

MINISTRY OF EDUCATION AND SCIENCE OF UKRAINE

Petro Mohyla Black Sea National University

Medical Institute

Department of Medical Biology and Physics, Microbiology, Histology, Physiology, Pathophysiology

APPROVED  
First Vice-Rector



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Course Description

**MEDICAL BIOLOGY**

field of knowledge 22 «Health care»  
in the specialty 222 «Medicine»

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*(Handwritten signatures of Mazur I. O., Kozii M. S., Klymenko M. O., Hryshchenko H. V., and Shkirchak S.I. over horizontal lines)*

## 1. Description of the discipline

| Characteristic   | Characteristics of the discipline      |                |
|--|--|----------------|
| Name of the discipline   | Medical biology                        |                |
| Branch of knowledge  | 22 “Health care”                       |                |
| Specialty  | 222 “Medicine”                         |                |
| Specialization (if any)  |  |                |
| Educational program  |  |                |
| Education level  | Master's degree                        |                |
| Discipline status  | Normative                              |                |
| Curriculum   | 1 st                                   |                |
| Academic year  | 2020-2021                              |                |
| Numbers of semesters:  | Day form                               | Part-time form |
|  | 1-й, 2-й                               |                |
| Total ECTS credits / hours   | 5,5 credit / 165 hours                 |                |
| Course structure:<br>- lectures<br>- seminars (practical, laboratory, semi-group)<br>- hours of independent work of students | Day form                               | Part-time form |
|  | 20 hours (10/ 10)<br>70 hours (36/ 34) |                |
|  | 75 hours (44/31)                       |                |
| Percentage of classroom load   | 55%                                    |                |
| Teaching language  | english                                |                |
| Intermediate control form (if any)   | attestation                            |                |
| Form of final control  | 2nd semester - exam                    |                |

## 2. Aim, tasks and learning outcomes of the discipline

**The purpose** of the discipline "Medical biology" follows from the goals of the educational-professional program for the training of graduates of a higher medical school and is determined by the content of those systems of knowledge and skills that a physician must possess. Knowledge, which students receive from the discipline, are basic for a block of disciplines providing natural sciences and professional and practical training. The study of the discipline "Medical Biology" provides the foundation for further learning by students of knowledge and skills from profile theoretical and clinical vocational and practical disciplines (biological and bioorganic chemistry, histology, cytology and embryology, physiology, medical genetics, clinical immunology, infectious diseases, epidemiology, pediatrics , etc.).

The purpose of teaching discipline training is to form knowledge and practical skills in human biology for further learning by the students of a block of disciplines providing natural science and professional and practical training.

### **The main tasks of studying the discipline "Medical biology" are:**

- Determine the biological nature and mechanisms of the development of diseases that arise as a result of anthropogenic changes in the environment.
- Identify manifestations of general biological laws in the course of human ontogenesis.
- Explain the patterns of manifestations of human life on the molecular-biological and cellular levels.
- Explain the essence and mechanisms of manifestation in the phenotype of human hereditary diseases.
- To make a preliminary conclusion on the presence of parasitic human invasion and to identify measures for the prevention of diseases.

### **Prerequisites for studying the discipline:**

Medical biology as academic discipline:

- a) is based on previously studied by students in secondary school subjects such as "General Biology", "Human Biology", "Animal Biology", "Biology of plants";
- b) provides a high level of general biological training;
- c) lays the foundation for students to further master their knowledge of the profile theoretical and clinical professional and practical disciplines (medical chemistry, medical genetics, clinical immunology, infectious diseases with epidemiology, internal medicine, surgery, pediatrics, etc.).

### **Learning outcomes:**

According to the requirements of the educational and professional program students must:

**Know:** general laws of the development of living nature, the essence of life, its forms, individual and historical development of the organic world and a person's place in it, forms of biotic connections in nature, life cycles of parasites, human genetic and parasitic diseases, etc.

**Be able:** freely use anatomical terminology; differentiate human chromosomal diseases, carry out genealogical analysis of genealogies with hereditary disease, diagnose pathogens and vectors of parasitic pathogens on macro- and micropreparations; identify different stages of the life cycle of human parasites; to solve situational problems having a clinical and biological direction.

### **Have competencies:**

According to the requirements of the standard, discipline ensures that students acquire the following **competencies**:

- about the application of knowledge of medical biology to promote a healthy lifestyle,
- as well as to prevent the occurrence and development of diseases;
- about the main perspective directions of development of medical biology.

**The curriculum corresponds to the educational and professional program (EPP) and oriented to the formation of *competencies*:**

#### **General (GK) – GK1-GK3 EPP:**

- Ability for abstract thinking, analysis and synthesis, ability to learn and master modern knowledge.
- Ability to apply knowledge in practical situations.
- Knowledge and understanding of the subject area and understanding of professional activity.

#### **Professional (PK) – PK2, PK13, PK20 EPP:**

- Ability to determine the required list of laboratory and instrumental studies and evaluate their results.
- Family planning counseling skills.
- Ability to evaluate the impact of environmental, socio-economic and biological determinants on the health of an individual, family, population.

**According to the educational and professional program (EPP), expected programmatic learning outcomes (PLO) include skills PLO4, PLO12 EPP:**

- Know the types and ways of adaptation, principles of action in a new situation. Be able to apply self-regulation tools, be able to adapt to new situations (circumstances) of life and activity. Make appropriate connections to achieve results. Be responsible for the timely use of self-regulation methods.

- Evaluate information on diagnosis in the setting of a healthcare facility, its subdivision, using the standard procedure, using knowledge of humans, their organs and systems, based on the results of laboratory and instrumental studies (List 4).

### **3. Program of the discipline**

The organization of the educational process is carried out under the The European Credit Transfer and Accumulation System (ECTS).

The curriculum consists of three information blocks:

#### **INFORMATION BLOCK 1**

##### **Topic 1. Magnifying devices. Methods of studying the cell**

Concept of life. Its definition. Properties and characters of living things. Organization levels of living things. Methods of studying living things (methods of biological sciences). Biology as a subject. Its significance for medicine. Human's standing in the animal world system. Human as a biological and social being.

The subject, tasks and methods of cytology. Magnifying devices and their purpose. Structure of a light micro-scope. Rules of working with the microscope. Rules of working with a high magnification ( $7 \times 40$ ) microscope.

**Topic 2. Biology of the cell. the flow of substance in the cell. the flow of energy in the cell**

The present state of the cell theory. Differentiating signs of pro- and eukaryotic cells. Basic forms of cellular organization. Structure (models) of plasma membrane, its properties and functions. Structural components of cytoplasm.

Methods of passing substances into the cell. Organization of a substances flow in the cell. Anabolic system of the cell. The catabolic system of the cell. Organization of an energy flow in the cell. Energy exchange. Enzyme systems of mitochondria.

### **Topic 2. The cell - the basic structural and functional unit of living things**

Structural and functional organization of the eukaryotic cell. Chemical composition of the cell: macro- and microelements. Water, the importance of hydrogen bonds in the processes of cell life. Organic compounds - carbon-containing substances of living organisms. Cytoplasm and cytoskeleton. Cyclosis. Cytoplasmic organelles - membrane and non-membrane, purpose and principles of functioning. Inclusions in cells, their functions. The nucleus is the central information apparatus of the cell. The structure of the interphase nucleus. Chromosomal and genomic levels of organization of hereditary material. Chromatin: euchromatin, heterochromatin. Methods of studying the structure and functioning of the cell

### **Topic 3. Molecular components of the cell. The role of nucleic acids in the preservation and transmission of hereditary information**

The cell as an open system. Assimilation and dissimilation. Cell membranes, their structure and functions. The principle of compartment. Cell receptors. Transport of substances through the plasmolemma. Organization of flows of matter and energy into cells. Stages of energy metabolism. Cell energy supply, ATP. Energy distribution.

Molecular basis of heredity. Characteristics of nucleic acids: DNA and RNA, spatial organization, species specificity, role in storage and transfer of hereditary information. DNA replication. Maintaining the genetic stability of cells: self-correction and DNA repair.

### **Topic 4. Protein biosynthesis, its stages and significance. Genetic code.**

Protein structure: primary, secondary, tertiary, quaternary structure. Peptide and disulfide bonds. Genetic code, its properties. Translation, its stages (activation of amino acids, initiation, elongation, termination, protein processing). Collinearity. The effect of antibiotics on translation.

Organization of information flow in the cell. The main dogma of molecular biology. Regulation of gene activity in eukaryotes at the chromosomal level. Regulation of gene expression at the level of transcription. Operon system. Lactose and tryptophan operons. Regulation of gene activity at the translation level. Post translational modification of proteins.

### **Topic 5. Molecular basis of regulation of gene expression**

Organization of information flow in the cell. Transcription. Processing, splicing. Broadcast (initiation, elongation, termination). Posttranslational modification of proteins. Regulation of gene expression in prokaryotes. Exon-intron organization of the eukaryotic genome. Molecular mechanisms of variability in humans

### **Topic 6. Cell life cycle. Cell division.**

Cell organization in time. Cell cycle. Attempts at cell division: amitosis, mitosis. Endomitosis, polytenia. Changes in cells and their structures during the mitotic (cell) cycle (interphase and mitosis). Cell growth. Growth factors. Mitotic tissue activity. Disorders of mitosis, somatic mutations. Meiosis, its biological significance. The life of cells outside the body. Cell cloning.

### **Topic 7. Sex cells.**

Sex cells. Structure and functions of male and female sex cells, the main stages of their development. Meiosis as a mechanism of germ cell formation. Its serving.

### **Topic 8. Final control work for the block 1.**

#### INFORMATION BLOCK 2

### **Topic 9. Features of human genetics. Manifestations of basic patterns**

**inheritance on the example of mendelian human traits (mono-, di- and polyhybrid crossing)**

Genetics: subject and tasks, stages of development; basic terms and concepts of genetics. Principles of hybridological analysis. Monohybrid crossing: the law of uniformity hybrids of the first generation, the law of cleavage. The law of "gamete purity". Cytological bases of laws. Analytical crossing, its practical application. Lethal genes. Deviation from the expected splitting. Di- and polyhybrid crossing: the law of independent combination of signs, its cytological bases. Dominant and recessive variants of inheritance of normal and pathological human traits. Intermediate nature of inheritance in humans

**Topic 10. Multiple allelism. Genetics of human blood groups. Interaction of allelic and non-allelic genes. The phenomenon of pleiotropy.**

Interaction of allelic genes (complete dominance, incomplete dominance, overdominance or superdominance, codominance) and non-allelic genes (complementary interaction, epistasis, polymer). Polygenic inheritance of human traits. Primary and secondary pleiotropy. Series of multiple alleles. Inheritance of blood groups by antigenic systems AB0 and MN. Rhesus factor. Rhesus conflict. Immunogenetics: subject, task. Tissue and species specificity of proteins, their antigenic properties.

### **Topic 11. Linked inheritance. Genetics of sex.**

Linked inheritance. Features of inheritance of coupling groups. Chromosomal theory of heredity. Mechanisms of crossover, cytological evidence, biological significance. Genetic chromosome maps. Methods of mapping human chromosomes. The current state of human genome research. Not chromosomal heredity. Inheritance of sex in humans. Inheritance of sex-linked human diseases. The current state of human genome research. Non-chromosomal heredity. Inheritance of human sex. Signs limited to sex and dependent on sex. Hemizygoty. Traits linked to the article, the laws of their inheritance. Mechanisms of genetic sex determination in humans and their disorders. Bisexual human nature. The problem of gender redefinition, psychosocial aspects.

### **Topic 12. Variability, its forms and manifestations.**

Variability, its forms and manifestations at the organismal level: phenotypic and genotypic variability. Modifications and reaction rate. Long modifications. Statistical regularities of modification variability. Combinatorial variability, its sources. Mutational variability in humans and its phenotypic manifestations. Classification of mutations: gene, genomic, chromosomal aberrations. Natural mutagenesis, induced mutagenesis. Mutagens: physical, chemical, biological. Genetic monitoring. Genetic danger of environmental pollution. The concept of antimutagens and commutagens. The law of homologous series of hereditary variability, its practical significance.

### **Topic 13. Genealogical and twin methods**

Fundamentals of medical genetics. Man as a specific object of genetic analysis. Methods of studying human heredity. Genealogical method. Rules of construction of pedigrees. Genetic analysis of pedigrees. The twin method. Determining the influence of

genotype and environment in the manifestation of pathological signs of man. Dermatoglyphic, immunological and methods hybridization of somatic cells.

**Topic 14. Chromosomal diseases. Cytogenetic method of their diagnosis**

Classification of hereditary human diseases. Chromosomal diseases caused by a violation of the number or structure of chromosomes, cytogenetic mechanisms, essence. Cytogenetic methods. Karyotyping. Analysis of karyotypes of patients with hereditary diseases. Determination of X- and Y-sex chromatin as a method of diagnosis of hereditary human diseases.

**Topic 15. Molecular diseases. Biochemical method and DNA diagnostics**

Monogenic human molecular diseases caused by changes in the molecular structure of the gene. Molecular diseases of carbohydrate, amino acid, protein, lipid, mineral metabolism. The mechanism of their occurrence and the principles of laboratory prenatal diagnostics. Genetic engineering. Biotechnology. The concept of gene therapy.

**Topic 16. Population-statistical method. Medical and genetic counseling**

Population-statistical method. The law of constancy of the genetic structure of ideal populations. Using the formula of Hardy-Weinberg's law in medicine to determine genetic structure of human populations. Medical and genetic aspects of the family. Medical and genetic counseling. Prevention of hereditary and congenital pathology. Prenatal diagnosis of hereditary diseases.

**Topic 17. Biological features of human reproduction. Gametogenesis.**

Subject and tasks of human embryology. Medical embryology. The ratio of onto- and phylogeny. Periodization of human embryogenesis.

Features of human reproduction in connection with its biosocial essence. Reproduction as mechanism for ensuring genetic continuity in several generations. Gametogenesis.

**Topic 18. Fertilization. Fragmentation.**

Human fertilization - the restoration of the diploid set of chromosomes, increasing the diversity of genes in the offspring. Conditions necessary for normal fertilization, the phenomenon of capacitation, acrosomal reaction, penetration of sperm, the formation of the male pronucleus. Cortical reaction of the oocyte, completion of meiosis, formation of the female pronucleus. The concept of in vitro fertilization. Its medical and social significance. Zygote as a unicellular organism.

Crushing of the human embryo, its characteristics. Structure and localization of the embryo during fragmentation. Types of blastomeres. Morula. Blastocyst formation. Embryo and trophoblast. Implantation. Its mechanisms, stages, chronology, features in humans.

**Topic 19. Features of the prenatal period of human development.**

Ontogenesis: types, periods, stages. Stages of human embryonic development. Differentiation at the molecular genetic, cellular and tissue levels. Congenital malformations. Classification: hereditary, exogenous, multifactorial, gametopathy, blastopathy, embryopathy, fetopathy. Regulation of gene function in ontogenesis. Experimental study of embryonic development The problem of determination and interaction of blastomeres. Embryonic induction. Regulation in the process of fragmentation and its violation (twins, malformations, ugliness). Critical periods of development. Teratogenesis. Teratogenic environmental factors.

**Topic 20. Final control work for the block 2.**

INFORMATION BLOCK 3

**Topic 21. Medical and Biological Basis of Parasitism. *Medical Protozoology*"**

Origin of parasitism. Criteria of parasitism. Classification of parasites and their hosts. Transmission routes of parasites. Morphological and physiological adaptations of parasites. Pathogenic action and specificity of parasites. Response of the host to parasitic invasion. Biological basis of prophylaxis of parasitic diseases.

### **Topic 22 Phylum Sarcomastigophora, classes Sarcodina, Zoomastigota**

General characteristic of the kingdom Protista. Parasitic Sarcodina (phylum Sarcomastigophora, class Sarcodina). *Entamoeba histolytica* (Dysenteric amoeba) Morphological peculiarities. Life cycle. Pathogenic action. Symptoms. Complication of amoebiasis. Laboratory diagnostics. Personal and social prophylaxis.

Parasitic flagellates (phylum Sarcomastigophora, class Zoomastigota). *Leishmania*. Morphological peculiarities. Life cycle. Pathogenic action. Symptoms. Complication of amoebiasis. Laboratory diagnostics. Personal and social prophylaxis.

Genus *Trypanosoma*. *Trypanosoma brucei gambiense* (West Africa) and *Trypanosoma brucei rhodesiense* (East Africa). Life cycle. Pathogenic action. Symptoms. Complication of amoebiasis. Laboratory diagnostics. Personal and social prophylaxis.

Genus *Giardia*. *Lamblia intestinealis* is a pathogen of lambliaiasis (giardiasis). Morphological peculiarities. Life cycle. Pathogenic action. Symptoms. Complication of amoebiasis. Laboratory diagnostics. Personal and social prophylaxis.

### **Topic 23. Phylum Infusoria, class Ciliata. Phylum Apicomplexa, class Sporozoa**

*Balantidium coli*. Life cycle. Pathogenic action. Symptoms. Complication of amoebiasis. Laboratory diagnostics. Personal and social prophylaxis.

Life cycle of malaria pathogen. Types of malaria parasites, their morphological characteristics in a thin blood smear. Life cycle. Ways of infecting human with malaria. Pathogenic action of the parasite. Symptoms and diagnosis of malaria. Laboratory diagnostics. Biological basics of malaria prophylaxis.

*Toxoplasma gondii* belongs to the class Sporozoa, order Coccidia. *Toxoplasma gondii* belongs to the class Sporozoa, order Coccidia.

### **Topic 24. Medical Helminthology. Phylum Plathelminthes, class Trematoda**

General characteristic and classification of the phylum. Progressive organization features of flukes and features of adaptability to parasitism. Peculiarities of life cycles in trematodes.

Common liver fluke. Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics. Personal and social prophylaxis.

**Topic 25. class Trematoda. Cat liver fluke, lung fluke, blood fluke.** Morphological peculiarities: Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics. Personal and social prophylaxis

### **Topic 26. Phylum Plathelminthes, class Cestoidea. Beef tapeworm, pork tapeworm, dwarf tapeworm.**

Characteristic of the class tapeworms, their adaptation to parasitism. Peculiarities of life cycles of *Taenia* and *Diphyllobothria*.

*Taenia solium* and *Taeniarhynchus saginatus* (beef tapeworm, pork tapeworm, dwarf tapeworm). Morphological peculiarities, Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics.

### **Topic 27. Phylum Plathelminthes, class Cestoidea. Echinococcus granulosus and Alveococcus multilocularis. Diphyllobothrium latum.**



Morphological peculiarities, Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics.

*Alveococcus multilocularis* is a biohelminth, pathogen of alveococcosis. Morphological peculiarities, Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics.

*Dyphyllobothrium latum*. Morphological peculiarities, Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics.

Biological basis of cestodoses prophylaxis.

### **Topic 28. Phylum Nematelminthes, class Nematoda (I)**

General characteristic of the phylum Nematelminthes and the class Nematoda.

*Ascaris lumbricoides*. Morphological peculiarities, Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics.

*Trichocephalus trichiurus* (human whipworm) Morphological peculiarities, Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics.

*Enterobius vermicularis* (seatworm or pinworm) Morphological peculiarities, Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics.

*Trichinella spiralis* Morphological peculiarities, Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics.

Biological basics of prophylaxis of nematodoses.

### **Topic 29. Phylum nematelminthes, class Nematoda (II)**

*Dracunculus medinensis* (Guinea worm). *Ancylostoma duodenale* (Old World hookworm). *Necator americanus* (New World hookworm). *Strongyloides stercoralis* (treadworm). Filarioidea (filarial worms). Morphological peculiarities, Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics.

*Wuchereria bancrofti*. *Onchocerca volvulus*. Morphological peculiarities, Life cycle. Pathogenic action. Clinical manifestations. Laboratory diagnostics.

Personal and social prophylaxis. Diagnostic techniques of helminthiases

Macroscopic techniques. Microscopic techniques. Enrichment techniques. Diagnosis of tissue helminthoses.

### **Topic 30. Medical Arachnoentomology. Phylum Arthropoda. Classis Arachnoidea**

General characteristic and taxonomy of the phylum Arthropoda. General characteristic and classification of the class Arachnida.

Acari (or Acarina). Classification: phylum Arthropoda, class Arachnida, order Acarina, families: Ixodidae, Argasidae, Gamasidae, Tyroglyphidae, Sarcoptidae. Representatives, morphology, life cycle, medical significance, prophylaxis of scabies.

The study of Yevgeny Pavlovsky about the natural foci of vector-borne diseases. Characteristics of a natural focus.

### **Topic 31. Phylum Arthropoda, class Insecta, order Diptera**

General characteristic and taxonomy of class Insecta. Morphology and biology of the order Diptera. Tiny flying insects assembling a gnat (black flies, midges, sand flies, horse-flies, mosquitoes).

Mosquitoes (family Culicidae). Genera *Culex*, *Anopheles* and *Aedes*. Morphology: Life cycle. Medical significance.

Flies (Muscidae family). Morphology: Life cycle. Medical significance. Protective measures against Flies

Medical significance of bot-flies (Oestridae family). Protective measures against Diptera insects. Lice and fleas – the carriers of human infections and invasions. Sucking lice (order Anoplura). Taxonomy. Morphology: Life cycle. Medical significance. Fleas (order Aphaniptera). Cockroaches (order Blattoidea). Bugs (order Heteroptera). Taxonomy. Morphology: Life cycle. Medical significance. Protective measures against bugs.

**Topic 32. Synthetic theory of evolution. Population structure of mankind. Anthropogenesis.**

Synthetic theory of evolution. Features of the action of evolutionary factors in human populations. Study of macro- and microevolution. Biogenetic law. Population structure of mankind. The origin of man. Human races as a reflection of the adaptive patterns of human development.

**Topic 33. Phylogeny of the main systems of vertebrate organs.**

Comparative analysis of body coverings, digestive, respiratory, excretory, sexual, nervous, endocrine, cardiovascular vascular systems.

Evolution of the main systems of vertebrate organs. Ontophylogenetically caused congenital malformations of human development.

**Topic 34. The biosphere as a system that ensures human existence. Human ecology.**

Structure and functions of the biosphere. The main provisions of VI Vernadsky's doctrine of the organization of the biosphere. Modern concepts of the biosphere. The noosphere. Humanity as an active geological force. Biosphere protection in national and international scientific programs. Human ecology. Environment as an ecological concept. Types of environments. Environmental factors. Unity of organism and environment. See ecosystems. Human penetration into biogeocenoses, formation of anthropocenoses. Anthropogenic migration of elements. Medicinal substances in food chains. Environmental forecasting. healthy (comfortable). Unhealthy (uncomfortable). Extreme environment. Adequate and inadequate environmental conditions. Adaptation of people to extreme conditions. The impact of anthropogenic environmental factors on public health. Characteristics of toxic to humans plants and animals

**Topic 35. Final control work for the block 3.**

**Structure of the discipline**

Full-time education

**INFORMATION BLOCK 1. BIOLOGICAL FEATURES OF HUMAN VITAL ACTIVITY**

| № | Topic  | Hours |    |      |
|---|--|-------|----|------|
|   |  | Lec   | Pr | Ind* |
| 1 | Introduction to the course of medical biology. Structural and functional organization of the cell. | 2     | 14 | 5    |
| 2 | The control of the learning of the block 1   |       | 2  |      |
|   | Total hours - 23. ECTS credits - 0.8   | 2     | 16 | 5    |

**INFORMATION BLOCK 2. ORGANIC LEVEL OF ORGANIZATION OF LIFE.  
FUNDAMENTALS OF HUMAN GENETICS**

| № | Topic   | Hours |    |     |
|---|---|-------|----|-----|
|   |   | Lec   | Pr | Ind |
| 3 | Organization of the flow of genetic information.<br>Organization of hereditary material | 2     | 2  | 10  |
| 4 | Patterns of inheritance. Variability.   | 2     | 6  | 5   |
| 5 | Fundamentals of human genetics. Hereditary human diseases.                              | 2     | 6  | 20  |
| 6 | Basics of human ontogeny. Sex biology and genetics.                                     | 2     | 6  | 5   |
| 7 | Disorders of ontogeny and their place in human pathology.                               | 2     | 2  | 5   |
| 8 | The control of the learning of the block 2  |       | 2  |     |
|   | Total hours - 79. ECTS credits – 2.6  | 10    | 24 | 45  |

**INFORMATION BLOCK 3  
POPULATION-SPECIES, BIOGEOCENOTIC  
AND BIOSPHERE LEVELS OF LIFE ORGANIZATION**

| №  | Topic  | Hours    |           |           |
|----|--|----------|-----------|-----------|
|    |  | Lec      | Pr        | Ind       |
| 9  | Medico-biological bases of parasitism. Protozoa are human parasites.   | 2        | 6         | 5         |
| 10 | Medical helminthology. Flat and round worms are human parasites  | 2        | 12        | 10        |
| 11 | Medical arachnoentomology. Arthropods as infectious agents and infectious agents   | 2        | 4         | 5         |
| 12 | Synthetic theory of evolution. Features of evolutionary factors in human populations.<br>The biosphere as a system that ensures human existence.<br>The control of the learning of the block 3 | 2        | 8         | 5         |
|    | Total hours - 63. ECTS credits – 2.1   | <b>8</b> | <b>30</b> | <b>25</b> |

\*- Individual work - a review of the scientific literature or experimental research

**4. The content of the discipline**

**4.1. Plan of lectures**

**INFORMATION BLOCK 1**

| № | Topic / Plan  | Hours    |
|---|---|----------|
| 1 | <b>Introducing to Medical Biology course.</b><br><b>A cell as elementary morpho-functional biological unit.</b><br>1. Concept of life. Its definition.<br>2. Properties and characters of living things.<br>3. Organization levels of living things.<br>4. Biology as a subject. Its significance for medicine.<br>5. Human's standing in the animal world system.<br>6. Cell as an elementary unit of living things. | <b>2</b> |

|   |   |   |
|---|---|---|
|   | <ul style="list-style-type: none"> <li>7. Cellular theory; its modern status.</li> <li>8. Basic forms of cellular organization.</li> <li>9. Biology of the cell.</li> <li>10. The flow of substance and energy in the cell</li> </ul>   |   |
| 2 | <p><b>INFORMATION BLOCK 2</b></p> <p><b>Organization of the flow of genetic information. Realization of hereditary information.</b></p> <ul style="list-style-type: none"> <li>1. Chromosomes: their structure and classification.</li> <li>2. Mitosis, meiosis.</li> <li>3. Structure and functions of nucleic acids</li> <li>4. Packing levels of genetic material</li> <li>5. DNA replication</li> <li>6. DNA transcription</li> <li>7. Genetic code and its properties</li> <li>8. Transcription regulation in prokaryots and eukaryots</li> <li>9. Protein biosynthesis in the cell</li> </ul>   | 2 |
| 3 | <p><b>Inheritance regularities. Variation</b></p> <ul style="list-style-type: none"> <li>1. Genetics as a science. Basic concepts of Genetics.</li> <li>2. Peculiarities of the hybridological method:</li> <li>3. Inheritance regularities in monohybrid cross.</li> <li>4. Hypothesis of purity of gametes and its cytological foundation.</li> <li>5. Inheritance regularities in polyhybrid cross. The law of independent assortment of characters.</li> <li>6. Conditions limiting the manifestation of Mendel's laws. Pleiotropy. Semi-lethal and lethal genes.</li> <li>7. Gene interactions.</li> <li>8. Inheritance of blood groups.</li> <li>9. Genetic linkage.</li> <li>10. Variation and its forms.</li> <li>11. Mutagenic factors and mutagenesis.</li> <li>12. Repair of genetic material.</li> <li>13. Biological bases of cancerogenesis.</li> </ul> | 2 |
| 4 | <p><b>The basic principles of human genetics. Genetic disorders of human.</b></p> <ul style="list-style-type: none"> <li>1. Human genetics: the subject and tasks.</li> <li>2. Specificity of human genetics.</li> <li>3. Methods of studying human genetics.</li> <li>4. Gene mutations as a cause of metabolic diseases.</li> <li>5. Characteristic of gene human diseases.</li> <li>6. Chromosome and genome mutations as a cause of chromosomal human diseases.</li> </ul>  | 2 |
| 5 | <p><b>Molecular and genetic mechanisms of ontogenesis. Biology and</b></p>  | 2 |

|   |   |   |
|---|---|---|
|   | <p><b>genetics of sex</b></p> <ol style="list-style-type: none"> <li>1. Periods of ontogenesis.</li> <li>2. Embryogenesis.</li> <li>3. Realization of genic actions in ontogenesis.</li> <li>4. Periods of postnatal ontogenesis.</li> <li>5. Growth: laws and growth regulation.</li> <li>6. Aging and old age.</li> <li>7. Death, clinical and biological.</li> <li>8. Sex as a biological character. Sex characters.</li> <li>9. X-linked and holandric characters.</li> <li>10. Chromosome theory of sex determination.</li> <li>11. Peculiarities of human sex determination and its impairments.</li> <li>12. Sex chromosome disorders.</li> </ol>  |   |
| 6 | <p><b>Breaks of the ontogeny and their place in human pathology.</b></p> <ol style="list-style-type: none"> <li>1. Critical periods of development.</li> <li>2. Teratogenesis. Teratogens.</li> <li>3. The variety and the reasons of congenital development</li> </ol>   | 2 |
| 7 | <p><b>INFORMATION BLOCK 3</b></p> <p><b>Medico-biological bases of parasitism. Protozoa are human parasites.</b></p> <ol style="list-style-type: none"> <li>1. Parasitism as a biological phenomenon.</li> <li>2. Age and origin of parasitism.</li> <li>3. Classification of parasites and their hosts.</li> <li>4. The system «parasite – host».</li> <li>5. General characteristic of the Protist kingdom.</li> <li>6. Parasitic Sarcodina (phylum Sarcomastigophora, class Sarcodina).</li> <li>7. Parasitizing filamentous protists (phylum Sarcomastigophora, class Zoomastigota).</li> <li>8. Phylum Infusoria, class Ciliata.</li> <li>9. Phylum Apicomplexa, class Sporozoa</li> </ol> | 2 |
| 8 | <p><b>Medical and Biological Basis of Parasitism. Medical Helminthology.</b></p> <ol style="list-style-type: none"> <li>1. Phylum plathelminthes, class Trematoda</li> <li>2. Phylum plathelminthes, class Cestoidea</li> <li>3. Phylum nemathelminthes, class Nematoda</li> </ol>  | 2 |
| 9 | <p><b>Medical Arachnoentomology</b></p> <ol style="list-style-type: none"> <li>1. General characteristic and systematization of the Arthropoda phylum (Arthropoda).</li> <li>2. Ixodous, argasal and gamasal ticks. Order of Acari — ticks. Family of Ixodae — ixodous ticks.</li> <li>3. Peculiarities of morphology and biology of Diptera order representatives.</li> <li>4. Gnats of Culex, Anopheles and Aedes genera.</li> </ol>  |   |

|    |   |           |
|----|---|-----------|
|    | 5. Order of Lice (Anoplura).<br>6. Order of Fleas (Aphaniptera).<br>7. Order of cockroaches and bugs  |           |
| 10 | <b>Synthetic theory of evolution. Features of evolutionary factors in human populations. The biosphere as a system that ensures human existence</b><br>1. The species and its criteria. The population structure of a species.<br>2. Genetic processes in large and small populations.<br>3. Synthetic theory of evolution.<br>4. Elementary evolutionary factors.<br>5. Human ecology and biosphere. | 2         |
|    | <b>Total</b>  | <b>10</b> |

#### 4.2 Plan of practical classes

##### INFORMATION BLOCK 1

|   |  | Hours |
|---|--|-------|
| 1 | Magnifying devices. Methods of studying cells  | 2     |
| 2 | The cell is the basic structural and functional unit of the living   | 2     |
| 3 | Molecular components of the cell. The role of nucleic acids in the conservation and transmission of hereditary information | 2     |
| 4 | Protein biosynthesis, its stages and significance. Genetic code.   | 2     |
| 5 | Molecular basis of regulation of gene expression   | 2     |
| 6 | Cell life cycle. Cell division.  | 2     |
| 7 | The Sex cells.   | 2     |
| 8 | The control of the learning of the block 1   | 2     |
|   | Total  | 16    |

##### INFORMATION BLOCK 2

|    |  |   |
|----|--|---|
| 9  | Features of human genetics. Manifestations of the basic patterns of inheritance on the example of human decaying features (mono-, di- and polyhybrid crossing) | 2 |
| 10 | Multiple allelism. Genetics of human blood groups. Interaction of allelic and non-allelic genes. The phenomenon of pleiotropy.                                 | 2 |
| 11 | Linkage inheritance. Genetics of sex.  | 2 |
| 12 | Variability, its forms and manifestations.   | 2 |
|    | Content module 3. Methods of studying human heredity.  | 2 |
| 13 | Hereditary diseases  | 2 |
| 14 | Genealogical and twin methods  | 2 |
| 15 | Chromosomal diseases. Cytogenetic method of their diagnosis  | 2 |
| 16 | Molecular diseases. Biochemical method and DNA diagnostics   | 2 |
|    | Content module 4. Biology of individual development  | 2 |
| 17 | Biological features of human reproduction. Gametogenesis.  | 2 |
| 18 | Fertilization. Fragmentation.  | 2 |
| 19 | Features of prenatal period of human development.  | 2 |
| 20 | Control of the learning of the block 2   | 2 |

##### INFORMATION BLOCK 3

|    |   |   |
|----|---|---|
| 21 | Sarcomastigophora type. Class Real amoebas (Lobosea). Rimostomatea is a | 2 |
|----|---|---|

|    |  |   |
|----|--|---|
|    | human parasite.  |   |
| 22 | Zoomastigophora - Human parasites  | 2 |
| 23 | Phylum Apicomplexa ( <i>Apicomplexa</i> ). Sporozoa is a human parasite  | 2 |
| 24 | Type Flat worms (Plathelminthes). Class Trematoda ( <i>Trematoda</i> ) - liver and cat liver flukes  | 2 |
| 25 | Type Flat worms (Plathelminthes). Class Trematoda ( <i>Trematoda</i> ) - lung and blood flukes   | 2 |
| 26 | Class tape worms ( <i>Cestoidea</i> ) – beef, pork, dwarf tape worms   | 2 |
| 27 | Classis Cestoidea: Echinococcus, Alveococcus, broad tapeworm (fish tapeworm). Methods of laboratory diagnosis of cestodes.   | 2 |
| 28 | Phylum Nematelminthes. Classis Nematoda: large intestinal roundworm, pinworm (seatworm), whipworm.   | 2 |
| 29 | Phylum Nematelminthes. Classis Nematoda: Ancylostoma duodenale, Strongiloides stercoralis, Trichinella spiralis, filaria   | 2 |
|    | Змістовий модуль 7. Медична арахноентомологія  | 2 |
| 30 | Phylum Arthropoda. Classis Arachnoidea. Ticks (Acarina) – the carriers of human infections and invasions   | 2 |
| 31 | Classis Insecta: Diptera, lice, fleas and bugs – the carriers of human infections and invasions  | 2 |
| 32 | Synthetic theory of evolution. The population structure of mankind. Anthropogenesis.   | 2 |
| 33 | Phylogeny of major systems of vertebrate organs. Comparative analysis of the covers of the body, digestive, respiratory, excretory, genital, nervous, endocrine, cardiovascular systems. | 2 |
| 34 | Phylogeny of major systems of vertebrate organs. Comparative analysis of systems. The biosphere as a system that ensures human existence. Human ecology.                                 | 2 |
| 35 | Control of the learning block 3  | 2 |

### 4.3 Tasks for independent work

|          | Topic   | Hours    |
|----------|---|----------|
|          | <b>INFORMATION BLOCK 1: Biological features of human life</b>   |          |
| 1        | Preparation for practical classes (theoretical training, development of practical skills)             | 1        |
| 2        | Online courses and online testing   | 1        |
| 3        | Independent elaboration of topics that are not included in the classroom plan Block 1 (list attached) | 1        |
| 4        | Individual work   | -        |
| 5        | Preparation for the final test  | 2        |
| <b>6</b> | <b>Total</b>  | <b>5</b> |
|          | <b>INFORMATION BLOCK 2: Organismal level of organization of life. Fundamentals of human genetics</b>  |          |
| 7        | Preparation for practical classes (theoretical training, development of practical skills)             | 10       |
| 8        | Online courses and online testing   | 5        |
| 9        | Independent elaboration of topics that are not included in the classroom plan Block 1 (list attached) | 20       |
| 10       | Individual work   | 5        |

|    |   |           |
|----|---|-----------|
| 11 | Preparation for the final test  | 5         |
|    | <b>Total</b>  | <b>45</b> |
|    | <b>INFORMATION BLOCK 3: Population-species, biogeocenotic and biosphere levels of life organization</b> |           |
| 12 | Preparation for practical classes (theoretical training, development of practical skills)               | 8         |
| 13 | Online courses and online testing   | 2         |
| 14 | Independent elaboration of topics that are not included in the classroom plan Block 1 (list attached)   | 8         |
| 15 | Individual work   | 2         |
| 16 | Preparation for the final test  | 5         |
|    | <b>Total</b>  | <b>25</b> |

### **Block 1**

1. The concept of the essence of life at the present level.
2. The place of man in the system of living nature.
3. Classify biological systems and levels of organization of living things.
4. The value of processes occurring at the molecular genetic level of the organization life to explain the occurrence of monogenic (molecular) human diseases.
5. The importance of processes occurring at the cellular level of life organization for understanding the pathogenesis of hereditary, somatic, oncological, infectious-inflammatory and other human diseases.
6. Morphophysiological properties of the cell and interpret the meaning of the violation of the main principles of its functioning in the occurrence of pathological processes in humans.
7. Modern objective and subjective methods of studying the human karyotype and the principles of classification of its chromosomes. • Interpret the importance of studying human karyotype for diagnosis of hereditary diseases.
8. Molecular mechanisms of realization of genetic information in the cell, as well as its regulation in pro- and eukaryotes.
9. Changes in cells and their structures during the life cycle and the importance of mitosis.
10. Mechanisms of meiotic divisions I and II, their biological significance.
11. The value of the modern method of cell culture for biology and medicine.

### **Block 2**

1. The importance of medical genetics.
2. Type of inheritance of mendelian signs of the person.
3. Inheritance of human blood groups by the antigenic system ABO as a manifestation of multiple allelism.
4. Types of interaction of non-allelic genes, manifestation of traits in different types of inheritance.
5. Knowledge of chromosomal theory of heredity to determine the manifestation in offspring as autosomal and sex-linked diseases.
6. The mechanism of genetic determination of sex as mendelian traits.
7. Values occur at the level of the organism of the organization of life of mechanisms of occurrence of congenital malformations, and also somatic, infectious and other diseases of the person.
8. Forms of variability as a fundamental property of living matter.
9. Significance of mutations and mutagenic factors (mutagens) of different nature in the occurrence of chromosomal and monogenic human diseases.
10. Influence of mutagenic, carcinogenic and teratogenic substances with the state of health of a certain contingent of persons.

### **Block 3**



1. The concept of "parasitism", "parasitic system", "source of invasion", "factor of transmission of invading pathogens".
2. Classification of parasites on obligatory and optional, permanent and temporary, specific and nonspecific, external and internal.
3. Morphophysiological adaptations of protozoa to parasitism.
4. Belonging of parasitic human diseases to the group of transmission and nature-mediated.
5. Identification of final, intermediate, obligate, optional and reservoir hosts of protozoa.
6. The impact of modern global migration processes on the spread of protozoan invasions in Ukraine.
7. Methods of laboratory diagnosis of protozoonoses, based on the localization and life cycles of protozoa.
8. Cycles of development of the simplest and ways of infection of protozoonoses with definition of means of prevention of disease by them.
9. Biological principles of control of transmissible and nature-mediated human diseases.

### **Individual tasks**

The individual task is chosen by the student at the beginning of studying of the block and is specified together with the teacher. Performed during the study of the block. If necessary, the teacher provides advice and makes adjustments to the work. The completed task is given to the teacher before the final control. The evaluation of the work is carried out by the teacher in accordance with the distribution of the maximum number of points.

Note: An individual block task is optional.

### ***Solving of typical problems***

1. How many adenine, thymine, guanine and cytosine nucleotides are contained in the DNA fragment if 950 cytosine nucleotides were revealed in it, that is 20% of the total amount of the nucleotides in this DNA molecule fragment?
2. Protein consists of 200 amino acids. What is the length of the coding region of its gene if the distance between two adjacent nucleotides in the DNA helix (measured along the helix axis) is  $3.4 \times 10^{-10}$  m?
3. The molecular weight of the phage nucleic acid (consists of one strand) is about  $10^7$ . How many proteins are encoded in it if its typical protein consists on average of 400 monomers and the molecular weight of the nucleotide is about 300.
4. Speed of enzymes performing DNA replication is 0.6 mkm/min. How much time will DNA replication take if it consists of 500 replicons? The length of each replicon is 60 mkm. The part of the protein molecule has the following structure: Serine – Lysine – Histidine – Valine. How many different variants of the DNA fragment (triplets) could code for this part of protein molecule?
5. Let's take the relative weight of one nucleotide as 1. Find the weight of bacterial operon where the promoter and initiator (together) consist of 10 nucleotide pairs, each of operator and terminator consists of 10 nucleotide pairs and each of three structural genes code for a polypeptide that consists of 50 amino acids.
6. How many and what type of gametes would be formed in the organisms with the genotypes: Find the genotypes. P: AaBb                      AAbb?
7. What will be the appearance of (a)  $F_1$  and (b)  $F_2$  progenies when a pure (homozygous) tall pea plant is crossed with a pure (homozygous) dwarf pea plant?
8. What will be the result in  $F_1$  and (b)  $F_2$  generation when a homozygous white normal male rabbit is crossed with a homozygous black dwarf female rabbit?
9. The allele of brown eyes' color dominate over the allele of blue color and the allele of right-handedness (a habit to use mostly the right hand to perform usual work) dominate over the allele of left-handedness. The genes of both characters are situated in the different chromosomes. Parents are brown-eyed right-handed diheterozygotes. What characters would their children get and what is their percentage ratio?
10. A woman has blood group I (0), Rh-, MN, her husband has blood group IV (AB), Rh+ (homozygote), N. Which combinations of blood groups by all systems will their children get?
11. Rare gene **a** causes anophthalmia (the absence of eyeballs). Its allele **A** is responsible for the normal of eyeballs, but heterozygotes have smaller eyeballs. Find all the phenotypes and genotypes (with %) of all children whose parents have undersized eyeballs.

12. The chicken's gene **C** responsible for the pigment synthesis. The dominant gene of another allele pair (**I**) suppresses the coloring. Diheterozygous hen was crossed with a recessive homozygous cock. What phenotypes will be in the species of the F1?
13. One of the spouses is heterozygous for both characters (Rh<sup>+</sup> was inherited from the one parent and the elliptocytosis from the other one). The other spouse has the Rh<sup>-</sup> and normal erythrocytes. Find out the percentage of the possible genotypes and phenotypes of the children in this family (distance between genes 3 CM).
14. Genes **L**, **M** and **N** are referred to one linkage group. It was revealed during the experiment that the distance between genes **L** and **M** is 5 centimorgans, and between genes **M** and **N** is 3 centimorgans. Is it possible to find the distance between genes **L** and **N**? During the additional experiment it was revealed that the distance between **L** and **N** is 2 centimorgans. Show the location of the genes **L**, **M** and **N** in the chromosome by a diagram.
15. Some cells of a sick person have normal karyotype, others – 47 or 45 chromosomes. What are the name and possible mechanisms of this phenomenon?
17. The father has blue eyes, the mother has brown ones and the daughter has one brown eye and the other is blue. How can it be explained?
18. The concordance of monozygotic twins according to the body weight is 80 %, and the concordance of dizygotic ones is 30 %. What is ratio of heredity and the environment in the formation of this character?
19. In the USA, the 30% of persons of the examined population feel the bitter taste of phenylthiocarbamide (PTC) and the 70% do not. The ability to feel its taste is determined by the recessive gene **a**. Find out the frequency of the alleles **A** and **a** in the population.
20. The family has a child aged 5 with the mice odour, increased muscle tone, convulsive epileptic attacks, mental retardation, macrocephaly, weak pigmentation of the skin and hair. What disease can be suspected? How can it be diagnosed? What is the possibility of giving birth to the next child with this pathology?
21. Recessive gene of hemophilia is located in the X-chromosome. There is a girl whose father is sick with hemophilia and mother is healthy and have no cases of hemophilia in the family. The girl marries a healthy man. What is the probability of giving birth to sick children in this family? Determine type of inheritance of hemophilia.
22. An albino woman (autosomal recessive character) married a daltonian man (recessive X-linked character). The rest of their genotype is normal. Which combinations of genotypes and characters are possible for their children?
23. In a young family a child was born whose cry sounds like the cat's cry. He has a moon-like face, muscular hypotony, microcephaly, antimongoloid eyes, epicanthus, squint, deformed low ear auricles, mental retardation. What disease can be suspected? Which methods should be used to diagnose it? What is the future viability forecast for this child?
24. In the family of healthy parents who are second-cousins, a full term child was born who was breast-fed by the mother. The vomit and diarrhea, jaundice, mental retardation, hepatomegalia and lien enlargement, general dystrophy, cataract gradually appeared and got stronger in the course of time. What disease can be suspected? What laboratory research should be made? Is it possible to stop the disease progression? What is the possibility of the second ill child birth in this family?
25. Patients with complaints applied to the doctor: pains in the right hypochondrium, nausea, vomiting, jaundice of scleras, indigestion, weakness, headache, skin itching, rash and fever. The liver is enlarged, dense and painful. Examination of the feces revealed large (135 × 80 μm), oval and yellowish-brown eggs with a lid on one of the poles. Which parasite caused these symptoms in a patient?
26. Patients with similar complaints applied to the doctor: intermittent fever attacks (the temperature drops to 35–36 °C and rapidly increase up to 40–41 °C), intoxication. Enlargement of the liver and spleen is observed, anemia. Examination of the thick blood smear revealed enlarged and distorted erythrocytes with fringed edges, affected by intracellular parasites. Which parasite caused these symptoms in a patient? How can you explain a patient's infection?
27. Patients with complaints applied to the doctor: severe pains in the right hypochondrium (in the liver area), worsening of appetite, nausea, vomiting, indigestion, weakness, headache. The liver is enlarged. It is known from the anamnesis that the patient likes to eat fresh water fish. Examination of the feces

revealed small (26–30 × 10–15 μm), oval and yellowish-brown eggs with a lid on one of the poles. Which parasite caused these symptoms in a patient? How can you explain a patient's infection?

28. A patient complains of skin itch, especially between fingers, in the inguinal creases, on the lower abdomen. Examination of these regions revealed there some small vesicles. Laboratory diagnostics allowed to establish that this condition had been caused by a representative of Arthropoda. Which parasite caused these symptoms in a patient? How can you explain a patient's infection? Specify the disease caused by this arthropod.

29. Patients with similar complaints applied to the doctor: itching around the anus, pain in the intestines, disorder of GIT, impairment of appetite, loss of weight, weakness. Examination of the faeces revealed rounded eggs with double-contour lined thick membrane, inside they contain a 6-hooked oncosphere. Which parasite caused these symptoms in a patient? How can you explain a patient's infection? What is the name of the disease that the patient suffers from?

30. Patients with complaints applied to the doctor: enlargement of lymphatic nodes on the posterior surface of the neck, rise of temperature, weakness, attenuation. Examination of the patient's body revealed red chancre on the skin after being bitten by some insect. Which parasite caused these symptoms in a patient? How can you explain a patient's infection?

31. Patients with complaints applied to the doctor: pains in the abdomen, nausea, vomiting, diarrhea, worsening of appetite, weakness, irritability, worsening of memory, loss of weight. Examination of the patient revealed mechanic intestinal obstruction by helminthes (the body of the helminthes is cylindrical, the length 20-30 cm, sharpened at the ends). Which parasite caused these symptoms in a patient? How can you explain a patient's infection?

32. Patients with complaints applied to the doctor: pains in the extremities, erythema, ulcers and thickening of the skin on it, movement impairment. Examination of the patient's legs revealed twisted subcutaneous rollers on it. Which parasite caused these symptoms in a patient? Specify the disease caused by this parasite. What preventive measures should be followed to exclude this invasion?

#### **4.4 Providing of educational process**

1. Working curriculum of discipline
2. Textbooks.
3. M 100600 graph projector - 1pc.
4. Microscopes:
  - a) ICBM-1 - 17 pcs.
  - b) MBI -1 - 14 pcs.
  - c) Biolam - 65 pcs.In total - 96 pieces.
5. Slideshows - 5 pcs.
6. Micropreparations (400 pcs)
7. Slides on practical topics - 23 sets.
8. Tables on topics of practical classes and lectures - 5 sets.
9. Sets of demonstration materials for lectures - 1 set.
10. Laptop - 1 pc.
11. Multimedia projector - 1 pc.

#### **List of micropreparations that need to be able to identify**

1. Dysenteric amoeba
2. Freshwater amoeba
3. *Lambliia intestinealis*
4. *Balantidium coli*
5. Cysts (*Lambliia intestinealis*, *Balantidium coli*)
6. *Trichomonas vaginalis*
7. *Plasmodium*
8. *Toxoplasma gondii*
9. *Fasciola hepatica*
10. *Opisthorchis felinus*

11. Trematode eggs (*Fasciola hepatica*, *Opisthorchis felinus*)
12. *Taenia solium* (mature proglottid)
13. *Taeniarhynchus saginatus* (mature proglottid)
14. *Hymenolepis nana* (mature proglottid)
15. *Echinococcus*
16. *Diphyllobothrium latum* (mature proglottid)
17. Cestode eggs (*Taeniarhynchus saginatus*, *Diphyllobothrium latum*, *Hymenolepis nana*)
18. *Echinococcus granulosus* (mature)
19. *Echinococcus granulosus* (phynn)
20. *Ascaris lumbricoides*
21. Mature and immature eggs of *Ascaris lumbricoides*
22. *Enterobius vermicularis*
23. Eggs of *Enterobius vermicularis*
24. *Trichocephalus trichiurus*
25. *Trichinella spiralis*
26. *Latrodectus tredecimguttatus*
27. *Lycosa tarantula*
28. *Sarcoptes scabiei*
29. *Demodex folliculorum*
30. *Ixodes ricinus*
31. *Dermacentor*
32. *Pediculus humanus capitis*
33. *Pediculus humanus humanus*
34. Karakurt.
35. Tarantula.
36. Human fleas
37. Pubic louse
38. *Sarcopsylla penetrans*
39. Mosquitoes (eggs and larvaes)
40. Gnats of *Culex*, *Anopheles* and *Aedes* genera (eggs)
41. Gnats of *Culex*, *Anopheles* and *Aedes* genera (larva)
42. Gnats of *Culex*, *Anopheles* and *Aedes* genera (pupa)
43. The head of a female malaria mosquito.
44. The head of the female is a non-malarial mosquito.
45. The head of a malarial mosquito.
46. The male head is a non-malarial mosquito.
47. Red and black cockroaches
48. Tsetse fly
49. Midge.
50. Mosquito.
51. Blind gold eye.
52. Housefly.
53. Green and blue meat fly.
54. Gastric gadfly larva.

**List of electronic micrographs for diagnosis**

1. Mitochondria
2. Granular endoplasmic reticulum
3. Golgi intracellular mesh apparatus
4. Lysosomes
5. Fibroblasts
6. Macrophage
7. Plasma cell
8. Tissue basophil
9. Basophilic granulocyte
10. Eosinophilic granulocyte
11. Neutrophilic granulocyte.
12. Lymphocyte
13. Blood capillary of fenestrated type
14. Lymphatic capillary
15. Myocardium
16. Family winding tubule
17. Sperm
18. Secondary follicle

## **5. Final control**

### ***Final control checklist***

1. Organization levels of living things. Properties and characters of living things.
2. Methods of studying living things (methods of biological sciences).
3. The significance of Biology for medicine.
4. The position of the human in the animal world system. Humans as biological and social beings.
5. The subject, tasks and methods of cytology. The present state of the cellular theory.
6. Differentiating signs of pro- and eukaryotic cells.
7. The structure (models) of elementary membrane, its properties and functions. Methods of passing substances into the cell.
8. Anabolic system of the cell. Catabolic system of the cell.
9. Energy exchange in the cell. Enzymatic systems of mitochondria.
10. The structure and functions of the nucleus.
11. Types of chromosomes. The structure of a metaphase chromosome.
12. Cell and mitotic cycles. Interphase, characteristic of its periods. Reasons of mitosis.
13. Characteristic and significance of mitosis.
14. Characteristic and significance of meiosis.
15. The concept of karyotype and ideogram. Methods of studying the human karyotype.
16. The Denver and Paris classifications of human chromosomes.
17. Nucleic acids (DNA and RNA): the structure and functions. Chargaff's rules.
18. Proofs of the nucleic acids role in transmission hereditary information.
19. Properties of genes. DNA replication.
20. The genetic code and its properties. Protein biosynthesis.
21. The central dogma of Molecular Biology.
22. Levels of packing genetic material. Classification of genes.
23. Transcription regulation in prokaryotes.
24. Transcription regulation in eukaryotes.
25. Cytoplasmatic heredity.
26. Stages of genetic engineering methods. Obtaining genetic material.
27. Introduction of DNA fragments into the molecule-vector.
28. Insertion of recombinant DNA in the cell-recipient.
29. Using methods of genetic engineering in medicine.
30. Peculiarities of the hybridological method.
31. Inheritance regularities in monohybrid cross.

32. Hypothesis of purity of gametes and its cytological foundation.
33. Analyzing cross. The concept of a phenotypic radical.
34. Inheritance regularities in polyhybrid cross. The law of independent assortment.
35. Conditions limiting the manifestation of Mendel's laws. Pleiotropy. Semi-lethal and lethal genes.
36. Intra-allelic interaction of genes. Inheritance of blood groups.
37. Inter-allelic interaction of genes.
38. Experiments of T. Morgan. Complete and incomplete genetic linkage.
39. Autosomal and gonosomal linkage groups. Crossing-over. Basic concepts of the chromosomal theory of heredity.
40. Maps of eukaryotes' chromosomes (genetic and cytological).
41. Variation and its types. Phenotypic variation. The reaction norm.
42. Genotypic variation and its forms. Mutagenic factors.
43. Classification of mutations. Genome, chromosome and gene mutations.
44. Stability and repair of genetic material; anti-mutagens.
45. Biological basis of cancerogenesis.
46. Sex as a biological character. Sex characters. Sex-controlled and sex-limited characters. X- linked and holandric characters.
47. Chromosome theory of sex determination.
48. Peculiarities of sex determination in humans and its impairments.
49. Sex chromatin. Chromosomal sex disorders.
50. Primary, secondary and tertiary ratios of sexes.
51. Present tasks of human genetics. The human as an object of genetic investigations.
52. Clinical-genealogical methods. Twin method.
53. Cytogenetic method. Biochemical methods.
54. Methods of a recombinant DNA. Human genome project.
55. Modeling methods. A law of N. I. Vavilov.
56. Characteristics of human populations. Types of marriages.
57. Genetic processes in the large populations. The law of Hardy-Weinberg.
58. Genetic processes in the small populations.
59. Genetic load and its biological nature.
60. Methods of prenatal diagnosis of hereditary disorders. Expressmethods.
61. Ontogenesis, its types, division into periods.
62. Characteristic of pro-genesis.
63. Division of the human embryonic development into periods.
64. Characteristic of embryogenesis stages. Provisional organs.
65. Realization of genetic information in the prenatal period.
66. Mechanisms of embryogenesis. Morphogenesis.
67. Critical periods of the prenatal ontogenesis. Teratogenesis.
68. Origin of parasitism. Criteria of parasitism.
69. Classification of parasites and their hosts.
70. Rotes of transmission of parasites.
71. Morphophysiological and biological adaptations of parasites.
72. Pathogenic action and specificity of parasites.
73. Host's response to parasitic invasion.
74. Biological basis of prophylaxis of parasitic diseases.
75. Balantidium: morphological peculiarities, life cycle, rotes of transmission, pathogenic action;
76. Parasitic Sarcodinae: dysenteric amoeba, Entamoeba coli, Entamoeba gingivalis. Life cycle of the dysenteric amoeba, its pathogenic action; characteristic symptoms, diagnosis and prophylaxis of amoebiasis.
77. Parasitizing flagellates: Lamblia and Trichomonas: morphological peculiarities, life cycle, rotes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis.
78. Life cycle of a malaria parasite. Types of malaria parasites, their appearance in a thin blood smear.
79. Rote of transmission of malaria, pathogenic action of malaria parasites; symptoms and diagnosis of malaria.
80. Toxoplasma: morphological peculiarities, life cycle, rotes of transmission, pathogenic action.

81. General characteristic and systematics of the phylum Plathelminthes.
82. Progressive adaptations of flukes to parasitic life.
83. Peculiarities of life cycles of flukes.
84. Liver fluke: morphological peculiarities, life cycle, routes of transmission, pathogenic action; symptoms, diagnosis and prophylaxis of fascioliasis.
85. Cat liver fluke: morphological peculiarities, life cycle, routes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of opisthorchiasis.
86. Biological basis of prophylaxis of trematodoses. Characteristic of the class tapeworms, their adaptations to parasitism. Life cycles of Taeniae and Diphyllbothria. Types of measles.
87. Taenia solium and Taeniarhynchus saginatus: morphological peculiarities, life cycle, routes of transmission, pathogenic action; symptoms, diagnosis and prophylaxis of taeniarhynchosis and cysticerciasis.
88. Dwarf tapeworm: morphological peculiarities, life cycle, routes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of hymenolepidosis.
89. Echinococcus and Alveococcus: morphological peculiarities, life cycle, routes of transmission, pathogenic action; characteristic symptoms. Diagnosis and prophylaxis of echinococcosis and alveococcosis.
90. Diphyllbothrium latum: morphological peculiarities, life cycle, routes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of diphyllbothriosis.
91. Biological basis of prophylaxis of cestodoses.
92. General characteristic of the phylum roundworms and the class Nematoda.
93. Ascaris lumbricoides and whipworm: morphological and biological peculiarities, routes of transmission, pathogenic action symptoms of migration and intestinal stages of ascariasis, diagnosis and prophylaxis of ascariasis and trichocephaliasis.
94. Seatworms: morphological and biological peculiarities, routes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of enterobiasis.
95. Trichinella: morphological and biological peculiarities, routes of transmission, pathogenic action; characteristic symptoms, diagnosis and prophylaxis of trichinelliasis.
96. Biological basis of prophylaxis of nematodoses.
97. General characteristic and taxonomy of the class Insecta.
98. Order Anoplura: peculiarities of morphology and biology; lice as pathogens and vectors of diseases; prophylaxis
99. Order Aphaniptera: peculiarities of morphology and biology; medical significance; prophylaxis
100. Order Blattoidea: peculiarities of morphology and biology; medical significance; prophylaxis
101. Order Heteroptera: peculiarities of morphology and biology; medical significance; prophylaxis
102. Morphological and biological peculiarities of the order Diptera.
103. Components of gnat (black flies, midges, sand flies, horse-flies, mosquitoes), their morphological and biological peculiarities and medical significance.
104. Mosquitoes of genera Culex, Anopheles and Aedes: morphological and biological peculiarities and medical significance.
105. Flies (house fly, stable fly, tsetse fly, spotted flesh fly), morphological and biological peculiarities and medical significance.
106. Medical significance of horse bot-flies.
107. Association between ontogenesis and phylogenesis. The biogenetic law.
108. Phylembryogeneses.
109. Methods of organogenesis. Correlations.
110. Phylogenesis of coverings and the skeleton of chordate animals. Phylogenesis of the nervous, circulation and respiratory, digestive and urogenital systems.
111. Ontophylogenetic conditioning of development defects of organ systems in chordate animals.
112. Synthetic theory of evolution. Population structure of mankind.
113. The biosphere and its structure.
114. Evolution of the biosphere.
115. Human ecology. Interrelations of the human and nature.
116. Medico-biological aspects of the biosphere. Protection of the environment.

**Petro Mohyla Black Sea National University**

master's level of higher education

Knowledge 22 "Health"

specialty 222 "Medicine"

Academic discipline - **MEDICAL BIOLOGY**

**EXAMINATION QUESTION "0"**

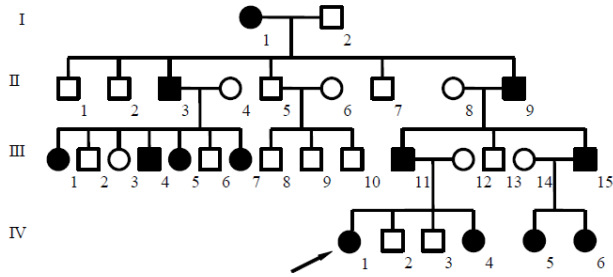
***Task 1 Choose the correct answer (50 points)***

- 1. A cell at the stage of mitosis anaphase was stimulated by colchicine that inhibits chromosome separation to the poles. What type of mutation will be caused?** A) Deletion; b) Inversion; c) Polyploidy; d) Duplication; e) Translocation.
- 2. Sexual reproduction forms are:** a) by vegetative organs and budding; b) conjugation and copulation; c) polyembryony; d) Sporogenesis; e) fragmentation.
- 3. Insulin provides:** a) increasing the level of glucose in blood; b) decreasing the level of glucose in blood; c) increasing the level of fructose in blood; d) decreasing the level of fructose in blood; e) increasing the level of galactose in blood;
- 4. A 28-year-old female patient consulted a gynecologist about sterility. Examination revealed underdeveloped ovaries and uterus, irregular menstrual cycle. Analysis of the sex chromatin revealed 2 Barr's bodies in most somatic cells. What chromosome disease is most likely?** A) Patau syndrome; b) Triple X syndrome; c) Edwards syndrome; d) Klinefelters syndrome; e) Turners syndrome.
- 5. An alcoholic woman has born a girl with mental and physical developmental lag. Doctors diagnosed the girl with fetal alcohol syndrome. What effect is the cause of the girls state?** a) Carcinogenic; b) Mechanic; c) Mutagenic; d) Malignization; e) Teratogenic.
- 6. A shepherd who has tended sheep together with dogs consulted a doctor about pain in his right subcostal area, nausea, vomiting. Roentgenoscopy revealed a tumour-like formation. What kind of helminthiasis might be suspected?** a) Echinococcosis; b) Diphyllbothriasis; c) Teniasis; d) Filariasis; e) Ascaridiasis
- 7. Medical aspect of cockroaches:** a) mechanical transmitting agents of eggs of helminths, cyst protists and originators of intestinal infections; b) specific transmitting agents of tularemia and a tuberculosis originators; c) specific transmitting agents of malaria and filariasis originators; d) originators of the cartarral symptoms in the gastrointestinal tract.
- 8. The mesoderm gives rise to:** a) the digestive system and many internal organs; b) the muscle cells and connective tissue in the body; c) the nervous system and the epidermis; d) the respiratory and excretory systems; e) the bone-muscle and nervous systems.
- 9. Function of t-RNA are:** a) storage of genetic information; b) transport of amino acids to ribosomes; c) transmission of the genetic information to daughter t-RNA molecules; d) transfer of the genetic information from cytoplasm to the nucleus; e) transfer of the genetic information from DNA to the ribosome.
- 10. Biological phenomenon breaking the genetic linkage is:** a) Epistasis; b) Polymeria; c) crossing-over; d) Meiosis; e) mitosis.

***Task 2 Solve the problems:***



**Problem 1.** Analyze the family tree, determine the inheritance type and find the genotypes of the parents (15 points)



**Problem 2. (15 points)**

Patients with similar complaints applied to the doctor: itching around the anus, pain in the intestines, disorder of GIT, impairment of appetite, loss of weight, weakness. Examination of the faeces revealed rounded eggs with double-contour lined thick membrane, inside they contain a 6-hooked oncosphere.

Questions:

1. Which parasite caused these symptoms in a patient?
2. How can you explain a patient's infection?
3. What is the name of the disease that the patient suffers from?
4. What preventive measures should be followed to exclude this invasion?

Approved at the meeting of the Department of "Medical Biology and Physics, Microbiology, Histology, Physiology, Pathophysiology Minutes No. 10 dated May 15, 2019.

**Head of the Department** \_\_\_\_\_ Kozii M. S.  
**Examiner** \_\_\_\_\_ Mazur I. O.

### Example of final control work on block 1 Solving problems Step-1

1. A patient with chronic hepatitis undergoes blood test for serum protein fractions. Total protein levels are low, which indicates that in the hepatic cells the following organelles are functionally disturbed:

Golgi apparatus

Lysosomes

Cytoskeleton

Granular endoplasmic reticulum

Mitochondria

2. Formation of a large amount of immunoglobulins with various antigen specificity from a small number of genes occurs due to:

Deletion

Replication

Translocation

Transcription

3. Examination of a patient revealed reduced contents of magnesium ions that are necessary for attachment of ribosomes to the granular endoplasmic reticulum. It is known that it causes disturbance of protein biosynthesis. What stage of protein biosynthesis will be disturbed?

Transcription

Aminoacid activation

Termination

Translation

Replication

### **Example of final control work on block 2 Solving problems Step-1**

1.The mother's karyotype has 45 chromosomes. It was determined that translocation of chromosome 21 to chromosome 14 had occurred. What disorder is likely to be observed in the child of this woman if the father's karyotype is normal?

Edwards syndrome

Morris syndrome (androgen insensitivity)

Klinefelter syndrome

Patau syndrome

Down syndrome

2.Cells of a person working in the Chernobyl Exclusion Zone have undergone a mutation in DNA molecule. However, with time the damaged interval of DNA molecule restored its initial structure with a specific enzyme. In this case the following occurred:

Translation

Repair

Transcription

Replication

Reverse transcription

3.The parents with normal hearing have two daughters and a son, who are congenitally deaf. Their other 5 children are healthy. What is the pattern of deafness inheritance in this case?

X-linked recessive

Autosomal dominant

Autosomal recessive

X-linked dominant

Y-linked

### **Example of final control work on block 3 Solving problems Step-1**

1. During regular examination of schoolchildren, a scrape from the perianal folds of a 10-year-old girl shows asymmetrical oval eggs with larvae inside. What diagnosis can be made?

Ancylostomiasis

Enterobiasis

Amebiasis

Ascariasis

Trichuriasis

2. A young woman, a foreign student from Tehran, has made an appointment with the urologist. She complains of the sensation of heaviness in her lower abdomen and a small amount of blood being excreted with urine at the end of each urination. Microscopy of urine detects the presence of parasite eggs, approximately 140x70 micron in size, with a terminal spike. What diagnosis can be made by the infectious diseases specialist?

Paragonimiasis

Fascioliasis

Opisthorchiasis

Dicrocoeliasis

Schistosomiasis

3. Patients with similar complaints applied to the doctor: weakness, pain in the intestines, disorder of GIT. Examination of the faeces revealed that one patient with four nucleus cysts should be hospitalized immediately. For what protozoa are such cysts typical?

Dysenteric amoeba

Balantidium

Lambliia

Trichomonas

Intestinal amoeba

And so 10 problems with the subsequent analysis of typical mistakes.

## **6. Assessment criteria and diagnostic tools for learning outcomes**

### **Methods of control**

1. Oral questioning (frontal, individual, combined), interview.
2. Practical examination of the formed professional skills. Conducted by the results of practical work at the end of the class.
3. Test control ("open" and "closed" test tasks)

*Current control* is carried out at each practical session according to the specific objectives of the topic. All practical classes is subject to objective control of theoretical

classes and the acquisition of practical skills. At the end of the class, one grade is given, comprising 60% of theoretical knowledge (oral questioning) and 40% of practical skills.

**Forms of current control:**

Theoretical knowledge - test tasks, computer-based testing, individual interviewing, interviewing, writing.

Practical skills - be able to show different organs and their structures on models, models, physical body, tablets, tables, orientation on radiographs, CT and MRI.

Student evaluation is integrated and includes all kinds of work.

In mastering each topic of the module for the current educational activity of the student marks are given on 5 point traditional scale.

Grade "5" corresponds to the maximum number of points that can be obtained by the student in the study of the topic of practical class more than 80%. Ratings "4" and "3" are accordingly 80% and 60% of the maximum grade.

In case of unsatisfactory evaluation of one of the forms of current control at the end of the class, the student receives a negative evaluation.

*The final control* is carried out at the last practical session after completion of the content module. Control of theoretical knowledge, acquired practical skills and abilities is exercised. The maximum score of module total control is 80. A module is counted if the student has scored at least 50 points.

| <b>I semester</b>                                 |               |               |                     |
|---|---------------|---------------|---------------------|
| <b>Type of activity</b>                           | <b>Number</b> | <b>Points</b> | <b>Total points</b> |
| Practical work                                    | 18            | 5             | 90                  |
| Two test-control works (Block 1 and 2)            | 2             | 15            | 30                  |
| The final control (FMC)                           | 1             | 80            | 80                  |
| <b>Total Points</b>                               |               |               | <b>200</b>          |
| <b>II semester</b>                                |               |               |                     |
| <b>Type of activity</b>                           | <b>Number</b> | <b>Points</b> | <b>Total points</b> |
| Practical work                                    | 17            | 5             | 85                  |
| One Test-control work (Block 3) (format "Step-1") | 1             | 15            | 35                  |
| FMC (Exam)  | 1             | 80            | 80                  |
| <b>Total Points</b>                               |               |               | <b>200</b>          |

**7. Recommended sources**

**Basic**

1. Bekish, O.-Y. L. Medical biology: textbook for student of higher educational establishments / O.-Y. L. Bekish. Vitebsk: VSMU Press, 2003. – 346 p.
2. Life: the science of biology, 10th edition / D. Sadava, D. Hillis, et al. – Gordonsville: Sinauer, 2012. – 1440 p.
3. Medical biology: textbook / Bazhora Yu. I., Bulyk R. Ye. [et al]. – Vinnynsia: Nova Knuha, 2018. – 448 p.

4. Introduction to medical and molecular biology / Daniel B., Vanda R. [et al]. – Bratislava: Asklepios, 2010. – 95 p.

#### **Subsidiary**

5. Allison L. A. Fundamental Molecular Biology / L. A. Allison. – Williamsburg: Blackwell, 2007. – 725 p.
6. Cell Biology, 3th edition / by Thomas D. Pollard MD, et al. – Philadelphia : Elsevier, 2017. — 884 p.
7. Garcia L.S. Diagnostic Medical Parasitology, 6th Edition / L.S. Garcia. — Washington: ASM Press, 2016. — 1411 p.
8. Gilbert S. F. Developmental Biology, 9th edition / S. F. Gilbert. – Sinauer Associates, 2010. — 685 p.
9. Human Parasitology, 5th Edition / Burton J. Bogitsh, Clint E. Carter, Thomas N. Oeltmann. – Academic press, 2018. – 409 p.
10. Klug W.S. Concepts of Genetics, 11th Edition. / M. R. Cummings, C. A. Spencer, M. A. Palladino. – Pearson Education Limited, 2016. — 894 p.
11. Mai L. L. The Cambridge Dictionary of Human Biology and Evolution / L. L. Mai, M. Young Owl, M. P. Kersting. – New York: Cambridge university press, 2005. – 648 p.
12. Meisenberg G. Principles of medical biology / G. Meisenberg, W. H. Simmons. – Philadelphia: Elsevier, 2017. – 617 p.
13. Molecular Cell Biology, 11th edition / Lodish H., et al. – New York: W. H. Freeman, 2016. – 1275 p.
14. Muehlenbein M. P. Human evolutionary biology / M. P. Muehlenbein. – New York: Cambridge university press, 2010. – 627 p.
15. Roberts L. Foundations of Parasitology, 8th Edition / L. Roberts, J. Janovy. – McGraw-Hill, 2008. — 701 p.
16. Sankar S. A. Essentials of Medical Parasitology / S. A. Sankar, S. Bhat K. – Jaypee Brothers Medical Publishers, 2014. — 358 p.
17. Sullivan J. T. Electronic Atlas of Parasitology / T. J. Sullivan. – The McGraw-Hill Companies, 2000. — 650 p.
18. Turnpenny P. D. Emery's Elements of Medical Genetics / P. D. Turnpenny, E. Sian. – Philadelphia: Elsevier, 2017. — 413 p.

#### **Information resources**

1. Vernadsky National Library of Ukraine / [Electronic resource]. - Access mode: <http://www.nbuv.gov.ua/>
2. Verkhovna Rada of Ukraine / [Electronic resource]. - Access mode: <http://www.rada.gov.ua/>.
3. Government portal / [Electronic resource]. - Access mode: <http://www.kmu.gov.ua/>.
4. Ministry of education and science of Ukraine / [Electronic resource]. - Access mode: <http://www.mon.gov.ua/>.
5. Ministry of Health of Ukraine / [Electronic resource]. - Access mode: / <http://moz.gov.ua/>
6. Biology. – Mode of access: <https://curlie.org/Science/Biology/>
7. Science Daily / Health & Medicine News. – Access mode: [https://www.sciencedaily.com/news/health\\_medicine/](https://www.sciencedaily.com/news/health_medicine/)
8. Wiley online Library. – Access mode: <http://onlinelibrary.wiley.com/subject/code/000030>
9. Science News / Biology news. – Access mode: <http://www.sci-news.com/news/biology>
10. Science. Biology. – Access mode: <http://www.sciencemag.org/category/biology>