

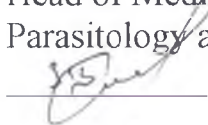



**WORKING PROGRAM OF THE DISCIPLINE**


**«MEDICAL BIOLOGY, PARASITOLOGY AND GENETICS»**

**OK 5**

**for the training of specialists of the 2<sup>nd</sup> (master's degree) level of higher education  
education sector 22 Public Healthcare  
Specialty 222 «Medicine»**

Discussed and approved  
at the methodical meeting of the  
department of Medical Biology,  
Parasitology and Genetics  
Protocol No19 from "15" 05. 2023  
Head of Medical Biology,  
Parasitology and Genetics department  
 Prof. Zinoviy VOROBETS

«Approved»  
the profile methodical commission on  
medical biological disciplines  
Protocol No3  
from "25" 05. 2023  
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**Changes and additions to the working program of the discipline  
«Medical biology, parasitology and genetics» (2023-2024)**

| No | Content of changes (additions)  | Date and protocol No of the department meeting | Notes |
|----|---|--|-------|
| 1. | Practical lesson No13 Topic «Linkage inheritance. Genetics of sex. Sex-linked inheritance»                          | Protocol No19<br>from 15 May 2023              |       |
| 2. | Practical lesson No14 Topic «Chromosomal theory of heredity. Linkage of genes. Crossing-over»                       | Protocol No19<br>from 15 May 2023              |       |
| 3. | IW No17 Topic « Phylogenesis of circulatory systems of Vertebrates. Onto-phylogenetic causes of congenital defects» | Protocol No19<br>from 15 May 2023              |       |

Head of the department

Prof. Zinoviy VOROBETS

## INTRODUCTION

### **Working Program of the discipline «Medical Biology, Parasitology and Genetics»**

according to the higher education academic standard of *the second (Master's) level*

education sector *22 Public Healthcare*

specialty *222 Medicine*

education program *Master of Medicine*

### **Description of the subject «Medical Biology, Parasitology and Genetics» (Annotation).**

Medical Biology as an Academic discipline:

a) is based on previously studied by students subjects in secondary school such as "General Biology", "Human Biology", "Biology of Animals", "Biology of Plants";

b) ensures a high level of general biological training;

c) provides for students a foundation for the further assimilation of knowledge of relevant theoretical and practical clinical professional disciplines (medical chemistry, medical genetics, clinical immunology, infectious disease epidemiology, internal medicine, surgery, pediatrics, etc.

The program of the discipline «Medical Biology, Parasitology and Genetics» is structured as follows:

Chapter 1. "Biological features of human vital functions. Molecular-genetic level of life organization. Organismic level of life organization. Basics of human genetics".

Chapter 2. "Population-species, biogeocenotic and biospheric levels of life organization".

In the Chapter 1 the molecular-genetic, cellular and ontogenetic levels of life organization are being considered, taking into account specificity of the human organism, cell biology, reproduction and basics of human genetics. The material is organized in the manner, so that obtained knowledges were closely related to the further study of hereditary diseases in theoretical and clinical departments and could be used by a physician in his practice.

In the Chapter 2 medical and biological aspects of human ecology are being revealed, which should ensure the formation of ecological thinking, necessary for the doctor nowadays. This section shows the animal world as part of the ecological human environment. Considerable attention is given to the study of parasites life cycles, various forms of relationships between them and the human organism, the origin and evolution of parasitism, modes of infection, methods of diagnosis, parasites prophylaxis. The study of various aspects of parasitology is important because a large number of parasitic diseases very common in the human population. From the perspective of modern synthetic theory of evolution questions of speciation, population patterns of species and microevolution process (for elementary evolutionary factors, elementary evolutionary phenomena) are being taught. Attention is drawn to the specific action of elementary evolutionary factors in human populations, genetic and phenotypic polymorphism of humankind. Androgenesis is considered in connection with animal world phylogeny and phylogenesis of organs and their systems in the chordates – ontophylogenetic preconditions of human congenital malformations.

Additionally, the issues of structure and function of the biosphere, the doctrine of the noosphere and the impact of human activity on the biosphere as a whole and its constituent parts are being considered, the attention is drawn to environmental protection in national and international research programs.

The types of lessons according to the working program are:

a) lectures; b) practical classes, c) individual student's work, d) consultations.

| Structure of the discipline  | Quantity of credits, hours, from them |                  |                           |           | Year of study, semester                    | Forms of the control |
|--|---------------------------------------|------------------|---------------------------|-----------|--|----------------------|
|  | Total                                 | Auditory         |                           | ISW       |  |                      |
|  |                                       | Lectures (hours) | Practical classes (hours) |           |  |                      |
| <b>Name of the discipline:<br/>Medical Biology,<br/>Parasitology and<br/>Genetics<br/>Chapters 2</b> | <b>5.5 credits /<br/>165 hours</b>    | <b>16</b>        | <b>64</b>                 | <b>85</b> | <b>I course<br/>( I, II<br/>semesters)</b> | <b>exam</b>          |
| <b>by semesters</b>  |                                       |                  |                           |           |  |                      |
| <i>Chapter 1</i>   | <b>2.5 credits /<br/>75 hours</b>     | <b>8</b>         | <b>30</b>                 | <b>37</b> | <b>I<br/>semester</b>                      |                      |
| <i>Chapter 2</i>   | <b>3.0 credits /<br/>90 hours</b>     | <b>8</b>         | <b>34</b>                 | <b>48</b> | <b>II<br/>semester</b>                     | <b>exam</b>          |

**The subjects of the Academic discipline study** are the basics of human vital functions, the study of the laws of heredity, variability, individual development and human morpho-physiological adaptation to the environment due to its biosocial nature and impact of molecular genetics, cellular, ontogenetic, population and ecological factors on human health.

**Interdisciplinary links:** the integration with related departments, in which biomedical disciplines are being studied (Histology, Cytology, Embryology, Human anatomy, Microbiology, Virology, Immunology, Epidemiology, Infectious diseases).

### 1. Aim and Objectives of the Academic discipline

1.1. **The overall aim** of "Medical Biology, Parasitology and Genetics" teaching process is determined by the goals of program, outlining educational and professional training of higher medical institutions, as well as by the content of systemic competence and practical skills required for a doctor. The knowledge that students gain during the study of "Medical Biology, Parasitology and Genetics" is a basic for a range of subjects providing both natural-science (NS unit) and professional-practical (PP unit) preparation.

1.2. **The ultimate goals** of the course "Medical Biology, Parasitology and Genetics" are:

1. To determine the biological nature and mechanisms of diseases that arise from anthropogenic changes in the environment.
2. To identify the manifestations of general biological laws during human ontogenesis.
3. To explain the patterns of human organism vital functions manifestation at the molecular-biological and cellular levels.
4. To explain the nature and mechanisms of inherited human diseases manifestation in a phenotype.
5. To make a preliminary conclusion about the presence of parasitic infestations in human organism and define measures of diseases prevention.

### 1.3 Competencies and training results

According to the Educational and Professional Program in the specialty 222 Medicine, the subject «Medical Biology, Parasitology and Genetics» provides the development of the *competencies*.

#### **Integral competencies**

The ability to solve complex problems, including those of a research and innovation nature in the field of medicine. Ability to continue learning with a high degree of autonomy.

#### **General competencies (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. Skills 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 $\Phi$ K):**

$\Phi$ K 2. The ability to determine the necessary list of laboratory and instrumental studies and evaluate their results.

$\Phi$ K 13. The ability to carry out sanitary and hygienic and preventive measures.

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

$\Phi$ K 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.

$\Phi$ K 24. Compliance with ethical principles when working with patients and laboratory animals.

$\Phi$ K 25. Adherence to the values of professional and academic integrity, to be responsible for the reliability of the obtained scientific results.

### The matrix of competencies

| No  | Competence   | Knowledge   | Skills   | Communication  | Autonomy and responsibility  |
|---|--|---|--|--|--|
| 1   | 2  | 3   | 4  | 5  | 6  |
| <b>General competences</b>  |  |   |  |  |  |
| Ability to interpret general biological regularities that are the basis of human life processes |  |   |  |  |  |
| <b>Special competences</b>  |  |   |  |  |  |
| 1.  | The ability to use in physician practice knowledge of molecular and cytological basis of heredity, mechanisms of hereditary and acquired human diseases. | Levels of the living things organization, forms of life and its fundamental properties; structural and functional organization and life cycle of eukaryotic cell; the forms of organisms reproduction, molecular basis of heredity, basic regularities of heredity and variation, methods for study of human heredity, classification of hereditary diseases. | To examine microscopic specimens at different magnification; to prepare temporary specimens; to differentiate components of animal cells on electron micrographs and drawings; to define the primary structure of the protein, number of amino acids, molecular weight of polypeptide according to the sequence of nucleotides of the gene encoding it; to predict phenotypes and genotypes for offspring according to genotypes of parents; to define the probability of birth a sick child with monogenic diseases when genotypes of the parents are known; to exclude paternity by determining blood groups of parents and children; to analyze karyotypes of patients with the most common chromosomal disease and determine the diagnosis; to build a family tree and spend its genealogical analysis; to define the role of heredity and environment in terms of characteristics | To be able to explain to the patient and his family the basic regularities of monogenic traits inheritance; possible causes of mutations and their connection with hereditary diseases; the essence of the methods used in human genetics. | Be responsible for the acquirement of relevant knowledge and skills. |

|    |  |   |  |   |   |
|----|--|---|--|---|---|
|    |  |   | (based on analysis of twins);<br>to calculate the frequencies of genes and genotypes based on the law of Hardy-Weinberg. |   |   |
| 2. | The ability to apply the knowledge of peculiarities of human ontogenesis and its connection with phylogenesis in diagnostic and treatment of various human diseases. | Ontogenesis and its periods; the main stages of embryonic development; molecular and cellular mechanisms of differentiation; classification of congenital malformations; teratogenic factors; types of regeneration; types of transplantation, causes of tissue incompatibility; placement of <i>Homo sapiens</i> in the system of the animal world, the main stages of anthropogenesis; concept of population as the elementary unit of evolution, the human population structure, small populations of people; regularities of phylogenesis of organ systems; ontophylogenetic preconditions of congenital malformations, examples of atavistic malformation of human organs and systems. | To recognize atavistic malformation  | To explain the importance of genetic and teratogenic factors in the formation of congenital malformations, importance of critical periods of human embryogenesis in formation of teratogenic congenital malformations | Be responsible for the acquirement of relevant knowledge and skills |
| 3. | The ability to   | The forms of  | To define the  | To explain ways of  | Be responsible  |

|    |  |  |  |  |   |
|----|--|--|--|--|---|
|    | <p>apply knowledge of biological basis of parasitism, life cycles of the human parasites for diagnostics, prevention and treatment of human parasitic diseases, development of preventive measures</p> | <p>symbiosis, parasitism as a biological phenomenon; principles of classification of parasites and hosts; transmission of parasitic diseases; obligate-borne and facultative vector-borne diseases; natural focal disease, the structure of the natural foci; basis of parasitic diseases prevention; the most common pathogens of protozoan infection, trematodiasis, cestodiasis, nematodiasis; <i>Arthropoda</i> as the vectors and pathogens of human infections; poisonous representatives of <i>Arthropoda</i></p> | <p>placement of biological object (causative agents of parasitic diseases) in the system of nature; to prove the relation of human parasitic diseases to the group of transmissible and natural foci; using macro- and microspecimen to diagnose pathogens and pathogens carriers of parasitic diseases which are studied; to prove the methods of laboratory diagnosis of parasitic diseases in humans; to prove prevention methods of parasitic diseases based on their modes of infection</p> | <p>transmission of parasitic diseases; to explain methods of personal prevention of parasitic diseases</p>   | <p>for the acquirement of relevant knowledge and skills</p>   |
| 4. | <p>The ability to estimate the impact of environmental factors on human health, use their professional activities for the environment protection</p>   | <p>The subject of ecology; types of environment; environmental factors, the role of man as environmental factor; main directions and results of anthropogenic changes in the environment; the main ideas of academician V.I. Vernadsky theory on the biosphere and the noosphere; adaptive ecotypes of people; functional types of people respond to environmental factors ("sprinter", "stayer", "mixed"); concept of biological rhythms, their</p>   | <p>To form the requirements themselves and others to protect the environment</p>   | <p>To explain the impact of environmental factors on human health and the role of man as an environmental factor; to promote conservation and environmental protection</p> | <p>Be responsible for the acquirement of relevant knowledge and skills; be responsible for the measures that preserve the environment within its competence</p> |



|  |  |  |  |  |  |
|--|--|--|--|--|--|
|  |  | medical significance; examples toxic to humans plants and animals. |  |  |  |
|--|--|--|--|--|--|

### Learning outcomes

Academic discipline «Medical Biology, Parasitology and Genetics» provides the foundations for a future in the following program learning outcomes in accordance with the Standards of higher education in Ukraine predegree training of second (master's) level specialists of speciality «Medicine»:

ІІPH 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.

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

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

ІІPH 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.

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

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

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

*The learning goals of the course:* After studying the discipline "«Medical Biology, Parasitology and Genetics» students should **know**:

- levels of living matter organization,
- forms of life and its fundamental properties;
- structural and functional organization of eukaryotic cells;
- molecular basis of heredity;
- cell cycle and types of cell division;
- basic patterns of heredity during mono-, dihybrid crosses and linked inheritance;
- inheritance of human blood groups according to the AB0 system and a Rhesus-factor;
- sex determination in humans and the inheritance of sex linked traits;
- variability, its forms and manifestations;
- methods of human heredity investigation: genealogy, study of twins, dermatoglyphics, cytogenetic, molecular genetic, biochemical and population-statistical;
- classification of hereditary diseases, principles of prenatal diagnosis of hereditary diseases;
- types of reproduction of organisms;
- characteristic of gametogenesis, structure of gametes;
- definition of ontogenesis and its periodization;
- the main stages of embryonic development, molecular and cellular mechanisms of differentiation;
- types of regeneration;
- types of transplantation, reasons of tissue incompatibility;

- types of symbiosis, parasitism as a biological phenomenon;
- the principles of classification of parasites and hosts;
- modes of parasitic diseases transmission; obligate and facultative transmission diseases optional;
- natural-focal diseases; the structure of the natural foci;
- classification of congenital abnormalities; teratogenic factors;
- basics of parasitic diseases prophylaxis;
- causative agents of the most spreaded protozoonosis, trematodosis, cestotodosis and nematodosis;
- principles of laboratory diagnosis of helminthoses;
- arthropods - vectors and causative agents of human diseases, the concept of mechanical and specific carriers;
- poisonous representatives of Phylum Arthropoda;
- concept of population as the smallest unit of evolution, population structure of mankind, demos, isolates;
- functional types of people respond to environmental factors («sprinter», «stayer», «mixed»);
- concept of biological rhythms, their medical significance;
- subject of ecology; types of environment, environmental factors;
- adaptive ecotypes of people;
- the role of human as environmental factor. Basic directions and results of anthropogenic environmental changes;
- examples of poisonous to humans animals and plants;
- the doctrine of academician B.I. Vernadsky about biosphere and a noosphere;
- position of *Homo sapiens* species in a system of the animal world, the main stages of anthropogenesis;
- patterns of phylogenesis of organ systems філогенезу систем органів, ontophylogenic basis of the congenital defects in humans, examples of ancestral (atavistic) defects of the development.

***be able:***

- to examine specimens under a light microscope at low and high magnification;
- to make temporary microslides;
- to differentiate the components of animal cell in electron micrographs and figures;
- to identify (schematically) the primary structure of the protein, quantity of amino acids, molecular weight of polypeptide, according to sequence of nucleotides of the gene, encoding it;
- to predict genotypes and phenotypes of offspring according to parental genotypes;
- to calculate the probability of a sick child with monogenic diseases birth in the family with certain genotypes of parents;
- to exclude paternity due to determination of blood groups for parents and child;
- to calculate the probability of hereditary diseases manifestation in the offsprings depending on penetrance of the gene;
- to analyze the human karyotype and to determine the diagnosis of the most common chromosomal diseases
- to draw a family tree and to conduct genealogical analysis;
- to calculate the role of heredity and conditions of environment in development of traits (based on analysis of twins);
- to calculate the frequencies of genes and genotypes according with Hardy- Wineberg's law;
- to distinguish the concepts of teratogenic and hereditary congenital malformations;

- to determine the place of a biological object (causative agents of parasitic diseases) in the system of nature;
- to substantiate affiliation of human parasitic diseases to the group of transmissible and natural focal;
- to diagnose on macro- and microspecimens causative agents and vectors of parasitic diseases that are studied;
- to substantiate methods of laboratory diagnosis of parasitic diseases of humans;
- to substantiate methods of parasitic diseases prophylaxis, based on their modes of infection.

## 2. Informational content of the discipline

For the discipline studying is given 5.5 credits ECTS / 165 hours.

### Structure of the discipline «Medical Biology, Parasitology and Genetics»:

#### Chapter I

Biological features of human vital activities. Molecular-genetic level of life organization.

Organism level of life organization. Fundamentals of human genetics.

#### Chapter II

Population-species, biogeocenotic and biospheric levels of living matter organization.

## 3. Structure of the discipline

| Topic  | Lectures  | Practical (seminar) classes | ISW       | Personal tasks |
|--|-----------|-----------------------------|-----------|----------------|
| <b>Section 1.</b> “Biological features of human vital activities. Molecular-genetic level of life organization. Organism level of life organization. Fundamentals of human genetics”.  |           |                             |           |                |
| Topic 1. Levels of living matter organization. Non-cellular and cellular forms of life. Structural and functional organization of a cell. Life safety during wartime.  | 2         | 7                           | 4         | -              |
| Topic 2. Characteristic of nucleic acids. The organization of the information flow in a cell.  | 2         | 4.5                         | 11        | -              |
| Topic 3. Reproduction – the basic property of living matter. Cell cycle.   |           | 4.5                         | 9         | -              |
| Topic 4. Peculiarities of human ontogenesis. Infringements of ontogenesis and their place in human pathology.  | 2         | 2                           | 15        |                |
| Topic 5. Peculiarities of human genetics. Basic patterns of the main types of inheritance. Gene interactions. Linkage inheritance. Genetics of sex. Chromosomal theory of heredity.  | 2         | 9                           | 4         | -              |
| Topic 6. Variability of organisms, its forms. The basic principles of medical genetics. Methods of human inheritance investigation. Hereditary human diseases. Provision of emergency medical and psychological assistance during wartime. | 2         | 9                           | 4         | -              |
| <b>Total for Section 1</b>   | <b>10</b> | <b>36</b>                   | <b>47</b> | <b>-</b>       |
| <b>Section 2. Population-species, biogeocenotic and biospheric levels of living matter</b>   |           |                             |           |                |

| <b>organization</b>  |             |           |           |   |
|--|-------------|-----------|-----------|---|
| Topic 7. Medical Protozoology. Phylum Sarcomastigophora, Class Lobosea. Class Zoomastigophorea Phylum Ciliophora. Class Rimostomatea. Phylum Apicomplexa. Class Sporozoa – the causative agents of human diseases. | 2           | 7         | 5         | - |
| Topic 8. Medical Helminthology. Phylum Flat worms (Platyhelminthes). Class Trematoda, Class Cestoidea; Phylum Round worms (Nemathelminthes). Class Nematoda – the causative agents of human diseases.              | 2           | 13        | 4         | - |
| Topic 9. Medical Arachnoentomology, Phylum Arthropoda. Class Arachnoidea. Class Insecta – vectors and causative agents of human diseases.  | 2           | 4         | 12        | - |
| Topic 10. Phylogenesis of Vertebrate organ systems. Onto-phylogenetic reasons for developmental defects.   |             | 2         | 9         | - |
| Topic 11. Biosphere as a system, supporting existence of human being. Human ecology..  |             | 2         | 4         | - |
| Topic 12. Synthetic theory of evolution. Population structure of mankind.  |             |           | 4         | - |
| <b>Total for Content module 2</b>  | <b>6</b>    | <b>28</b> | <b>38</b> |   |
| <b>Total hours 165/5.5 credits ECTS</b>  | <b>16</b>   | <b>64</b> | <b>85</b> |   |
| <b>Final control</b>   | <b>Exam</b> |           |           |   |

#### 4. Thematic plan of lectures

| No | TOPIC   | Hours     |
|----|---|-----------|
| 1. | Introduction to Medical Biology Course. Structural and functional organization of a cell.   | 2         |
| 2. | Molecular basis of heredity. Realization of hereditary information. Novel coronavirus (SARS-CoV-2): structure, methods of diagnostics and prophylaxis of coronavirus disease. | 2         |
| 3. | Molecular and genetic mechanisms of ontogenesis. Breaks of the ontogeny and their place in human pathology.   | 2         |
| 4. | Organismic level of the genetic information organization. Gene interactions. Chromosomal theory of heredity. Genetics of sex.   | 2         |
| 5. | Variation in human as life property and genetic phenomenon. Methods of the human inheritance investigation. Hereditary human diseases.  | 2         |
| 6. | The medical and biological basis of parasitism. Protozoa are human parasites.   | 2         |
| 7. | Medical Helminthology. Flatworms and round worms are human parasites.   | 2         |
| 8. | Medical Arachnoentomology. Arthropods as the carriers of human infections and invasions.  | 2         |
|    | <b>Total</b>  | <b>16</b> |

#### 5. Thematic plan of practical classes

| No | TOPIC  | Hours |
|----|--|-------|
| 1  | Levels of living matter organization. Optical systems in biological investigations. Cell membranes. Transport of substances across the | 2     |

|    |  |   |
|----|--|---|
|    | plasmalemma.   |   |
| 2  | Cell morphology. Structural components of cytoplasm.   | 2 |
| 3  | Chromosomes morphology. Human karyotype.   | 2 |
| 4  | Characteristic of nucleic acids. The organization of the information flow in cell  | 2 |
| 5  | The gene structure in pro- and eukaryotes. Structural and regulatory genes. Processes of genetic information realization. The genome structure of the human immunodeficiency virus. Genome organization of coronavirus (SARS-CoV-2). | 2 |
| 6  | Reproduction – the basic property of living matter. Cell cycle. Mitosis.   | 2 |
| 7  | Biological features of human reproduction. Gametogenesis. Meiosis. Fertilization.  | 2 |
| 8  | Peculiarities of the prenatal period of human development. The possibility of perinatal transmission of the virus in HIV-infected pregnant women. Postnatal period of ontogenesis.   | 2 |
| 9  | Practical skills for Part «Cell biology. Reproduction».  | 2 |
| 10 | Peculiarities of human genetics. Basic patterns of human mendelian traits inheritance. Properties of the gene.   | 2 |
| 11 | Allelic gene interactions. Inheritance of blood groups according to the ABO and rhesus factor systems.   | 2 |
| 12 | Non-allelic gene interactions.   | 2 |
| 13 | Linkage inheritance. Genetics of sex. Sex-linked inheritance.  | 2 |
| 14 | Chromosomal theory of heredity. Linkage of genes. Crossing-over.   |   |
| 15 | Variability of organisms, its forms. Phenotypic and genotypic variation.   | 2 |
| 16 | The basic principles of medical genetics. Gene and chromosomal diseases. Cytogenetics and biochemical methods of human inheritance investigation.  | 2 |
| 17 | Genealogy of human as the method of human inheritance investigation. Study of twins.   | 2 |
| 18 | Study of heredity by the method of dermatoglyphics. Population statistic method of heredity study.   | 2 |
| 19 | Practical skills for the Part "Basic principles of heredity and variation. Methods of the human inheritance investigation".  | 2 |
| 20 | Medical Protozoology. Phylum Sarcomastigophorea, Class Lobosea. Phylum Ciliophora. Class Rimostomatea.   | 2 |
| 21 | Representatives of the Class Zoomastigophorea – human parasites.   | 2 |
| 22 | Phylum Apicomplexa. Representatives of the Class Sporozoea – human parasites.  | 2 |
| 23 | Medical Helminthology. Phylum Flat worms (Platyhelminthes). Class Trematoda: liver, lancet, cat and lung flukes.   | 2 |
| 24 | Class Trematoda: blood flukes, causative agents of metagonimus and nanophyetus.  | 2 |
| 25 | Class Cestoidea: unarmed, armed and dwarf tapeworms.   | 2 |
| 26 | Class Cestoidea: echinococcus, alveococcus, broad tapeworm.  | 2 |
| 27 | Phylum Round worms (Nemathelminthes). Class Nematoda: large intestinal roundworm, pinworm (seatworm), whipworm and trichina worm.  | 2 |
| 28 | Phylum Round worms (Nemathelminthes). Class Nematoda: threadworm, hookworm, Guinea worm and Filariae.  | 2 |
| 29 | Practical skills for the Parts "Medical Protozoology" and "Medical Helminthology".   | 2 |
| 30 | Phylum Arthropoda. Class Arachnoidea. Ticks and mites are activators and vectors of human diseases.  | 2 |
| 31 | Class Insecta: diptera, lice and fleas – vectors and causative agents of human infections and invasions.   | 2 |

|              |   |           |
|--------------|---|-----------|
| 32           | Biosphere as a system, supporting the existence of human beings. Human ecology. | 2         |
| <b>Total</b> |   | <b>64</b> |

## 6. Thematic plan of individual student's work

| No           | TOPIC   | Hours     | Type of control                          |
|--------------|---|-----------|--|
| 1            | Organization for matter and energy flow in a cell.  | 4         | Current control during practical classes |
| 2            | Structure of human immunodeficiency virus and coronavirus SARS-CoV-2 genomes. Realization of hereditary information in viruses. | 6         |  |
| 3            | Methods of diagnosis and prophylaxis of coronavirus disease.  | 5         |  |
| 4            | Influence of biological teratogenic factors on the prenatal period of human ontogenesis.  | 5         |  |
| 5            | Ageing as final stage of human ontogenesis. Theories of ageing.   | 5         |  |
| 6            | Regeneration and its types: physiological and reparative. The importance of the regeneration system for homeostasis.            | 5         |  |
| 7            | The life of cells outside the organism. Cell cloning.   | 4         |  |
| 8            | Genetic engineering. Biotechnology. Concept about gene therapy.   | 4         |  |
| 9            | Genetic maps. Methods of the human chromosomes mapping. The modern state of human genome investigation.                         | 4         |  |
| 10           | Transplantation and immunity. Achievements of transplantology.  | 15        |  |
| 11           | Methods of laboratory diagnosis of protozoan diseases.  | 5         |  |
| 12           | Methods of laboratory diagnosis of helminthiasis.   | 5         |  |
| 13           | Poisonous plants and animals for human.   | 4         |  |
| 14           | Midges and its components: characteristic, importance as the intermediate hosts of helminthes and vectors of human diseases.    | 4         |  |
| 15           | Cockroaches and bedbugs: their species, medical importance.   | 4         |  |
| 16           | Phylogenesis of urogenital systems of Vertebrates. Onto-phylogenetic causes of congenital defects.                              | 4         |  |
| 17           | Phylogenesis of circulatory systems of Vertebrates. Onto-phylogenetic causes of congenital defects.                             | 4         |  |
| 18           | Origin of human. Human races as the reflection of the adaptive patterns of human development.                                   | 4         |  |
| 19           | Synthetic theory of evolution. Population structure of mankind.   | 4         |  |
| <b>Total</b> |   | <b>85</b> |  |

7. **Individual tasks.** Preparing scientific reports for a scientific students' association meetings and for the Annual Student Scientific Conference.

## 8. Teaching methods:

- verbal methods: lecture, conversation;
- visual methods: illustration, demonstration;
- practical methods: practical work and solving situational problems to develop skills;
- independent work of students with material understanding and learning;
- using the educational computer programs on discipline.

## 9. Control methods

- Current control is based on control of theoretical knowledge and skills during practical classes.
- The final control is performed in the form of written exam (II semester).

**Criteria for evaluation.** The teacher evaluates each student's knowledge at each practice according to four-mark (traditional) system, taking into account the approved evaluation criteria:

**Excellent ("5")** – the student perfectly mastered the theoretical material of the topic, demonstrates deep and comprehensive knowledge of the topic, 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.

**Good ("4")** – 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.

**Satisfactory ("3")** – 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 a practical nature, reveals inaccuracies in knowledge, is unable to assess facts and phenomena, relate them to future activities, makes mistakes in the implementation of practical skills

**Unsatisfactory ("2")** – 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.

Traditional scales are converted into the points.

**10. Current control** is performed on the basis of a comprehensive assessment of student activities and acquired competencies (knowledge, skills, abilities, etc.), which includes the entry-level control of knowledge, quality of practical work, level of theoretical training and the results of the final knowledge control.

**Current control** is performed during the studying classes and is aimed at checking the mastering by students the learning material.

The forms of current control are:

- 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");
- b) individual oral examination, interview;
- c) solving of typical situational problems;
- d) identification of causative agents and vectors of parasitic diseases in the photos, macro- and micropreparations;
- e) control of practical skills.

10.1. Evaluation of student current educational activity is carried out at each practical (laboratory or seminar) class according to four-mark system, taking into account the approved evaluation criteria for the discipline and is represented in the Journal of Academic Performance. All types of work and the list of competencies, provided by the curriculum and methodical recommendations for the topic study, are taken into account. A student must receive a grade on each topic.

10.2. Individual work of students is estimated during current control on the relevant lesson.

## 11. A form of final control of learning success (exam)

**Exam** – a form of final control of mastering of student theoretical and practical material from studying discipline.

The final control is carried out in the form of a written exam according with exam card tasks, which includes:

- a) test tasks (50), composed in accordance with the topics (50 points – 1 point for each test task);
- b) 4 describing questions (20 points – 5 points for each question);
- c) two situational problems (on molecular biology, and medical genetics) (10 points – 5 points for one problem).

Totally – 80 points.

## 12. The scheme of calculation and distribution of points that are received by students:

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

**Minimum quantity of points**, which student can collect for the current educational activity for admission to the exam (differentiated credit) makes 72 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:

$$x = \frac{AM \times 120}{5}$$

**Maximum quantity of points**, which a student can collect on the exam, makes 80 points.

**Minimum quantity of points** on the exam – not less than 50.

**Mark of the discipline, which is completed with an exam** is defined as the sum of points for current educational activity (at least 72) and points for the exam (at least 50).

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.

Points of discipline 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:

| Points from discipline  | Estimation on 4-point scale |
|---|-----------------------------|
| 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                           |

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

## 13. Methodological support

### Methodological support of the lecture course:

1. Lecture theses from the discipline.
2. Methodical recommendations for lectures.
3. Presentations of lectures.
4. Video content of lectures, placed on the platform for distance learning MISA.



### **Methodological support of practical classes:**

1. Methodical recommendations for practical classes for lecturers.
2. Methodical recommendations for practical classes for students.
3. Variants of test questions and tasks to check the initial level of knowledge on each topic.
4. Variants of situational tasks to check the mastering by students the learning topics.
5. Questions and tasks for final control (exam).
6. Methodical materials, placed on the platform for distance learning MISA.

### **Logistical support**

1. Multimedia projector.

## **14. Recommended literature**

### **1. 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.

### **2. Additional:**

1. Bihunyak T.V. Medical biology / T.V. Bihunyak. – Ternopil: TSMU Ukrmedknyha, 2020. – 214 p.
2. Bogitsh B.J., Carter C.E., Oeltmann T.N. Human parasitology. – 5th ed. Textbook. – Academic Press, 2019. – 407 p.
3. Elsheikha H.M., Jarroll E.L. Illustrated Dictionary of Parasitology in the Postgenomic Era. – Caister Academic Press, 2017. – 332 p.
4. Ghosh S., Chander J. Paniker's Textbook of Medical Parasitology. 8th Edition. – Jaypee Brothers Medical Pub, 2018. – 276 p.
5. Kaplan Medical's USMLE STEP 1. Biochemistry and Medical Genetics. Lecture notes. – 2018. – 432 p.
6. 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.
7. Ryabokon E.V., Onishchenko T.E., Ushenina L.O., Furyk E.A., Mashko O.P. Manual of helminthiasis: for the students of medical faculty. – Zaporozhye: [ZSMU], 2013. – 66 p.

## **15. 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.ucsc.edu/ENCODE/>