

MINISTRY OF HEALTH OF UKRAINE
ODESSA NATIONAL MEDICAL UNIVERSITY
Department of clinical immunology, genetics and medical biology



APPROVED
A.i. vice-rector for research and educational work
Professor _____ I.P. Shmakova
" 09 _____ 2021

**CURRICULUM ON EDUCATIONAL DISCIPLINE
"MEDICAL BIOLOGY"**

Level of higher education: second (master's)

Branch of knowledge: 22 «Health care»

Speciality: 222«Medicine»

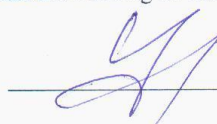
Educational-professional program: Medicine

The curriculum is composed on the base of the educational-qualification program "Medicine" for training specialists of the second (master's) level of higher education standard of higher education of Ukraine in specialty 222 "Medicine" in the field of knowledge 22 "Health care", approved by the Academic Council of ONMedU, from 04.06.2020, protocol №11.

Developers: honoured worker of science and technology of Ukraine, laureate of the State Prize of Ukraine, Doctor of Medicine, Professor: Bazhora Y.I, Phd of Medical Sciences, Associate Professor Shevelenkova A.V., Phd of Medical Sciences, Associate Professor Chesnokova M.M.

Program was discussed and approved on the methodic meeting of the department at 27.08.2021. Protocol № 1

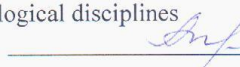
Head of the department
Professor



Goncharuk S. F.

Program was approved on the meeting of the cycle methodical committee of the medical and biological disciplines on 27.08. 2021. Protocol № 1

Head of the committee of the medical and biological disciplines
Professor



Appelhans O. L.

Program was approved on the Central methodical committee meeting of ONMedU Protocol № 1 on 30.08. 2021

1. Description of the discipline

Name of indicators	Characteristics of the discipline	
	Full-time education	
The total number of: Credits - 5.5 Hours - 165 Sections - 3	Compulsory discipline	
	Year of preparation	1
	Semester	I-II
	Lectures	20 hours
	Practical classes	70 hours
	Independent work	75 hours
	Individual tasks	0
	Form of final control	Exam

2. The purpose and tasks of the discipline

The **purpose** of the discipline is the formation of knowledge and practical skills in human biology for the further learning by the students of a block of disciplines providing natural sciences and professional and practical training.

The main **tasks** are:

1. To explain the regularities of human life manifestations at the molecular-biological, cellular and organism levels.
2. To explain the etiology of human hereditary diseases.
3. To determine the biological nature and mechanisms of the development of diseases that arise as a result of ecological factors influence.
4. To make a preliminary conclusion on the presence of parasitic human invasions and identify measures for disease prevention.

The process of studying the discipline is aimed at forming elements of the following competencies:

- Integral competencies of magister:

- Ability to solve complex problems and problems in a certain field professional activity or in the process of learning that involves conducting research and/or implementing innovations and characterized by complexity and uncertainty of conditions and requirements.

- Genera competencies:

GC1. Ability to abstract thinking, analysis and synthesis.

GC2. Knowledge and understanding of the subject area. and understanding of professional activity.

GC 3. Ability to communicate in the state language

GC 4. Ability to learn and master modern knowledge, use information and communication technologies; ability to search, process and analyze information from various sources.

GC 15. Ability to be aware of equal opportunities and gender issues; appreciate and respect diversity and multiculturalism

Special:

SC2. Ability to determine required clinical-laboratory and instrumental examinations and estimate it results.

Learning outcomes for discipline:

"Medical biology" as an educational discipline sets the foundation for the further formation of the following **program educational outcomes:**

PEO 2 Evaluate information about the diagnosis using a standard procedure, based on the results of laboratory and instrumental studies. Determine the list of necessary clinical, laboratory and instrumental studies and evaluate their results (according to list 4).

PEO 10 To plan and carry out sanitary and hygienic and preventive measures

PEO 11 Plan and implement preventive and anti-epidemic measures for infectious diseases

(according to list 2).

PEO 15 Organize the necessary level of individual safety (own and persons cared for) in case of typical dangerous situations in the individual field of activity

Upon completion of the study of the discipline "Medical biology" students must know:

- levels of living matter organization,
- life forms and their fundamental properties;
- structural and functional organization of the eukaryotic cell;
- molecular basis of heredity;
- cell cycle and types of cell division;
- basic patterns of heredity in mono- and dihybrid breeding and linked inheritance, inheritance of human blood groups by ABO system and Rh factor;
- inheritance of a sex and sex-linked characteristics;
- variation, its forms and manifestations;
- methods for the study of human heredity: genealogical, twins, dermatoglyphic, cytogenetic, molecular genetic, biochemical and population-statistical;
- classification of hereditary diseases, principles of prenatal diagnosis of hereditary diseases;
- forms of reproduction of organisms;
- characterization of gametogenesis, structure of sex cells;
- definition of ontogenesis and its periodization;
- basic stages of embryonic development, molecular and cellular mechanisms of differentiation;
- types of regeneration;
- types of transplantation, causes of tissue incompatibility;
- forms of symbiosis, parasitism as a biological phenomenon;
- principles of the classification of parasites and hosts;
- ways of transmission of parasitic diseases; obligatory vector-borne and facultative vector-borne diseases; notion of natural-focal diseases; structure of the natural focus;
- the basics of prophylaxis of parasitic diseases;
- causative agents of the most common protozoosis, trematodosis, cestodiosis, nematodosis; principles of laboratory diagnosis of helminthiasis;
- arthropods - vectors and causative agents of human diseases, the concept of mechanical and specific(biological) vectors; poisonous representatives of the Arthropods;
- the concept of a population as an elementary unit of evolution, the population structure of mankind, dems, isolates;
- functional types of people's response to environmental factors ("sprinter", "stayer", "mix"); human adaptive ecotypes;
- the concept of biological rhythms, their medical significance;
- subject of ecology; types of environment, environmental factors;
- The role of man as an environmental factor. Main directions and results of anthropogenic changes of the environment; the main statements of the biosphere and the noosphere doctrine of Academician V.I. Vernadsky;
- examples of poisonous plants and animals for humans;
- the position of *Homo sapiens* species in the system of animal world, the main stages of anthropogenesis;
- regularities of phylogeny of organ systems, ontophylogenetic birth defects, examples of atavistic defects in the development of organs and organ systems of humans.

be able:

- to make temporary slides, to study micro specimens under a light microscope at low and high magnifications;
- to differentiate the components of the animal cell on microphotographs and diagrams;
- to identify (schematically) the primary protein structure, the amount of amino acids, the molecular weight of the polypeptide based on the sequence of the nucleotides of the gene;
- to predict genotypes and phenotypes of children by the genotypes of parents;

- to calculate the probability of birth of a sick child with monogenic diseases if genotypes of parents are known:
- to exclude paternity by analyzing the blood groups of parents and the child;
- to analyze the karyotype of a person and determine the most common chromosomal diseases;
- to compose a pedigree and conduct its genealogical analysis;
- calculate the role of heredity and environment in the development of characteristics (based on the results of twins analysis);
- calculate the frequency of genes and genotypes under Hardy-Weinberg law;
- to determine the place of the biological object (agents of parasitic diseases) in the system of life;
- to diagnose on gross and micro specimens agent and vectors of parasitic diseases under study;
- to substantiate diagnostic methods and prophylaxis of human parasitic diseases, basing on the biology of the parasite.

3. Contents of the curriculum

Section 1. BIOLOGICAL PECULIARITIES OF HUMAN ACTIVITIES

Content section 1. Molecular and cellular levels of living matter organization

Topic 1. Introduction into the course of medical biology. Optical systems in biological experiences. Levels of living matter organization.

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 stage 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 on 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 the eukaryotic cell.

Structural and functional organization of eukaryotic cell

Chemical and functional organization of eukaryotic cell.

Chemical composition of the 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. Biological membranes. Transport across the cell membrane. Structural components of cytoplasm.

Cell as an open system. Assimilation and dissimilation.

Cellular membranes, their structure and functions. Compartment organization principle. Cells receptors. Transport across the cell membrane. Active and passive transport.

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

Topic 4. Structural components of nucleus. Chromosomes morphology. Human karyotype.

Structural components of nucleus: nuclear membrane, karyoplasm, chromosomes,

nucleolus. Human karyotype. Morphofunctional characteristics and classification of human chromosomes. Rules of the chromosomes. Chromosomes analysis. Nucleolus as a derivative of chromosomes, its role in ribosome production. Ideogram.

Topic 5. Organization of information flow in the cell. Organization of gene in prokaryotes and eukaryotes.

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, self- correction and repair of DNA. Genetic code and its properties. Organization of information flow in the cell. Molecular basis of heredity. Gene as a unit of the genetic function. Gene structure in prokaryotes and eukaryotes. Genes: structural, regulatory genes, tRNA and rRNA.

Topic 6. Stages of protein synthesis. Regulation of gene expression in prokaryotes and eukaryotes.

Molecular mechanisms of variation in humans. Gene as a unit of genetic function. Gene structure of prokaryotes and eukaryotes. structural genes, regulatory genes. Exon-intron organization of eukaryotic gene. Transcription. Processing, splicing. Translation: initiation, elongation, termination. Post translation modifications of the proteins. Regulation of gene expression in prokaryotes. Operon system. Peculiarities of gene activity regulation in eukaryotes. Molecular mechanisms of variation in humans.

Topic 7. Cell life cycle. Cell division. Regulation of mitotic cycle.

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. Meiosis and its biological importance.

Cultivation of cells beyond the organism. Cloning of the cells.

Content section 2. Biology of individual development.

Topic 8. Biological peculiarities of human reproduction. Meiosis. Gametogenesis. Fertilization.

Peculiarities of the human reproduction as a result of his biosocial nature.

Reproduction as a mechanism that provides morphogenetic continuity of generations. Gametogenesis. Fertilization in humans – restoration of diploid set of the chromosomes, recombination in posterity.

Topic 9. Peculiarities of the prenatal period of ontogenesis and preconditions of congenital defects in humans.

Ontogenesis: type, periods and stages.

Embryonic period of the development in human.. 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 10. Postnatal period of human ontogenesis.

Postembryonic period of ontogenesis, its periodization.

Growth and differentiation in postnatal period.

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

Biological fields, biological rhythms and its medical importance.

Types and ways of repair. Types of transplantation in humans.

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

Topic 11. Summary class on “Biological peculiarities of human activities”.

SECTION 2. HEREDITY AND VARIATION IN HUMANS.

Content section 2. Regularities of heredity and variation.

Topic 12. Peculiarities of human genetics. Mono- and dihybrid, polyhybrid crossing.

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.

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

Intermediate inheritance in humans.

Topic 13. Multiple alleles. Genetics of blood groups.

Multiple alleles.

Inheritance of blood groups of ABO and MN antigen systems. Rh-factor. Rh-conflict.

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

Topic 14. Interaction of allele and non-allele genes. Pleyotropy.

Gene interaction and its manifestations in different types of inheritance.

Interaction of the allele (dominance, incomplete dominance, overdominance, co-dominance) and non allele (complementarity, epistasis, polymery) genes. Polygenic inheritance of quantitative traits.

Primary and secondary pleyotropy.

Topic 15. Chromosomal theory of heredity. Genetics of sex.

Gene linkage. Peculiarities of linked inheritance

Chromosomal theory of heredity.

Mechanisms of crossing over: cytological proves and biological importance.

Genetic maps of human chromosomes. Methods of human chromosome mapping. Modern state of human genome studying.

Non-chromosomal heredity.

Inheritance of sex in humans. Inheritance of sex-linked diseases in humans. Sex-linked, sex-influenced and sex-limited characters. Hemizygosity. Genetics of sex.

Mechanisms of genetic differentiation in humans and its failure. Bisexual nature of humans. Psychosocial aspects.

Topic 16. Phenotypic and genetic variation, its forms and manifestation.

Variation, its forms and manifestations on the organism level: phenotypic and genotypic variation. Modification and norm of reaction. Prolonged modifications. Statistic regularities of modification. Main differences between modifications and mutations. The role of modifications in human ontogenesis.

Genotypic variation: combinative and mutational. Combinative variation, its sources, biological significance.

Topic 17. Mutations, their forms and manifestation.

Mutational variation in humans and its phenotypic manifestations. Classification of mutations: genomic, chromosomal aberrations, genetic. Somatic and germ mutations. Spontaneous and induced mutations. Natural mutagenesis, induced mutagenesis. Mutagens: physical, chemical, biological. Genetic monitoring. Genetic risk of environmental pollution. The notion of antimutagens and comutagens.

Law of homologous rows of genetic variation, its practical importance.

Content section 4. Methods of studying of human genetics. Hereditary diseases.

Topic 18. Methods of human heredity studying. Pedigree and twins methods of human genetics.

Basis of medical genetics

Man as a specific subject of genetic analysis.

Methods of human heredity studying.

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.

Dermatoglyphic, immunological methods and hybridization of somatic cells.

Topic 19. Cytogenetic method of human genetics. Chromosomal disorders.

Classification of hereditary disorders in humans

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

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

Topic 20. Biochemical method. DNA-diagnostics. Single gene disorders. Population-statistics method of human genetics. Medical-genetic consulting.

Gene (molecular) diseases: inborn errors of metabolism, diseases of the protein, amino acids, carbohydrate, lipids, nucleic acids, minerals, vitamins, hormones metabolism; Mechanisms of its development and principles of laboratory diagnosis. .

Gene engineering. Biotechnology. Gene therapy .

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

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

Medical-genetic aspects of the family. Medical-genetic counseling. Prevention of heredity diseases. Prenatal diagnosis of the heredity pathology.

Topic 21. Summary class on "HUMAN HEREDITY AND VARIATION".

SECTION 3. POPULATION, SPECIES, BIOGEOCEONOTIC AND BIOSPHERE LEVELS OF LIVING MATTER ORGANIZATION.

Content section 5. Medical protozoology.

Topic 22. Sarcodina. Dysentery amoeba and other amoeba species. Infusoria. Balantidium.

Introduction into the course of medical parasitology. The origin and evolution of parasitism.

Principles of parasites classification. The principles of interaction between the parasite and the host.

Morphological adaptation of the parasites.

The concept of intensity and extensiveness of invasion.

Prominent scientists Parasitologists: V. A. Dogiel, V. M. Beklemishev, E. N. Pavlovsky, K. I. Skryabin, O. P. Markevich, L.V. Gromashevsky etc.

Characteristics and classification of protozoa.

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

Geographical distribution, morphofunctional peculiarities, life cycle of balantidium. Ways of infection, laboratory diagnosis and prophylaxis of balantidiasis.

Topic 23. Flagellates. Lamblia, Trichomonas, Leishmania, Trypanosoma.

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

Topic 24. Apicomplexa. Malaria parasites. Toxoplasma.

Type Apicomplexa. Class Sporozoa. Geographical distribution, morphofunctional peculiarities, life cycles of malaria parasites. Ways of infection, laboratory diagnosis and prophylaxis of malaria.

Geographical distribution, morphofunctional peculiarities, life cycles of toxoplasma. Ways of infection, laboratory diagnosis and prophylaxis of toxoplasmosis
Methods of laboratory diagnosis of the diseases.

Content section 6. Medical helminthology.

Topic 25. Flat worms. Flukes – agents of the human diseases.

Medical helminthology. Flat worms – human parasites. Phylum Flat worms (*Plathelminthes*). Class Flukes (*Trematoda*) - agents of the human diseases.

Geographical distribution, morphofunctional peculiarities, life cycle of liver fluke (*Fasciola hepatica*), cat fluke (*Opisthorchis felineus*), lancet fluke (*Dicrocoelium lanceatum*), lung fluke (*Paragonimus*). Ways of infection, pathogenicity, laboratory diagnosis and prophylaxis.

Agents of metagonimosis, nanophietosis

Blood flukes – agent of parasitic diseases

Mollusks, crustacean and chordates as intermediate hosts of helminthes.

Topic 26. Flat worms. Class Cestoidea. Pork tapeworm and beef tapeworm.

Phylum Flatworms (*Plathelminthes*). Class *Cestoidea*) Geographical distribution, morphofunctional peculiarities, life cycles of pork tapeworm, beef tapeworm. Ways of infection, pathogenicity, laboratory diagnosis and prophylaxis of teniasis, cysticercosis, taeniarhynchosis.

Topic 27. Dwarf tapeworm, echinococcus, alveococcus, broad tapeworm.

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

Topic 28. Class Nematoda. Ascaris, pinworm, whipworm.

Phylum Roundworms (*Nemathelminthes*). Class *Nematoda* (*Nematoda*) Round worms as agents of the human disease. Geographical distribution, morphofunctional peculiarities, life cycle of ascaris, pinworm, whipworm. Ways of infection, pathogenicity, laboratory diagnosis and prophylaxis of ascariasis, enterobiosis, trichocephaliasis.

Topic 29. Ancylostoma, necator, trichina worm, strongiloid, Guinea worm, filarial worms.

Geographical distribution, morphofunctional peculiarities, life cycle of ancylostoma, necator, trichina worm, strongiloid. Ways of infection, pathogenicity, laboratory diagnosis and prophylaxis.

Guinea worms, filarial worms as agents of human diseases

Vector-born and natural-foci diseases

Principles and techniques of the main micro- and macroscopic methods of stool test, water, soil and etc. for detection of helminthes. Peculiarities of egg morphology of the flukes, tapeworms and roundworms. K. I. Scryabin's notion about dehelminthation and devastation, total and partial eradication of the parasites.

Content section 7. Medical arachnoentomology.

Topic 30. Arthropodes. Arachnoidea. Spiders, ticks.

Arthropods (*Arthropoda*) as pathogens and carriers of pathogens of infections and invasions. Class *Arachnoidea*. Features of morphology, nutrition and reproduction of species. Poisonous Spiders (scorpions, spiders). The medical significance of ticks as pathogens of diseases and carriers of human pathogens.

Mites - dwellers of human shelters and their medical significance.

Topic 31. Insects as agents and vectors of human diseases.

Class *Insecta*. Order *Diptera*. Flies, mosquitoes, sand flies and its medical importance.

Cockroaches, medical importance.

Midges: characteristics and importance as intermediate hosts of helminths.

Order Lice (*Anoplura*), Fleas (*Aphaniptera*), Bugs (*Hemiptera*). Medical importance of lice, fleas, bugs and as agents and vectors of the infectious diseases.

Topic 32. Summary class on “POPULATION, SPECIES, BIOGEOCEONOTIC AND BIOSPHERE LEVELS OF LIVING MATTER ORGANIZATION”.

Content module 8. Interaction between ontogenesis and phylogenesis. Biosphere and human being.

Topic 33. Synthetic theory of evolution. Phylogenesis of skin, skeleton, digestive, respiratory, and circulatory systems of Vertebrates.

Synthetic theory of evolution. Peculiarities of evolution factors in human populations. Population structure of mankind. Anthropogenesis. Human races as reflection of adaptation rules in human evolution.

Notion about macro- and microevolution. Biogenetic law.

Evolution of skin, skeleton, digestive, respiratory, circulatory nervous, excretory and reproductive systems. The onto-phylogenetically based (ancestral) congenital defects in humans.

Topic 34. Biosphere as human environment. Human ecology. Adaptation for environment. Stress.

Structure and functions of biosphere. Main aspects of the V. I. Vernadsky notion about biosphere organization. Noosphere. Modern concepts of biosphere. Mankind as an active geological force. Protection of biosphere in national and international programs.

Human ecology. Environment as ecological concept. Kinds of environment. Factors of environment. Types of ecosystems. Anthropocenosis. Anthropogenic migration of elements. Ecological prediction. Healthy, discomfort, extreme environment. Adequate and inadequate environmental conditions. Human adaptation to extreme conditions. Adaptive ecological types of humans: arctic, tropic, zones of temperate climate, deserts, highland.

Characteristics of poisonous plants, fungi, animals.

Topic 35: Summary test control.

5. Structure of the discipline “Medical biology”

№	Topic	Total	Lectures	Practical classes	SIW
Section 1. Biological peculiarities of human activities					
Content section 1. Molecular and cellular levels of living matter organization					
1	Introduction into the course of medical biology. Optical systems in biological studies. Levels of organization and fundamental characters of living matter.	4	1	2	1
2	Morphology of the eukaryotic cell.	4	1	2	1
3	Biological membranes. Transport across the cell membrane. Structural components of cytoplasm.	3	-	2	3
4	Structural components of the nucleus. Chromosomes morphology. Human karyotype.	3	-	2	1
5	Organization of information flow in the cell. Gene structure in prokaryotes and eukaryotes.	4	1	2	1
6	Stages of protein synthesis. Regulation of gene expression in prokaryotes and eukaryotes.	4	1	2	1
7	Cell life cycle. Cell division. Regulation of mitotic cycle.	5	-	2	3
Content section 2. Biology of individual development					

8	Biological peculiarities of reproduction in humans. Meiosis. Gametogenesis. Fertilization.	3	-	2	1
9	Peculiarities of the prenatal period of ontogenesis and preconditions of congenital defects in humans.	5	2	2	1
10	Postnatal period of human ontogenesis.	9	2	2	5
11	Summary class on "Biological peculiarities of human activities".	5	-	2	3
Section 2. Heredity and variation in humans.					
Content section 3. Regularities of inheritance and variation					
12	Peculiarities of human genetics. Mono- and dihybrid, polyhybrid crossing. Mendelian characters in human.	4	1	2	1
13	Multiple alleles. Blood groups genetics.	3,5	0,5	2	1
14	Interaction of allele and non-allele genes. Pleiotropy.	3,5	0,5	2	1
15	Chromosomal theory of heredity. Genetics of sex.	3	-	2	1
16	Phenotypic and genetic variation, its forms and manifestation.	5	1	2	2
17	Mutation variation, its forms and manifestations.	5	1	2	2
Content section 4. Methods of studying of human genetics. Hereditary diseases					
18	Bases of human genetics. Methods of studying of human genetics. Pedigree and twins methods of human genetics.	5,5	0,5	2	3
19	Cytogenetic method of human genetics. Chromosomal disorders.	4	1	2	1
20	Biochemical method. DNA-diagnostics. Population-statistics of human genetics. Single gene disorders. Medical-genetic counselling.	5,5	0,5	2	3
21	Summary class on "Human inheritance and variation".	5	-	2	3
Content 3. Population, species, biogeocenotic and biosphere levels of living matter organization. Content section 5. Medical protozoology.					
22	Protozoa. Sarcodina. Dysentery amoeba and other amoeba species. Infusoria. Balantidium.	4	1	2	1
23	Flagellates. Lambliia, Trichomonas, Leishmania, Trypanosoma.	3	-	2	1
24	Apycomplexa (Sporozoa). Malaria parasites. Toxoplasma.	3	-	2	1
Content section 6. Medical helminthology					
25	Flat worms. Flukes. Liver fluke, cat fluke, Chinese liver fluke, lung fluke and lancet fluke.	6	1	2	3
26	Tapeworms. Pork (armed) and beef (unarmed) tape worms.	3	-	2	1
27	Tapeworms. Dwarf tapeworm, echinococcus, alveococcus, broad tapeworm.	3	-	2	1
28	Roundworms. Ascaris, pinworm, whipworm.	3	-	2	1
29	Roundworms. Hookworm, American hookworm, trichina worm, Guinea worm.	5	-	2	3
Content section 7. Medical arachnoentomology					
30	Arthropodes. Arachnoidea. Spiders, Ticks.	4	-	2	2

31	Insects as agents and vectors of human diseases.	5		2	3
32	Summary class on “Population, species, biogeocoenotic and biosphere levels of living matter organization”	5	-	2	3
Content module 8. Interaction between ontogenesis and phylogenesis. Biosphere and human being					
33	Synthetic theory of evolution. Phylogenesis of organ systems of vertebrates.	7	2	2	3
34	Biosphere as a system of human existence. Human ecology. Adaptation and stress.	6	2	2	2
35	Summary test control	4	-	2	2
	Independent preparation for the exam	11	-		11
	Total (hours)	165	20	70	75

5. Topics of the lectures

№	Topic	Hours
1	Introduction into the medical biology. Structural and functional organization of the cell.	2
2	Molecular basis of heredity. Realisation of hereditary information.	2
3	Molecular – genetic mechanisms of ontogenesis. Ontogenesis failure and its role in human pathology.	2
4	Modern aspects of regeneration and transplantation. Biological mechanisms of homeostasis.	2
5	Organism level of organization of genetic information. Interaction of genes.	2
6	Variation of man as a property of life and genetic phenomenon	2
7	Basics of human genetics. Methods of medical genetics.	2
8	Medical- biological bases of parasitism.	2
9	Synthetic theory of evolution. Peculiarities of elementary evolutionary factors in human population.	2
10	Biosphere as a system that ensures human existence.	2
	Total	20

6. Topics of the practical classes

№	Topic	Hours
1	Optical systems in biological studies. Levels of organization and fundamental characters of living matter.	2
2	Morphology of the eukaryotic cell.	2
3	Biological membranes. Transport across the cell membrane. Structural components of cytoplasm.	2
4	Structural components of nucleus. Chromosomes morphology. Human karyotype.	2
5	Organization of information flow in the cell. Gene structure of prokaryotes and eukaryotes.	2
6	Stages of protein synthesis. Regulation of gene expression in prokaryotes and eukaryotes.	2
7	Cell life cycle. Cell division. Regulation of mitotic cycle.	2
8	Meiosis. Gametogenesis. Fertilization.	2
9	Peculiarities of the prenatal period of ontogenesis and preconditions of congenital defects in humans.	2

10	Postnatal period of human ontogenesis.	2
11	Summary class on “Biological peculiarities of human activities”.	2
12	Peculiarities of human genetics. Mono- and dihybrid, polyhybrid crossing. Mendelian characters in human.	2
13	Multiple alleles. Blood groups genetics.	2
14	Interaction of allele and non-allele genes. Pleiotropy.	2
15	Chromosomal theory of heredity. Genetics of sex.	2
16	Phenotypic and genotypic variation.	2
17	Mutation variation, its forms and manifestations	
18	Pedigree and twins methods of human genetics.	2
19	Cytogenetic method of human genetics. Chromosomal disorders.	2
20	Biochemical method. DNA-diagnostics. Population-statistics of human genetics. Single gene disorders. Medical-genetic counseling.	2
21	Summary class on “Human heredity and variation”.	2
22	Protozoa. Sarcodina. Dysentery amoeba and other amoeba species. Infusoria. Balantidium.	2
23	Flagellates. Lamblia, Trichomonas, Leishmania, Trypanosoma.	2
24	Apycomplexa (Sporozoa). Malaria parasites. Toxoplasma.	2
25	Flat worms. Flukes. Liver fluke, cat fluke, Chinese liver fluke, lung fluke and lancet fluke.	2
26	Tapeworms. Pork (armed) and beef (unarmed) tape worms.	2
27	Tapeworms. Dwarf tapeworm, echinococcus, alveococcus, broad tapeworm.	2
28	Roundworms. Ascaris, pinworm, whipworm.	2
29	Roundworms. Hookworm, American hookworm, trichina worm, Guinea worm.	2
30	Arthropodes. Arachnoidea. Spiders, Ticks.	2
31	Insects as agents and vectors of human diseases.	2
32	Summary class on “population, species, biogeocoenotic and biosphere levels of living matter organization”..	2
33	Chordata. Phylogenesis of organ systems of vertebrates.	2
34	Human ecology. Adaptation and stress.	2
35	Summary test control	2
	Total	70

7. Independent work

№	Topic	Hours
1	Work on the themes that are not included into the plan of classroom work	
	Content section 1. Molecular –cellular level of life organization	
1.1.	Cell culturing beyond the organism. Cell cloning	2
	Content section 2. Biology of individual development	
1.2.	Aging as a final stage of ontogenesis. Theory of aging.	2
1.3	Notion of biological fields, biological rhythms and their medical significance	2
	Content section 3. Regularities of heredity and variation	
1.4.	Genetic danger of environmental contamination. Notion of antimutagenes and co-mutagenes	2
	Content section 4. Methods of studying of human genetics. Hereditary diseases	
1.5.	Gene engineering. Biotechnologies. Notion of gene therapy.	2
1.6.	Methods of human genetics: dermatoglyphic, immunologic, hybridization of somatic cells	2
	Content section 6. Medical helminthology	

1.7.	Blood flukes – causative agents of human diseases. Causative agents of metagonimosis, nanophytosis	2
1.8.	Guinea worm and filaria – causative agents of human diseases	2
Content section 7. Medical arachnoentomology		
1.9.	Mites – habitants of human shelters, its medical importance	1
1.10	Midges: characteristics and importance as intermediate hosts of helminthes.	2
Content section 8. Interaction of individual and historical development. Biosphere and a human being.		
1.11.	Origin of the human. Human races as reflection of adaptation laws of human evolution.	2
1.12.	Plants and animals poisonous to a human	1
2.	Preparation for practical classes	31
3.	Preparation for Summary test control	2
4.	Preparation for content section controls	9
5	Preparation for exam	11
	Total	75

8. Individual tasks

Not provided

9. Teaching methods

Lectures. Verbal and visual teaching methods are used - explanatory-illustrative method (students gain knowledge by listening to a lecture and studying illustrative material in the form of multimedia presentations).

Practical classes: conversation, explanations, case studies, practical work.

Independent work: independent work with the textbook, independent work with the data base of MCQ tasks for Krok-1, independent case studies.

10. Methods of control and evaluation criteria of educational outcomes

Summary control is carried out on the basis of control of theoretical knowledge, practical skills and abilities: recitation, testing, assessment of practical skills conducting, case studies, assessment of activity in the classroom.

Final control: oral exam, testing.

The structure of the current assessment in the practical lesson:

1. Assessment of theoretical knowledge on the topic of the lesson:
 - methods: recitation, interview, case studies;
 - maximum grade - 5, minimum grade - 3, unsatisfactory grade - 2.
2. Assessment of practical skills and abilities on the topic of the lesson:
 - Case studies, methods: assessing the accuracy of practical skills conducting
 - maximum score - 5, minimum score - 3, unsatisfactory score - 2;

Criteria for current assessment in the practical lesson:

«5»	The student is fluent in the material, takes an active part in the discussion and case studies, confidently demonstrates practical skills during performing and interpreting of practical work on the topic of the lesson, expresses his opinion on the topic of the lesson.
«4»	The student is well versed in the material, participates in the discussion and case studies, demonstrates practical skills while performing practical work with some mistakes, expresses his opinion on the topic of the lesson.
«3»	The student does not have enough knowledge in theoretical material, insecurely participates in the discussion and case studies, performs practical work with significant errors.
«2»	The student does not have knowledge in theoretical material, does not participate in the discussion and case studies, does not demonstrate practical skills during the practical work on the topic of the lesson.

An obligatory component of the implementation of the curriculum "Medical Biology" is

the final test control of the discipline, which includes 50 test questions (30 minutes), as an indicator of students' acquisition of knowledge. Test control is carried out in the Training and Production Complex of Innovative Technologies of Teaching, informational support and Continuing Education of ONMedU at the last lesson according to the schedule of the educational department, approved by the rector of the university. The student must provide the correct answers by at least 90% (45 questions).

A student who has not passed the final test control in the discipline is considered to have failed the program in the discipline.

At the end of the discipline, the current performance is calculated - the average current score (arithmetic mean of all current grades on a traditional scale, rounded to two decimal places). The current grades "3" or "4" are not reattempted in aim to increase the average score in the discipline.

If a student receives a minimum grade point average of 3.00 for current academic performance, even if there are unsatisfactory grades, he receives a credit for the discipline.

Evaluation of independent work.

Independent work of students, which is included in the topic of the lesson along with the auditory work, is evaluated during current control of the topic on the proper lesson. Mastering of themes which are placed out only on independent work is checked during the exam.

Final control of the discipline - Exam.

The exam is held at the stage of completion of the student's study of the discipline. A student is allowed to take the discipline exam if he has performed all types of work provided for in the working curriculum and has not passed the final test control in the discipline and has received a minimum grade point average of 3.00 for current academic performance.

The results of the exams are evaluated on a 4-point national scale ("excellent", "good", "satisfactory", "unsatisfactory").

Exam structure

The content of the evaluation activity	Number
Answer to theoretical questions	2
Practical task on medical genetics	1
Practical task for parasite identification	2

Criteria for assessing the educational outcomes of students at the exam:

«5»	is given to the student who systematically worked during a semester, showed during examination various and deep knowledge of a program material, is able to successfully carry out tasks which are provided by the program, has mastered the maintenance of the basic and additional literature, has understood interrelation of separate sections of discipline. importance for the future profession, showed creative abilities in understanding and using educational material, showed the ability to independently update and replenish knowledge; level of competence - high (creative);
«4»	is given to a student who has shown full knowledge of the curriculum, successfully completes the tasks provided by the program, mastered the basic literature recommended by the program, showed a sufficient level of knowledge in the discipline and is able to independently update and renew during further study and professional activity; level of competence - sufficient (constructive-variable);
«3»	is given to the student who has shown knowledge of the basic educational program material in the volume necessary for the further training and the subsequent work on a profession, copes with performance of the tasks provided by the program, has made separate mistakes in answers on examination and during conducting of examination tasks, but has the necessary knowledge to overcome mistakes under the guidance of a researcher; level of competence - average (reproductive);
«2»	is given to the student who did not show sufficient knowledge of the basic educational

and program material, made fundamental mistakes in performance of the tasks provided by the program, cannot use the knowledge at the further training without the teacher's help, failed to master skills of independent work; level of competence - low (receptive-productive).
--

11. Distribution of grades obtained by applicants for higher education

The grade obtained for the answer to the exam and the score of the average current performance during the study of the discipline are used to calculate the arithmetic mean, which is the overall grade for the discipline. The average score for the discipline is transformed into a national grade and converted into scores on a multi-point scale.

Converting of the traditional grade from the discipline to 200-point is performed by the information and computer center of the university program "Contingent" by the formula: average grade point of success (current /in discipline) x 40

National grade for the discipline	Total grades for the discipline
«5»	185-200
«4»	151-184
«3»	120-150

Further calculations are made by the information and computer center of the University.

According to the points got on a 200-point scale, students are evaluated on a rating scale ECTS. Students enrolled in one course (one specialty) based on the number of points scored in the discipline are ranked on a scale according to ECTS system by the following way:

ECTS Point	Statistics indicator
«A»	The best 10 % of the students
«B»	Next 25 % students
«C»	Next 30 % students
«D»	Next 25 % students
«E»	The last 10 % students

Marks ranging "A", "B", "C", "D", "E" are made by the Dean office or by any other structural department according to the Academic council decision by the educational department for the students of the definite course, which have the same specialty and **successfully** finished the discipline study.

12. List of control questions for the exam

1. Definition of biology as a science. The place and the goals of biology in medical education.
2. Definition of life according to a modern level of biology science.
3. Cell as an elementary structural and functional unit of living matter.
4. The pro- and eukaryotes.
5. Cell theory, its modern state and importance for medicine.
6. Morphology and physiology of the cell. Cytoplasm and organelles.
7. Cell membranes. Chemical composition of the cytoplasmic membrane. Its structure.
8. Active and passive transport. Examples.
9. The structure of the cell nucleus. Its function. Chromatin and levels of organization of hereditary material. Give the definition of euchromatin and heterochromatin.
10. Chemical composition of chromosomes. The structure of chromosomes in metaphase of mitosis. Shapes of chromosomes.
11. Karyotype of human. The classification of human chromosomes. The significance of the karyotype studying in medicine.
12. Nucleic acids. DNA structure and functions.

13. RNA. Types of RNA, its function
14. The structure of eukaryotic gene. Classification of genes.
15. What is DNA replication? DNA proof-reading and reparation.
16. The genetic code and its properties.
17. The main stages of protein biosynthesis in the cell.
18. What is translation? Initiation, elongation, termination. Posttranslational modification.
19. Peculiarities of realization of hereditary information in eukaryotes. Exons and introns organization of eukaryotic genes. Processing, splicing.
20. Regulation of genes expression in pro- and eukaryotes. Operon
21. Cell cycle, its periods. Interphase and its stages.
22. Mitosis. Failure of mitosis.
23. Meiosis. Mechanisms of genetic variation in gametes.
24. Subject and goals of human genetics and medical genetics. Heredity and variation. Allele genes. Homozygotes and heterozygotes.
25. Genotype, phenotype
26. Monohybrid cross. First and second Mendel's laws. Mendelian characters in man. Single gene disorders.
27. Di and polyhybrid cross. Third Mendel's law
28. Multiple alleles. Inheritance of ABO blood groups and Rh-factor. Significance for medicine.
- Rh-conflict.
29. Interaction of allelic genes: dominance, incomplete dominance, co-dominance.
30. Interactions of non-allelic genes: complementary, epistasis, polymery.
31. Pleyotropy.
32. Linked inheritance of genes (the law of Morgan). Crossing over.
33. Chromosomal theory of inheritance.
34. Inheritance of sex in humans. Chromosomal disorders caused by abnormal number of sex chromosomes.
35. Sex-linked inheritance
36. Variation, its forms and importance for ontogenesis and evolution.
37. Modification, its characteristics. Norm of reaction. Phenocopy.
38. Genotypic variation, its forms. Recombination. Mechanisms of origin and significance.
39. Mutations and its phenotypic manifestations. Classification of mutations according to the genotype changes.
40. Gene mutations, mechanisms of origin. The concept of single gene disorders.
41. Chromosomal aberrations. Mechanisms. Examples of the diseases.
42. Genome mutations (numerical chromosomal aberration) and it origin (polyploidy, haploidy, monosomy, polysomy).
43. Hereditary disorders caused by abnormal number of autosomes and sex chromosomes.
44. Mutations in germ and somatic cells, their significance. Mosaicism.
45. Spontaneous and induced mutations. Mutagenic agents, it classification. Genetic monitoring.
46. Disorders with hereditary predisposition. Concept of multifactorial disorders.
47. Methods of medical genetics. Human as a specific subject of genetic analysis.
48. Genealogic method (pedigree analysis) and twins methods of medical genetics.
49. Biochemical method for the study of genetic diseases. Screening programs.
50. Cytogenetic methods of medical genetics.
51. Medical genetic aspects of a family. Medical genetic concealing. Prenatal diagnostics of hereditary diseases
52. Population-statistical method of human genetics.
53. Multiplication as universal characteristics of life. Forms of multiplication. Possibility of organism cloning.
54. Gametogenesis. Spermatogenesis and oogenesis. Human germ cells.

55. Fertilization. Peculiarities in human
56. Ontogenesis, its periods. Embryonic development, its stages. Provisory organs.
57. Molecular and cellular mechanisms of differentiation
58. Differentiation of germ layers and tissues. Embryonic induction. Cloning of tissues and organisms.
59. Critical periods of embryonic development in human. Teratogenic factors.
60. Modern classification of congenital abnormalities: hereditary, teratogenic, multifactorial, embryopathy, fetopathy, phylogenetic (ancestral) and non-phylogenetic.
61. Postnatal development of man and its periodization. Neuro-hormonal regulation of growth and development.
62. Aging as a stage of ontogenesis. Theories of aging. The concept of gerontology and Geriatrics.
63. Clinical and biological death. Thanatology.
64. Regeneration of tissues and organs. Types of regeneration, importance for medicine.
65. Tumor growth
66. Problems of transplantation. Types of transplants (grafts). Problem of graft rejection.
67. Homeostasis. Mechanisms of its regulation on different levels of organization of living matter.
68. Vector-borne (transmissible) disease. Facultative-transmissible and obligate-transmissible diseases. Specific and mechanical vectors.
69. Classification of parasites (obligate, facultative, temporary, constant, endo- and exoparasites). The definitive and intermediate hosts.
70. Natural focal diseases. The components of the natural focus. Examples of diseases. Anthroponotic and zoonotic diseases.
71. Giardia Lamblia, the name of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of disease
72. Trichomonas vaginalis, the name of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of disease.
73. Agents of cutaneous and visceral leishmaniasis, the names of diseases, morphology, life cycles of parasites. Way of transmission, the principles of diagnosis and prevention of diseases.
74. Trypanosoma species, names of the diseases, morphology, life cycles of parasites. Way of transmission, the principles of diagnosis and prevention of the diseases.
75. Dysentery amoeba, name of the disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
76. Balantidium, name of the disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
77. Plasmodium (malaria parasite), the names of the diseases, morphology, life cycles of parasites. Way of transmission, the principles of diagnosis and prevention of the disease.
78. Toxoplasma, the names of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
79. Phylum Plathelminthes. Classification, morphological and physiological peculiarities, medical importance. Concept of bio- and geohelminths. Examples.
80. Liver fluke, the names of disease, morphology, life cycles of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
81. Cat (Siberian) fluke, the names of disease, morphology, life cycle of parasites. Way of transmission, the principles of diagnosis and prevention of the disease.
82. Lung fluke, the names of diseases morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
83. Chinese, lancet, blood flukes. The names of diseases, morphology, life cycles of parasites. Way of transmission, the principles of diagnosis and prevention of the diseases.
84. Pork (armed) tapeworm, the names of diseases, morphology, life cycle of parasites. Way of transmission, the principles of diagnosis and prevention of the diseases.
85. Beef (unarmed) tapeworm, the names of disease, morphology, life cycle of parasite. Way of

- transmission, the principles of diagnosis and prevention of the disease.
86. Cysticercosis. Modes of transmission and prevention measures.
 87. Dwarf tapeworm, the names of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
 88. Echinococcus and alveococcus. The names of diseases, morphology, life cycles of parasites. Way of transmission, the principles of diagnosis and prevention of the diseases.
 89. Broad (fish) tapeworm, the names of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
 90. Ascaris, the names of disease, morphology, life cycle of parasites. Way of transmission, the principles of diagnosis and prevention of disease. Larva of animal round worms as the agents of the diseases (*Larva migrans* syndrome).
 91. Pinworm. The name of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
 92. Whipworm, the names of disease, morphology, life cycles of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
 93. American hookworm and hookworm, the names of diseases, morphology, life cycles of parasites. Way of transmission, the principles of diagnosis and prevention of the diseases.
 94. Trichina worm, the name of disease, morphology, life cycle of parasites. Way of transmission, the principles of diagnosis and prevention of diseases.
 95. Guinea worm. The name of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
 96. Filaria worms: *Wuchereria Bancrofti*, *Brugia*, loa loa, *onchocercus*. The names of diseases, morphology, life cycles of parasites. Way of transmission, the principles of diagnosis and prevention of the diseases.
 97. Laboratory diagnostics of helminthes. Ovo-, larvo- and helminthoscopy.
 98. Phylum Arthropoda. Classification, morphology, medical importance. Poisonous Arthropods.
 99. Mites as human pathogens (itch mite and follicle mite).
 100. Ticks as the vectors of human diseases (*Ixodidae*, *Gamasidae* and *Argasidae* ticks).
 101. Flies. Species of the flies. Peculiarities of the morphology and life cycle, medical importance.
 102. Mosquitoes. Species, peculiarities of the structure and development, medical importance.
 103. Lice. Species, morphology and life cycle, medical importance.
 104. Fleas. Morphology and life cycle. Species of fleas. Bed bug and its medical importance.
 105. Synthetic theory of evolution.
 106. Structure of human population. Dem, isolate.
 107. Influence of the mutations, migration, isolation and drift of genes on the genetic structure of human populations. Peculiarities of natural selection in human populations.
 108. Problems of genetic load and an influence of mutagens (radiation, chemical ones) on human population. Functional types of people respond to environmental stress ("sprinter", "stayer", "mixt").
 109. Doctrine of biosphere and noosphere. Characteristics of living matter.
 110. Medical and biological aspects of biosphere influence on human health. Biological fields and biorhythms, it medical importance.
 111. Onto- and phylogenesis interreletion. The biogenetic law of Heckel and Muller.
 112. Atavistic (ancestral) congenital malformations in human.
 113. Phylogenesis of the integument of chordates. Congenital ancestral defects.
 114. Comparative review of the skeletal system of the chordates. Congenital ancestral defects.
 115. Phylogenesis of the digestive system of the chordates. Congenital ancestral defects.
 116. Phylogenesis of the nervous system of the chordates. Congenital ancestral defects.
 117. Phylogenesis of the cardiovascular system of the chordates. Congenital ancestral defects.
 118. Phylogenesis of the respiratory system of the chordates. Congenital ancestral defects.
 119. Phylogenesis of the urogenital system of the chordates. Congenital ancestral defects.

120. Main stages of anthropogenesis. Position of the *Homo sapiens* in Classification of the animal world.
121. Ecology. Environment as an ecological notion. Types of environment. Ecological factors. The unity of an organism and environment.
122. Biological variation in humans as the reflection of biogeographic peculiarities of the environment. Adaptive ecotypes of man.
123. Man as an environmental factor. The main directions and results of anthropogenic environmental changes. Protection of the environment.
124. Plants, fungi and animals poisonous for human.

List of practical skills and abilities:

- to master the technique of microscoping
- to prepare temporary specimens
- to differentiate cell components on micrographs
- to identify the primary structure of polypeptide, amino acids number, molecular weight of it by the sequence of nucleotides in gene
- to analyze a human karyotype, to identify chromosomal disorder and type of mutation
- to determine genotypes and phenotypes of offspring by the genotypes of the parents
- to exclude paternity by determining blood groups of parents and child
- to calculate the probability of birth of a sick child with monogenic diseases if genotypes of parents are known
- to choose appropriate methods for the study of human heredity for diagnosis of various genetic diseases
- to compose a family tree and analysis it
- calculate the role of heredity and environment in the development of characteristics (based on the results of twins analysis);
- calculate the frequency of genes and genotypes under Hardy-Weinberg law;
- to determine the place of the biological object (agents of parasitic diseases) in the system of life;
- to identify on gross and micro specimen and microphotographs the agents of parasitic diseases on different life stages;
- to substantiate diagnostic methods of human parasitic diseases
- to identify on gross and micro specimen and microphotographs arthropods that have medical importance as venomous animals and vectors of human diseases
- to propose the preventive measures of parasitic diseases based on their modes of infection

List of specimen that should be determined during the final control of medical

biology:

Giardia lamblia	Ascaris
Trichomonas vaginalis	Pinworms
Disenteric Amoeba	Whipworm
Malarial plasmodium	Ancylostoma
Toxoplasma	Trichinella' encapsulated larvae
Liver fluke	Karakurt
Cat (Siberian) fluke	Tarantula
Mature proglottid of armed (pork) tapeworm	Itch mite
Mature proglottid of unarmed (beef) tapeworm	Follicle mite
Larva of a armed (pork) tapeworm	Dog (taiga) tick
Larva of a unarmed (beef) tapeworm	Larvae of ticks Ixodes
Dwarf tapeworm	Pasture tick
Echinococcus larva	Head louse
Mature proglottid of a broad tapeworm	Body louse
	Pubic louse
	Human flea

Bed bug
Eggs of malarial mosquitoes
Eggs of non malarial mosquitoes
Larvae of malarial mosquitoes
Larvae of non malarial mosquitoes
Pupae of non malarial mosquitoes

Pupae of malarial mosquitoes
Female head of malarial mosquitoes
Male head of malarial mosquitoes
Female head of non malarial mosquitoes
Male head of non malarial mosquitoes

13. Methodological support:

- Curriculum of the discipline;
- Syllabus of the discipline;
- Power point presentations of lectures;
- Methodological recommendations and developments for the teacher;
- Methodical instructions for students for practical classes;
- Methodical materials providing independent work of students;
- Electronic data bank of MCQ tasks by sections of the discipline.

14. List of recommended materials

Main literature

1. Medical biology. Yu. I. Bazhora, R. Ye. Bulyk, M.M. Chesnokova, A. V. Shevelenkova, O.O. Smetyuk, Yu. V. Lomakina. - Vinnytsya: Nova Knyha – 2019. - P.448

Additional literature

1. Emery's Elements of medical genetics. 15th ed. / Peter Turnpenny, Sian Ellard. – Elsevier, 2017. – 400 pp.
2. Young Ian. D. Medical genetics. – 2nd ed. – Oxford university press, 2010. – 304 pp.
3. Vogel and Motulsky's human genetics. Problems and approaches / M. R. Speicher, S. E. Antonarakis, F. G. Motulsky. 4th addition. – Springer, 2010. – 981 pp.
4. Human parasitology / Bruton J. Bogitsh, Clint E. Carter. – 4th ed. – Elsevier, 2013. – 430 pp.
5. Markell and Voge's Medical parasitology / David. T. John, William A. Petri. – 9th ed. – Elsevier, 2017. – 463 pp.
6. Chiodini P. L. Atlas of Medical Helminthology and Protozoology 4th ed. – Churchill Livingstone, 2003. – 87 pp.
7. Langman's medical embryology / T. W. Salder. – 13th ed. – Wolter Kluwer Health, 2015. – 423 pp.
8. Before we are born : Essentials of embryology and birth defects / Keith L. Moore, T. V. N. Persaud, Mark G. Torchia. – 8th ed. – Elsevier, 2013. – 348 pp.
9. Medical genetics/ Lynn B. Jorde, John C. Carey, Michael J. Bamshad. – 4th ed. – Elsevier, 2010. – 368 pp.
10. Campbell biology / Lisa Urry, Michael Cain, Steven Wasserman, Peter Minorsky, Jane Reece. – 11th restricted ed. – Hoboken : Pearson Higher Education, 2016.

15. Information resources:

1. Testing Center - the base of licensing test tasks "Krok" - 1: <http://testcentr.org.ua/>
2. OMIM (Online Mendelian Inheritance in Man) – An Online Catalog of Human Genes and Genetic Disorders <http://omim.org/>
3. The tech interactive: <https://genetics.thetech.org/genetics-news>
4. Phys.org internet news portal provides the latest news on science. <https://phys.org/biology-news/>
5. Sci-News.com provides the latest science news from around the world, covering breaking news in astronomy and astrophysics, archaeology, paleontology, medicine, biology, physics, genetics & more <http://www.sci-news.com/news/biology>

6. link to the most thought-provoking, well researched online items in the world of science and technology <https://scitechdaily.com/news/biology/>