	oral interview; test control;
3	Revision of 1-5 lessons	15	processing of educational and scientific literature	speech on a given topic
Total for Independent work of students		80		

3. EVALUATION

3.1. Current Learning Activity (CLA): The assessment of student performance is carried out in accordance with the *Instructions for the Assessment of Learning Activities of Higher Education Students at KhNMU* (https://knmu.edu.ua/doc_block_type/instrukcziyi-navchalnogo-proczesu/). The grade for a practical or final class ranges from 2 to 5 points. Submission of assignments late without a valid reason leads to a reduction in the grade proportional to the delay time from the assignment deadline. Assignments are checked within 24 hours. Grades are entered into the electronic gradebook. Unsatisfactory grades are remediated in accordance with the *Regulations on the Procedure for Remediation of Classes by KhNMU Students* (https://knmu.edu.ua/wp-content/uploads/2021/05/pol_por-vidprac-zaniat.pdf).

Individual Assignments (IA)

Individual student assignments (hereinafter – ISA) are not a mandatory component of the course. However, at the student’s discretion, they may be completed and are assessed in ECTS points (up to 10), which are added to the total points earned for current learning activity. The list of approved individual assignments has been determined by the department (including participation with reports in student conferences, profile-related Olympiads, preparation of analytical reviews with presentations checked for plagiarism) along with the corresponding points for completion. These points may be added as bonus points (not exceeding 10).

Final Exam: Eligibility to take the exam requires no outstanding academic debts. The exam is graded on a scale from 50 to 80 points.

Course Grade (CG): The final grade for the educational component includes points from overall learning activity (OLA), points for individual assignments (IA), and the exam grade. The total course grade ranges from 120 to 200 points.

Appeals: Appeals regarding the results of the final assessment are conducted in accordance with the procedure established at KhNMU

(https://knmu.edu.ua/wpcontent/uploads/2021/05/polog_apel_kontrol.pdf).

3.2. Examination questions on medical biology

1. The science of biology. Role and place of biology in medical training.
2. Concept of life in modern biological science. Forms and main characteristics of living things.
3. Levels of life organization and their importance to medicine.
4. Cell theory, its modern state and importance to medicine. General principles of cell structure.
5. Cell: basic structural and functional unit of life. Pro- and eukaryotic cells.
6. Methods of studying cellular structure and functions.
7. Chemical composition of cell.
8. Morphophysiology of cell. Cytoplasm. Double-membrane organelles.
9. Single-membrane organelles.
10. Non-membrane cell organelles. Organelles of motion. Inclusions.
11. Cellular membranes: chemical composition, structure and functions. Supra-membrane and infra-membrane complexes.
12. Membrane transport and its importance to medicine.
13. Cell as an open system. Transport of substances and energy flows in the cell. Cell energy supply.
14. Structure and functions of nucleus. Euchromatin and heterochromatin. Chromatin: levels of hereditary material organization. Sex chromatin.
15. Chemical composition, morphological features of chromosomes. Dynamics of their structure in the cell cycle (interphase and metaphase). Polytene chromosomes.
16. Human karyotype. Morphological and functional characteristics and classification of human chromosomes. The importance of studying human karyotype in medicine.
17. Ultrastructural cell pathology.
18. Molecular level of the inheritance information organization. Nucleic acids, their structure and functions.
19. Methods of genetic information transfer in bacteria: transformation, transduction, conjugation. Their importance in medicine.
20. Pro- and eukaryote genome structure. Gene structures: regulatory, tRNA and rRNA synthesis. Mobile genetic components.
21. Information flow organization in the cell. Replication of DNA and its importance. Self-correction and reparation of DNA.
22. Genetic code and its characteristics.
23. Main stages of cell protein biosynthesis. Transcription.
24. Translation: initiation, elongation, termination. Posttranslational protein transformation as a basis for their functioning.
25. Realization of genetic information in pro- and eukaryotes. Exon-intron gene organization in eukaryotes. Processing, splicing.
26. Characteristics of regulating gene expression in pro- and eukaryotes.
27. Gene engineering and biotechnology.
28. Cell lifecycle, its possible realization and periodization. Cell cycle. Interphase.

29. Cell division. Mitosis.
30. Disorders of mitosis. Somatic mutations. Amitosis.
31. Regulation cellular cycle. Cell growth, growth factors. Concept of mitotic cell activity.
32. Cell death: apoptosis, necrosis.
33. Cell life out of the organism. Cell cloning. The importance of the tissue culture method for medicine.
34. Subject and problems of human and medical genetics. Pharmacogenetics and immunogenetics.
35. Human genotype as a system of interactive genes.
36. Human phenotype as a combination of species and individual traits and characters. Qualitative and quantitative traits.
37. Inheritance regularities in monohybrid crossing. The first and second laws of G.Mendel. Mendelian characters. Monogenic human characters.
38. Inheritance regularities in di- and polyhybrid crossing. The third law of G.Mendel.
39. Множинні алелі. Генетика груп крові. Значення для медицини. Multiple alleles. Genetics of blood groups and its importance for medicine.
40. Interaction of allelic genes: complete dominance, incomplete dominance, overdominance, codominance.
41. Interaction of non-allelic genes: complementation, epistasis.
42. Polymeric inheritance of traits in humans. Pleiotropy.
43. Linked inheritance (law of T.Morgan). Crossing over. Genetic and cytologic chromosome maps.
44. Chromosome theory of inheritance.
45. Modern state of human genome researches. Genetic maps of human chromosomes.
46. Genes of autosomes, sex chromosomes. Sex-linked, dependent and sex-limited traits. Hemizygoty.
47. Genetics of sex. Mechanisms of genetic sex determination. Gene dose. Gene position effect.
48. Variation, its forms and importance in the ontogenesis and evolution.
49. Modification variation and its characteristics. Reaction norm.
50. Multi-factor principle of the phenotype formation. Influence of the habitat on the gene expressivity and penetrance. Phenocopies.
51. Genotypic variation and its forms. Combinative variation.
52. Mutation and their phenotypic manifestations. Mutation theory. Classification of mutations.
53. Mutagenic factors, their types. Mutagenesis. Genetic monitoring. Risk-reducing methods in mutations.
54. Gene mutations, mechanisms of their occurrence. Concept of monogenic diseases.
55. Chromosome aberrations. Mechanisms of their occurrence. Examples of diseases caused by chromosome aberrations.
56. Mechanisms of genome mutation occurrence (polyploids, haploids, polysomes, monosomes)
57. Classification of human hereditary diseases, principles of their diagnostics.
58. Methods of studying human inheritance: genealogic, twin, molecular cytogenetic , biochemical, microbiologic, immunologic, dermatoglyphic, statistical method of population genetics, hybridization of somatic cells. Genetic markers.
59. Genealogical method. Types of traits inheritance.
60. Gene (molecular) diseases: enzymopathologies, diseases of metabolism of aminoacids, proteins, carbohydrates, lipids, nucleic acids, vitamins, hormones; mechanisms of their occurrence and principles of laboratory diagnostics.
61. Gene diseases caused by primary pleiotropy.
62. Non-chromosome inheritance. Mitochondrial inheritance. Mitochondrial genome. Mitochondrial diseases.

63. Hereditary diseases with an undetected biochemical defect.
64. Hereditary diseases caused by disorder in the number of autosomes and sex chromosomes; mechanisms of their occurrence, principles of laboratory diagnostics.
65. Mutations in the sexual and somatic cells, their relevance to medicine, Mozaicism.
66. Genetic heterogeneity in the hereditary diseases. Genocopies.
67. Diseases with genetic predisposition. Concept of multi-factor diseases.
68. Medico-genetic family aspects. Medico-genetic counselling.
69. Prenatal diagnostics of hereditary diseases. Screening-programs for indicating inherited metabolism disorders in the newborns.
70. Prevention and treatment of hereditary diseases. Future prospects of genotherapy.
71. Reproduction as a universal property of life. Methods and forms of reproduction. Future prospects of cloning organisms.
72. Meiosis. Mechanisms conditioning genetic variety of gametes.
73. Gametogenesis: spermatogenesis, oogenesis.
74. Sexual cells of humans, their cytogenetic characteristics and qualitative distinctions from somatic cells.
75. Fertilization. Parthenogenesis. Characteristics of human reproduction.
76. Ontogenesis and its periodization. Stages of embryonic development. Provision organs.
77. Genetic control of individual development. Differentiation of cells, embryonic leaves, tissues. Embryonic induction. Cloning organisms and tissues.
78. Characteristics of prenatal period of human development, critical periods of embryonic development of humans. Teratogenic factors of the environment.
79. Congenital developmental disorders, their modern classification: hereditary, exogenous, multi-factor; embryopathies and fetopathies; phylogenetic and non-phylogenetic disorders.
80. Postembryonic development of humans and its periodization.
81. Interaction between onto- and phylogenesis. Biogenetic law and its interpretation by A.N. Severtsov.
82. Phylogenesis of the body skin, skeleton, digestive, respiratory, blood circulatory, nervous, urinary and reproductive system of Chordata. Congenital development disorders conditioned by ontophylogenesis.
83. Neurohumoral regulation of growth and development.
84. Correlation of growth and differentiation in the postnatal period.
85. Ageing as a stage of ontogenesis. Theories of ageing.
86. Concepts of gerontology and geriatrics.
87. Clinical and biologic death.
88. Organs and tissues regeneration. Types of regeneration. The importance of regeneration in biology and medicine.
89. Characteristics and value of the regenerative process in humans. Typical and atypical regeneration. Growth of tumors.
90. Regulation capacity of the regenerative processes.
91. Problems of organs and tissues transplantation. Types of transplantation. Tissue incompatibility and methods of its overcoming.
92. Concept of homeostasis. Mechanisms of regulating homeostasis in the different levels of life.
93. Modern theory of biologic evolution as a synthesis of darwinism and populational genetics.
94. Biological species: reality and dynamics of its existence, criteria. Genofund (allelofund) of species.
95. Structure of species. Population as a main component of a species unit. Population characteristics: morphologic, ecologic, genetic. Gene pool of the population.
96. Ideal and real populations. The law of constant genetic structure in the ideal populations (Hardy-Weinberg' law), its use for calculating genetic structure of real and human populations.

97. Conception of microevolution. Population as an elementary evolutionary unit.
98. Elementary evolutionary factors (directed and undirected) and their interaction.
99. Natural selection as a main driving factor of evolution; its forms.
100. Main outcomes of evolution: speciation, genetic polymorphism, adaptation.
101. Types of speciation.
102. Genetic heterogeneity and genetic polymorphism of natural populations as a basis for evolutionary plasticity.
103. Genetic load of the population.
104. Adaptation of organisms to their habitat. Origin of biological expedience.
105. Human population. Population structure of mankind. Large and small populations (demes, genetic isolates).
106. Influence of marriage structure and demographic rates on the gene pool of human populations.
107. Influence of mutagenesis, isolation, migration on the genetic structure of population and genetic constitution of humans. Genetic drift in isolates.
108. Features of natural selection in human populations. Selection and counter-selection.
109. Genetic and phenotypic polymorphism of mankind. Types of genetic polymorphism: adaptive (ecological) and balanced (heterozygous).
110. The conception of macroevolution. Interaction of macro- and microevolution.
111. Taxonomic position of *Homo sapiens* species in the living world. Qualitative features of humans. Correlation of biological and social factors in the process of anthropogenesis.
112. The origin of the human races as a result of adaptive laws of human development. The unity of mankind.
113. Parasitism. Morphophysiological adaptations of parasites. Evolution of parasitism.
114. Principles of the parasites classification: obligate, facultative, temporary, permanent, monoxenous, heteroxenous, specific and nonspecific parasites, endo- and ectoparasites.
115. The effects of a parasite on a host
116. Pathogenicity and virulence of the parasites.
117. The effects of a host on a parasite.
118. Modes, routes and mechanisms of a parasitic transmission.
119. Life cycles of parasites. Alternation of parasitic generations and phenomenon of the host alternation. Definitive, intermediate, additional, reservoir, obligate, and facultative hosts of parasites.
120. Biological and mechanical vectors of the diseases causative agents.
121. Organism as a habitat for parasites. Autoinvasion and reinvasion.
122. Parasitocenology. Human being as a main component of the symbiocoenosis.
123. Transmissible and natural focal diseases. Conception of obligate and facultative transmissible diseases.
124. E.N. Pavlovsky's theory of natural focality (nidality) of transmissible diseases. A natural focus and its components: a causative agent, its vector and reservoir hosts.
125. Types of natural foci. Synanthropic foci. Anthroponoses and zoonoses.
126. Biological principles of eradication of transmissible and natural focal diseases.
127. Essentials of prevention of parasitic diseases. Prophylaxis of parasitic diseases: biological, immunological, ecological, and public methods.
128. Factors of distribution of parasitic diseases. Influence of global human migrations on spreading parasitic diseases.
129. Famous parasitologists and their contribution to science.
130. Subkingdom Protozoa. Classification, structure, and medical importance of their representatives.

Give the characteristics of a parasite according to the following plan:

1) Classification (Taxonomy); 2) Latin name; 3) Disease; 4) Geographic distribution; 5) Morphological features; 6) Localization inside human body; 7) Invasive stage for a human; 8) Route and factors of transmission; 9) Source of invasion; 10) Life cycle; 11) Pathogenicity; 12) Laboratory diagnosis; 13) Prophylaxis (Prevention).

131. *Entamoeba histolytica*.

132. Amoebae– facultative parasites of humans. Non-pathogenic amoebae.

133. *Lamblia intestinalis*.

134. Trichomonads.

135. Causative agents of cutaneous and visceral leishmaniasis.

136. Causative agents of trypanosomiasis.

137. Malaria plasmodium. Species of malaria plasmodium. Malaria prevention and control activities in modern medicine.

138. *Toxoplasma gondii*.

139. *Balantidium coli*.

140. Phylum Plathelminthes (Flatworms). Classification, structure, and medical importance of their representative species.

141. Features of helminth life cycles. Geohelminths, biohelminths, contact helminths.

142. Liver fluke.

143. Cat fluke.

144. Lung fluke.

145. Chinese liver fluke.

146. Lancet fluke.

147. Blood flukes.

148. Causative agent of metagonimosis

149. Causative agent of nanophyethosis

150. Pork tapeworm.

151. Beef tapeworm.

152. Cysticercosis. Routes of transmission and prophylactic measures.

153. Dwarf tapeworm.

154. *Echinococcus* species: *E. granulosus* and *E. multilocularis*.

155. Broad fish tapeworm.

156. Phylum Nematelminthes (Roundworms). Classification, structure, and medical importance of representative species.

157. Maw worm.

158. Larval ascarids: causative agents of human diseases (larva migrans syndrome).

159. Pinworm.

160. Whipworm.

161. Hookworms.

162. Palisade worm.

163. Trichina worm.

164. Guinea worm. L.M. Isaev's contribution to eradication of dracunculiasis foci.

165. Filariidae (*Wuchereria bancrofti*, *Brugia malayi*, *Loa loa*, *Onchocerca volvulus*).

166. *Dirofilaria* species.

167. Laboratory diagnosis of helminthic invasions. Ovo-, larvo-, helminthoscopy.

168. Phylum Arthropoda. Classification, structure, and medical importance of representative species.

169. Class Crustacea: general characteristics. Crustaceans of medical importance.

170. Class Arachnoidea: general characteristics. Arachnids of medical importance.

171. Venomous arthropods. Mites - causative agents of human diseases.

172. Ticks – causative agents and vectors of human diseases.

173. Class Insecta. Morphology, features of life cycles, and medical importance of representative species.
174. Flies: species and their medical importance.
175. Cockroaches: species and their medical importance.
176. Lice: species, body structure and medical importance.
177. Fleas: features of body structure and development. Species of fleas.
178. Bugs: medical importance.
179. Mosquitoes: species, features of body structure and development, medical importance.
180. Sandflies. Biting midges.
181. Molluscs (snails) as intermediate hosts of helminths.
182. Venomous animals. Poisonous plants and fungi.
183. The biosphere and noosphere theories of V.I. Vernadsky. Living matter of biosphere and its functions.
184. Biogeochemical cycles and energy flows in biosphere.
185. Ecology. Conception of environment. Types of environment: aerial, aquatic, terrestrial, and internal.
186. Medical and biological aspects of biosphere impact on human health. Biofields and biological rhythms, their medical significance.
187. Ecological factors. Unity of an organism and environment
188. Human genetic variation caused by biological and geographical features of habitat.
189. Human adaptive ecotypes, their characteristics: arctic, tropical, temperate zone, desert, high altitude ecotypes.
190. Human adaptation to extreme conditions (the Arctic, deserts, space, etc.).
191. Hereditary differences in human response to environmental factors. The concept of ecogenetics.
192. Qualitative parameters of the environment and their effects on human health.
193. Healthy (comfort), unhealthy (discomfort), and extreme environments. Adequate and inadequate environmental conditions.
194. The concept of stress. Functional types of human response to the environmental factors (“sprinter”, “stayer”, “mixed”).
195. Human activity as an ecological factor. Basic directions and consequences of anthropogenic environmental changes. Environmental protection.
196. Major ecological problems of Ukraine.

List of practical skills

- Microscope techniques;
- making temporary preparations;
- differentiation of cellular components;
- making up an ideogram of human chromosomes;
- identifying primary structure, number of aminoacids, molecular mass of a polypeptide by the gene structure;
- analyzing the sequence of stages in the gene expression regulation ;
- determining the type of inheritance of Mendelian traits in humans;
- predicting genotypes and phenotypes in the offsprings on the basis of the parental genotypes;
- excluding the parenthood on the basis of blood groups of the child and parents;
- analyzing complex mechanisms of inherited traits in humans;
- working out measures for reducing the level of pathologic condition manifestation in patients with hereditary pathologies;

- choosing relevant methods of studying human inheritance for diagnosing different hereditary diseases;
- to calculate probability of arising hereditary diseases in the offsprings depending on the gen penetrance;
- to differentiate chromosome human diseases;
- to construct a family tree and do its genealogical analysis;
- to calculate the role of heredity and environmental conditions in the development of traits (by the results of twin analysis);
- to calculate population genetic structure;
- to apply biogenetic law for determining inherited human disorders conditioned by ontophylogenesis;
- to compare occurrence of human inherited disorders of different genesis;
- to study essential principles of regeneration and transplantation;
- to identify the place of biological object in the system of living nature;
- to substantiate the belonging of parasitic diseases to the group of transmissible and environmental ones;
- to diagnose causative agents and vectors of the parasitic diseases on the macro- and microslides;
- to distinguish the species – causative agents and vectors of protozoal diseases;
- to identify different stages in the lifecycle of human parasites;
- to substantiate methods of laboratory diagnostics for parasitic diseases;
- to distinguish the species of helminths and their ova;
- to differentiate diagnosing invasions by means of laboratory methods;
- to distinguish the species - vectors of human infectious diseases;
- to prove effectiveness of preventive measures for parasitic diseases depending on the ways of infection;
- to predict the influence of ecological factors on the human organism.

List of preparations to be determined during the summarizing control on the discipline

1. *Lambliia Intestinalis*
2. *Trichomonas vaginalis*
3. *Amoeba* dysentery.
4. *Malaria plasmodium*
5. *Toxoplasma gondii*.
6. Liver fluke.
7. Liver fluke (transverse section).
8. Digestive system of the liver fluke.
9. Excretory system of the liver fluke.
10. Cat fluke.
11. Lancet fluke.
12. Scolex of the beef tapeworm.
13. Mature segment of the beef tapeworm.
14. Scolex of the pork tapeworm
15. Mature segment of the tapeworm.
16. Mature segment of the broad fish tapeworm.
17. Dwarf tapeworm
18. Transverse section of the *Ascaris lumbricoides* (male and female)
19. Whipworm (male and female)
20. Hookworm (male and female)

21. Encapsulated larva of the Trichina worm
22. Cyclops.
23. Spider mouthparts.
24. Karakurt.
25. Itch mite.
26. Demodex folliculorum.
27. Ixodes ricinus.
28. Mite mouthparts.
29. Larva of Ixodes.
30. Mite nymphs.
31. Ornithodoros papillipes
32. Cockroach mouthparts.
33. Fleas.
34. Lice (male and female).
35. Coddler louse (male and female)
36. Pubic louse (male and female)
37. Bed bug
38. Kissing bug
39. Ova of malarial mosquitoes.
40. Ova of non-malarial mosquitoes.
41. Larva of malarial mosquitoes.
42. Larva of non-malarial mosquitoes.
43. Pupa of malarial mosquitoes
44. Pupa of non-malarial mosquitoes.
45. Head of malarial mosquitos (male and female).
46. Head of non-malarial mosquitoes (male and female).
47. Head of the house fly.
48. Head of the stable fly.

Micropreparations: larva of Echinococcus , beef tapeworm, broad fish tapeworm, larva of pork tapeworm, ascaris (male and female), scorpion, tarantula, camel spider.

3.3. Control Questions

1. Levels of organization of living matter.
2. Forms of life and its fundamental properties.
3. Structural and functional organization of the eukaryotic cell.
4. Molecular basis of heredity.
5. The cell cycle and methods of cell division.
6. Basic patterns of inheritance in mono- and dihybrid crosses and in linked inheritance.
7. Inheritance of human blood groups according to the **ABO system** and the **Rh factor**.
8. Inheritance of human sex and sex-linked traits.
9. Variability, its forms and manifestations.
10. Methods of studying human heredity: genealogical, twin, dermatoglyphic, cytogenetic, molecular-genetic, biochemical, and population-statistical.
11. Classification of hereditary diseases; principles of prenatal diagnosis of hereditary diseases.
12. Forms of reproduction of organisms.
13. Characteristics of gametogenesis and the structure of sex cells.
14. Definition of ontogenesis and its periodization.

15. Main stages of embryonic development; molecular and cellular mechanisms of differentiation.
16. Types of regeneration.
17. Types of transplantation and causes of tissue incompatibility.
18. Forms of symbiosis; parasitism as a biological phenomenon.
19. Principles of classification of parasites and hosts.
20. Routes of transmission of parasitic diseases; obligately transmissible and facultatively transmissible diseases.
21. Natural-focal diseases; the structure of a natural focus.
22. Classification of congenital malformations; teratogenic factors.
23. Fundamentals of prevention of parasitic diseases.
24. Pathogens of the most common protozoan infections, trematodoses, cestodoses, and nematodoses.
25. Principles of laboratory diagnosis of helminthiases.
26. Arthropods as vectors and causative agents of human diseases; the concept of mechanical and specific vectors.
27. Poisonous representatives of the phylum Arthropoda.
28. The concept of a population as an elementary unit of evolution; population structure of humanity, demes, isolates.
29. Functional types of human responses to environmental factors (“sprinter,” “stayer,” “mixed”).
30. The concept of biological rhythms and their medical significance.
31. The subject of ecology; types of environment; ecological factors.
32. Adaptive ecotypes of humans.
33. The role of humans as an ecological factor. Main directions and results of anthropogenic environmental changes.
34. Examples of plants and animals poisonous to humans.
35. Main provisions of the doctrine of **Academician V. I. Vernadsky** on the biosphere and the noosphere.
36. The position of the species **Homo sapiens** in the animal kingdom; the main stages of anthropogenesis.
37. Patterns of phylogenesis of organ systems; ontophylogenetic prerequisites of congenital malformations; examples of atavistic malformations of human organs and organ systems.

3.4. Individual Assignments (approved at the department meeting; the list specifies the number of points awarded for completion, which may be added as incentive points)

1. Pathways of interspecies exchange of biological information.
2. RNA interference.
3. Multimeric organization of proteins as the structural basis of interallelic interactions.
4. Proteomics and its significance for medicine.
5. Genomics and its significance for medicine.
6. Transcriptomics and its significance for medicine.
7. Principles of designing transgenic organisms.
8. Treatment of hereditary diseases: reality or fantasy?
9. The concept of genetic risk.
10. Gene therapy and its prospects.
11. Genetic load and its biological essence.
12. Genetic polymorphism of humanity: scale and factors of formation.
13. Balanced polymorphism and the adaptive potential of populations.

14. Biological aspects of the evolutionary development of sexual dimorphism.
15. Ontophylogenetic determination of malformations of human organs and systems.
16. Genetic consequences of natural selection in human populations.
17. Evolutionary pathways of origin of different groups of parasites.
18. The malaria situation in Ukraine: analysis and dynamics.
19. The state of human immunity during trematode invasion.
20. Contact helminthiasis: hymenolepiasis and enterobiasis in pediatric practice.
21. Trichinellosis. The current epidemiological situation in Ukraine.
22. Anniversary of the main staining dye in parasitology.
23. Ecological principles of combating parasitic diseases.
24. Parasites in mythology.

Independent work (IWS) is aimed at deepening and consolidating theoretical knowledge acquired during classroom learning and contributes to the formation of professional competencies. The results of independent study are subject to assessment and are included in the final knowledge evaluation.

Consultations: Online consultations are conducted according to the department schedule with prior registration via the instructor's corporate email.

Teaching Methods: oral questioning (individual and group); written assessment; test-based evaluation; creative assignments; individual tasks; project-based learning; self-assessment; presentations on assigned topics; poster presentations; and others.

POLICIES OF THE EDUCATIONAL COMPONENT

Course Recommendations: Students are encouraged to actively participate in all forms of class activities, dedicate 1–2 hours daily to independent work and preparation for classes, ask questions during sessions, attend consultations, submit assignments on time, and complete all forms of assessment.

Attendance: Attendance at lectures and practical classes is mandatory. The required attire for in-person sessions is a white medical coat. When visiting clinical base departments, students must wear a surgical suit, cap, medical mask, and changeable footwear. Students arriving more than 5 minutes late may be denied entry to the class. Missed classes must be made up in accordance with the *Regulations on the Procedure for Making Up Classes by Students at KhNMU* (https://knmu.edu.ua/wp-content/uploads/2021/05/pol_por-vidprac-zaniat.pdf).

Academic Integrity: KhNMU maintains a zero-tolerance policy toward academic dishonesty. Any violations of academic integrity are subject to accountability in accordance with the procedures established at KhNMU (https://knmu.edu.ua/wp-content/uploads/2021/05/polog_ad-1.pdf).

Use of Electronic Devices and Artificial Intelligence Tools: Use of electronic devices and AI tools is permitted only with the teacher's approval.

Policy for Students with Special Educational Needs: Students with special educational needs should contact the teacher to develop an individualized educational trajectory.

Teacher Response Time: 24 hours

Technical Requirements for the Course:

- Access to a computer, laptop, tablet, or smartphone.
- A corporate Google account with a personal photo.
- Skills in using Google Workspace (Google Meet, Docs, Sheets, Slides, Forms) and Moodle.

Technical Support:

- ASM: ev.shevtsov@knmu.edu.ua

- Google: tehotdelknmu@gmail.com
- Moodle: al.korol@knmu.edu.ua

RECOMMENDED SOURCES

1. Cell Biology. 3rd ed. / T. Pollard, W. Earnshaw, J. Lippincott-Schwartz, G. Johnson. — Philadelphia: Elsevier, 2017. — 908 p.
2. Medical Genetics. 6th ed. / L.B. Jorde, J.C. Carey, M.J. Bamshard. — Philadelphia: Elsevier, 2019. — 352 p.
3. Molecular Cell Biology. 9th ed. / H. Lodish, A. Berk, Kaiser C.A. et al. — New York: W.H. Freeman & Co. Ltd, 2021. — 1264 p.
4. Medical Parasitology: textbook for the students of medical universities / L.Digol, V. Myasoyedov, O. Khromenkova. – Kharkiv: 2020. – 114 p.
5. Human parasitology. 5th ed. / B. Bogitsh, C. Carter, T. Oeltmann. — Academic Press: London, 2019. — 422 p.
6. Advanced Textbook on Gene Transfer, Gene Therapy and Genetic Pharmacology Principles, Delivery and Pharmacological and Biomedical Applications of Nucleotide-Based Therapies. 2nd ed. / D. Scherman (Ed.). — Singapore: World Scientific Publishing, 2019. — 636 p.
7. First Aid For The USMLE Step 1 2019 : a student-to-student guide. 29th ed. / T. Le, V. Bhushan, M. Sochat et al. — New York: McGraw Hill Education, 2019. — 792 p.
8. Human Molecular Genetics. 5th ed. / T. Strachan, A. Read. — Boca Raton: CRC Press (Taylor & Francis Group), 2018. — 770 p.
9. Kumar & Clark's Clinical Medicine / ed.: P. Kumar [et al.] . - 9th ed., International. – Edinburgh : Elsevier . - 1437 p., 2017