KHARKOV NATIONAL MEDICAL UNIVERSITY

Faculty: V faculty for training foreign students

Department of medical biology

Field of knowledge 22 – Health protection

Specialty (specialization) 222 “General Medicine”

Academic program of professional(scientific) training for the second (master’s) level of higher education

**SYLLABUS OF THE ACADEMIC DISCIPLINE**

 **MEDICAL BIOLOGY**

|  |  |  |
| --- | --- | --- |
| Syllabus is approved at the meeting of the department of medical biology Protocol “ 28 ” of august, 2020 № 1\_  Acting Head of the Department\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ I.P.Meshcheryakova  (signature) (surname and initials) |  | Syllabus is approved by KhNMU commission on the problems of natural sciences training (name) Protocol “ 28 ” of august, 2020 № 8\_ Head\_\_\_\_\_\_\_\_\_\_\_\_ prof. О.А. Nakonechna (signature) (surname and initials) |

2020

**MEDICAL BIOLOGY**

**Information about professors and lecturers**

 Compiler/author of the syllabus: professor, doctor of medicine Myasoyedov V.V., acting head of the department, ass.professor, candidate of medical science Meshcheryakova I.P.

lecturer, ass. professor Zahoruiko Y.V.

Information about the lecturer - researches in the field of education quality, author of 65 scientific works and academic publications.

Contact number and e-mail of the lecturer 707-73-36, yv.zahoruiko@knmu.edu.ua

lecturer, ass. professor Dzhamieiev V.Y.

Information about the lecturer - researches in the field of education quality, author of 55 scientific works and academic publications.

Contact number and e-mail of the lecturer 707-73-36, vy.dzhamieiev@knmu.edu.ua

Information about counselling: on-cite and on-line consultations by appointment.

Location of the department of medical biology – building A, 2d floor.

**Information about the discipline**

**1. Опис дисципліни 1.Description of the discipline**

Course: 1st

**Academic semester/academic year** - I and II semester of the 2020-2021 academic year.

**Discipline consists of** 4,5 ECTS credits, 20 lecture hours, 60 practical class hours, 55 hours of self-dependent student’s work.

**General characteristics of the discipline**. The discipline is based on the such previously learned school subjects as ”General biology”, “Human biology”, “Animal biology”, “Vegetal biology”. The discipline program includes sections: “Molecular and cytologic basics of human life”, “Organismic level of life organization”, ”Basics of human genetics”, “Population-and-species, biogeocenotic and biosphere levels of life organization” that provide a high level of training in general biology.

**Role and place of the discipline in the system of training specialists**. Academic discipline “Medical biology” lays the foundation for further obtaining knowledge and skills in the special theoretical and clinical disciplines (biologic and bioorganic chemistry, histology, cytology and embryology, physiology, medical genetics, clinical immunology, infectious diseases, epidemiology, pediatrics, etc.)

Reference on video-annotation of the discipline – discipline page in the Moodle system

<http://31.128.79.157:8083/course/view.php?id=1532>

**2. Purpose and objectives of the discipline**. The purpose of teaching academic discipline “Medical Biology” is formation of profound knowledge and practical skills n human biology providing the basis for further scientific and practical professional training.

 The main objectives of studying the discipline “Medical Biology” are:

2.1. Explaining regularities of human life on the molecular and cell level.

2.2. Identifying the influence of general biologic laws of human ontogenesis.

2.3. Identifying biological essence and mechanisms of the disease development arising due to anthropogenic changes in the environment.

2.4. Explaining the essence and mechanisms of the hereditary diseases manifested in the human phenotype.

2.5.Making preliminary analysis of human parasitic invasions and determining preventive measures.

**3.Status of the discipline**: normative

**Format of the discipline**: mixed

**4.** **Teaching methods:** verbal (lectures, explanations, giving instructions, talks with students, thematic discussions), visual (illustrating and demonstrating aids, independent observations), practical (doing exercises, solution of situational problems), innovative (role-play, case-method), student’s self-training for understanding and learning new material, performing individual tasks, use of computer programs for academic studies and tests in the discipline.

**5. Teaching aids:** presentations, animations, computer programs, lecture notes, methodological instructions for practical training, methodological materials providing student’s self-training, records of practical classes.

**6. Recommended literature**

1. Medical biology / Yu. I. Bazhora, R. Ye. Bulyk, M. M. Chesnokova [et al.]. - Vinnytsia : Nova Knyha, 2018 — 448 p.
2. Campbell N. A. Biology: a global approach. -11th ed. New York: Pearson Education, 2017 — 1342 p.
3. Kumar & Clark's Clinical Medicine / ed.: P. Kumar [et al.] . - 9th ed., international. – Edinburgh : Elsevier, 2017- 1437 p.
4. First Aid For The USMLE Step 1 2019 : a student-to-student guide / T. Le, V. Bhushan, M. Sochat [et al.]. - 29th ed. - New York : McGraw Hill Education, 2019 — 792 p.
5. Le, Tao. First Aid For The USMLE Step 1 2016 : a student-to-student guide. - New York : McGraw Hill Education, 2016 — 760 p.
6. Lieberman, Michael A. Biochemistry, Molecular Biology, and Genetics / M. A. Lieberman, R. Ricer. - 6th ed. – Philadelphia : Wolters Klumer/Lippincott Williams&Wilkins, 2014— 449 p.
7. Bogitsh B. Human Parasitology. -4th ed. Amsterdam: Elsevier, 2013 — 430 p.
8. Medical Biology: the study guide for the practical classes course / O. V. Romanenko, O. V. Golovchenko, M. G. Kravchuk, V. M. Grinkevych, 2008
9. Biology / ed. P. H. Raven [et al.]. - 7th ed, 2005
10. Mader, S. S. Biology / S. S. Mader. - 8th ed., 2004
11. General cytology and histology: textbook / Edited by M.Ye. Dzerzhinsky. – K.: Kyiv University, 2010. – 570 p.
12. Cells / Ed by B. Lyuin and others — М.: BINOM. Лаборатория знаний, 2011. — 951 с.
13. Clinical parasitology/ A.Ya.Lysenko, M.G.Vladimova, A.V.Kondrashin, G. Maiory/ ed.by Lysenko A.Ya.— Geneva: WHO, 2002. — 752 с.
14. Principles and Practice of Clinical Parasitology / Ed. Gillespie S.H., Pearson R.D. — Chichester: John Wiley & Sons, 2001. — 630 p.

**Information sources**

1. Testing Center of the Ministry of Health of Ukraine – Information for preparing students to the licensed examination “Krok-1” <http://testcentr.org.ua/>
2. OMIM (Online Mendelian Inheritance in Man): Online Catalogue of Human Genes and Genetic Disorders — http://www.omim.org/
3. Centers for Disease Controls and Prevention — <http://www.cdc.gov/>
4. The web-site of the medical biology department, Khnmu— <http://nauka.knmu.edu.ua/medbio/>

**7. Discipline pre-requisites and co-requisites:** biology, medical chemistry, biological and bioorganic chemistry, histology, cytology and embryology, human anatomy, physiology, pathomorphology, pathophysiology, medical and biological physics, medical informatics, microbiology, virology and immunology, pharmacology, medical genetics, clinical pharmacology, clinical immunology and allergology, social medicine and public health, hygiene and ecology, epidimiology and principles of evidence-based medicine, all range of subjects for professional training.

**8. Results of studies.**

*Integrative final results of training* provided by the academic discipline:

According to the Standard of Ukrainian Higher Education for the second (master’s) level pre-diploma training in the specialty “General Medicine” academic discipline “Medical biology” lays foundation for further formation of the following academic program results:

1. Making nosological or preliminary clinical diagnosis for a dental disease by standard methods using data of a patient’s medical history, data of patient’s examination, knowledge about humans, their organs and systems.
2. Gathering information about general patient’s condition, making assessment of psychomotor and physical patient’s development and condition of his maxillofacial area organs.
3. Making analysis of epidemiological situation and taking mass and individual, general and local medicinal and non-medicinal measures for preventing dental diseases.
4. Making assessment of the environmental influence on the population health condition within a medical institution using standard techniques.
5. Following the rules of a healthy lifestyle, using methods of self-control and self-regulation.

*Results of studies for the discipline:* On completion of studying the discipline “Medical biology” students **must know**:

* levels of life organization;
* forms of life and their fundamental features;
* structure and functions of eukaryotic cells;
* molecular basics of heredity;
* cell cycle and methods of cell division;
* basic hereditary patterns in mono- and dihybrid crossing and sex-linked inheritance; inheritance of human blood groups in the system AB0 and rhesus factor;
* human sexes and inheritance of the sex-linked characteristics;
* variation, its forms and manifestations;
* methods of studying human inheritance: genealogical, twin, dermatoglyfic, cytogenetic, molecular-genetic, biochemical, and stastistical method of population genetics;
* classification of hereditary diseases, principle of prenatal diagnostics of hereditary diseases;
* forms of organismic reproduction;
* characteristics of gametogenesis, structure of gametes;
* conception of ontogenesis, its periodization;
* main stages of the embryonic development, molecular and cell mechanisms of differentiation;
* types of regeneration;
* types of transplantation, causes of tissue incompatibility;
* forms of symbiosis, parasitism as a biological phenomenon;
* principles of classification of parasites and their hosts;
* ways of transmitting parasitic diseases; obligate transmissible and facultative transmissible diseases;
* diseases of natural environment; structure of natural environment;
* classification of congenital disorders; teratogenic factors;
* basics of parasitic diseases prevention;
* vectors of the most common protozoan, trematode, cestode, and nematode infections;
* principles of laboratory diagnostics of helminthiasis;
* Phylum Arthropoda – vectors of human diseases, concept of mechanical and specific vectors;
* venomous representatives of Arthropoda;
* definition of population as an elementary evolutionary unit, population structure of mankind, demes, isolates;
* functional types of human response to the environment factors (“sprinter”, “stayer”, “mixed”);
* conception of biological rhythms, their medical importance;
* subject of ecology; types of environment, ecological factors;
* adaptive ecotypes of humans;
* role of humans as an ecological factor; main tendencies and results of the environmental anthropogenic changes;
* examples of plants and animals poisonous to people;
* the key points of V.I.Vernadsky theory about biosphere and noosphere;
* *Homo sapiens* in the system of animal world, main stages of anthropogenesis;
* basic patterns of the organs systems phylogenesis, ontophylogenetic background of congenital disorders, examples of atavistic anomalies of the human organs and organs systems.

**to know how**

* to study microslides under the light microscope in small and big magnification;
* to make temporary microslides;
* to distinguish animal cell components in the electron micrographs and drawings;
* to identify primary protein structure, number of aminoacids, polypeptide molecular mass by the nucleotide sequence;
* to predict genotypes and phenotypes in the offsprings on the basis of parents genotypes;
* to calculate probability for birth of a child with monogenic diseases based on the known genotypes of parents;
* to exclude parenthood on the basis of identifying blood groups of the parents and child;
* to calculate probability of arising hereditary diseases in the offsprings depending on the gen penetrance;
* to analyze karyotype of a man and diagnose the most common chromosome diseases;
* to construct a family tree and do its genealogical analysis;
* to calculate the role of inheritance and environmental conditions in the development of traits

 ( by the results of twin analysis);

* to calculate gens and genotypes frequencies according to Hardy-Weinberg law;
* to distinguish between teratogenic and hereditary congenital deformities;
* to identify the place of biological object (vectors of parasitic diseases) in the system of living nature;
* to substantiate the belonging of human parasitic diseases to the group of transmissible and environmental ones;
* to diagnose vectors of the parasitic diseases studied on the macro- and microslides;
* to substantiate methods of laboratory diagnostics for human parasitic diseases;
* to substantiate preventive methods for parasitic diseases depending on the ways of infection.

**Content of the discipline**

**Structure of the academic discipline**

|  |  |
| --- | --- |
| Titles of discipline sections and topics  | Number of hours |
| Form of studies (full-time and part-time) |
| total | У тому числі |
| lec | prac | lab | ind | self-training |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| **Section1.Biological charateristics of human life .** |
| Topic 1.Introduction to the course of medical biology. Transport of substances through the plasmalemma | 4,0 | 0,5 | 2,0 |  | Review of scientific literatures | 1,5 |
| Topic2. Morphology of cell. Structural components of cytoplasm and nucleus | 3,5 | 0,5 | 2,0 |  | 1,0 |
| Topic3.Morphology of chromosomes. Human karyotype | 3,25 | 0,25 | 2,0 |  | 1,0 |
|  Topic 4. Lifecycle of a cell. Cell division. Mitosis. Meiosis. Gametogenesis.Human ontogenesis. Biological mechanisms of homeostasis maintanence  | 4,75 | 0,75 | 2,0 |  | 2,0 |
| Topic 5. Molecular basics of inheritance. Characteristics of nucleic acids. | 3,5 | 0,5 | 2,0 |  | 1,0 |
| Topic 6. Structure of a pro- and eukaryote gene. Stuctural and regulatory genes, tRNA,rRNA. | 4,0 | 1,0 | 2,0 |  | 1,0 |
| Topic 7. Molecular mechanisms of human variability. Regulation of gene expression | 3,5 | 0,5 | 2,0 |  | 1,0 |
| Topic 8. Summarizing lesson 1: Biological characteristics of vital functions of humans | 4,0 | ‒ | 2,0 |  |  | 2,0 |
| Total in section1 | **30,5** | **4** | **16** |  |  | **10,5** |
| **Section 2. Organismic level of life organization****Basics of human genetics** |
| Topic 9. Organismic level of the genetic information structure. Main inheritance regularities based on the example of periodic Mendelian traits.Pleiotropy.Multiple allelism | 5,0 | 1,0 | 2,0 |  | Review of scientific literatures | 2,0 |
| Topic 10. Interaction of allelic and non-allelic genes. Genetics of blood groups | 5,5 | 1,5 | 2,0 |  | 2,0 |
| Topic 11. Chromosome theory. Linked inheritance. Genetics of sex. | 6,0 | 2,0 | 2,0 |  | 2,0 |
| Topic 12. Human variation as a life feature and genetic phenomenon: phenotype and genotype variation. Basics of medical genetics. Methods of studying human inheritance Molecular diseases. Biochemical method and DNA- diagnostics | 7,5 | 2,5 | 2,0 |  | 3,0 |
| Topic 13. Chromosome diseases. Cytogenic method of their diagnostics | 5,5 | 1,5 | 2,0 |  | 2,0 |
| 1 | 2 | 3 | 4 | 5 | 7 |
| Topic 14. Biological features of human reproduction. Medical genetic counselling. Statistical method of population genetics | 6,5 | 1,5 | 2,0 |  | 3,0 |
| Topic 15. Summarizing lesson 2: Organismic level of life organization. Basics of human genetics | 6,0 | - | 2,0 |  |  | 4,0 |
| Total in section 2 | **42** | **10** | **14** |  |  | **18** |
|  **Section 3. Population-and-species, biosphere and biogeocenotic level of life organization** |
| Topic 16. Medical and biological basics of parasitism. Medical protozoology. Subkingdom Protozoa. Phylum Sarcomastigophora. Class Lobosea | 5,0 | 1,0 | 2,0 |  | Review of scientific literatures | 2,0 |
| Topic 17. Represantitives of Zoomastigofora – human parasites. | 4,5 | 0,5 | 2,0 |  | 2,0 |
| Тopic 18. Phylum Apicomplexa. Representatives of Sporozoa — human parasites. Phylum Ciliophora. Representatives of Rimostomatea — human parasites. | 4,5 | 0,5 | 2,0 |  | 2,0 |
| Topic 19. Summarizing lesson 3. Medico- biological basics of parasitism. Medical protozoology | 4,0 |  | 2,0 |  | 2,0 |
| Topic 20-21. Medical helminthology.Phylum Plathelminthes. Class Trematoda – causative agents of human diseases | 8,0 | 1,0 | 4,0 |  | 3,0 |
| Topic 22. Phylum Plathelmintes. Class Cestoidea – causative agents of human diseases | 4,5 | 0,5 | 2,0 |  | 2,0 |
| Topic 23-24. Phylum Nemathelminthes. Class Nematoda – causative agents of human diseases | 7,0 | 1,0 | 4,0 |  | 3,0 |
| Topic 25. Methods of laboratory diagnostics of helminthiasis | 3,5 |  | 2,0 |  | 1,5 |
| Topic 26. Summarizing lesson. Medical helminthology | 4,0 |  | 2,0 |  | 2,0 |
| Topic 27. Medical arachnoentomology. Phylus Arthropoda. Class Arachnoidea. Mites (Acarina) – Causative agents and vectors of human diseases | 4,5 | 1,0 | 2,0 |  | 1,5 |
| Topic 28. Class Insecta.Lice (Anoplura), fleas (Aphaniptera), , bedbugs (Hemipthera), cockrouches (Blattoidea), dipterous insects (Diptera) – causative agents and vectors of human diseases. | 5,0 | 0,5 | 2,0 |  | 1,5 |
| Topic 33. Modern evolutionary synthesis. Population structure of mankind.Biosphere as a system providing human existence. Basics of general and human ecology.  | 4,0 |  | 2,0 |  | 2,0 |
| Topic 32. Summarizing lesson 5: Medical arachnoentomology | 4,0 |  | 2,0 |  | 2,0 |
| Total in section 3 | **62,5** | **6** | **30** |  |  | **26,5** |
| Total in the discipline | **135** | **20** | **60** |  |  | **55** |

**Lectures**

|  |  |  |
| --- | --- | --- |
| № | Topics | Number of hours |
| 1 | Introduction to the course of medical biology. Cell structure and functions. Reproduction at a cellular level | 2 |
| 2 | Molecular basics of inheritance | 2 |
| 3 | Organismic level of the genetic information structure. Interaction of genes | 2 |
| 4 | Chromosome theory of inheritance. Genetics of sex | 2 |
| 5 | Human variation as a life peculiarity and genetic phenomenon | 2 |
| 6 | Basics of human genetics. Gene diseases | 2 |
| 7 | Human chromosome diseases. Medical and genetic counselling | 2 |
| 8 | Medical and biological basics of parasitism. Protozoa –human parasites | 2 |
| 9 | Medical helminthology.  | 2 |
| 10 | Medical arachnoentomology. Arthropoda as causative agents and vectors of infections and invasions | 2 |
| Total lecture hours  | 20 |

**Practical classes**

|  |  |  |
| --- | --- | --- |
| № | Topics | Number of hours |
| 1 | 2 | 3 |
| 1 | Forms of living matter. Plasmatic membrane structure.Transport of substances through the plasmallema | 2 |
| 2 | Cell Morphology. Structural components of cytoplasm and nucleus. | 2 |
| 3 | Chromosome morphology. Human karyotype | 2 |
| 4 | Cell cycle. Cell division. Mitosis. Meiosis.Gametogenesis. | 2 |
| 5 | Characteristics of nucleic acids | 2 |
| 6 | Structure of a pro- and eukaryotic gene. Structural and regulatory genes, tRNA, rRNA. Information flow in the living cell. | 2 |
| 7 | Molecular mechanisms of human variation. Regulation of gene expression | 2 |
| 8 | Summarizing lesson 1. Biological characteristics of human life | 2 |
| 9 | Human genetics. Main inheritance regularities based on the example of Mendelian traits. Pleiotropy.Multiple allelism | 2 |
| 10 | Interaction of allelic and non-allelic blood groups. Blood groups genetics | 2 |
| 11 | Chromosome theory. Linked inheritance. Genetics of sex | 2 |
| 12 | Human variation, its forms and manifestations. Genealogical and twin methods of studying human genetics. Molecular diseases. Biochemical method and DNA-diagnostics. | 2 |
| 13 | Chromosome diseases. Cytogenetic method of their diagnostics  | 2 |
| 14 | Biological characteristics of human reproduction. Medical genetic counselling. Statistical method of population genetics | 2 |
| 15 | Summarizing lesson 2: Organismic level of life organization. Basics of genetics. | 2 |
| 16 | Introduction to medical parasitology. Medical protozoology. Phylum (Sarcomastigophora). Class Lobosea | 2 |
| 17 | Phylum Sarcomastigophora. Class Zoomastigophora | 2 |
| 18 | Phylum Apicomplexa. Representatives of Class Sporozoea - human parasites. Phylum Ciliophora. Repesentatives of Class Rimistomatea – human parasites | 2 |
| 1 | 2 | 3 |
| 19 | Summarizing lesson 3. Medical and biological basics of parasitism. Medical protozoology | 2 |
| 20 | Phylum Plathelminthes. Class Trematoda – vectors of human diseases  | 2 |
| 21 | Medical helminthology. Phylum Plathelminthes. Class Trematoda – vectors of human diseases  | 2 |
| 22 | Phylus Plathelmintes. Class Cestoidea – vectors of human diseases | 2 |
| 23 | Phylus Nemathelminthes. Class Nematoda — vectors of human diseases  | 2 |
| 24 | Class Nematoda — human diseases vectors. Biohelminths. | 2 |
| 25 | Laboratory diagnostics of helminthiasis | 2 |
| 26 | Summarising lesson 4. Medical helminthology | 2 |
| 27 | Medical arachnoentomology. Phylum Arthropoda. Class Crustacea. Class Arachnida. Ticks and mites Acarina — causative agents and vectors of human diseases  | 2 |
| 28 | Phylum Arthropoda. Class Insecta – causative agents and vectors of human diseases  | 2 |
| 29 | Biosphere as a system providing human existence. Human ecology | 2 |
| 30 | Summarizing lesson 5. Medical arachnoentomology | 2 |
| Total practical hours | 60 |

**Self- training**

|  |  |  |
| --- | --- | --- |
| № | Topics | Number of hours |
| 1 | Learning theoretical foundation for practical classes and developing practical skills | 24 |
| 2 | Work on the topics which are not enlisted in the class curriculum |  |
| 2.1 | Methods of biological researches | 2 |
| 2.2 | Organization of flows of matter and energy in the cell | 1 |
| 2.3 | Cell life out of the organism. Cell cloning | 1 |
| 2.4 | Gametogenesis. Human’s fertilization – the restoration of the diploid set of chromosomes, increasing the diversity of genes in offspring | 1 |
| 2.5 | Stages of human embryonic development. Differentiation in the molecular and genetic, cellular and tissue levels | 1 |
| 2.6 | Stages of human postembryonic development.  | 1 |
| 2.7 | Types and ways of regeneration. Types of tissue transplantation in human | 1 |
| 2.8 | Ageing as a final stage of human ontogenesis. Theories of ageing | 1 |
| 2.9 | Conception of biofields, biorhythms and their medical relevance | 1 |
| 2.10 | Regulation of gene functions in ontogenesis  | 1 |
| 2.11 | Genetic maps. Methods of human chromosome mapping. Modern state of human genome researches | 1 |
| 2.12 | Genetic threat of the habitat contamination. Concept of antimutagenes and comutagenes | 1 |
| 2.13 | Gene engineering. Biotechnology. Concepts of gene therapy. | 1 |
| 2.14 | Methods of human genetics: dermatoglyphic, immunologic, hybridization of somatic cells | 1 |
| 2.15 | Congenital disorders of development. Critical periods of development. | 1 |
| 2.16 | Blood flukes –vectors of parasitic human diseases, vectors of metagonimosis and nanophyetiasis | 0.5 |
| 2.17 | Guinea worm and filaria – vectors of human diseases | 0.5 |
| 2.18 | Mites as inhabitants of people’s dwelling , their medical charateristics | 0.5 |
| 2.19 | Characteristics of mosquitos, midges, sandflies as intermediary helminths hosts and human diseases vectors | 0.5 |
| 2.20 | Origin of a man. Human races as reflection of adaptive patterns of development | 1 |
| 2.21 | The concept of microevolution. Population is an elementary unit of evolution  | 1 |
| 2.22 | Structure and functions of the biosphere. Human ecology | 0.5 |
| 2.23 | Plants and animals poisonous to people | 0.55 |
| 3 | Revision of 1-5 lessons  | 15 |
| Total self-training hours | 60 |

**Discipline policy and values**

**Demands**: Students must have profound knowledge of such secondary school subjects as “General biology”, ”Human biology”, “Animal biology”, ”Vegetal biology” and be ready to fruitful co-working.

**Academic attendance and behavior:** In class students must wear only medical clothing; a 5 minutes’ late student is considered to be absent; on condition of violating the discipline teacher may ask the student leave the classroom.

**Using electronic gadgets** is allowed only by teacher’s permission.

**Policy of student’s academic honesty and conscientiousness**: Violation of student’s academic honesty (cribbing from other students and plagiarism of any kind) involves annulling the grade, reworking to special examination board and holding response according to the order adopted in KhNMU.

 **Policy regarding the persons with special academic demands**: students with special academic demands have to get in touch with a course lecturer for developing individual curriculum.

**Recommendations on successful passing the discipline**: take an active part in all types of the class work, try to share 2-3 hours to doing your homework and self-training every day, put questions during the lesson and attend consultations, hand in your papers in time and do all kinds of tests.

 **Rewards and penalties**: Doing individual independent work (writing essays, theses of the report for the conference, articles, etc.) gives a student additional 10 points to his grade; the work which were handed in untimely without serious excuse are assessed 25% lower.

**Safety measures:** Instructions on accidents prevention are given at the first lesson of the course. Safety regulations are represented on the site of medical biology department <http://nauka.knmu.edu.ua/medbio>

**Information about changes in the syllabus**: changes in the syllabus are made according to the regulations established by KhNMU every year; the syllabus approved is placed on the site of medical biology department <http://nauka.knmu.edu.ua/medbio> and in the distant-learning system of the university.

**Policy of assessment**

**System of assessment and demands:**

* *types of control -*  primary, current, final;
* *forms of control:* individual, group, general questioning;
* *methods of current control: oral questioning, interview, solution of situational problems and other methods of written control, checking the professional skills obtained, testing, oversight;*

*methods of control:* summarizing control at the end of each section is conducted in the form of final written work including test tasks taken from the inter-disciplinary licensed examination “Krok-1” (“General Medicine”), check-up of theoretical questions and practical skills obtained.

Final control of the discipline is conducted in the form of examination.

The examination is conducted by the board of examiners appointed by the Rector’s order within the terms of concluding academic session.

Access to examination is determined in the number of points : min -70, max -120, on condition of absence of missed classes and unsatisfactory grades. All missed classes and unsatisfactory grades must be reworked.

Assessment of practical skills and theoretical knowledge on all discipline topics is conducted during the examination.

**Criteria of assessment of practical skills and theoretical knowledge (tables 1,2)**

Table 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number of skills | «5» | «4» | «3» | Giving answers to the practical part questions | For each practical skill students get from 10 to 16 points :«5» - 16 points;«4» - 13 points;«3» - 10 points. |
| 1 | 16 | 13 | 10 |
| 2 | 16 | 13 | 10 |
|  | 32 | 26 | 20 |

Assessment of theoretical knowledge is conducted in accordance with the list of questions including all topics of the discipline.

Table 2

**Criteria of assessment of theoretical knowledge**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Number of questions | «5» | «4» | «3» | Oral replies to the questions including theoretical part of the discipline | For each answer students get from10 to16 points «5» - 16 балів;«4» - 13 балів;«3» - 10 балів. |
| 1 | 16 | 13 | 10 |
| 2 | 16 | 13 | 10 |
| 3 | 16 | 13 | 10 |
|  | 48 | 39 | 30 |

The examination is assessed from 50 to 80 points.

**Recalculation of the average grade in current activities in the multi-point scale**

is conducted in compliance with “Instruction on assessment of academic activities in the European credit-transfer system of organization of the academic activities” (table 3)

Table 3

**Recalculation of the average grade in multi-point scale**

| 4-point scale | 120-point scale |  | 4-point scale | 120-point scale |
| --- | --- | --- | --- | --- |
| 5,00 | 120 | 3,91-3,94 | 94 |
| 4,95-4,99 | 119 | 3,87-3,90 | 93 |
| 4,91-4,94 | 118 | 3,83-3,86 | 92 |
| 4,87-4,90 | 117 | 3,79-3,82 | 91 |
| 4,83-4,86 | 116 | 3,74-3,78 | 90 |
| 4,79-4,82 | 115 | 3,70-3,73 | 89 |
| 4,75-4,78 | 114 | 3,66-3,69 | 88 |
| 4,70-4,74 | 113 | 3,62-3,65 | 87 |
| 4,66-4,69 | 112 | 3,58-3,61 | 86 |
| 4,62-4,65 | 111 | 3,54-3,57 | 85 |
| 4,58-4,61 | 110 | 3,49-3,53 | 84 |
| 4,54-4,57 | 109 | 3,45-3,48 | 83 |
| 4,50-4,53 | 108 | 3,41-3,44 | 82 |
| 4,45-4,49 | 107 | 3,37-3,40 | 81 |
| 4,41-4,44 | 106 | 3,33-3,36 | 80 |
| 4,37-4,40 | 105 | 3,29-3,32 | 79 |
| 4,33-4,36 | 104 | 3,25-3,28 | 78 |
| 4,29-4,32 | 103 | 3,21-3,24 | 77 |
| 4,25-4,28 | 102 | 3,18-3,20 | 76 |
| 4,20-4,24 | 101 | 3,15-3,17 | 75 |
| 4,16-4,19 | 100 | 3,13-3,14 | 74 |
| 4,12-4,15 | 99 | 3,10-3,12 | 73 |
| 4,08-4,11 | 98 | 3,07-3,09 | 72 |
| 4,04-4,07 | 97 | 3,04-3,06 | 71 |
| 3,99-4,03 | 96 | 3,00-3,03 | 70 |
| 3,95-3,98 | 95 | Less than 3,00 | Insufficient |

The overall grade in the discipline is calculated as a sum of points for ПНД? (CAA – current academic activities) and equals min 120 to max 200. The grading conformity between 200-point, 4-point national and ECTS scale is given in table 4.

Table 4

**Grading conformity scale for 200-point, ECTS and 4-point national grades**

|  |  |  |
| --- | --- | --- |
| 200 – point scale  |  ECTS | 4-point national scale |
| 180–200 | А | Excellent |
| 160–179 | В | Good |
| 150–159 | С | Good |
| 130–149 | D | Satisfactory |
| 120–129 | E | Satisfactory  |
| Less than 120 | F, Fx | Unsatisfactory |

Only the students who passed all concluding sessions and exams will get the final grade of the discipline.

The students who did not fulfil the requirements of the academic discipline curriculum

get grade **Fx** if they were admitted to take examination but did not passed it. The students who were not admitted to take the examination get grade **F**.

* Elimination of academic failures (reworking): missed classes and unsatisfactory grades are reworked according to the order established in the Kharkiv National Medical University regulations.

**Examination questions on medical biology**

1. The science of biology. Role and place of biology in medical training.

2. Concept of life in modern biological science. Forms and main characteristics of living things.

3. Levels of life organization and their importance to medicine.

4. Cell theory, its modern state and importance to medicine. General principles of cell structure.

5. Cell: basic structural and functional unit of life. Pro- and eukaryotic cells.

6. Methods of studying cellular structure and functions.

7. Chemical composition of cell.

8. Morphophysiology of cell. Cytoplasm. Double-membrane organelles.

9. Single-membrane organelles.

10. Non-membrane cell organelles. Organelles of motion. Inclusions.

11. Cellular membranes: chemical composition, structure and functions. Supra-membrane and infra-membrane complexes.

12. Membrane transport and its importance to medicine.

13. Cell as an open system. Transport of substances and energy flows in the cell. Cell energy supply.

14. Structure and functions of nucleus. Euchromatin and heterochromatin. Chromatin: levels of hereditary material organization. Sex chromatin.

15. Chemical composition, morphological features of chromosomes. Dynamics of their structure in the cell cycle (interphase and metaphase). Polytene chromosomes.

16. Human karyotype. Morphological and functional characteristics and classification of human chromosomes. The importance of studying human karyotype in medicine.

17. Ultrastructural cell pathology.

18. Molecular level of the inheritance information organization. Nucleic acids, their structure and functions.

19. Methods of genetic information transfer in bacteria: transformation, transduction, conjugation. Their importance in medicine.

20. Pro- and eukaryote genome structure. Gene structures: regulatory, tRNA and rRNA synthesis. Mobile genetic components.

21. Information flow organization in the cell. Replication of DNA and its importance. Self-correction and reparation of DNA.

22. Genetic code and its characteristics.

23. Main stages of cell protein biosynthesis. Transcription.

24. Translation: initiation, elongation, termination. Posttranslational protein transformation as a basis for their functioning.

25. Realization of genetic information in pro- and eukaryotes.

Exon-intron gene organization in eukaryotes. Processing, splicing.

26. Characteristics of regulating gene expression in pro- and eukaryotes.

27. Gene engineering and biotechnology.

28. Cell lifecycle, its possible realization and periodization. Cell cycle. Interphase.

29. Cell division. Mitosis.

30. Disorders of mitosis. Somatic mutations. Amitosis.

31. Regulation cellular cycle. Cell growth, growth factors. Concept of mitotic cell activity.

32. Cell death: apoptosis, necrosis.

33. Cell life out of the organism. Cell cloning. The importance of the tissue culture method for medicine.

34. Subject and problems of human and medical genetics. Pharmacogenetics and immunogenetics.

35. Human genotype as a system of interactive genes.

36. Human phenotype as a combination of species and individual traits and characters. Qualitative and quantitative traits.

37. Inheritance regularities in monohybrid crossing. The first and second laws of G.Mendel. Mendelian characters. Monogenic human characters.

38. Inheritance regularities in di- and polyhybrid crossing. The third law of G.Mendel.

39. Множинні алелі. Генетика груп крові. Значення для медицини.Multiple alleles. Genetics of blood groups and its importance for medicine.

40. Interaction of allelic genes: complete dominance, incomplete dominance, overdominance, codominance.

41. Interaction of non-allelic genes: complementation, epistasis.

42. Polymeric inheritance of traits in humans. Pleiotropy.

43. Linked inheritance (law of T.Morgan). Crossing over. Genetic and cytologic chromosome maps.

44. Chromosome theory of inheritance.

45. Modern state of human genome researches. Genetic maps of human chromosomes.

46. Genes of autosomes, sex chromosomes. Sex-linked, dependent and sex-limited traits. Hemizygosity.

47. Genetics of sex. Mechanisms of genetic sex determination. Gene dose. Gene position effect.

48. Variation, its forms and importance in the ontogenesis and evolution.

49. Modification variation and its characteristics. Reaction norm.

50. Multi-factor principle of the phenotype formation. Influence of the habitat on the gene expressivity and penetrance. Phenocopies.

51. Генотипова мінливість, її форми. Комбінативна мінливість. Механізми виникнення і значення.Genotypic variation and its forms. Combinative variation.

52. Mutation and their phenotypic manifestations. Mutation theory. Classification of mutations.

53. Mutagenic factors, their types. Mutagenesis. Genetic monitoring. Risk-reducing methods in mutations.

54. Gene mutations, mechanisms of their occurence. Concept of monogenic diseases.

55. Chromosome aberrations. Mechanisms of their occurence. Examples of diseases caused by chromosome aberrations.

56. Mechanisms of genome mutation occurence (polyploids, haploids, polysomes, monosomes)

57. Classification of human hereditary diseases, principles of their diagnostics.

58. Methods of studying human inheritance: genealogic, twin, molecular cytogenetic , biochemical, microbiologic, immunologic, dermatoglyphic, statistical method of population genetics, hybridization of somatic cells. Genetic markers.

59. Genealogical method. Types of traits inheritance.

60. Gene (molecular) diseases: enzymopathologies, diseases of metabolism of aminoacids, proteins, carbohydrates, lipids, nucleic acids, vitamins, hormones; mechanisms of their occurrence and principles of laboratory diagnostics.

61. Gene diseases caused by primary pleiotropy.

62. Non-chromosome inheritance. Mitochondrial inheritance. Mitochondrial genome. Mitochondrial diseases.

63. Hereditary diseases with an undetected biochemical defect.

64. Hereditary diseases caused by disorder in the number of autosomes and sex chromosomes; mechanisms of their occurrence, principles of laboratory diagnostics.

65. Mutations in the sexual and somatic cells, their relevance to medicine, Mozaicism.

66. Genetic heterogeneity in the hereditary diseases. Genocopies.

67. Diseases with genetic predisposition. Concept of multi-factor diseases.

68. Medico-genetic family aspects. Medico-genetic counselling.

69. Prenatal diagnostics of hereditary diseases. Screening-programs for indicating inherited metabolism disorders in the newborns.

70. Prevention and treatment of hereditary diseases. Future prospects of genotherapy.

71. Reproducton as a universal property of life. Methods and forms of reproduction. Future prospects of cloning organisms.

72. Meiosis. Mechanisms conditioning genetic variety of gametes.

73. Gametogenesis: spermatogenesis, oogenesis.

74. Sexual cells of humans, their cytogenetic characteristics and qualitative distinctions from somatic cells.

75. Fertilization. Parthenogenesis. Characteristics of human reproduction.

76. Ontogenesis and its periodization. Stages of embryonic development. Provision organs.

77. Genetic control of individual development. Differentiation of cells, embryonic leaves, tissues. Embryonic induction. Cloning organisms and tissues.

78. Characteristics of prenatal period of human development, critical periods of embryonic development of humans. Teratogenic factors of the environment.

79. Congenital developmental disorders, their modern classification: hereditary, exogenous, multi-factor; embryopathies and fetopathies; phylogenetic and non-phylogenetic disorders.

80. Postembryonic development of humans and its periodization.

81. Interaction between onto- and phylogenesis. Biogenetic law and its interpretation by A.N. Severtsov.

82. Phylogenesis of the body skin, skeleton, digestive, respiratory, blood circulatory, nervous, urinary and reproductive system of Chordata. Congenital development disorders conditioned by ontophylogenesis.

83. Neurohumoral regulation of growth and development.

84. Correlation of growth and differentiation in the postnatal period.

85. Ageing as a stage of ontogenesis. Theories of ageing.

86. Concepts of gerontology and geriatrics.

87. Clinical and biologic death.

88. Organs and tissues regeneration. Types of regeneration. The importance of regeneration in biology and medicine.

89. Characteristics and value of the regenerative process in humans. Typical and atypical regeneration. Growth of tumors.

90. Regulation capacity of the regenerative processes.

91. Problems of organs and tissues transplantation. Types of transplantation. Tissue incompatibility and methods of its overcoming.

92. Concept of homeostasis. Mechanisms of regulating homeostasis in the different levels of life.

93. Modern theory of biologic evolution as a synthesis of darwinism and populational genetics.

94. Biological species: reality and dynamics of its existence, criteria. Genofund (allelofund) of species.

95. Structure of species. Population as a main component of a species unit. Population characteristics: morphologic, ecologic, genetic. Gene pool of the population.

96. Ideal and real populations. The law of constant genetic structure in the ideal populations (Hardy-Weinberg’ law), its use for calculating genetic structure of real and human populations.

97. Conception of microevolution. Population as an elementary evolutionary unit.

98. Elementary evolutionary factors (directed and undirected) and their interaction.

99. Natural selection as a main driving factor of evolution; its forms.

100. Main outcomes of evolution: speciation, genetic polymorphism, adaptation.

101. Types of speciation.

102. Genetic heterogeneity and genetic polymorphism of natural populations as a basis for evolutionary plasticity.

103. Genetic load of the population.

104. Adaptation of organisms to their habitat. Origin of biological expedience.

105. Human population. Population structure of mankind. Large and small populations (demes, genetic isolates).

106. Influence of marriage structure and demographic rates on the gene pool of human populations.

107. Influence of mutagenesis, isolation, migration on the genetic structure of population and genetic constitution of humans. Genetic drift in isolates.

108. Features of natural selection in human populations. Selection and counter-selection.

109. Genetic and phenotypic polymorphism of mankind. Types of genetic polymorphism: adaptive (ecological) and balanced (heterozygous).

110. The conception of macroevolution. Interaction of macro- and microevolution.

111. Taxonomic position of *Homo sapiens* species in the living world. Qualitative features of humans. Correlation of biological and social factors in the process of anthropogenesis.

112. The origin of the human races as a result of adaptive laws of human development. The unity of mankind.

113. Parasitism. Morphophysiological adaptations of parasites. Evolution of parasitism.

114. Principles of the parasites classification: obligate, facultative, temporary, permanent, monoxenous, heteroxenous, specific and nonspecific parasites, endo- and ectoparasites.

115. The effects of a parasite on a host

116. Pathogenicity and virulence of the parasites.

117. The effects of a host on a parasite.

118. Modes, routes and mechanisms of a parasitic transmission.

119. Life cycles of parasites. Alternation of parasitic generations and phenomenon of the host alternation. Definitive, intermediate, additional, reservoir, obligate, and facultative hosts of parasites.

120. Biological and mechanical vectors of the diseases causative agents.

121. Organism as a habitat for parasites. Autoinvasion and reinvasion.

122. Parasitocenology. Human being as a main component of the symbiocoenosis.

123. Transmissive and natural focal diseases. Conception of obligate and facultative transmissive diseases.

124. E.N. Pavlovsky's theory of natural focality (nidality) of transmissive diseases. A natural focus and its components: a causative agent, its vector and reservoir hosts.

125. Types of natural foci. Synanthropic foci. Anthroponoses and zoonoses.

126. Biological principles of eradication of transmissive and natural focal diseases.

127. Essentials of prevention of parasitic diseases. Prophylaxis of parasitic diseases: biological, immunological, ecological, and public methods.

128. Factors of distribution of parasitic diseases. Influence of global human migrations on spreading parasitic diseases.

129. Famous parasitologists and their contribution to science.

130. Subkingdom Protozoa. Classification, structure, and medical importance of their representatives.

*Give the characteristics of a parasite according to the following plan:*

*1) Classification (Taxonomy); 2) Latin name; 3) Disease; 4) Geographic distribution; 5) Morphological features; 6) Localization inside human body; 7) Invasive stage for a human; 8) Route and factors of transmission; 9) Source of invasion; 10) Life cycle; 11) Pathogenicity; 12) Laboratory diagnosis; 13) Prophylaxis (Prevention).*

*131.Entamoeba histolytica*.

132. Amoebae– facultative parasites of humans. Non-pathogenic amoebae.

*133. Lamblia intestinalis*.

134. Trichomonads.

135. Causative agents of cutaneous and visceral leishmaniasis.

136. Causative agents of trypanosomiasis.

137. Malaria plasmodium. Species of malaria plasmodium. Malaria prevention and control activities in modern medicine.

*138. Toxoplasma gondii*.

*139. Balantidium coli*.

140. Phylum Plathelminthes (Flatworms). Classification, structure, and medical importance of their representative species.

141. Features of helminth life cycles. Geohelminths, biohelminths, contact helminths.

142. Liver fluke.

143. Cat fluke.

144. Lung fluke.

145. Chinese liver fluke.

146. Lancet fluke.

147. Blood flukes.

148. Causative agent of metagonimosis

149. Causative agent of nanophyethosis

150. Pork tapeworm.

151. Beef tapeworm.

152. Cysticercosis. Routes of transmission and prophylactic measures.

153. Dwarf tapeworm.

154. *Echinococcus* species: *E. granulosus* and *E. multilocularis*.

155. Broad fish tapeworm.

156. Phylum Nemathelminthes (Roundworms). Classification, structure, and medical importance of representative species.

157. Maw worm.

158. Larval ascarids: causative agents of human diseases (larva migrans syndrome).

159. Pinworm.

160. Whipworm.

161. Hookworms.

162. Palisade worm.

163. Trichina worm.

164. Guinea worm. L.M. Isaev’s contribution to eradication of dracunculiasis foci.

165. Filariidae (*Wuchereria bancrofti, Brugia malayi, Loa loa, Onchocerca volvulus*).

*166. Dirofilaria* species.

167. Laboratory diagnosis of helminthic invasions. Ovo-, larvo-, helminthoscopy.

168. Phylum Arthropoda. Classification, structure, and medical importance of representative species.

169. Class Crustacea: general characteristics. Crustaceans of medical importance.

170. Class Arachnoidea: general characteristics. Arachnids of medical importance.

171. Venomous arthropods. Mites - causative agents of human diseases.

172. Ticks – causative agents and vectors of human diseases.

173. Class Insecta. Morphology, features of life cycles, and medical importance of representative species.

174. Flies: species and their medical importance.

175. Cockroaches: species and their medical importance.

176. Lice: species, body structure and medical importance.

177. Fleas: features of body structure and development. Species of fleas.

178. Bugs: medical importance.

179. Mosquitoes: species, features of body structure and development, medical importance.

180. Sandflies. Biting midges.

181. Molluscs (snails) as intermediate hosts of helminths.

182. Venomous animals. Poisonous plants and fungi.

183. The biosphere and noosphere theories of V.I. Vernadsky. Living matter of biosphere and its functions.

184. Biogeochemical cycles and energy flows in biosphere.

185. Ecology. Conception of environment. Types of environment: aerial, aquatic, terrestrial, and internal.

186. Medical and biological aspects of biosphere impact on human health. Biofields and biological rhythms, their medical significance.

187. Ecological factors. Unity of an organism and environment

188. Human genetic variation caused by biological and geographical features of habitat.

189. Human adaptive ecotypes, their characteristics: arctic, tropical, temperate zone, desert, high altitude ecotypes.

190. Human adaptation to extreme conditions (the Arctic, deserts, space, etc.).

191. Hereditary differences in human response to environmental factors. The concept of ecogenetics.

192. Qualitative parameters of the environment and their effects on human health.

193. Healthy (comfort), unhealthy (discomfort), and extreme environments. Adequate and inadequate environmental conditions.

194. The concept of stress. Functional types of human response to the environmental factors (“sprinter”, “stayer”, “mixed”).

195. Human activity as an ecological factor. Basic directions and consequences of anthropogenic environmental changes. Environmental protection.

196. Major ecological problems of Ukraine.

**List of practical skills**

* Microscope techniques;
* making temporary preparations;
* differentiation of cellular components;
* making up an ideogram of human chromosomes;
* identifying primary structure, number of aminoacids, molecular mass of a polypeptide by the gene structure;
* analyzing the sequence of stages in the gene expression regulation ;
* determining the type of inheritance of Mendelian traits in humans;
* predicting genotypes and phenotypes in the offsprings on the basis of the parental genotypes;
* excluding the parenthood on the basis of blood groups of the child and parents;
* analyzing complex mechanisms of inherited traits in humans;
* working out measures for reducing the level of pathologic condition manifestation in patients with hereditary pathologies;
* choosing relevant methods of studying human inheritance for diagnosing different hereditary diseases;
* to calculate probability of arising hereditary diseases in the offsprings depending on the gen penetrance;
* to differentiate chromosome human diseases;
* to construct a family tree and do its genealogical analysis;
* to calculate the role of heredity and environmental conditions in the development of traits

 ( by the results of twin analysis);

* to calculate population genetic structure;
* to apply biogenetic law for determining inherited human disorders conditioned by ontophylogenesis;
* to compare occurence of human inherited disorders of different genesis;
* to study essential principles of regeneration and transplantation;
* to identify the place of biological object in the system of living nature;
* to substantiate the belonging of parasitic diseases to the group of transmissible and environmental ones;
* to diagnose causative agents and vectors of the parasitic diseases on the macro- and microslides;
* to distinguish the species – causative agents and vectors of protozoal diseases;
* to identify different stages in the lifecycle of human parasites;
* to substantiate methods of laboratory diagnostics for parasitic diseases;
* to distinguish the species of helminths and their ova;
* to differentiate diagnosing invasions by means of laboratory methods;
* to distinguish the species - vectors of human infectious diseases;
* to prove effectiveness of preventive measures for parasitic diseases depending on the ways of infection;
* to predict the influence of ecological factors on the human organism.

 **List of preparations to be determined during the summarizing control on the discipline**

1. Lamblia Intestinalis
2. Trichomonas vaginalis
3. Amoeba dysentery.
4. Malaria plasmodium
5. Toxoplasma gondii.
6. Liver fluke.
7. Liver fluke (transverse section).
8. Digestive system of the liver fluke.
9. Excretory system of the liver fluke.
10. Cat fluke.
11. Lancet fluke.
12. Scolex of the beef tapeworm.
13. Mature segment of the beef tapeworm.
14. Scolex of the pork tapeworm
15. Mature segmentof the tapeworm.
16. Mature segment of the broad fish tapeworm.
17. Dwarf tapeworm
18. Transverse section of the Ascaris lumbricoides (male and female)
19. Whipworm (male and female)
20. Hookworm (male and female)
21. Encapsulated larva of the Trichina worm
22. Cyclops.
23. Spider mouthparts.
24. Karakurt.
25. Itch mite.
26. Demodex foliculorum.
27. Ixodes ricinus.
28. Mite mouthparts.
29. Larva of Ixodes.
30. Mite nymphs.
31. Селищний кліщ?
32. Cockroach mouthparts.
33. Fleas.
34. Lice (male and female).
35. Coddler louse (male and female)
36. Pubic louse (male and female)
37. Клоп постільний (блощиця)
38. Поцілунковий клоп
39. Ova of malarial mosquitoes.
40. Ova of non-malarial mosquitoes.
41. Larva of malarial mosquitoes.
42. Larva of non-malarial mosquitoes.
43. Pupa of malarial mosquitoes
44. Pupa of non-malarial mosquitoes.
45. Scolex of malarial mosquitos (male and female).
46. Scolex of non-malarial mosquitoes (male and female).
47. Scolex of the house fly.
48. Scolex of the stable fly.

**Мicropreparations**: larva of Echinoccocus , beef tapeworm, broad fish tapeworm, larva of pork tapeworm, ascaris (male and female), scorpion, tarantula, camel spider.

**Appeal.** The students may apply for reviewing their grades. The grade on the discipline is reviewed according to the order established by the Kharkiv National Medical University.

Переклала з української на англійську викладач Мухортова О.Д.