

MINISTRY OF HEALTH OF UKRAINE
ODESSA NATIONAL MEDICAL UNIVERSITY
Clinical immunology, genetics, and medical biology department



APPROVED

Vice-rector of Odessa National Medical University on
educational work,
Professor

I.P.Shmakova

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CURRICULUM
ON EDUCATIONAL DISCIPLINE
“BIOLOGY WITH BASIS OF GENETICS”

The level of high education: second (magister)

Branch of knowledge: 22 “Health Care”

Speciality: 226 “Pharmacy, industrial pharmacy”

Educational- professional program: Pharmacy, industrial pharmacy

Odessa 2021-2022

Curriculum is proposed on the base of the educational- professional program “Pharmacy” for education of specialists of second(magister) level of high education for the speciality 226 “Pharmacy” of the branch of knowledge 22 “Health Care” approved by the Scientific Committee of ONMedU at 04.06.2020, Protocol № 11

Proposal writer: senior teacher O.M. Komlevyi, assistant Kondrusina O.V.

Program was discussed and approved on the methodical meeting of the department at “_27_” _____ 08 _____ 2021, Protocol № 1 .

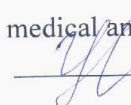
Head of the department
Professor



S. F. Goncharuk

Program was discussed and approved on the meeting of the cycle methodical committee of the medical and biological disciplines “_27_” _____ 08 _____ 2021. Protocol № 1 .

Head of the committee of the medical and biological disciplines
Professor



L.M. Unguryan

Program was approved on the Central methodical committee meeting of ONMedU at “_30_” _____ 08 _____ 2021. Protocol № 1

N a	Characteristic of the educational discipline	
	Full-time form of study	
T Credits – 3,5 Hours – 120 Content parts a-7 l n u	obligatory	
	The year of study	
	semester	I - II
	lectures	hours
	practical	hours
	Individual work	hours
	Including individual tasks	
T	Differential credit	

The goal and tasks of the educational discipline

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1. To explain regularities of the vital functions of organism of a man at molecular-biological and cellular levels of living matter organisation;
 2. T
 3. To determine biological essence and mechanisms of development of disease, which arise up as a result of anthropogenic changes in an environment.
 4. To explain essence and mechanisms of phenotypic manifestation of hereditary disorders in a man.
 5. To make a preliminary conclusion about parasitic invasion in a man
 6. T

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

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- SC - An ability to explain essences for diagnostics and prevention of parasitic diseases, on a base of parasitic life cycles, their location and ways of transmission.
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Expected learning outcomes. At the end of the course students have to:

- know:**
- levels of living matter organization;
 - forms of life and their fundamental properties;
 - structural and functional organization of eukaryotic cell;
 - molecular bases of heredity;
 - cell cycle and types of cell division;
 - main laws of heredity in mono-, di- and polyhybrid crossing and linked inheritance;
 - genetic inheritance of blood groups by ABO antigen system and of rhesus factor;
 - genetic inheritance of sex in human and sex-linked characters;
 - variation, its forms and properties;
 - methods of human genetics: pedigree, twins, dermatoglyphic, cytogenetic, molecular-genetic, biochemical and population-statistic methods;
 - classification of hereditary diseases and principles of prenatal diagnosis of hereditary diseases;

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- forms of reproduction of organisms;
- gametogenesis, forms of sex cells;
- definition of ontogenesis and its periodization;
- main stages of embryogenesis, molecular and cellular mechanisms of differentiation;
- types of regeneration;
- types of transplantation, reasons of tissue incompatibility;
- forms of symbiosis, parasitism as biological phenomenon;
- principles of classification of parasites and hosts;
- ways of transmission of parasitic diseases: obligate transmissible, facultative transmissible diseases;
- natural focal diseases, structure of natural focus;
- methods of hereditary diseases determination;
- elements of human ecology;
- biological basics of parasitism;
- vector-borne and natural focal disease.

Able:

- to solve case studies of the main discipline sections;
- to differentiate cell components;
- to make ideogram of human chromosomes;
- to identify the primary structure, number of amino acids, molecular weight of polypeptide structure of the gene encoding it;
- to analyze the structure of genes of pro- and eukaryotes;
- to analyze the sequence of gene regulation expression stages;
- to define the types of mendelian characters inheritance in human;
- to expect genotypes and phenotypes of offspring by the genotypes of the parents;
- to exclude paternity in determining blood groups of parents and child;
- to analyze complex mechanisms of humans traits inheritance;
- to develop measures to reduce the display of a pathological condition in patients with inherited pathology;
- to choose appropriate methods for the study of human heredity genetic for diagnosis of various diseases;
- to calculate the probability of hereditary diseases manifestation in off springs depending on gene penetrance;
- to differentiate chromosomal disease in humans;
- to conduct genealogical analysis of pedigrees with hereditary disease;
- to determine the role of heredity and environment in characters development (according to the twins analysis);
- to calculate the genetic composition of human populations;
- to apply the biogenetic law, to determine ontophylogenetic congenital malformations;
- to compare mechanisms of congenital malformations of various human genesis;
- to learn the basic principles of regeneration and transplantation;
- to determine the place of man as a biological object in the system of nature;
- to justify parasitic diseases belonging to the group of transmissible human and natural foci;
- to diagnose macro- and microspecimens of agents and carriers of parasitic diseases;
- to identify the different stages of parasites life cycle;
- to justify the methods of parasitic diseases laboratory diagnosis;
- to differentiate invasions diagnosis by laboratory methods;
- to prove the effectiveness of parasitic diseases prevention methods, depending on the ways of infection;
- to predict the impact of environmental factors on human.

Master skills:

- of microscoping technique;
- of making temporary micropreparations;
- of construction and analysis of family human pedigrees;
- of ideogram analysis;
- of belonging to blood group according to ABO system;
- of determination of protozoan pathogens species belonging;
- of determination of helminthes and their eggs species belonging;
- of determination of carriers of infections species belonging.

3. The content of the educational discipline**Content part 1. Molecular- cellular level of life organization****T****o**

p 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.

Introduction into the development of biology with bases of genetics. Levels of organization and fundamental characters of living matter. Optical systems in biological experiences.

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 the eukaryotic cell. Structural components of cytoplasm.

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. Cell as an open system. Assimilation and dissimilation.

Topic 3. Biological membranes. Transport across the cell membrane.

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. Morphological and functional characteristics and classification of human chromosomes. Rules of chromosomes. Chromosomes analysis. Nucleolus as a derivative of chromosomes, its role in ribosome production. Ideogram.

Topic 5. Structure of nucleic acids. Organization of information flow in the cell. Regulation of gene expression.

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, self-

correction and repair of DNA. Genetic code and its properties.

Topic 6. Organization of information flow in the cell. Regulation of gene expression.

Gene as a unit of the genetic function. Gene structure in prokaryotes and eukaryotes. Genes: structural, regulatory genes, tRNA and rRNA. 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.

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. 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. Molecular-genetic mechanisms of ontogenesis. Peculiarities of the prenatal period of ontogenesis. Ontogenesis disorders and their place in human pathology. Periods of postembryonic human development.

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.

Postembrionic 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 10. Summary class on cell structure and reproduction.

Content section 3. Regularities of inheritance and variation.

Topic 11. Organism level of genetic information organisation. Peculiarities of human genetics (mono- and dihybrid, polyhybrid crossing).

Genetics: subject and tasks, periods; main terms and notions. Principles of hybridologic 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 12. Multiple alleles. Genetics of blood groups. Interaction of allele and non-allele genes.

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 pleiotropy.

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 13. Chromosomal theory. Genetic linkage. 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 14. Variation in human as feature of life and genetic phenomenon: phenotypic and genotypic variation.

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

Modification and norm of reaction. Prolonged modifications. Statistic 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.

Low of homological rows of genetic variation, its practical importance.

The main differences between modifications and mutations. The role of modification variation in human ontogeny. Combinative variation, its sources, biological significance. Classification of mutation: genomic, chromosomal aberrations, gene. Somatic and generative mutations. Spontaneous and induced mutations.

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

Topic 15. Basics of human genetics. Methods of human heredity studying. Pedigree and twins methods of human genetics. Population-statistics method 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.

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.

Topic 16. Chromosomal disorders. Cytogenetic method of human genetics. Molecular diseases. Biochemical method. DNA-diagnostics. Medical-genetic consulting.

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.

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

Topic 17. Summary class on “Human inheritance and variation”.

Content section 5. Medical and biological basics of parasitology. Medical protozoology.

Topic 18. Medical and biological basis of parasitology. Medical protozoology. Protozoa. Human parasites as causative agents of protozoonoses. Sarcodina. Infuzoria.

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 19. Medical and biological basis of parasitology. Medical protozoology. Protozoa. Human parasites causative agents of protozoonoses. Type Flagellates.

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

Topic 20. Medical and biological basis of parasitology. Medical protozoology. Protozoa. Human parasites causative agents of protozoonoses. Type Apicomplexa.

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

Content section 6. Medical helminthology.

Topic 21. Medical helminthology. Type Flat worms. Class Flukes.

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

Geographical distribution, morphofunctional peculiarities, life cycle of liver fluke (*fasciola*), 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

Molluscs, crustacean and chordata as intermediate hosts of helminths.

Topic 22. Medical helminthology. Type Flat worms. Class tapeworms.

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.

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 23. Medical helminthology. Type Round worms.

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.

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. Biosphere and human being.

Topic 24. Medical arachnoentomology. Ticks and insects – causative agents and disease vectors. Biosphere as a system supplying human existence. Basics of human ecology.

Morphology, nutrition and reproduction of arachnids.

Spiders and scorpions as a poisonous animals. Ticks as agents of the diseases, vectors and natural reservoirs of the infectious diseases. Medical importance of ticks - dwellers of the human shelters.

Class Insects (Insecta). Flies, mosquitoes, sand flies and its medical importance.

Midges: characteristics and importance as intermediate hosts of helminthes. Progressive and regressive features in organization of insects because of its adaptation for environment. Peculiarities of morphology, nutrition and reproduction of insects. Medical importance of lice, fleas, bugs and cocroaches as agents and vectors of the infectious diseases.

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 25. Differentiated credit

The structure of the educational discipline

Topic	Hours number			
	totally	including		
		L	Pr.cl.	ISW
T o p i				
T	4,5	0,5	2	2
T	3	1	2	
T	4,5	0,5	2	2
T	4		2	2
T	6	2	2	2

genes				
T o	4		2	2
T o	4		2	2
T o p				
T	4			2
Organism level of genetic information organisation. Regularities of inheritance and variation.				
T o p i				
T o p				
T o				
T o				
T o p i	6	2	2	2
T o	6	2	2	2
T	4			2
Medical and biological basics of parasitology. Medical protozoology.				
T o p				2
T o				2
T o				
Medical helminthology.				
T				
T				
Topic 23. Medical helminthology. Type Round worms.				
Medical arachnoentomology. Biosphere and human being.				
T o	10	4		4

system supplying human existence. Basics of human ecology.				
T	6			4
Всього:hours:				

Topics of lectures

№	Topic	Hours
1	Introduction into the biology with bases of genetics. Structural and functional organization of the cell.	2
2	Molecular basis of heredity. Realisation of hereditary information.	2
3	Organism level of organization of genetic information. Introduction into genetics, interaction of allele and non-allele genes.	2
4	Methods of studying heredity in human. Pedigree, twins, dermatoglyphic, population-statistic methods.	2
5	Methods of studying heredity. Cytogenetic method. Chromosomal disorders. Biochemical method and DNA-diagnostic.	2
6	Introduction into medical parasitology. Medical and biological basis of parasitism. Protozoa – human parasites.	2
7	Medical helminthology. Tapeworms – human parasites.	2
8	Phylum Plathelminthes. Class Cestoda – causative agents of human diseases.	2
9	Medical arachnoentomology. Arthropoda as causative agents and carriers of infection agents and invasions.	2
10	Biosphere as a system that ensures human existence. Basis of human ecology.	2
	Totally	20

6. Topics of practical classes

№	Topic	Hours
	Levels of living matter organization. Optical systems in biological studies.	
	Biological membranes. Transport across the cell membrane.	
	Cell morphology. Structural components of cytoplasm	
	Nucleus. Chromosomes morphology. Human karyotype.	
	Characteristics of nucleic acids.	
	Organization of information flow in the cell. Regulation of gene expression.	
	Cell cycle. Cell division. Reproduction and its forms.	
	Biological peculiarities of human reproduction. Gametogenesis. Fertilization.	
	Peculiarities of prenatal and postnatal development in human.	
	Summary class on cell structure and reproduction topics.	
	Peculiarities of human genetics. Mendelian human characters as demonstration of main laws of heredity (mono- and dihybrid, polyhybrid crossing).	
	Multiple alleles. Blood groups genetics. Interaction of genes.	
	Chromosomal theory. Linked inheritance.	
	Variation. Phenotypic and genetic variation.	
	Pedigree, twins methods of human genetics.	

	Cytogenetic and biochemical methods. Chromosomal disorders.	
	Summary class on learned topics on genetics.	
	P	
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	A	
	Flat worms. Liver fluke, cat (Siberian) fluke and lung fluke.	
	T	
	R	
	A	
	Differential credit	
Total hours		

7

7. Student's independent work

No	Types of SIW	Hours
1.	Preparation for practical classes	46
4.	Preparation for differential credit	4
	Total hours	50

Individual tasks are not planned.

9. Methods of education

System of

Current control is based on the monitoring of theoretical knowledge and practical skills.

Forms of current control:

- Theoretical knowledge - tests with multiple choice answers and those that involve determining the correct sequence of actions, case problems, individual survey interviews;
- Practical skills - the solution of typical problems, individual control of practical action.

Final control is based on the monitoring of theoretical knowledge and practical skills.

Forms of total control:

- Theoretical knowledge - the system of questions, tests with multiple choice answers, solutions and common situational problems;
- Practical skills - individual control of practical action.

11. Rating system points that are awarded to students

Score academic discipline is determined by the sum of current educational activity marks (the mean of current activity) and test scores (traditional evaluation), which is put at the evaluation of theoretical knowledge, practical skills and abilities according to the list defined by the program discipline. Thus, the part of current educational activity results and final module control are respectively 50% and 50%.

Evaluation of current educational activity.

Current educational activity of students on practical and seminar classes is rated on a 4-point scale (traditional) scale. During the practical classes most of the time (at least 60%) should be dedicated to main stage of study - self independent work of students under the guidance of the teacher with professional -oriented tasks (real objects of the future profession - situational tasks on the topic of the lesson, studying of biological objects under a light microscope, figures, charts). Remaining time is spent on analysis and joint discussion of students self independent work results

with error correction. Evaluation of students' educational activity is not obligatory for every practical (seminar) classes. However, on a practical classes should be interviewed at least 50% of students and in seminar classes - at least 30% of students.

Evaluation of self independent work.

Self 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 self independent work is checked during the exam and differential credit.

Evaluation of the summary section practical classes.

After studying the relevant course section the final practice session is held. To this control students who do not have lectures, seminars and practical classes absences or fulfilled missed classes. Complex tasks to control final sessions include tests, theoretical questions, situational tasks, practical skills and abilities. The final lesson is assessed as usual class by traditional (4 - point) scale: "5", "4", "3", "2".

At the end of the course the current students' study activity is calculated as the average score of all student marks obtained by traditional scale, rounded to two decimal places:

Examination.

Upon completion of the course conducted examination is held. To examination allowed only those students who don't have academic debts, worked out all summary classes and received an average score for current educational activity at least 3.00. Exam is graded by traditional (four-point) scale. The exam is standardized and includes admission test, oral examination, control of practical skills and abilities.

Evaluation of the course.

Evaluation of the course consists of two components:

1. 50% - the current activity (average of all students' marks).
2. 50% - mark on the exam.

Thus, in the examination list is going to be two marks:

1. The arithmetic mean of all current marks (calculated as number with two decimal places, eg 4.76).
2. Traditional score on the exam.

Average score for the academic discipline (traditional evaluation) is calculated as the average of current activity marks and examination mark:

Current activity - 4.76.

Mark at the exam - 4.

$(4 + 4.76) : 2 = 4.38$.

The resulting score on academic discipline is regarded as a percentage of the required volume of knowledge of the course:

Converting traditional discipline mark by multi-scale.

Of particular methodological importance is the question of conversion result of students' discipline study according to the 200-point scale and the subsequent ranking by the Rating Scale (ECTS). It is necessary for the implementation of academic mobility of students, giving them the possibility to continue discipline study in another university or in another country.

The resulting average mark for the discipline allows to make the conversion of a mark for 200-point scale.

Thus, the student receives two marks: the first - traditional 4-point scale and the second - 200-point system.

Converting of the traditional discipline mark and total points on a scale ECTS.

Further calculations are made by the Information Centre of the University.

According to the points got on a 200-point scale, students are evaluated on a rating scale ECTS. Students of the same course and same specialty are ranged according to ECTS system by the following way:

ECTS Point	Statistics
«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 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. THE REFERENCE LIST OF CONTROL QUESTIONS

1. Definition of biology as a science. The place and the goals of biology in pharmacological education.
- 1 2. Definition of life according to a modern level of biology science. Forms and properties of living matter.
3. Structural levels of life organization, their importance for medicine.
4. Cell as an elementary structural and functional unit of living matter. 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. The structure of the cell nucleus. Its function. Chromatin and levels of organization of hereditary material. Give the definition of euchromatin and heterochromatin.
9. Chromosomal and genome levels of living matter organization during mitotic cell division.
10. Chemical composition of chromosomes. The structure of chromosomes in metaphase of mitosis. Shapes of chromosomes.
11. Human karyotype. The classification of human chromosomes. The significance of the karyotype studying in medicine.
12. Molecular level of hereditary information organization. Nucleic acids. DNA structure and functions.
13. Gene structure. Structural genes, regulation genes, synthesis of tRNA and rRNA.
14. DNA replication, its importance. Self correction and DNA reparation.
15. The genetic code and its properties.
16. The main stages of protein biosynthesis in the cell.
17. What is translation? Initiation, elongation, termination. Posttranslational modification.
18. Peculiarities of realization of hereditary information in eukaryotes. Exons and introns organization of eukaryotic genes. Processing, splicing.
19. Regulation of genes expression in pro- and eukaryotes. Operon.
20. Gene engineering and biotechnology.
21. Cell cycle, its periods. Interphase and its stages.
22. Cell division. Mitosis. Failure of mitosis. Meiosis.
23. Reproduction – universal property of life. Forms of reproduction.
24. Cell life out the organism. Cell cloning. Importance of tissue cultivation for medicine.

Organism level of genetic information organisation. Regularities of inheritance and variation.

25. Subject and goals of human genetics and medical genetics.
26. Genotype, phenotype.
27. Laws of heredity in monohybrid crossing. I and II laws of G. Mendel. Mendelian characters. Single gene disorders.
28. Di and polyhybrid cross. Third Mendel's law
29. Multiple alleles. Inheritance of ABO blood groups and Rh-factor. Significance for medicine. Rh-conflict.
30. Interaction of allelic genes: dominance, incomplete dominance, co-dominance.
31. Interactions of non-allelic genes: complementary, epistasis.
32. Polymeric character inheritance in human. Pleyotropy.
33. Linked inheritance of genes (the law of Morgan). Crossing over.
34. Chromosomal theory of inheritance.
35. Modern state of genome investigation in human. Gene engineering. Genetic cards of chromosomes in human.
36. Inheritance of sex in humans. Gene dosage. Chromosomal disorders caused by abnormal number of sex chromosomes.
37. Inheritance of sex-linked characters.
38. Variation, its forms and importance for ontogenesis and evolution.
39. Modification, its characteristics. Norm of reaction. Phenocopy.
40. Penetrance and gene expression.
41. Genotypic variation, its forms. Recombination. Mechanisms of origin and significance.
42. Mutations and its phenotypic manifestations. Classification of mutations according to the genotype changes. Spontaneous and induced mutations.
43. Gene mutations, mechanisms of origin. The concept of single gene and multiple gene disorders.
44. Chromosomal aberrations. Mechanisms of origin. Examples of the diseases.
45. Genome mutations (numerical chromosomal aberration) and it origin (polyploidy, haploidy, monosomy, polysomy).
46. Hereditary disorders caused by abnormal number of autosomes and sex chromosomes.
47. Mutations in germ and somatic cells, their significance. Mosaicism.
48. Mutagenic agents, it classification. Genetic monitoring.
49. Disorders with hereditary predisposition. Concept of multifactorial disorders.

50. Methods of medical genetics. Human as a specific subject of genetic analysis.
51. Methods of human genetics (pedigree, Heredity) and diseases. methods of medical genetics.
52. Biochemical method for the study of genetic diseases. Screening programs.
53. Cytogenetic methods of medical genetics.
54. Prenatal diagnostics of hereditary diseases.
55. Medical genetic aspects of a family. Medical genetic concealing.
56. Population-statistical method of human genetics.

57. Peculiarities of reproduction in human.
58. Gametogenesis. Spermatogenesis and oogenesis. Human germ cells.
59. Biology of ontogenesis
60. Ontogenesis, its periods.
61. Embryonic development, its stages. Provisory organs.
62. Molecular and cellular mechanisms of differentiation
63. Differentiation of germ layers and tissues. Embryonic induction. Cloning of tissues and organisms.
64. Critical periods of embryonic development in human. Teratogenic factors.

65. Modern classification of congenital abnormalities: hereditary, teratogenic, multifactorial, embryopathy, fetopathy, phylogenetic (ancestral) and non-phylogenetic.
66. Postnatal development of man and its periodization. Neuro-hormonal regulation of growth and development.
67. Aging as a stage of ontogenesis. Theories of aging. The concept of gerontology and Geriatrics.
68. Clinical and biological death. Thanatology.
69. Regeneration of tissues and organs. Types of regeneration, importance for medicine.
70. Importance of regeneration processes in human. Typical and atypical regeneration. Tumor growth.
71. Problems of transplantation. Types of transplants (grafts). Problem of graft rejection.
72. Homeostasis. Mechanisms of its regulation on different levels of organization of living matter.

C

73. Parasitism. Principles of parasite- human host interaction. Ways of adaptation.
74. Vector-borne (transmissible) disease. Facultative-transmissive and obligate-transmissive diseases. Specific and mechanical vectors.
75. ~~Classification of parasites (obligate, facultative, temporary, constant, endo- and exoparasites). The definitive and intermediate hosts.~~ **Medical and biological bases of parasitology. Medical protozoology.**
76. Parasites life cycles. Rotation of generations and change of host phenomenon. The definitive and intermediate hosts. Obligate, facultative, temporary hosts.
77. Natural focal diseases. The components of the natural focus. Examples of diseases. Anthroponotic and zoonotic diseases.
78. Basics of parasite caused diseases prophylaxis: biological, ecological, public etc.
79. Phylum Protozoa. Classification, organization, importance in medicine of main representatives.
80. Giardia Lamblia, the name of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of disease.
81. Trichomonas vaginalis, the name of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of disease.
82. 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.
83. Trypanosoma species, names of the diseases, morphology, life cycles of parasites. Way of transmission, the principles of diagnosis and prevention of the diseases.
84. Dysentery amoeba, name of the disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
85. Balantidium, name of the disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
86. 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.
87. Toxoplasma, the names of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
88. ~~Medical Helminthology.~~ **Medical Helminthology.** Classification, morphological and physiological peculiarities, medical importance. Concept of bio- and geohelminthes. Examples.
89. Liver fluke, the names of disease, morphology, life cycles of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
90. Cat (Siberian) fluke, the names of disease, morphology, life cycle of parasites. Way of transmission, the principles of diagnosis and prevention of the disease.
91. Lung fluke, the names of diseases morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
92. 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.

93. Pork (armed) tapeworm, the names of diseases, morphology, life cycle of parasites. Way of transmission, the principles of diagnosis and prevention of the diseases.
94. Beef (unarmed) tapeworm, the names of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
95. Cysticercosis. Modes of transmission and prevention measures.
96. Dwarf tapeworm, the names of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
97. Echinococcus and alveococcus. The names of diseases, morphology, life cycles of parasites. Way of transmission, the principles of diagnosis and prevention of the diseases.
98. Broad (fish) tapeworm, the names of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
99. Phylum Roundworms. Classification, main characters of organization, medical importance of main representatives.
100. 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).
101. Pinworm. The name of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
102. Whipworm, the names of disease, morphology, life cycles of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
103. 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.
104. Trichina worm, the name of disease, morphology, life cycle of parasites. Way of transmission, the principles of diagnosis and prevention of diseases.
105. Guinea worm. The name of disease, morphology, life cycle of parasite. Way of transmission, the principles of diagnosis and prevention of the disease.
106. 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.
107. Laboratory diagnostics of helminthes. Ovo-, larvo- and helminthoscopy.
108. ~~Medical characters of the classes of the phylum being~~ Medical importance. Poisonous Arthropods.
109. Mollusks, crustaceans, Chord – intermediate hosts of helminthes.
110. Mites as human pathogens (itch mite and follicle mite).
111. Ticks as the vectors of human diseases (Ixodidae, Gamasidae and Argasidae ticks).
112. Flies. Species of the flies. Peculiarities of the morphology and life cycle, medical importance.
113. Mosquitoes. Species, peculiarities of the structure and development, medical importance.
114. Lice. Species, morphology and life cycle, medical importance.
115. Fleas. Morphology and life cycle. Species of fleas. Bed bug and its medical importance.
116. Synthetic theory of evolution.
117. Macro- and microevolution. Population – elementary unit of evolution.
118. Structure of human population. Dem, isolate.
119. Influence of the mutations, migration, isolation and drift of genes on the genetic structure of human populations. Peculiarities of natural selection in human populations.
120. 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", "mix").
121. Doctrine of biosphere and noosphere. Characteristics of living matter.
122. Medical and biological aspects of biosphere influence on human health. Biological fields and biorhythms, it medical importance.

123. Onto- and phylogenesis interrelation. The biogenetic law of Haeckel and Muller.
124. Human origin. Main stages of anthropogenesis.
125. Position of the *Homo sapiens* in Classification of the animal world.
126. The origin of the human race as a reflection of adaptive patterns of human development.
The unity of mankind.
127. Ecology. Environment as an ecological notion. Types of environment. Ecological factors.
The unity of an organism and environment.
128. Biological variation in humans as the reflection of biogeography peculiarities of the environment. Adaptive ecotypes of man.
129. Man as an environmental factor. The main directions and results of anthropogenic environmental changes. Protection of the environment.
130. Peculiarities of ecology in Ukraine
131. Plants, fungi and animals poisonous for human

13. A CONTENTATIVE LIST OF PRACTICAL SKILLS AND ABILITIES:

- to master the technique of microscoping
- to prepare temporary specimens
- to differentiate cell components
- to make ideogram of a healthy and sick human on chromosome diseases
- to identify the primary structure, amino acids number, molecular weight of polypeptide by the gene structure encoding it
- to analyze the sequence of gene regulation expression stages in pro- and eukaryotes
- to determine the type of inheritance of normal and pathological human Mendelian traits
- to diagnose genotypes and phenotypes of offspring by the genotypes of the parents
- to exclude paternity in determining blood groups of parents and child
- to analyze the complex mechanisms of human traits inheritance
- to develop measures to reduce the manifestation of a pathological condition in patients with hereditary pathology
- to choose appropriate methods for the study of human heredity for diagnosis of various genetic diseases
- to calculate the probability of hereditary diseases manifestation in the offspring depending on gene penetrance
- to differentiate human chromosomal diseases
- to build a family tree and spend its genealogical analysis of a patient with hereditary disease
- to calculate the role of heredity and environment in the characters development (for twins analysis results)
- to calculate the genetic structure of human populations
- to use the biogenetic law, to differentiate ontophylogenetic determined congenital malformations in human
- to compare origin mechanisms of human congenital malformations of different genesis
- to learn the basic principles of regeneration and transplantation
- to determine the place of a biological object in the system of nature
- to prove the belonging of human parasitic diseases to the group of vector born diseases
- to diagnose the carriers of pathogens and parasitic diseases on micro and macro specimens
- to determine the species identity of human protozoa pathogens
- to identify the different stages of the parasites life cycle
- to justify the methods of laboratory diagnosis of parasitic diseases in human

- to identify worms and their eggs species belonging
- to differentiate diagnosis of invasive disease with the help of laboratory methods
- to determine the species identity of infections carriers
- to prove the effectiveness of parasitic diseases prevention methods based on their modes of infection

- Curriculum of the educational discipline
- S
- F
- Multi-media presentations
- Situational tasks-problems
- Methodical preparations for practical classes
- Electronic data bank of MCQ tasks by sections of the discipline.

15. A list of recommended materials

Main list

1. LECTURES of biology with bases of genetics; MEDICAL BIOLOGY. Yu. I. Bazhora, R. Ye. Bulyk, M. M. Chesnokova, A. V. Shevelenkova, O. O. Smetyuk, Yu. V. Lomakina. – Vinnytsya: Nova Knyha – 2019. – 448 pp

Additional literature

1. Emery's Elements of medical genetics. 15th ed. / Peter Turnpenny, Sian Ellard. – Elsevier, 2017. – 400 pp. Young Ian. D. Medical genetics. – 2nd ed. – Oxford university press, 2010. – 304 pp.
2. Vogel and Motulsky's human genetics. Problems and approaches / M. R. Speicher, S. E. Antonarakis, F. G. Motulsky. 4th addition. – Springer, 2010. – 981 pp.
3. OMIM (Online Mendelian Inheritance in Man) – An Online Catalog of Human Genes and Genetic Disorders <http://omim.org/>
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 RECTRICTED ed. – Hoboken : Pearson Higher Education, 2016.

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/>