

**PRIVATE HIGHER EDUCATIONAL INSTITUTION  
"INTERNATIONAL ACADEMY OF ECOLOGY AND MEDICINE"  
Department of Fundamental Disciplines**

**WORKING PROGRAM OF EDUCATIONAL DISCIPLINE**

**"Medical Biology"**

**LEVEL OF HIGHER EDUCATION** Second (master's) level  
**DEGREE OF HIGHER EDUCATION** Master's degree  
**BRANCH OF KNOWLEDGE** 22 Healthcare  
**SPECIALTY** 222 Medicine

Reviewed and approved  
at the meeting of the Academic Council  
Protocol No. 1, dated August 01, 2016

**Kiev 2016**

Working program of education discipline Neurology for the preparation of students of higher education of the second (master's) level of higher education in specialty 222 Medicine.

## Introduction

The program of the discipline "Medical Biology" is composed according to the educational-professional program for training specialists of the second (master's) level of specialty 222 Medicine, field of knowledge 22 Health care, the Law of Ukraine "On Higher Education" from 01.07.2014 № 1556-VII (Article 13, item 7), the provision "On the organization of the educational process in the PHEE" International Academy of Ecology and Medicine ", methodological recommendations approved by the Central Methodical Cabinet of Higher Medical Education of the Ministry of Health of Ukraine on curriculum development standards of higher education. The discipline "Medical Biology" belongs to the section of the General preparation of the curriculum for the preparation of higher education applicants of the second educational (master's) level.

## Description of the discipline

The structure of educational discipline	Branch of knowledge, training direction, specialty, education level	Characteristics of educational discipline	
		Daily learning	
Credits ECTS – 5,5	Field of knowledge: 22 Healthcare		
Modules – 3 Submodules – 8	Specialty: 222 Medicine	<b>Year of the education:</b>	
		1 <sup>st</sup>	
		<b>Semester</b>	
		1 <sup>st</sup>	II <sup>nd</sup>
The amount of hours -165		<b>Lectures</b>	
		10 h.	10 h.
		<b>Practical classes</b>	
		30 h.	40 h.
		<b>Self-education (individual work)</b>	
		35 h.	40 h.
		Type of control: Current and final, exam	

**The subject of the discipline** is the basics of human life, the study of patterns of heredity, variability, individual development and morphophysiological adaptation of man to the

environment in connection with its biosocial nature and the impact of molecular genetic, cellular, ontogenetic, population, environmental factors on health. I'm human.

**Interdisciplinary links:** the discipline "Medical Biology" is integrated with the following disciplines: "Histology, Cytology and Embryology", "Biological and Bioorganic Chemistry", "Microbiology", "Pathological Physiology", "Medical Genetics", "Obstetrics and Gynecology" Infectious Diseases ", " Pediatrics ".

## **1. PURPOSE AND TASKS OF THE DISCIPLINE.**

**1.1. The purpose** of teaching the discipline "Medical Biology" consistent with objectives of the educational-professional training program for applicants for the second educational (master's) level of higher education and are determined by the content of those systemic knowledge and skills that must be mastered by a doctor. The knowledge that students receive from the discipline "Medical Biology" is basic for the block of disciplines that provide scientific and professional training.

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

- to determine the biological essence and mechanisms of disease development that occur due to anthropogenic changes in the environment;
- to determine the manifestations of general biological laws during human ontogenesis;
- to explain the patterns of manifestations of the human body at the molecular biological and cellular levels;
- to explain the essence and mechanisms of manifestation in the phenotype of hereditary human diseases;
- to make a preliminary conclusion about the presence of parasitic human infestations and determine disease prevention measures.

**1.3. Competencies and learning outcomes**, the formation of which is facilitated by the discipline "Medical Biology".

According to the requirements of the Standard of Higher Education, the discipline "Medical Biology" provides students with the following competencies:  
*integrated:*

Ability to interpret the general biological patterns that underlie the processes of human life.

*general:*

- ability to 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;
- ability to make informed decisions;
- skills of using information and communication technologies;
- definiteness and perseverance in terms of tasks and responsibilities.

*Special (professional, substantive):*

- ability to determine the necessary list of laboratory and instrumental research and evaluate their results;
- ability to assess the impact of the environment, socio-economic and biological determinants on the health of the individual, family, population.

### Matrix of competencies

№	Competence	Knowledge	Skills	Communication	Autonomy and responsibility
	2	3	4	5	6
	<b>General competencies</b>				
	The ability to interpret the general biological patterns that underlie the processes of human life				
	<b>Special competencies</b>				
1	Ability to use knowledge in the practice of a doctor; Molecular and cytological basis of heredity, mechanisms of development of hereditary and acquired human diseases.	Levels of organization of living organisms, life forms and its fundamental properties; structural and functional organization and life cycle of a eukaryotic cell; forms of reproduction of organisms, molecular bases of heredity, basic laws of heredity and variability, methods of studying human heredity, classification of hereditary diseases.	To study micropreparations by a microscope at low and high magnification; to make temporary micropreparations; differentiate animal cell components on electronic microphotographs and drawings; to determine the primary structure of the protein, the number of amino acids, the molecular weight of the polypeptide by the nucleotide sequence of the gene encoding it; to predict the genotypes and phenotypes of offspring by parental genotypes; to calculate the probability of giving birth to a sick child with monogenic diseases with known genotypes of parents; to be able to exclude paternity when determining the blood groups of parents and children; to analyze the karyotypes of patients with the most common chromosomal diseases and determine the diagnosis; to build a pedigree and conduct its genealogical analysis; to calculate the role of heredity and environmental conditions in the development of traits (based on the results of twin analysis); to calculate the frequencies of genes and	To be able to explain to the patient and his family the basic patterns inheritance of monogenic human traits; possible causes of mutations and their connection with hereditary diseases; the essence of the methods used in human genetics	To be responsible for mastering the relevant knowledge and skills.

			genotypes according to Hardy Weinberg's law;		
2	Ability to apply knowledge of the features of human ontogenesis and its connection with phylogeny in the diagnosis and treatment of various human diseases.	Ontogenesis and its periodization; 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. The position of the species <i>Homo sapiens</i> in the system of the animal world, the main stages of anthropogenesis; the concept of population as an elementary unit of evolution, the population structure of mankind, demos, isolates; regularities of phylogeny of organ systems; ontophylogenetic preconditions of congenital malformations, examples of atavistic malformations of human organs and systems.	To recognize atavistic developmental defects.	To explain the importance of genetic and teratogenic factors in the formation of congenital malformations, the role of critical periods of human embryogenesis in the formation of congenital malformations of teratogenic origin.	To be responsible for mastering the relevant knowledge and skills.
3	Ability to apply knowledge of the biological basis of parasitism, life cycles of human parasites for the diagnosis, prevention and treatment of human parasitic diseases, development of	Forms of symbiosis, parasitism as a biological phenomenon; principles of classification of parasites and hosts; ways of transmission of parasitic diseases; obligate-transmissible and optionally transmissible diseases; natural	To determine the place of a biological object (pathogens of parasitic diseases) in the system of living nature; to substantiate the affiliation of parasitic human diseases to the group of transmissible and naturally focal; to diagnose on macro- and micropreparations of pathogens and vectors of parasitic diseases under study;	To explain the ways of transmission of parasitic diseases; To explain the methods of personal prevention of parasitic diseases.	To be responsible for mastering the relevant knowledge and skills.

	anti-epidemic measures. Ability to apply knowledge of the biological basis of parasitism, life cycles of human parasites for the diagnosis, prevention and treatment of human parasitic diseases, development of anti-epidemic measures.	focal diseases, the structure of the natural foci; basics of prevention of parasitic diseases; pathogens of the most common protozoa, trematodes, cestodes, nematodes; arthropods - vectors and pathogens of human diseases; poisonous arthropods.	to substantiate methods of laboratory diagnosis of parasitic human diseases; to substantiate methods of prevention of parasitic diseases, based on the ways of their infection.		
4	Ability to assess the impact of environmental factors on human health, to use their own professional activities to preserve the environment.	The subject of ecology; types of environments; environmental factors, the role of man as an environmental factor; main directions and results of anthropogenic changes in the environment; the main provisions of the teachings of Academician V.I. Vernadsky on the biosphere and noosphere; adaptive ecotypes of people; functional types of human response to environmental factors ("Sprinter", "Stayer", "Mixed"); the concept of biological rhythms, their medical significance; examples of toxic to humans plants and animals.	To form requirements for yourself and others to preserve the environment.	To explain the impact of environmental factors on the human body and the role of man as an environmental factor; To promote conservation and protection measures environment.	To be responsible for mastering the relevant knowledge and skills. To be responsible for the implementation of environmental protection measures within its competence

### Learning outcomes:

*Integrative final learning outcomes*, the formation of which is facilitated by the discipline: "Medical Biology" as an academic discipline lays the foundation for the further formation of the following program learning outcomes in accordance with the Standard of Higher Education of Ukraine for undergraduate training of specialists of the second (master's) level of the specialty 222 "Medicine":

1. To establish the most probable or syndromic diagnosis of the disease and to appoint a laboratory and / or instrumental examination of the patient - in relation to hereditary and parasitic diseases.
2. To plan measures to prevent the spread of infectious diseases, to detect and early diagnosis of infectious diseases.
3. To identify risk factors for the occurrence and course of the disease.
4. To identify negative environmental factors. To assess the impact of socio-economic and biological determinants on the health of the individual, family, population.
5. To adhere to a healthy lifestyle, to use the means of self-regulation and self-control.

*Learning outcomes for the course:* On completion of study of discipline "Medical biology" students must

**know:**

- levels of organization of living,
- forms of life and its fundamental properties;
- structural-functional organization eukarotic cells;
- molecular basis of heredity;
- cell cycle and methods of cell division;
- basic patterns of inheritance in mono - and digibridge the crossing and linked inheritance;
- inheritance of blood groups human AB0 and RH factor;
- inheritance of human sex-trait sex-linked;
- the variability, its forms and manifestations;
- methods of study of human heredity: genealogical, bliznuki, dermatology, cytogenetic, molecular genetic, biochemical and populationstatisticsfor;
- classification of hereditary diseases, the principles of prenatal diagnosis of hereditary diseases;
- knows and understands the epidemiology of infections with viruses and bacteria as well as infections with fungi and parasites, taking into account the geographical range of their occurrence;
- knows and understands forms or developmental stages of selected parasitic protozoa, helminths and arthropods that are invasive to humans, taking into account the geographical range of their occurrence;
- knows and understands the principle of functioning of the parasite-host system and the basic symptoms of disease caused by parasites;
- knows and understands the basics of microbiological and parasitological diagnostics
- forms of reproduction of organisms;
- characteristics of gametogenesis, structure of germ cells;
- definition of ontogenesis and its periodization;
- the main stages of embryonic development, the molecular and cellular mechanisms of differentiation;
- types of regeneration;
- types of transplant, causes, tissue incompatibility;
- forms of symbiosis, parasitism as a biological phenomenon;
- principles of classification of parasites and hosts;

- ways of transmission of parasitic diseases; obligate and facultative transmissible vector-borne diseases;
- natural-focal diseases; the structure of a natural focus;
- classification of congenital malformations; teratogenic factors;
- basics of prevention of parasitic diseases;
- the most common pathogens protozoon, the trematode, cestodes, of nematodoses;
- principles of laboratory diagnosis of helminthiasis;
- arthropod vectors and agents of human diseases, the concept of mechanical specific vectors;
- poisonous representatives of the type of Arthropods;
- the concept of population as an elementary unit of evolution the population structure of humanity, demos, isolates;
- functional responses of people to environmental factors (Sprinter, Stayer, "mixt");
- the concept of biological rhythms and their medical importance;
- the subject of environment; types of environment, environmental factors;
- adaptive ecotype people;
- the role of man as an ecological factor. The main directions and results of anthropogenic modifications of the environment;
- examples are poisonous to humans plants and animals;
- main provisions of the teachings of academician V. I. Vernadsky about biosphere and noosphere;
- the position of Homo sapiens in the system of the animal world, the main stages of anthropogenesis;
- the regularities of phylogenesis of organ systems, ontore background inborn malformations, examples of atavistic malformations of organs and systems of organs.

***to be able:***

- to study micropreparations under a light microscope at low and high magnification;
- produce temporary micropreparations;
- to differentiate components of the animal cell on the electronic photomicrographs and drawings;
- to identify (schematically) the primary structure of a protein, number of amino acids, molecular mass of the polypeptide with the sequence of nucleotides of a gene, its encoding;
- to provide the genotype and phenotype of offspring genotypes of parents;
- to calculate the probability of having a sick child with a monogenic disease with known genotypes of the parents;
- to exclude paternity when determining the blood groups of the parents and the child;
- to calculate the probability of hereditary diseases in the descendants, depending on penetrantnost gene;
- is able to assess environmental threats and use basic methods to detect the presence of harmful factors (biological and chemical) in the biosphere;
- can recognize the most common human parasites based on their structure, life cycles and disease symptoms;
- can prepare preparations and recognize pathogens under a microscope;
- to analyze a human karyotype and determine the diagnosis of the most common



chromosomal disorders;

- to build and the pedigree to hold his genealogical analysis;
- to calculate the role of heredity and environment in the development of the signs (according to the results of cytogenetics analysis);
- to calculate the frequency of genes and genotypes according to the law of hardy-Weinberg equilibrium;
- to distinguish between teratogenic and genetic of congenital malformations;
- to determine the place of a biological object (causative agents of parasitic diseases) in the system of nature;
- to justify the affiliation of the parasitic diseases of man to the group of transmissible and natural-focal;
- to diagnose at the macro - and micropreparations of pathogens and vectors of pathogens of parasitic diseases that are studied;
- to substantiate methods of laboratory diagnosis of parasitic diseases of man;
- to substantiate methods of prevention of parasitic diseases based on the methods of infecting them.

**is ready to:**

- noticing and recognizing one's own limitations and self-assessing deficits and educational needs;
- using objective sources of information;
- formulating conclusions from your own measurements or observations;
- assuming responsibility for decisions made in the course of business professional life, including in terms of your own safety and the safety of others.

## **2. CONTENTS OF EDUCATIONAL DISCIPLINE.**

165 hours of 5.5 ECTS credits are for the study of the academic discipline, incl. lectures 20 hours, practical (seminars) 70 hours, independent work 75 hours. Normative discipline.

***Module 1. Biological features of human vital activity.***

***Submodule 1. Molecular-cellular level of living organization.***

***Specific goals:***

- **To interpret** the concept of essence of life at modern level and to determine the place of man in the system of living nature.
- **To classify** the biological systems and levels organizations of living matter.
- **To interpret** an importance of the processes on the molecular-genetic, sub-cellular and cellular levels of organization for understanding of pathogenesis of hereditary, somatic, oncological, infectious, and other diseases.
- **To master** the morphologic and physiologic properties of a cell and to interpret the importance of its malfunctions in the origin of pathological processes in man.
- **To interpret** the modern objective and subjective methods of karyotyping and principles of classification of human chromosomes.

- To master the molecular mechanisms of realization of genetic information in a cell, and its regulation in prokaryotes and eukaryotes.
- To analyze changes of a cell in cell cycle and importance of mitosis and meiosis failure in human pathology.
- To explain mechanisms of meiosis I and meiosis II and its biological importance.
- To interpret the importance of method of cell cultivation for biology and medicine.

**Topic 1. Introduction to the Medical Biology course. Levels of living matter organization. Optic systems in biological investigation and their usage.**

Medical biology as a science about biological peculiarities of human vital activity, studies regularities of heredity, variation in human ontogenesis and morphophysiological and social adaptation of humans towards environment according to the biosocial nature of a man.

Modern state of development of general and medical biology. Role of biology in the system of medical education.

Biological essence of life. Life forms, main properties and strategy of life. Levels of life organization and main biological phenomena in the each level. Importance of biological knowledge about level organization for medicine.

Human place in the system of organic world. Correlation of physical, chemical, biological and social phenomena in human activities.

Optical systems in biological experiences. Optical microscope and how to work with it. Techniques of temporal slides preparation and studying.

**Topic 2. Morphology of a cell. Structural components of cytoplasm and a nucleus.**

Structural and functional organization of eukaryotic cell chemical and functional organization of eukaryotic cell.

Chemical composition of cell. Micro- and macro-elements, role of water and hydrogen bonds in cell activities. Organic compounds - carbon substances of living organisms.

Cytoplasm and cytoskeleton. Cyclosis. Organelles of cytoplasm - membranous and non membranous, tasks and principles of functioning. Inclusions and its functions.

Nucleus as the central information apparatus of the cell. Structure of interphase nucleus. Chromosomal and genomic levels of organization of heredity material. Euchromatin and heterochromatin

**Topic 3. Cellular membranes. Transport of substances through plasmalemma.**

Cell as an open system. Assimilation and dissimilation.

Cellular membranes, compartment organization principle.

Cells receptors.

Transport across the cell membrane.

Organization of substances and energy flow in cell. Stage of dissimilation. Provision of energy, ATP. Energy distribution.

**Topic 4. Nucleus and its structural components. Morphology of chromosomes. Human karyotype.**

Human karyotype. Morphofunctional characteristics and classification of human

chromosomes. Chromosome analysis. Nucleolus as a derivative of chromosomes, its role in ribosome production. Ideogram.

### **Topic 5. Molecular bases of a heredity. Characteristic of nucleic acids.**

Molecular basis of heredity. Characteristics of the nucleic acids: DNA and RNA, their role in the storage and transmission of the hereditary information, chemical structure and organization, species specificity. DNA replication. Maintenance of the genetic constancy of the cells, selfcorrection and repair of DNA. Organization of information flow in the cell. Transcription. Processing, splicing. Translation: initiation, elongation, termination. Post translation modifications of the proteins. Regulation of gene expression in prokaryotes. Mobile genetic elements. Exon-intron organization of eukaryotic gene. Molecular mechanisms of the variation in humans.

### **Topic 6. Structure of genes pro- and eukaryotes.**

Gene as a unit of the genetic function. Gene structure in prokaryotes and eukaryotes. Genes: structural, regulatory, tRNA. and r-RNA genes. Genetic code and its properties.

### **Topic 7. Organization of information flows in the cell. Regulation of genes expression. Molecular mechanisms of the human variability.**

Molecular mechanisms of realization of genetic information in a cell (gene expression) and their regulation. Gene loci. Gene as a unit of genetic function. Transcription, processing, splicing. Broadcast, initiation, elongation, termination. Posttranslational transformations of proteins as a basis for their further functioning.

Molecular genetic maintenance of cell environment homeostasis. Molecular mechanisms of variability in humans. DNA nucleotide sequence changes. Gene mutations. Genetic engineering and biotechnology.

### **Topic 8. Life cycle of a cell. Cell division.**

Temporal organization of the cell. Life cycle of the cell (cell cycle). Types of cell division: mitosis, amitosis. Endomitosis, polyteny. Changes of the cell and its structures during the mitotic cycle (interphase and mitosis). Cell growth, growth factors. Concept of the mitotic activity. Mitosis arrest. Somatic mutations. Cultivation of cells beyond the organism, cloning of the cells.

### **Topic 9. Control of mastering of the module 1 "Biological features of human vital activity."**

*Module 2. Organism level of living organization. Bases of human genetics.*

*Submodule 2. Laws of heredity and variability.*

*Specific goals:*

- To formulate the importance of medical genetics.
- To determine the type of inheritance of mendelian characters in man.
- To illustrate inheritance of AB0 blood antigen system as an example of multiple alleles.

- To differentiate the types of co-operation of non-allele genes, and manifestation of pathological characters in different types of inheritance.
- To use knowledges of chromosomal theory of heredity for detection of autosomal linked and sex linked disorders on children.
- To interpret the mechanism of genetic determination of sex as a mendelian sign of human.
- To classify forms of variability as a fundamental property of living matter.
- To explain the importance of mutations and mutagenic factors (mutagens) of different nature in the occurrence of chromosomal and monogenic human diseases.
- To correlate the impact of mutagenic, carcinogenic and teratogenic substances with the state of health of a certain contingent of persons.

**Topic 10. Biological characteristic of human reproduction. Gametogenesis. Features of human genetics. Mono-, di-, and polyhybrid crossing. Mendelian signs.**

Features of human reproduction in connection with its bio-social nature.

Reproduction as a mechanism for maintaining genetic continuity in several generations. Gametogenesis. Fertilization in humans - the restoration

Mendelian characters in human. Genetics: subject and tasks, periods; main terms and notions. Principles of hybridological analysis. Monohybrid cross: law of dominance, law of segregation. Law of "gamete purity". Cytological basis of the laws.

Test cross and its practical usage.

Lethal genes. Deviations from the expected ratio.

Di- and polyhybrid cross: law of independent assortment and its cytological basis.

Primary and secondary pleiotropy.

Dominant and recessive modes of inheritance of normal and pathological characters.

Intermediate inheritance in humans.

**Topic 11. Interaction of allelic and non-allelic genes. Multiple allelism. Genetics of blood groups.**

Gene interaction and its manifestations in different types of inheritance.

Interaction of the allelic (dominance, incomplete dominance, overdominance, codominance).

Interaction of the non-allelic (complementarity, epistasis, polymery) genes. Polygenic inheritance of quantitative traits.

Multiple alleles. Inheritance of blood groups of ABO and MN antigen systems. Rh-factor. Rhconflict.

Immunogenetics: subject and tasks. Tissue and species specificity of the proteins, its antigen properties.

**Topic 12. Linked inheritance. Sex genetics.**

Gene linkage. Peculiarities of linked inheritance. Chromosomal theory of heredity.

Non-chromosomal heredity.

Inheritance of sex in humans. Inheritance of sex-linked diseases in humans. Sex-linked, sexinfluenced and sex-limited characters. Hemizygosity. Genetics of sex. Mechanisms of genetic differentiation in humans and its failure. Bisexual nature of humans. Psychosocial aspects.

**Topic 13. Human variability as property of a life and the genetic phenomenon: phenotypic and genotypic variability.**

Variation, its forms and manifestations on the organism level: phenotypic and genotypic variation.

Modification and norm of reaction. Prolonged modifications. Statistical regularities of modification.

Recombination, its sources.

Mutations and its phenotypic manifestation.

Classification of mutations: numerical and structural chromosome aberrations, gene mutations.

Spontaneous and induced mutations. Mutagens: physical, chemical, biological. Genetic monitoring. Genetic danger of pollution. Notion of anti-mutagens and co-mutagens. Law of homologous rows of genetic variation, its practical importance.

***Submodule 3. Methods of human heredity studying. Hereditary diseases.***

***Specific goals:***

- To make genealogical analysis of pedigrees of families with hereditary diseases.
- To determine the influence of the ratio of heredity and environment on the example of the twin method.
- To classify chromosomal diseases according to the type and types of mutations.
- To analyze the karyotypes of patients and diagnose chromosomal disease.
- To explain the importance of the problem of genetic burden in humans.
- To apply knowledge of the essence of the law of genetic equilibrium of genes and genotypes in populations to determine their genetic structure.

**Topic 14. Fundamentals of Medical Genetics. Methods of studying of human heredity, genealogy and twins.**

Basis of medical genetics.

Man as a specific subject of genetic analysis.

Methods of human heredity studying. Classification of hereditary disorders in humans

Cytogenetic methods. Karyotyping. Analysis of karyotypes of patients with hereditary disorders. Detection of X and Y-chromatin as method of diagnosis of chromosomal disorders.

Chromosomal diseases caused by quantitative or qualitative chromosomal aberrations; mechanisms of its formation.

Genealogic methods. Rules of pedigree composition. Pedigree analyses.

Twins method. Detection of the genotype and environment influence on the manifestation of pathological characters in humans.

**Topic 15. Chromosomal diseases. Cytological method of their diagnostics.**

Chromosomal diseases caused by a violation of the number or structure of chromosomes, cytogenetic mechanisms, essence.

Cytogenetic methods. Karyotyping. Analysis of karyotypes of patients.

Monogenic human diseases.

#### **Topic 16. Molecular diseases. Biochemical method and DNA-diagnostics.**

Molecular diseases of carbohydrate, amino acid, protein, lipid, mineral metabolism. Enzymopathy and hemoglobinopathy.

Phenylketonuria: genetic characteristics, diagnosis, prevention.

Hemoglobinopathies: sickle cell anemia, thalassemia.

Brachydactyly, achondroplasia.

Hemophilia: genetic characteristics, diagnosis, prevention. Color blindness: forms, genetic characteristics.

(Optional: genetic engineering; biotechnology; the concept of gene therapy.)

#### **Topic 17. Population-statistical method. Medical-genetic consultancy.**

Population-statistic method. Law of constancy of genetic structure of the population.

Usage of Hardy-Weinberg's law for studying of the genetic structure of the population.

Medical-genetic aspects of the family. Medical-genetic counseling. Prevention of hereditary diseases. Prenatal diagnosis of the hereditary pathology. Dermatoglyphic, immunological methods and hybridization of somatic cells.

#### **Topic 18. Practical skills of substantial modules 2 and 3. "Laws of a heredity", "Methods of human heredity studying. Hereditary diseases."**

##### ***Submodule 4. Biology of individual development.***

##### ***Specific goals:***

- To have an understanding of the mechanisms of genetic continuity in a number of generations;
- To classify the forms of asexual and sexual reproduction;
- To analyze the peculiarities of gametogenesis: the oogenesis and spermatogenesis in humans;
- To analyze the cytogenetic mechanisms occurring in the 1st and 2nd division of meiosis;
- To explain the importance of the process of fertilization.
- To have an idea on modern scientific level about molecular-genetic mechanisms of ontogenesis;
- To analyze the features of prenatal and postnatal human development;
- To classify disorders of ontogenesis and to determine their place in human pathology;
- To analyze the congenital malformations and their significance in human pathology;
- To have an understanding of critical periods of development and teratogenesis.

**Topic 19. Molecular-genetic mechanisms of ontogenesis. Characteristic of the human prenatal period.**

Ontogenesis and its periods.

Embryonic period of the development, its stages. Differentiation on the molecular-genetic, cellular and tissue levels. Congenital defects, its classification: hereditary, exogenic, multifactorial; gametopathy, blastopathy, embryopathy, phetopathy;

Regulation of gene function in ontogenesis. Experimental studying of embryonic development. Problem of differentiation and interaction of blastomeres. Embryonic induction.

Regulation of cleavage and its failure (twins, congenital defects).

Critical periods of development. Teratogenesis. Teratogenic factors of environment.

**Topic 20. Ontogenesis disorder and their place in a human pathology. Postnatal period of ontogenesis. Biological mechanisms of organism homeostasis maintenance.**

Postembrionic period of ontogenesis, its periodisation.

Growth and differentiation in postnatal period.

Peculiarities of the postnatal period of human development because of its biosocial nature.

Senility as a final stage of human ontogenesis. Modern theories of aging.

**Topic 21. Control of mastering of the module 2 "Organism level of living organization. Bases of the human genetics."**

***Module 3. Population-species, biogeocenotical and biosphere levels of living organization.***

***Submodule 5. Medical and biologic bases of parasitism. Medical protozoology.***

***Specific goals:***

- To determine notion "parasitism", "parasitic system" source of invasion", "factors of transmission of invasion agents"
- To classify parasites into obligate and facultative, constant and temporary, specific and non-specific, external and internal.
- To ground including of the parasitic diseases to group of the vector-born and nature-foci diseases.
- To identify definitive, intermediate, obligate, facultative and reservoir hosts of the protists
- To explain the influence of the migration of population on the prevalence of protozoan invasions in Ukraine.
- To detect the methods of laboratory test for parasitic diseases basing on the location and life cycles of the parasites.
- To correlate life cycles of the parasites with modes of infection and preventive measures.
- To interpret biological principles of struggle with vector-born and nature-foci diseases.
- To explain interactions in the "parasite-host" biological system.

**Topic 22. Medical and biologic basis of parasitism. Medical protozoology. Protozoa. Sarcomastigophora. Amoeba (Lobosea.)**

Introduction into medical parasitology. Origin and evolution of parasitism.

Principles of classification of the parasites. Principles of parasite-host interaction.

Morphophysiological adaptations of the parasites Concept of intensity and extensity of invasion.

Prominent scientists - parasitologists: V.O. Dogel, V.M. Beklemishev, E.N. Pavlovsky, K.I.

Scryabin, O.P. Markevitch, L.V. Gromashevsky.

Typical features of Subregnum Protozoa.

Phylum Sarcomastigophora, Classis Lobozea. Dysenteric amoeba (*Entamoeba histolytica*), intestinal amoeba (*E. coli*), gingival amoeba (*E. gingivalis*). Geographical distribution, morphofunctional peculiarities, life cycles of dysenteric amoeba. Ways of infection, laboratory diagnosis and prophylaxis of amebiasis.

**Topic 23. Class Zoomastigophora – human parasites.**

Geographical distribution, morphology, life cycle of lamblia, trichomonas, leishmania and trypanosome. Ways of infection, laboratory diagnosis and prophylaxis of lambliosis, urogenital trichomoniasis, leishmaniasis, trypanosomosis.

**Topic 24. Phylum Apicomplexa. Representatives of Class Sporozoea – human parasites. Class Ciliophora – human parasites. Class Rimostomatea – human parasites.**

Geographical distribution, morphofunctional peculiarities, life cycles of malaria parasites and toxoplasma. Ways of infection, laboratory diagnosis and prophylaxis of malaria and toxoplasmosis. Methods of laboratory diagnosis of diseases caused by protists.

***Submodule 6. Medical helminthology.***

***Specific goals:***

- To explain notion “helminthes”, “biohelminthes and geohelminthes”, “autoinvasion”, “autoreinvasion”, “retroinvasion”.
- To interpret morphophysiological adaptation of helminthes for parasitism.
- To explain interactions in the “parasite-host” biological system.
- To explain the influence of the migration of population on the prevalence of helminthoses in Ukraine.
- To identify definitive, intermediate, and reservoir hosts of the helminthes
- To detect the methods of laboratory test of helminthoses basing on the location and life cycles of the parasites.
- To ground including of the parasitic diseases to the group of vector-born and nature-foci diseases.
- To correlate concepts of dehelminatation and eradication of the helminthes.
- To interpret concepts of specific and mechanical vectors of invasion diseases pathogens.



**Topic 25. Medical helminthology. Flat worms – human parasites. Flat worms (Plathelminthes). Class Trematoda – agents of human diseases.**

Geographical distribution, morphofunctional peculiarities, life cycles of liver fluke (*Fasciola hepatica*) and lancet fluke (*Dicrocoelium lanceatum*). Ways of infection, pathogenicity, laboratory diagnosis and prophylaxis of fasciolosis and dicrocoeliosis.

Mollusks, crustacea and chordata as intermediate hosts of helminthes.

Geographical distribution, morphofunctional peculiarities, life cycles, ways of infection, pathogenicity, laboratory diagnosis and prophylaxis of opisthorchosis, paragonimosis.

Blood flukes – agents of parasitic diseases.

Mollusks, crustacea and chordata as intermediate hosts of helminthes.

**Topic 26. Phylum Flat worms (Plathelminthes). Class Trematoda – agents of human diseases (paragonimiasis and schistosomiasis).**

Bloodsuckers are the causative agents of human parasitic diseases.

Medical geography, morphofunctional features, development cycles, ways of infection, pathogenic influence, laboratory diagnostics and prevention of schistosomiasis and paragonimiasis.

**Topic 27. Phylum Flat worms (Plathelminthes). Class Cestoidea – agents of human diseases: taeniasis saginata, taeniasis solium, cysticercosis, hymenolepiasis.**

Geographical distribution, morphofunctional peculiarities, life cycle of pork tapeworm, beef tapeworm, dwarf tapeworm. Ways of infection, pathogenicity, laboratory diagnosis and prophylaxis of teniasis, cysticercosis, teaeniarhynchosis, hymenolepidosis.

Class Cestoidea. Characteristics of the class. The causative agents of cestodes: unarmed or bovine stickleback (*Taeniarhynchussaginata*), armed or porcine stickleback (*Taeniasolium*), dwarf stickleback (*Hymenolepisnana*).

Morphology, cycles of parasite development, ways of invasion, pathogenic influence, methods of laboratory diagnostics, prevention.

**Topic 28. Phylum Flat worms (Plathelminthes). Class Cestoidea – agents of human diseases: echinococcosis, alveococcosis, diphyllbothriasis.**

Geographical distribution, morphofunctional peculiarities, life cycle of broad tapeworm, echinococcus, alveococcus. Ways of infection, pathogenicity, laboratory diagnosis and prophylaxis.

**Topic 29. Phylum Round worms Nemathelminthes. Class Nematoda – human parasites: ascariasis, trichuriasis, ancylostomiasis, necatoriasis.**

Type Nemathelminthes. Characteristics, medical significance. Class Nematoda. Pathogens of nematodes: human roundworm (*Ascarislumbricoides*), human hairworm (*Trihocephalustrichiurus*), pinworm (*Enterobiusvermicularis*), hookworm (*Ancylostomaduodenale*), larvae of animal roundworms - pathogens of cutaneous larvae and viscera. Morphology, cycles of parasite development, ways of infection, pathogenic

influence, substantiation of methods of laboratory diagnostics and prevention. Laboratory diagnosis of helminthiasis.

The doctrine of deworming and devastation; total and partial devastation, achievements in Ukraine in the fight against helminthiasis.

**Topic 30. Phylum Round worms Nemathelminthes. Class Nematoda – human parasites: enterobiasis, trichinosis, strongyloidiasis. Laboratory diagnostics of helminthosis.**

Type Nemathelminthes. Characteristics, medical significance. Class Nematoda. Pathogens of nematodes: some (*Necator americanus*), intestinal urticaria (*Strongyloides stercoralis*), *Trichinella Trichinella spiralis*, scab (*Dracunculus medinensis*), filariasis: *Wuchereria bancrofti* - causative agent of wuchereriosis, *Brugia malayi* - pathogen, *Brugia malayi* - pathogen. *Ascaris* larvae of animals are pathogens of cutaneous and visceral forms of larvamigrans. Morphology, cycles of parasite development, ways of infection, pathogenic influence, substantiation of methods of laboratory diagnostics and prevention.

Principles and content of the main macro- and microhelminthoscopic methods of research of feces, water, soil, etc. Features of the structure of eggs of mammals, tapeworms and roundworms - human parasites.

The doctrine of deworming and devastation; total and partial devastation, achievements in Ukraine in the fight against helminthiasis.

**Topic 31. Practical skills of content modules 5 and 6.**

*Submodule 7. Medical arachnoentomology.*

*Specific goals:*

- To interpret concepts of specific and mechanical vectors of invasion diseases pathogens.
- To compare the value of arthropods as agents and carriers of infectious diseases.
- To correlate the value transovarial and transfusive transmission of infectious diseases and their prevalence in human populations.

**Topic 32. Medical arachnoentomology. Phylum Arthropods (Arthropoda) - agents and carriers of infections and invasions. Class Arachnoidea. Ticks (Acarina) – agents and vectors of human diseases.**

Characteristics, classification, medical importance. Spiders and scorpions as a poisonous animals. Ticks as agents of the diseases, vectors and natural reservoirs of the infectious diseases. Acariform and parasitiform ticks. Itch mite (*Sarcoptes scabiei*), follicle mite (*Demodex folliculorum*). Ixodidae ticks: dog tick (*Ixodes ricinus*), taiga tick (*I. persulcatus*); Argasidae ticks: *Ornithodoros papillipes*. Morphophysiological peculiarities, life cycles, prevention of bites and fighting with ticks. Importance of transovarial transmission of the agents of the diseases. Medical importance of ticks - dwellers of the human shelters.

**Topic 33. Class Insecta: lice Anoplura, fleas Aphaniptera, bugs Hemiptera, cockroaches Blattoidea, flies Diptera – agents and vectors of human diseases.**

Progressive and regressive changes in organization of Classis Insecta due to environment of existence. Peculiarities of insect morphology, feeding and reproduction.

Mosquitoes, flies, sand flies and their medical importance.

Midges: characteristic, importance as an intermediate hosts of the helminthes, viruses and bacteria.

Transmission and natural-focal helminthiasis.

Medical importance of lice, fleas, bugs, cockroaches as causative agents and vectors of human diseases.

***Submodule 8. Interrelation individual and historical development. Biosphere and human.***

***Specific goals:***

- To interpret the concept of human populations as an object of influence of evolutionary factors.
- To explain the synthetic theory of evolution as one of the stages of evolutionary theory.
- To interpret the problem of genetic predisposition in human populations and its medical and biological consequences.
- To interpret the importance of human ecology as a direction in the system of biological sciences, the theoretical basis for the development of measures for nature protection and public health, rational use of natural resources.
- To substantiate social and biological aspects of adaptation of the population to living conditions and formation of adaptive ecotypes of people.
- To interpret the anthropogenesis of environmental pollution by emissions from industrial production, vehicles, and agricultural chemicals as the root cause of occupational human diseases.

**Topic 34. Synthetic theory of evolution. Population structure of humanity. Biosphere as a system of the human existence. Final control work.**

Synthetic theory of evolution. Peculiarities of the elementary evolution factors in human populations. Regularities and problems of the macroevolution and anthropogenesis. Interaction of the onto- and phylogenesis. Biogenetic law, its interpretation by O.M. Severtsev.

Human origin. Formation of the Homo sapiens as an object stage of the organic world evolution.

Stages of anthropogenesis. Position of Homo sapiens species in a system of the animal world.

Correlation of the biological and social factors in the human evolution. Biological and social inheritance. Origin of the human races as a reflection of adaptive rule of the human evolution. Medical and biological importance of the race problem. Structure and functions of biosphere. The doctrine of academician B. I. Vernadsky about biosphere and a noosphere. Mankind as active geological force. Protection of the biosphere in national and international scientific programs.

Human ecology. Environment as ecological concept. Kinds of environment: atmosphere, hydrosphere, lithosphere, internal environment of an organism. Factors of environment: abiotic, biotic, anthropogenic (anthropogenic). Unity of the organism and environment. Types of ecosystem: natural and artificial. Human introduction into the biogeocenosis, formation of anthropocenosis, types of anthropocenosis: naturocenosis, agrocenosis, urbanocenosis, technocenosis. Results of ecosystem disturbance, constancy and lability of ecosystems. Anthropogenic migration of chemical elements. Drugs in the chains of feeding. Ecologic prediction. Healthy or comfort environment, non-healthy or discomfort environment, extreme environment. Adequate and inadequate conditions of environment. Human adaptation to the extreme conditions.

The influence of anthropogenic factors of environmental pollution on human health. Characteristic of poisonous to humans plants and animals.

**Topic 35. Control of mastering of the module 3 "Population-species, biogeocenotical and biosphere levels of living organization".**

### 3. THE STRUCTURE OF EDUCATIONAL DISCIPLINE.

Names of modules, submodules and topics	Lectures	Practical classes	ISW	Individual work
<b>Module 1. Biological features of human vital activity.</b>				
<b>Submodule 1. Molecular-cellular level of living organization.</b>				
Theme 1. Introduction to the Medical Biology course. Levels of living matter organization. Optic systems in biological investigation and their usage.	0,5	2	3	
Theme 2. Morphology of a cell. Structural components of cytoplasm and a nucleus.	1	2	3	
Theme 3. Cellular membranes. Transport of substances through plasmalemma.	0,5	2	4	-
Theme 4. Nucleus and its structural components. Morphology of chromosomes. Human karyotype.	1	2	4	
Theme 5. Molecular bases of a heredity. Characteristic of nucleic acids.	1	2	4	
Theme 6. Structure of genes pro- and eukaryotes.	1	2	3	
Theme 7. Organization of information flows in the cell. Regulation of genes expression. Molecular mechanisms of the human variability.	0,5	2	3	
Theme 8. Life cycle of a cell. Cell division.	0,5	2	3	
Theme 9. Control of mastering of the module 1. "Biological features of human vital activity."	-	2	3	
<b>Total for module I</b>	<b>54</b>	<b>6</b>	<b>18</b>	<b>30</b>
<b>Module II. Organism level of living organization. Bases of human genetics.</b>				
<b>Submodule 2. Laws of heredity and variability.</b>				
Theme 10. Biological characteristic of human reproduction. Gametogenesis.	0,5	2	2	

Theme 11. Features of human genetics. Mono-, di-, and polyhybrid crossing. Mendelian signs.	0,5	2	2	
Theme 12. Interaction of allelic and non-allelic genes. Multiple allelism. Genetics of blood groups.	0,5	2	2	
Theme 13. Linked inheritance. Sex genetics.	0,5	2	2	
<b>Submodule 3. Methods of human heredity studying. Hereditary diseases.</b>				
Theme 14. Fundamentals of Medical Genetics. Methods of studying of human heredity, genealogy and twins.	0,5	2	2	
Theme 15. Chromosomal diseases. Cytological method of their diagnostics.	0,5	2	2	
Theme 16. Molecular diseases. Biochemical method and DNA-diagnostics.	1	2	2	
Theme 17. Population-statistical method. Medical-genetic consultancy.	0,5	2	2	
Theme 18. Practical skills of substantial modules 2 and 3. "Laws of a heredity", "Methods of human heredity studying. Hereditary diseases."	-	2	2	
<b>Submodule 4. Biology of individual development.</b>				
Theme 19. Molecular-genetic mechanisms of ontogenesis. Characteristic of the human prenatal period.	0,5	2	2	
Theme 20. Ontogenesis disorder and their place in a human pathology. Postnatal period of ontogenesis. Biological mechanisms of organism homeostasis maintenance.	1	2	2	
Theme 21. Control of mastering of the module 2 "Organism level of living organization. Bases of the human genetics."	-	2	3	
<b>Total for module II</b>	<b>55</b>	<b>6</b>	<b>24</b>	<b>25</b>
<b>Module III. Population-species, biogeocenotical and biosphere levels of living organization.</b>				
<b>Submodule 5. Medical and biologic bases of parasitism. Medical protozoology.</b>				
Theme 22. Medical and biologic basis of parasitism. Medical protozoology. Protozoa. Sarcocystis. Amoebozoa (Lobosea.)	1	2	2	
Theme 23. Class Zoomastigophora – human parasites.	0,5	2	2	
Theme 24. Phylum Apicomplexa. Representatives of Class Sporozoea – human parasites. Class Ciliophora – human parasites. Class Rimostomatea – human parasites.	0,5	2	2	
<b>Submodule 6. Medical helminthology.</b>				
Theme 25. Medical helminthology. Flat worms – human parasites. Flat worms (Plathelminthes). Class Trematoda – agents of human diseases.	0,5	2	1	
Theme 26. Phylum Flat worms (Plathelminthes). Class Trematoda – agents of human diseases (paragonimiasis and schistosomiasis).	0,5	2	1	
Theme 27. Phylum Flat worms (Plathelminthes). Class Cestoidea – agents of human diseases: taeniasis saginata, taeniasis solium, cysticercosis, hymenolepiasis.	0,5	2	1	
Theme 28. Phylum Flat worms (Plathelminthes). Class Cestoidea – agents of human diseases: echinococcosis, alveococcosis, diphyllbothriasis.	0,5	2	1	
Theme 29. Phylum Round worms Nematelminthes. Class Nematoda – human parasites: ascariasis, trichuriasis, ancylostomiasis, necatoriasis.	0,5	2	1	

Theme 30. Phylum Round worms Nematelminthes. Class Nematoda – human parasites: enterobiasis, trichinosis, strongyloidiasis. Laboratory diagnostics of helminthosis.	0.5	2	1	
Theme 31. Practical skills of content modules 5 and 6.	-	2	2	
<b>Submodule 7. Medical arachnoentomology.</b>				
Theme 32. Medical arachnoentomology. Phylum Arthropods (Arthropoda) - agents and carriers of infections and invasions. Class Arachnoidea. Ticks (Acarina) – agents and vectors of human diseases.	1	2	1	
Theme 33. Class Insecta: lice Anoplura, fleas Aphaniptera, bugs Hemiptera, cockroaches Blattoidea, flies Diptera – agents and vectors of human diseases.	1	2	1	
<b>Submodule 8. Interrelation individual and historical development. Biosphere and human.</b>				
Theme 34. Synthetic theory of evolution. Population structure of humanity. Biosphere as a system of the human existence. Final control work.	1	2	2	
Theme 35. Control of mastering of the module 3 “Population-species, biogeocenotical and biosphere levels of living organization”.	-	2	2	
<b>Total for module III</b>	<b>56</b>	<b>8</b>	<b>28</b>	<b>20</b>
<b>Total hours</b>	<b>165 / 5.5 ECTS credits</b>	<b>20</b>	<b>70</b>	<b>75</b>
<b>Final control</b>				<b>Exam</b>

#### 4. THEMATIC PLAN OF LECTURES

<b>The 1<sup>st</sup> semester</b>	
<b>№</b>	<b>Topic</b>
	<b>Module 1. Biological features of human vital activity.</b>
1.	Introduction to Medical Biology. Levels of living things organization.
2.	Cell morphology. Reproduction on cellular level.
3.	Chromosomal heredity theory. Sex genetics.
	<b>Module 2. Organism level of living organization. Bases of human genetics.</b>
4.	Human variability as a property of life and a genetic phenomenon.
5.	Fundamentals of human genetics. Hereditary human diseases.
	<b>Total:</b>
<b>The 2<sup>nd</sup> semester</b>	
<b>№</b>	<b>Topic</b>
6.	Chromosomal diseases. Cytogenetic and population-statistical methods.
	<b>Module 3. Population-species, biogeocenotical and biosphere levels of living organization.</b>

7.	Medical-biological basis of parasitism.
8.	Helminthology. Flatworms and roundworms are human parasites.
9.	Medical arachnoentomology.
10.	The biosphere as a system that ensures human existence. Human ecology.
	<b>Total:</b>

## 5. THEMATIC PLAN OF PRACTICAL CLASSES

The 1 <sup>st</sup> semester	
№	Theme
<b>Module 1. Biological features of human vital activity.</b>	
<b>Submodule 1. Molecular-cellular level of living organization.</b>	
1.	Introduction to the Medical Biology course. Levels of living matter organization. Optic systems in biological investigation and their usage.
2.	Morphology of a cell. Structural components of cytoplasm and a nucleus.
3.	Cellular membranes. Transport of substances through plasmalemma.
4.	Nucleus and its structural components. Morphology of chromosomes. Human karyotype.
5.	Molecular bases of a heredity. Characteristic of nucleic acids.
6.	Structure of genes pro- and eukaryotes.
7.	Organization of information flows in the cell. Regulation of genes expression. Molecular mechanisms of the human variability.
8.	Life cycle of a cell. Cell division.
9.	Control of mastering of the module 1. "Biological features of human vital activity."
<b>Module 2. Organism level of living organization. Bases of human genetics.</b>	
<b>Submodule 2. Laws of heredity and variability.</b>	
10.	Biological characteristic of human reproduction. Gametogenesis. Features of human genetics. Mono-, di-, and polyhybrid crossing. Mendelian signs.
11.	Interaction of allelic and non-allelic genes. Multiple allelism. Genetics of blood groups.
12.	Linked inheritance. Sex genetics.
13.	Human variability as property of a life and the genetic phenomenon: phenotypic and genotypic variability.
<b>Submodule 3. Methods of human heredity studying. Hereditary diseases.</b>	
14.	Fundamentals of Medical Genetics. Methods of studying of human heredity, genealogy and twins. Chromosomal diseases. Cytological method of their diagnostics.
15.	Diff.credit
The 2 <sup>nd</sup> semester	
№	Theme
16.	Molecular diseases. Biochemical method and DNA-diagnostics.

17.	Population-statistical method. Medical-genetic consultancy.
18.	Practical skills of substantial modules 2 and 3. "Laws of a heredity", "Methods of human heredity studying. Hereditary diseases."
<b>Submodule 4. Biology of individual development.</b>	
19.	Molecular-genetic mechanisms of ontogenesis. Characteristic of the human prenatal period.
20.	Ontogenesis disorder and their place in a human pathology. Postnatal period of ontogenesis. Biological mechanisms of organism homeostasis maintenance.
21.	Control of mastering of the module 2 "Organism level of living organization. Bases of the human genetics."
<b>Module 3. Population-species, biogeocenotical and biosphere levels of living organization.</b>	
<b>Submodule 5. Medical and biologic bases of parasitism. Medical protozoology.</b>	
22.	Medical and biologic basis of parasitism. Medical protozoology. Protozoa. Sarcomastigophora. Amoeba (Lobosea.)
23.	Class Zoomastigophora – human parasites.
24.	Phylum Apicomplexa. Representatives of Class Sporozoea – human parasites. Class Ciliophora – human parasites. Class Rimostomatea – human parasites.
<b>Submodule 6. Medical helminthology.</b>	
25.	Medical helminthology. Flat worms – human parasites. Flat worms (Plathelminthes). Class Trematoda – agents of human diseases.
26.	Phylum Flat worms (Plathelminthes). Class Trematoda – agents of human diseases (paragonimiasis and schistosomiasis).
27.	Phylum Flat worms (Plathelminthes). Class Cestoidea – agents of human diseases: taeniasis saginata, taeniasis solium, cysticercosis, hymenolepiasis.
28.	Phylum Flat worms (Plathelminthes). Class Cestoidea – agents of human diseases: echinococcosis, alveococcosis, diphyllbothriasis.
29.	Phylum Round worms Nemathelminthes. Class Nematoda – human parasites: ascariasis, trichuriasis, ancylostomiasis, necatoriasis.
30.	Phylum Round worms Nemathelminthes. Class Nematoda – human parasites: enterobiasis, trichinosis, strongyloidiasis. Laboratory diagnostics of helminthosis.
31.	Practical skills of content modules 5 and 6.
32.	Medical arachnoentomology. Phylum Arthropods (Arthropoda) - agents and carriers of infections and invasions. Class Arachnoidea. Ticks (Acarina) – agents and vectors of human diseases.
33.	Class Insecta: lice Anoplura, fleas Aphaniptera, bugs Hemiptera, cockroaches Blattoidea, flies Diptera – agents and vectors of human diseases.
<b>Submodule 8. Interrelation individual and historical development. Biosphere and human.</b>	
34.	Synthetic theory of evolution. Population structure of humanity. Biosphere as a system of the human existence. Final control work.
35.	Control of mastering of the module 3 "Population-species, biogeocenotical and biosphere levels of living organization".



## 6. THEMATIC PLAN OF INDEPENDENT WORK OF STUDENTS (IWS)

The 1st semester	
№	Theme
<b>Module 1. Biological characteristic of the human vital activity.</b>	
<b><i>Submodule 1. Molecular-cellular level of living organization.</i></b>	
1.	Preparation for the practical classes - theoretical preparation and working off the practical skills.
2.	Working off the topics which are not included into the classes plans.
2.1.	The organization of flows of substance and energy in a cell.
2.2.	Life of cells outside of an organism. Cloning of cells.
3.	Preparation for the final control of mastering of the module 1.
<b>Module 2. Organismic level of living organization. Bases of human genetics.</b>	
<b><i>Submodule 2. Laws of a heredity and variability.</i></b>	
1.	Preparation for the practical classes - theoretical preparation and working off the practical skills
2.	Working off the topics which are not included into the classes plans.
2.1.	Genetic maps. Methods of human chromosomes mapping. Modern condition of human genome research.
<b>The 2<sup>nd</sup> semester</b>	
№	Theme
<b><i>Submodule 3. Methods of the human heredity studying . Hereditary diseases.</i></b>	
1.	Preparation for the practical classes - theoretical preparation and working off the practical skills.
2.	Working off the topics which are not included into the classes plans.
2.1.	Genetic engineering. Biotechnology. Concept of genetic therapy.
2.2.	Methods of human genetics: immunonological, somatic cells hybridizations.
3.	Solving of medical genetics tasks.
<b><i>Submodule 4. Biology of ontogenesis.</i></b>	
1.	Preparation for the practical classes - theoretical preparation and working off the practical skills.
2.	Working off the topics which are not included into the classes plans.
2.1.	Ageing as the final stage of human ontogenesis. Theories of ageing.
2.2.	Concepts about a biofield, biological rhythms and their medical value.
3.	Preparation for the control of mastering of the module 2
<b>Module 3. Population-species, biocenotical and biosphere levels of living organization.</b>	
<b><i>Submodule 5. Medical and biologic bases of parasitism. Medical protozoology.</i></b>	

1.	Preparation for the practical classes - theoretical preparation and working off the practical skills.
2.	Working off the topics which are not included into the classes plans.
2.1.	Methods of laboratory diagnostics of the diseases caused by the parasitic Protozoa.
<b>Submodule 6. Medical helminthology.</b>	
1.	Preparation for the practical classes - theoretical preparation and working off the practical skills.
2.	Working off the topics which are not included into the classes plans.
2.1.	Trematodes - activators of parasitic human diseases. Activators of metagonimosis, nanofietosis.
2.2.	Filariidae - activators of human diseases.
3.	Preparation for the control of practical skills mastering of substantial modules 5, 6.
<b>Submodule 7. Medical arachnoentomology.</b>	
1.	Preparation for the practical classes - theoretical preparation and working off the practical skills.
2.	Working off the topics which are not included into the classes plans.
2.1.	Ticks inhabitants of the habitation of people and their medical value.
2.2.	Midges and its components: the characteristic, value of intermediate hosts of helminths and carriers of the human diseases activators.
<b>Submodule 8. Interrelation individual and historical develop ment. Biosphere and the man.</b>	
1.	Preparation for the practical classes - theoretical preparation and working off the practical skills.
2.	Working off the topics which are not included into the classes plans.
2.1.	Human races as reflections of adaptable laws of the human development.
2.2.	Plants poisoning for the human and animals.
3.	Preparation for the control of mastering of the module 3

## 7. THE LIST OF THEORETICAL QUESTIONS FOR PREPARATION OF STUDENTS FOR THE FINAL MODULAR CONTROL.

1. Biology. Methods of biological research. The importance of biology for medicine, agriculture, preservation of the biosphere.
2. Signs of living organisms. The properties of the living.
3. Levels of organization of life.
4. The variety of existing life forms.
5. The development of cell theory (N. Schleiden, T. Schwann, G. Virgo).
6. The modern state the cell theory.

7. The structure of cells.
8. The nucleus of the cell, its structure and functions.
9. The composition and structure of chromosomes. Types of chromosomes. Sets of chromosomes. Karyotype.
10. The elemental composition of living organisms.
11. Inorganic compounds: water, mineral salts.
12. The composition, structure and function of proteins.
13. The composition, structure and function of lipids.
14. The composition, structure and functions of carbohydrates.
15. The composition, structure and function of DNA.
16. The complementarity. Reduplication DNA.
17. The composition, structure and function of RNA, types of RNA and their significance. ATP: structure, importance.
18. The protein biosynthesis.
19. The life cycle of cells. Periods of interphase.
20. Cell division: Ames, mitosis.
21. Meiosis, its cytological characteristics.
22. Physico-chemical properties of cytoplasm: osmosis, plasmas, turgor.
23. The purpose and General characteristics of the metabolism. Plastic and energy metabolism.
24. The reproduction of organisms. Asexual and sexual reproduction.
25. Sexual reproduction, its shape. The structure of the germ cells.
26. Sexual dimorphism. The hermaphroditism.
27. The gametogenesis.
28. Fertilization and its biological significance.
29. Parthenogenesis.
30. Genetics, its objectives and methods. Hybridological method for the study of heredity.
31. Managed crossing. The first law of Mendel — law of uniformity of hybrids of the first generation.
32. Homozygotes and heterozygotes, the phenotype and genotype.
33. The second law of Mendel — law of segregation of characteristics of the hybrids of the second generation.
34. Dihybrid crossing. Law of independent inheritance of traits.
35. The interaction of allelic genes.
36. The interaction of nonallelic genes.
37. The chromosomal theory of heredity. Chromosomal sex determination.
38. Linked inheritance.
39. The gene and its properties.
40. Variability of organisms and its form. Classification of mutations. Mutagens, their classification.
41. Inheritance of traits, sex-linked.
42. Research methods for the study of anthropogenetic.
43. A hereditary disease. Prevention of hereditary diseases.
44. Ontogeny, characteristics, and periods.

45. The embryonic period of development: fertilization, cleavage, gastrulation. Histogenesis and organogenesis.
46. Makeshift bodies, their value.
47. Anomalies of embryonic development. Gemini. Malformations in humans and their causes.
48. Post-embryonic period. Direct and indirect development.
49. Aging as a natural stage of ontogenesis. Morphophysiological characteristics of the aging process. Theories of aging.
50. Death is a natural stage of ontogenesis.
51. Clinical death and biological. The intensive care unit.
52. Regeneration, its forms.
53. Transplantation of organs and tissues, its types.
54. The teaching of evolution. Characterization of the evolutionary concepts of Charles Darwin.
55. The main provisions of evolutionary theory of Charles Darwin.
56. Biological species, its criteria and structure.
57. The main directions of macroevolution. Biological progress and regress.
58. The doctrine of microevolution.
59. Population — the basic unit of the species. Factors increase.
60. Synthetic theory of evolution.
61. Proof of organic evolution.
62. The origin of life on Earth. Hypotheses of the origin of life.
63. The development of life on Earth. Basic geological era, their biological characteristics.
64. The origin of man. The anthropogenesis. Race.
65. Fundamentals of ecology. Ecological factors of the organisms.
66. The ecosystem and its structure. The power supply circuit. Ecological pyramid.
67. Medical Parasitology, its subject and objectives.
68. Parasitic forms of protozoa. Their morphology, development cycles, laboratory diagnosis, prevention.
69. Worms. Geohelminths and biohelminths.
70. The teachings of K. I. Scriabin on deworming and devastate.
71. A type of flatworm. Class Suckling, their morphology, development cycles, laboratory diagnosis, disease prevention.
72. A type of flatworm. The class of tapeworms. Morphology and development cycles, ways of transmission, prevention of diseases.
73. A type of Round worms. The class round worms. Morphology and cycles of development, ways of infection, laboratory diagnosis and prevention of disease.
74. Type Arthropods. General characteristics. Medical value type. The Class Arachnida. Transmissible diseases.
75. Type Arthropods. The Insect Class. The morphology and biology of insects with medical importance.
76. Biosphere. The structure of the biosphere. Biomass.
77. Evolution of the biosphere.
78. The human role in the biosphere.
79. The noosphere as the highest stage of the biosphere evolution.

80. Scientific bases of nature protection and perspectives of environmental management.
81. Medicinal plants.

### **The list of practical skills for final module control**

- technique microscopy;
- to produce temporary micropreparations;
- differentiate components of cells;
- to make cariogram human chromosomes;
- to identify primary structure, number of amino acids, molecular weight of the polypeptide according to the structure of the gene encoding it;
- to perform the sequence of steps in the regulation of gene expression;
- to determine the type of inheritance Mandaluyong features of a human;
- to provide the genotype and phenotype of offspring genotypes of parents;
- to exclude paternity when determining the blood groups of the parents and the child;
- to analyze the complicated mechanisms of inheritance of traits in humans;
- to develop measures to reduce the degree of manifestation of the pathological state in patients with hereditary pathology;
- to choose appropriate methods of study of human heredity for the diagnosis of various hereditary diseases;
- to calculate the probability of hereditary diseases in the descendants, depending on gene penetrance;
- to differentiate between the chromosomal human disease;
- build and conduct a genealogical analysis of pedigrees with hereditary disease;
- to calculate the role of heredity and environment in the development of the signs (according to the results of cytogenetics analysis);
- calculate the genetic composition of human populations;
- to apply biogenetic law to determine ontophylogenetically caused congenital malformations of human development;– to compare the mechanisms of occurrence of congenital malformations of the human of various origins;
- to learn the basic principles of regeneration and transplantation;
- to determine the place of a biological object in the system of nature;
- to justify the affiliation of the parasitic diseases of man;
- to diagnose pathogens and vectors of parasitic diseases on macro- and micropreparats;
- to determine the species of pathogens protozoon;
- to identify the different stages of the life cycle of human parasites;
- to substantiate methods of laboratory diagnostics of parasitic diseases;
- to determine the species of helminths and their eggs;
- to differentiate the diagnosis of infestations by laboratory methods.
- to determine species vectors of pathogens;
- to prove the effectiveness of methods of prevention of parasitic diseases based on the methods of infection of them;
- to provide for the effect of environmental factors on the human body.

## **8. TEACHING METHODS**

1. Verbal (lecture, explanation, story, conversation, instruction);
2. Visual (observation, illustration, demonstration);
3. Practical (different types of exercises, graphic works, experiment, practice).

The training process uses the following teaching methods:

- explanatory-illustrative or informational-receptive, which provides for the ready presentation of information by the teacher and its assimilation by students;
- reproductive, which is based on the performance of various types of tasks on the sample;
- method of a problem statement - the teacher puts the problem and he solves it, demonstrating the contradictions that characterize the process of cognition, the task of students is to monitor the sequence of presentation, evidence of materiality, the prediction of the next steps of the teacher; the MN is implemented by teaching students to problem situations to ensure successful preliminary preparation for upcoming work in real conditions of practical medical institutions;
- partially search or heuristic, aims at the mastery of the separate elements of search activity, for example: the teacher formulates the problem, students hypothesis;
- research, the essence of which is to organize teacher search creative activity of students by setting new problems and problem tasks.
- methods to ensure the perception and assimilation of knowledge by students (lectures, independent work, instruction, consultation);
- methods of application of knowledge and acquisition and consolidation of skills (practical sessions, assignments);
- methods of verification and assessment of knowledge and skills.

## **9. METHODS OF CONTROL**

**9.1. Current control** is performed based on the control of theoretical knowledge, skills and abilities in practical classes. Independent study students are assessed in practical classes, and is an integral part of the final grade of the student. Current control is performed during the training sessions and aims at checking the assimilation of students learning the material. Forms of current control are:

- a) test tasks with a choice of one correct answer, with the definition of the correct sequence of actions, with determination of the conformity, defining the specific portion of the photo or diagram ("detection");
- b) individual oral questioning, interview;
- c) the solution of typical situational tasks;
- g) identification of pathogens and carriers of pathogens of parasitic diseases in the photographs, macro - and micropreparats;
- d) control of practical skills;
- e) the typical problems of genetics and medical genetics.

**9.2. Form of final control** of education is carried out in the form of the exam (written, oral) (second semester).

The semester examination is a form of final control of mastering by the student the theoretical and practical material of the discipline. The final control (exam) is held on the last control class.

To FC allowed students who attended all included in the curriculum for the discipline of classroom training and the study module scored points not less than the minimum (72

points). A student who for good or without good reason, had the missing classes, you are allowed to work on academic debt to a fixed term.

The form of the final control should be standardized and include control of theoretical and practical training.

## 10. SCHEME OF CALCULATION AND DISTRIBUTION OF POINTS RECEIVED BY APPLICANTS FOR HIGHER EDUCATION.

**Evaluation of current educational activities.** During the assessment of mastering each topic for the current educational activity of the student scores are set on a 4-point (national) assessment scale. This takes into account all types of work provided by the discipline program. The student must receive a score on each topic. Scores on the traditional scale are converted into points. The final assessment of the current academic activity is the arithmetic mean (the sum of scores for each lesson is divided by the number of lessons per semester) and translated into points according to Table 1.

The maximum number of points that a student can collect for current educational activity during semester in order to be admitted to the exam is 120 points.

The minimum number of points that a student can collect for current educational activity during semester in order to be admitted to the exam is 72 points.

Calculating of the number of points is based on obtained marks of student according to traditional scale while learning subject during the semester, by calculating the arithmetic mean (AM) that is rounded to two signs after comma.

**Table 1. Conversion of the average score for the current activity into a multi-scale scale (for disciplines completed by credit)**

4- point scale	200- point scale	4- point scale	200- point scale	4- point scale	200- point scale	4- point scale	200- point scale
5	200	4,47	179	3,94	158	3,42	137
4,97	199	4,45	178	3,92	157	3,4	136
4,95	198	4,42	177	3,89	156	3,37	135
4,92	197	4,4	176	3,87	155	3,35	134
4,9	196	4,37	175	3,84	154	3,32	133
4,87	195	4,35	174	3,82	153	3,3	132
4,85	194	4,32	173	3,79	152	3,27	131
4,82	193	4,3	172	3,77	151	3,25	130
4,8	192	4,27	171	3,74	150	3,22	129
4,77	191	4,24	170	3,72	149	3,2	128
4,75	190	4,22	169	3,7	148	3,17	127
4,72	189	4,19	168	3,67	147	3,15	126
4,7	188	4,17	167	3,65	146	3,12	125
4,67	187	4,14	166	3,62	145	3,1	124
4,65	186	4,12	165	3,6	144	3,07	123
4,62	185	4,09	164	3,57	143	3,05	122
4,6	184	4,07	163	3,55	142	3,02	121
4,57	183	4,04	162	3,52	141	3	120
4,55	182	4,02	161	3,5	140	<3	Not enough
4,52	181	3,99	160	3,47	139		
4,5	180	3,97	159	3,45	138		

**Evaluation of individual student tasks.** Points for individual tasks are accrued only if they are successfully completed and defended. The number of points awarded for different types of individual tasks depends on their scope and significance, but not more than 10-12 points. They are added to the amount of points gained by the student in the classroom during the current educational activity. In no case may the total amount for current activities exceed 120 points.

**Evaluation of independent work of students.** Independent work of students, which is provided by the topic of the lesson together with the classroom work, is evaluated during the current control of the topic in the relevant lesson. Assimilation of topics that are submitted only for independent work is checked during the final module control.

**Evaluation of final control.**

The maximum number of points that a student can score during the exam is **80 points**. The final control is considered credited if the student scored at least 60% of the maximum amount of points (for a 200-point scale - at least **50 points**).

**Determining the number of points that a student scored in the discipline:** the number of points that a student scored in the discipline is defined as the sum of points for the current academic activity and for the final control (exam).

**Conversion of the number of points from the discipline into grades on the ECTS scale and on a four-point (traditional) scale**

Scores from disciplines are independently converted into both the ECTS scale and the national assessment scale, but not vice versa. **Table 2.**

**Table 2. Conversion of the average score for the current activity into a multi-point scale (for disciplines completed by exam)**

4- point scale	120- point scale	4- point scale	120- point scale	4- point scale	120- point scale	4- point scale	120- point scale
5	120	4,45	107	3,91	94	3,37	81
4,95	119	4,41	106	3,87	93	3,33	80
4,91	118	4,37	105	3,83	92	3,29	79
4,87	117	4,33	104	3,79	91	3,25	78
4,83	116	4,29	103	3,74	90	3,2	77
4,79	115	4,25	102	3,7	89	3,16	76
4,75	114	4,2	101	3,66	88	3,12	75
4,7	113	4,16	100	3,62	87	3,08	74
4,66	112	4,12	99	3,58	86	3,04	73
4,62	111	4,08	98	3,54	85	3	72
4,58	110	4,04	97	3,49	84	<3	Not enough
4,54	109	3,99	96	3,45	83		
4,5	108	3,95	95	3,41	82		

**Criteria for establishing the assessment on the traditional 4-point and ECTS scale after passing the exam:**

Points by the multi-point (200) scale	Grade by the 4-point scale (National assessment scale)	Score ECTS
180-200	5	A
160-179	4	B
150-159		C
130-149		D
120-129	3	E
50-119	2	FX
0-49		F

**The criteria for the evaluation.**

During assessment of the assimilation of each topic for current educational activities of the applicant higher education grades are given on a national scale (traditional) scale with regard to the approved evaluation criteria:

- "excellent" (5)- student flawlessly learned the theoretical material of the topic, demonstrates deep and comprehensive knowledge of the relevant topics, the main provisions of scientific sources and recommended literature, to think logically and builds



a response, freely use the acquired theoretical knowledge in the analysis of practical material, expresses his attitude to certain issues, demonstrates a high level of mastering of practical skills;

- *"good" rating (4)* - the student has well learned the theoretical material of the lesson has the basic aspects of primary sources and recommended literature, convincingly expounds it; possesses practical skills and expressed their concerns about certain problems, but it is assumed certain inaccuracies and errors in the logic of presentation of theoretical content or performing practical skills.

- *"satisfactory" (3)* - the student has basically mastered the theoretical knowledge training topics, versed in the primary sources and recommended literature, but unconvincing answers, confuses, additional issues are the student's uncertainty or lack of stable knowledge; answering questions of a practical nature, reveals inaccuracies in knowledge, does not know how to evaluate facts and phenomena linked with the future activity, allows for errors in the performance of practical skills;

- *"unsatisfactory" (2)* the student has not mastered the learning material of the topic, knows scientific facts, definitions, is almost oriented in the primary sources and recommended literature, no scientific thinking, practical skills are not formed.

Exhibited on the traditional scale are converted in points. The minimum number of points that need to recruit a student for current educational activity per semester for admission to the exam is 120 points.

## 11. METODICAL SUPPLY

1. Work program of the discipline.
2. Calendar-thematic plans of lectures and practical classes.
4. Examples of test tasks for classes.
5. Test tasks for the exam.
6. "Test tasks for the state license exam "Krok-1. General medical training" in medical biology. For independent work of students specialty 222 "Medicine". Electronic edition (issued annually with updates, in Ukrainian, Russian and English).

## 12. RECOMMENDED LITERATURE

### 1. Basic:

1. Alters S. Biology. Understanding life. – Fifth edition. – Mosby-Year Book, 1996. – 845 p.
2. Bhatti K. A to Z in Biology: Textbook. – Forth edition. – Jahandhar City: Maanglik Printers, Focal Point, 2003. – 1246 p.
3. Kimball J.W. Cell Biology, 3rd Ed. Addison-Wesley Publishing Company, 1984. – 330 p.
4. Mader S.S. Human biology / S.S. Mader. – Seventh edition. (McGraw Hill) ISBN 0073301132. 2002. – 514 p.
5. Roberts M., Reiss M., Monger G. Advanced Biology. – Midas Printing International, Ltd, 2000. – 800 p.
6. Romanenko O.V. Medical biology: The study guide of the practical classes course / O.V. Romanenko, O.V. Golovchenko, M.G. Kravchuk, V.M. Grinkevych; Edited by O.V. Romanenko. – K.: Medicine, 2008. – 304 p.

### 2. Additional:

1. Campbell Neil A., Reece Jane B. Biology. – 7<sup>th</sup> edition. - San Francisco: Pearson Education, Inc. publishing as Benjamin Cummings, 1301 Sansome St., CA 94111, 2005. – 1231 p.
2. Parasitology II. The U.S. Army medical department center and school subcourse MD0842 Edition 200. Fort SAM Houston, Texas 78234-6100.

3. Hengge U. R., Currie B. J., Jäger G., Lupi O., Schwartz R. A. / Scabies: a ubiquitous neglected skin disease. Lancet Infect Dis. – 2006. Vol 6. – P. 769-779.
4. Gray J.S. Biology of *Ixodes* species ticks in relation to tick-borne zoonoses. Wien Klin Wochenschr. – 2002. Vol 114, N 13-14. – P. 473-478.
5. Medical Biology (lectures), Textbook for students / Bazhora Y.I., Clamazdina N.N., Nickolaevsky V.V., Chesnokova M.M. – Odessa, 2001.
6. Medical Parasitology (lecture notes) / Assafa D., Kibru E., Nagesh S., Gebreselassie S., Deribe F., Ali J. – Ethiopia Public Health Training Initiative, 2004. – 139 p.

### 3.Information Resources:

- <http://testcentr.org.ua/>
- <http://omim.org/> OMIM (Online Mendelian Inheritance in Man) – An Online Catalog of Human Genes and Genetic Disorders
- <http://elementy.ru/>
- <http://humbio.ru/>

Approved:



**В.о.Пекропа /Acting Rector**

**Mykhailo SALIUTA**