MINISTRY OF EDUCATION AND SCIENCE OF THE RUSSIAN FEDERATION,
MINISTRY OF EDUCATION AND SCIENCE OF THE KYRGYZ REPUBLIC

Government-run Educational-Institution of Higher Professional Education
Kyrgyz-Russian Slavic University
School of Medicine

ENDORSED BY
Prof Anes Zarifyan

Деканат медицинского факультета
12.05.2021 г.

Biology

Course Outline (Module)

Assigned to the department of **Physics, Medical Informatics and Biology**

Academic Curriculum 31050150_21_1лд ин.plx
31.05.01. - RF, 560001 - KR General Medicine

Mode of Study **Intramural**

Total Credit Value **6 credit point**

Course Hours 216
including:
in-class learning 126
individual work 53,7
exam 35,5

Scope of Testing Semesters :
exam 2
credit 1

Course Hours Scheduling (per semester)

Semester Academic Year	1 (1.1)		2 (1.2)		Total	
Weeks	18		21 3/6			
Type of Traning	AC	CO	AC	CO	AC	CO
Lectures	36	36	18	18	54	54
Practical Session	36	36	36	36	72	72
Face-to-face Learning during the period of theoretical training	0, 3	0,3			0,3	0,3
Face-to-face Learning during examination session			0,5	0,5	0,5	0,5
Including Interactive	3	3	4	4	7	7
Total In-class Session	72	72	54	54	126	126
Face-to-face Learning	72	72,3	54,5	54,5	126,8	126,8
Individual Work	35	35,7	18	18	53,7	53,7
Hours for control			35,5	35,5	35,5	35,5
Total	10	108	108	108	216	216

The Course outline developed by:

Candidate of Biological Sciences, associate professor, Karaeva R.R.; Candidate of biological Sciences, associate professor, Morkovkina A.B.; Doctor of Biological Science, professor, Kobzar V.N. _____

Reviewers:

Doctor of Medical Sciences, professor , Kuttubaev O.T. _____

The Course Outline

Biology

developed in full compliance with FSES 3++:

Federal State Education Standards of Higher Professional Education for students trained for specialty 31.05.01 General Medicine (The Ministry of Education and Science of the Russian Order of 12.08.2020 г. № 988)

in accordance with Academic Curriculum:

Specialty 31.05.01. - RF, 560001 - KR General Medicine

confirmed by KRSU Board of Academics in 29.06.2021 record № 10.

The Course Outline endorsed by

Physics, Health Informatics and Biology Department Meeting

Record of 26.08.2021 y. № 1
Valid for: 2021-2027 academic year
The Head of Department Candidate of Biological Sciences, associate professor Karaeva R.R.

The course outline endorsed for the following academic year

Chairman of the Educational and Methodological Board
06. 10. 2022 y.

The course outline has been revised, considered and endorsed
for implementation in 2022-2023 Academic Year at the Staff Meeting of
Physics Medical Informatics and Biology Department

Record of 03. 10 2022 y. № 3
The Head of Department, Candidate of Biological Sciences, associate professor Karaeva R.R.

Chairman of the Educational and Methodological Board
__ _____ 2023 y.

The course outline has been revised, considered and endorsed
for implementation in 2023-2024 Academic Year at the Staff Meeting of
Physics Medical Informatics and Biology Department

Record of __ _____ 2023 y. № __
The Head of Department, Candidate of Biological Sciences, associate professor Karaeva R.R.

Chairman of the Educational and Methodological Board
__ _____ 2024 y.

The course outline has been revised, considered and endorsed
for implementation in 2024-2025 Academic Year at the Staff Meeting of
Physics Medical Informatics and Biology Department

Record of __ _____ 2024 y. № __
The Head of Department, Candidate of Biological Sciences, associate professor Karaeva R.R.

Chairman of the Educational and Methodological Board
__ _____ 2025 y.

The course outline has been revised, considered and endorsed
for implementation in 2025-2026 Academic Year at the Staff Meeting of
Physics Medical Informatics and Biology Department

Record of __ _____ 2025 y. № __
The Head of Department, Candidate of Biological Sciences, associate professor Karaeva R.R.

1. THE PURPOSE OF LEARNING	
1.1	to form students' biological thinking and integral natural science worldview which are necessary in doctor's practical activities; to form basic knowledge and general concepts and to single out humans as a central object of biology studying;
1.2	to show human bio-social nature, dependence on general biological developmental laws, unity of human with life environment with emphasis on biological regularities which are advantageous for practical healthcare and to get acquainted to the effect of total consistent pattern of ecological factors on an organism;
1.3	to study parasitism and basics of medical parasitology in the context of ecology and to teach the intelligent perception of practical issues connected with biology, including human health, nature protection, recovery from ecological crisis and environmental consciousness education;

2. PLACE OF THE COURSE IN THE EDUCATIONAL PROGRAM	
Cycle (section) ООП:	B1.O
2.1	**Students' Preliminary Training Requirements:**
2.1.1	Biology, anatomy and general biology which are included in a high school level;
2.1.2	Chemistry in the frame work of a high school level.
2.2	**Course Units and Practical Sessions imposing the prior Proficiency:**
2.2.1	microbiology, virology;
2.2.2	normal physiology;
2.2.3	biochemistry;
2.2.4	pathophysiology, clinical pathophysiology;
2.2.5	histology;
2.2.6	medical genetics;
2.2.7	epidemiology;
2.2.8	immunology;
2.2.9	general hygiene.

3. THE COMPETENCE OF THE LEARNER, FORMED AS A RESULT OF LEARNING (MODULE)	
OPC-10: readiness to solve standard tasks of professional activity using information, bibliographic resources, medical and biological terminology, information and communication technologies and taking into account the basic information security requirements.	
Know:	
Level 1	basic biological, physico-chemical, mathematical and natural science concepts and laws, natural science methods, general laws of natural science for solving professional problems
Ability:	
Level 1	apply methods of basic biological, physico - chemical, mathematical and other natural and science concepts, to analyze the results of experimental studies
Skills:	
Level 1	to use of fundamental laws of natural and science concepts, to apply methods of mathematical analysis in experimental studies

Final Students' Competences

3.1	**Know:**
3.1.1	the role of biological elements and their compounds in living organisms;
3.1.2	basic laws of development and life activity of organisms on the basis of cell structural organization, tissues, organs;
3.1.3	structure and functions of the most important chemical compounds (nucleic acids, natural proteins, etc);
3.1.4	genetics laws and their significance for medicine;
3.1.5	general regularities of origin and development of life, anthropogenesis and human ontogenesis;
3.1.6	basic notions and issues of biosphere and ecology, phenomenon of parasitism and bioecological diseases;
3.1.7	basic regularities of development and vital activities of adults and teenagers;
3.1.8	cell differentiation, mechanism of formation of congenital malformations in children;
3.2	**Ability:**
3.2.1	practice of graphically represent the examined objects and processes in the form of diagrams, drawings, animations;
3.2.2	practice to create of compilation diagram which illustrate causes and mechanisms of chromosomal pathology;

3.2.3	practice to prepare of temporary specimen for microscopy (onion and water weed cells, cell inclusions);
3.2.4	practice to conduct microscopic examination;
3.2.5	practice to use basic data conversion technologies: text, table editors, search in the Internet;
3.2.6	practice to apply methods of studying human heredity (cytogenetic, genealogical, twin methods);
3.2.7	practice to solve case tasks on parasitology, phylogenetic system and organs and ecology.
3.3	**Skills:**
3.3.1	to work with magnifying devices (microscopes, optical and simple magnifying lenses);
3.3.2	to solve genetic and case tasks;
3.3.3	to diagnose causative agents of human parasitic diseases using sample, slide, photo;
3.3.4	to use computers for processing medical information;
3.3.5	to use information from science, popular and science literature, internet network for professional activities;
3.3.6	to solve case tasks on models of genetic counseling;
3.3.7	to compose pedigree tree and detect type and character of heredity with the benefit of genealogical method;
3.3.8	to use knowledge to solve case tasks on parasitology, phylogenetic system and organs as well as
3.3.9	ecology.

4. COURSE (MODULE) STRUCTURE AND CONTENT

Class Code	Subject Name /Type of Class/	Semester / Academic Year	Hours	Competencies	Literature	Interact.	Pr. prep.	Note
	Section 1. Introduction. Molecular genetic level of life organization. Cell biology. Implementing fundamental processes of life-sustaining activity.							
1.1	Introduction to biology. Levels of life organization. /Lec/	1	2	OPC-10	L1.1L1.2			
1.2	Cell biology. /Lek/	1	4	OPC -10	L1.1L1.2			
1.3	Microscope. Techniques of microscopic examination. Prepa-ration of temporary slides.	1	2	OPC -10	L1.1L1.2			
1.4	Cell biology. /Pr/	1	2	OPC -10	L1.1L1.2			
1.5	Regularities of cell existence through time. Multiple choice questions: “Cell” /Pr/	1	2	OPC -10	L1.1L1.2			
1.6	History of advances in cell structure. Cell as an elementary structural functional biological unit. Methods of cytology: progress and perspectives. /Iw/	1	4	OPC -10	L1.1L1.2			
1.7	Cell as an open system. Flow of energy, information and matter. /Iw/	1	2	OPC -10	L1.1L1.2			
	Section 2. Ontogenetic level of life organization. Reproduction. Developmental biology. Postnatal ontogenesis.							
2.1	Reproduction. /Lec/	1	2	OPC -10	L1.1L1.2			
2.2	Postnatal ontogenesis. /Lec/	1	2	OPC -10	L1.1L1.2			
2.3	Regeneration and transplantation. /Lec/	1	2	OPC -10	L1.1L1.2			
2.4	Reproduction. /Pr/	1	2	OPC -10	L1.1L1.2			
2.5	Developmental biology. Ontogenesis, Embryogenesis. /Pr/	1	2	OPC -10	L1.1L1.2			
2.6	The critical periods of development. Multiple choice questions: “Reproduction and Embryogenesis”. /Pr/	1	2	OPC -10	L1.1L1.2			

2.7	Biological role of sexual reproduction and special aspects of human reproduction. /Pr/	1	4	ОРС -10	L1.1L1.2			
2.8	The critical periods of the organism development. Biological rhythms. /Pr/	1	4	ОРС -10	L1.1L1.2			
2.9	Stem cells. /Pr/	1	2		L1.1L1.2			
	Section 3. General and medical genetics. Trend of formation and inherited character.							
3.1	Introduction to genetic. /Lec/	1	2	ОРС -10	L1.1L1.2			
3.2	Gene interactions. /Lec/	1	2	ОРС -10	L1.1L1.2			
3.3	Cellular basics of heredity. /Lec/	1	2	ОРС -10	L1.1L1.2			
3.4	Molecular basics of heredity. /Lec/	1	2	ОРС -10	L1.1L1.2			
3.5	Variability. /Lec/	1	2	ОРС -10	L1.1L1.2			
3.6	Human genetics and medical genetics. /Lec/	1	2	ОРС -10	L1.1L1.2			
3.7	Introduction to genetic. Solution of genetic tasks. /Pr/	1	2	ОРС -10	L1.1L1.2	1		
3.8	Gene interactions. Solution of genetic tasks. /Pr/	1	2	ОРС -10	L1.1L1.2	1		
3.9	Regularities of inheritance at the cellular level. Solution of genetic tasks. /Pr/	1	2	ОРС -10	L1.1L1.2			
3.10	Complete and incomplete linked genes. SEX-Linked inheritance. Solution of tasks. /Pr/	1	2	ОРС -10	L1.1L1.2			
3.11	Regularities of inheritance at the molecular level. Extranuclear inheritance. Solution of tasks. /Pr/	1	2	ОРС -10	L1.1L1.2	1		
3.12	Variability. Solution of genetic tasks. /Pr/	1	2	ОРС -10	L1.1L1.2			
3.13	Human genetics and medical genetics. Solution of genetic tasks. /Pr/	1	2	ОРС -10	L1.1L1.2			
3.14	Genetic counselling. Multiple choice questions: “Genetics”. /Pr/	1	2	ОРС -10	L1.1L1.2			
3.15	Linked inheritance. Genetics of sex. Sex-linked inheritance. /Iw/	1	4	ОРС -10	L1.1L1.2			
3.16	Twins and genealogical research methods. Biotechnology. Gene therapy for diseases. /Iw/	1	4	ОРС -10	L1.1L1.2			
3.17	Mitochondrial heredity. The structure of the gene pro- and eukaryotes. Structural, regulatory, tRNA, rRNA genes. /Iw/	1	4	ОРС -10	L1.1L1.2			
3.18	Hereditary syndromes. /Iw/	1	4	ОРС -10	L1.1L1.2			
	Section 4. Biocenosis level of organization of life. Medical parasitology: protozoology, helminthology and archaeoentomology							
4.1	Biological basics of parasitism and transmissible diseases. /Lec/	1	4	ОРС -10	L1.1L1.2			
4.2	Basics of protozoology. Phylum Protozoa. Class Flagellates. /Pr/	1	2	ОРС -10	L1.1L1.2			
4.3	Class Sporozoa. /Pr/	1	2	ОРС -10	L1.1L1.2			

4.4	Class Sarcodina and Infusoria. /Pr/	1	2	OPC -10	L1.1L1.2			
4.5	Multiple choice questions: “Protozoology”. /Pr/	1	2	OPC -10	L1.1L1.2			
4.6	Toxoplasma as behavior manipulator of animals and people. /Iw/	1	3,7	OPC -10	L1.1L1.2			
4.7	CWTO /CWTO/	1	0,3	OPC -10				
4.8	Credit /Credit/	1		OPC -10				
4.9	Phylum Flatworms. Class Trematoda (Flukes). 1. Liver, Cat and Chinese flukes. /Pr/	2	2	OPC -10	L1.1L1.2			
4.10	Phylum Flatworms. Class Trematoda (Flukes). 2. Lancet, Pulmonary and Blood flukes. /Pr/	2	2	OPC -10	L1.1L1.2	1		
4.11	Phylum Flatworms (Platyhelminthes), Class Tapeworms (Cestodea). 1. The Pork and Beef tape worms. /Pr/	2	2	OPC -10	L1.1L1.2			
4.12	Class Tapeworms (Cestodea). 2. Echinococcus, Alveococcus, Dwarf tapeworm, Broadfish tapeworm. /Pr/	2	2	OPC -10	L1.1L1.2	1		
4.13	Phylum Roundworms (Nemathelminthes), Class Actually roundworms (Nematoda). 1. Ascaris, Pinworm, Human Whipworm. /Pr/	2	2	OPC -10	L1.1L1.2			
4.14	Class Actually roundworms (Nematoda). 2. Human Hookworms, Trichinosis, Guinea worm. /Pr/	2	2	OPC -10	L1.1L1.2			
4.15	Multiple choice questions: “Medical helminthology”. /Pr/	2	2	OPC -10	L1.1L1.2			
4.16	Phylum Arthropoda, Class Crustacea and Arachnids. /Pr/	2	2	OPC -10	L1.1L1.2			
4.17	Class Insecta. 1. Order Cockroach: Lice, Fleas, Hemiptera. /Pr/	2	2	OPC -10	L1.1L1.2			
4.18	Class Insecta. 2. Order Diptera: housefly, mosquito and Sandfly. /Pr/	2	2	OPC -10	L1.1L1.2			
4.19	Multiple choice questions: “Medical entomology”. /Pr/	2	2	OPC -10	L1.1L1.2			
4.20	The phenomenon of parasitism. /Iw/	2	2	OPC -10	L1.1L1.2			
4.21	Mites as the phenomenon of parasitism. /Iw/	2	2	OPC -10	L1.1L1.2			
4.22	Mosquitoes as vector of transmissible diseases. /Iw/	2	2	OPC -10	L1.1L1.2			
4.23	Arthropods - vectors and pathogens of human diseases. /Iw/	2	2	OPC -10	L1.1L1.2			
	Section 5. Population species level of life organization. Evolution issues. Anthropogenesis.							
5.1	Biological evolution. Darwin’s evolutionary theory. /Lec/	1	2	OPC -10	L1.1L1.2			

5.2	Elementary factors of evolution. Regularities of microevolution and macroevolution. /Lec/	1	2	OPC -10	L1.1L1.2			
5.3	Inherited polymorphism of natural populations. Genetic polymorphism of humanity. /Lec/	1	2	OPC -10	L1.1L1.2			
5.4	Population structure of humanity. /Lec/	1	2	OPC -10	L1.1L1.2			
5.5	Modern system of organic world – result of evolution. Phylogenetic and ecological relationships in nature /Lec/	2	2	OPC -10	L1.1L1.2			
5.6	Interrelation of onto- and phylogenesis. Interrelation between historical and individual development. General regularities of organs evolution. /Lec/	2	2	OPC -10	L1.1L1.2			
5.7	Anthropogenesis. /Lec/	2	2	OPC -10	L1.1L1.2			
5.8	Humans of the future. /Lec/	2	2	OPC -10	L1.1L1.2			
5.9	Phylogenesis of the brain and urogenital system. /Pr/	2	2	OPC -10	L1.1L1.2			
5.10	Phylogenesis of the respiratory and digestive system. /Pr/	2	2	OPC -10	L1.1L1.2			
5.11	Phylogenesis of the blood and vascular system. /Pr/	2	2	OPC -10	L1.1L1.2			
5.12	Onto phylogenetic congenital abnormality systems of organs. /Iw/	2	2	OPC -10	L1.1L1.2			
5.13	Evolution systems and organs of vertebrates. /Iw/	2	4	OPC -10	L1.1L1.2			
	Section 6. Population-specific level of organization. Basics of ecology. Human ecology. Biosphere level of organization of the living things. Biosphere and humans.							
6.1	Basics of ecology. /Lec/	2	2	OPC -10	L1.1L1.2			
6.2	Human ecology. /Lec/	2	2	OPC -10	L1.1L1.2			
6.3	Theory of biosphere. /Lec/	2	2	OPC -10	L1.1L1.2			
6.4	Problems of environment protection. /Lec/	2	4	OPC -10	L1.1L1.2			
6.5	Basics of ecology. /Pr/	2	2	OPC -10	L1.1L1.2	2		
6.6	Human ecology. /Pr/	2	2	OPC -10	L1.1L1.2			
6.7	Multiple choice questions: “Phylogenesis. Ecology.” /Pr/	2	2	OPC -10	L1.1L1.2			
6.8	Diagnostic signs of parasites. /Pr/	2	2	OPC -10	L1.1L1.2			
6.9	Ecological diseases of the human. Problems of environmental protection. /Iw/	2	2	OPC -10	L1.1L1.2			
6.10	Axioms of human ecology. /Iw/	2	2	OPC -10	L1.1L1.2			
6.11	CWEx /CWEx/	2	0,5	OPC -10				
6.12	Exam /Exam/	2	35,5	OPC -10				

5. ASSESSMENT FUND

5.1. Advancement Questions and Assignments

Questions for check student’s competences Knowledge (Annex 2):
- theory of biological systems, their organization, molecular mechanisms of normal and pathology processes;
- cellular organization of living organisms, hypotheses of evolutionary origin of membrane cell components, molecular

mechanisms of transport, intercellular communication, energy transduction in cells;
- regularities of processes and mechanisms of storage, transfer and use of biological information in the cell, principles of gene expression control;
- structural functional organization of genetic material, features of the genome prokaryotes and eukaryotes, organization of the human genome;
- cytological basis of various forms of organisms reproduction;
- molecular mechanism of organisms individual development, aging mechanism, cellular and humoral factors of body protective systems;
- new approaches to treatment of hereditary human diseases, gene and cell therapy;
- biological basis of diagnostic and preventive measures that address at prevention of emergence infectious and parasitic diseases;
- optimal schemes for identification of homologous and analogous structures in organ systems of vertebrates and rationale of hereditary diseases and ontophylogenetic congenital anomaly (blood, urinogenital, nervous and other systems);
- general patterns of direction and factors of evolution for explanation of adaptive nature of evolutionary process;
- patterns of population ecology, processes of development and functioning of ecosystems and biosphere in general for planning strategies of human existence in the biosphere, as well as for the organization of preventive measures and medical care for the population.

Ability:
- common pattern, directions and factors of evolution for explanation of adaptive principles of evolutionary process;
- comparative features of the structure and functioning of different kingdoms and the human body;
- comparison of biological objects, processes, phenomena at all levels of life organization;
- establishment sequences of environmental and evolutionary processes, phenomena of parasitism and bio ecological skills.

Skills:
- to be able to work with microscope;
- to identify biological objects;
- to work with texts, drawings, tables, models;
- to solve typical tasks on cytology and molecular biology; for example, knowledge in the field of protein biosynthesis, the composition of nucleic acids, cell energy exchange;
- to solve genetic tasks on mono- and polyhybrid cross;
- to compile and analyze pedigree, genetic linkage and inheritance characteristics, sex-linked chromosomes;
- to identify pathogens of human parasitic diseases on microslide and photos;
- to solve typical case tasks for self-control on all subjects of the discipline.

Assignments for testing student's competencies Ability and Skills.
Solution of genetic tasks starts with segregation analysis.
1. Number and types of gametes are determined. Number of gametes depends on homo- or heterozygosis of genes arrangement in one or different chromosome pairs. All homozygotes form one type of gamete. Number of types of gametes in heterozygotes depends on the number of alleles in its genotype and is 2n, where n is the number of heterozygous alleles. Therefore, in species with AaBb genotype formed 4 (22) types of gametes: AB, Ab, aB, ab are.
2. Type of gene interaction and their localization in chromosomes as well as survival of descendents of different genotypes, i.e. absence of lethal and semilethal genes, is determined.
3. Phenotype of descendents of test cross is determined by types of gametes of heterozygous parent and split depends on numerical relation of these gametes and character of genes inheritance.
4. The main principle of genetic analysis is analysis of unit (single) characters. During the first stage, generations are reviewed on every character separately, independently from other characters. Then split into character pairs is analyzed, etc.

Knowledge of theoretical material plays significant role in tasks solution: formula of split into phenotype and genotype which causes induced deviations in them, ability to write down gametes formed by species of different genotypes correctly.
Solution of tasks includes a brief record of the condition with the help of genetic symbols.
Syndactylia (ankylodactylia) is determined by the dominant gene which resists separation of fingers during embryogenesis. A woman has this defect and has been married twice. Both husbands had normal fingers. From the first marriage two children were born. One of them had fused fingers. From the second marriage three children were born. Two of them had fused fingers. What can you say about genotype of the women and her husbands?

Draw up task condition in the form of "Gene – character – genotype" table.
Gene Character Genotype
A Syndactylia Aa ♀
a Normal structure of fingers aa ♂

Since all husbands of this woman have normal fingers, then they have (aa) genotype. The split occurred in their children, and this could happen only if the woman was heterozygous (Aa). Syndactylia is the dominant character.
P: ♀ Aa (syndactylia) x ♂ aa (normal fingers)
G: A, a a
F1: Aa : aa

Answer: All husbands had normal fingers and their genotypes were aa. There were gene fissions, and it happened in case of the

woman heterozygote (Aa, syndactylia - dominant character).
Every student must solve 50 genetic tasks on mono- and polyhybrid crossing as student individual work.

5.2. Themes of course works (projects)

The discipline doesn't involve writing a coursework.

5.3. Evaluation Fund

Case study. The list of typical and situational tasks for self-control includes the following topics: cytology (10 tasks), reproduction and embryogenesis (11 tasks), genetics (20 tasks), medical helminthology (58 tasks), medical entomology (35 tasks), phylogeny of systems and organs (20 tasks), ecology and biosphere (19 tasks).

Case studyis a form of control which doesn't change in the course of formative, midterm and summative assessment. It can be divided into two main stages of algorithm in solving any situational task from biology: 1) case study based on input assumptions (what is given?); 2) establishing diagnosis (what is found?). There can be given both significant and nonessential signs in the conditions of the case study, therefore standards of case problem solving are given.

Case study. Amygdalin (laetrile) was once recommended as anti tumor agent. Under the influence of digestive enzymes it degrades with release of cyanide. There are known cases when patients died from poisoning with cyanide having taken overdose of amygdalin. Cyanide inactivates certain components of electron transport chain. How can its toxic action be explained?
Standard answer. Cyanide suppresses processes of oxidation and oxidative phosphorylation which provides mitosis with energy, i.e. prevents beginning of mitosis, but not chromosome doubling. Mitosis doesn't occur, but nuclear volume increases.

Case study. All the cells of a diseased man with a syndrome have 47 chromosomes due to the extra X-chromosome. Specify the name of mutation, all possible mechanisms of its formation and probability of its transfer to the generation.
Standard answer. It is aneuploidy – trisomy of sex chromosomes (Klinefelter syndrome).
Mechanism: nondisjunction of chromosomes during meiosis in the process of spermatogenesis or ovogenesis: 1) conjugate ovum having two X- chromosomes and sperm with Y - chromosome; 2) conjugate ovum having X- chromosome and sperm having X and Y - chromosomes.

Case study. A patient has fever, enlarged spleen and liver. Reduction of red blood cells content was established. Microscopic examination of breast punctate smears revealed that there are a great number of small nonflagellate parasites in the bone marrow cells. The core is located in cytoplasm. Rod-like kinetoplast is obvious. In parasite cultivation, the artificial medium doesn't turn into flagellant form. Which disease can be supposed in this case?
Standard answer. Visceral leishmaniasis.

Case study. A 28 years old patient complains of the pain in the liver and nausea. According to the medical history in the acute disease phase, he had temperature increase, sharp pain in the abdomen, suffocating feeling and respiratory difficulty. On examination of faeces, oval eggs with size of 150 - 90 micrometer with caps are revealed. What is the diagnosis?
Standard answer. Fascioliasis.

Case study. A patient has periodic febrile attacks and inflammations in the respiratory system. According to the medical history it is known that the patient likes to go to the mountains for several days sleeping in abandoned mud houses near caves and holes of rodents. What is the specific name of the parasite and who is its carrier? What is the diagnosis?
Standard answer. Ornithodoros papillipes.
Solution of case study develops students' professional thinking, enables them to solve the following problems: 1) mastering the skills of situation analysis; 2) surgical decision-making; 3) using additional information to clarify the initial situation; 4) making decision on their own; 5) getting experience from their own or others' mistakes.

Credit on diagnostics of parasitic microslides includes 17 slides on helminthology and 22 – on arachnoentomology.

Reference answer. Total microslide of liver fluke (Fasciola hepatica)
Diagnostic character:
1. Body foliated.
2. Length 3-5, width – 0,8–1,2 sm.
3. Two suckers: oral and ventral.
4. Two branches of the intestine – right and left with numerous lateral branches.
5. Uterus branched, egg-filled yellowish-brown.
6. Two branching testes.
7. Branched ovary is located behind and on the right side of the uterus.
8. Numerous vitelline glands are located on the sides.

Reference answer. Total microslide of pubic louse (Phtirus pubis)
Diagnostic character:
1. Body short, broad, trapezoidal, merged, the widest part of the body is chest.
2. Female size - 1,5 mm, male 1,0 mm.
3. Head is big, the eyes lie at the base of the antennae.
4. There are warty growths with long hair on abdominal sides.
5. Legs aren't the same size: more developed is third pair of legs with large claws on the legs; claws bent helically.
6. There are spiracles on the sides of breasts.

7. Females are different from males by bifurcated posterior end of abdomen; the angle between them is blunt.

Students attending practical classes on biology should keep the records in the “Workbook” during 1-2 semesters. The workbook contains 201 drawings for all thematic sections of biology.

List of microslides on medical helminthology for credit
1. Total microslide of Liver fluke (Fasciola hepatica).
2. Digestive system of the Liver fluke (Fasciola hepatica).
3. Excretory system of the Liver fluke (Fasciola hepatica).
4. Total microslide of Cat fluke (Opistorchis felineus).
5. Total microslide of Lancet fluke (Dicrocoelium lanceatum).
6. Measles with inverted head of Pork tape worm (Taenia solium).
7. Gravid proglottid of the Pork tape worm (Taenia solium).
8. Mature proglottid of the Pork tape worm (Taenia solium).
9. Gravid proglottid of Beef tape worm (Taeniarhynchus saginatus).
10. Mature proglottid of the Beef tape worm (Taeniarhynchus saginatus).
11. Measles with inverted head of the Beef tape worm (Taeniarhynchus saginatus).
12. Total microslide of Echinococcus (Echinococcus granulosus).
13. Total microslide of Dwarf tapeworm (Hymenolepis nana).
14. Mature proglottid of Broadfish tapeworm (Diphyllobotrium latum).
15. Cross section of Ascaris (Ascaris lumbricoides).
16. Total microslide of male and female of human Whipworm (Trichocephalus trichiurus).
17. Encapsulated larvae of Porkworm (Trichinella spiralis) in the muscles
18. Total microslide of male and female of Pinworm (Enterobius vermicularis).

Outline for the identification of a microslide on Medical helminthology
1. Name of a microslide;
2. Helminthes systematic position (Phylum, Class, Order) in English and Latin;
3. Disease name;
4. Diagnostic signs of the microslide;
5. Helminthes localization in the human body;
6. Life cycle stages (in series);
7. Hosts of helminthes: a) the final, b) intermediate;
8. Invasive stage for humans;
9. Ways of infection of the person;
10. Pathogenic action;
11. Laboratory experience;
12. Prevention.

List of microslides on medical entomology
1. Larva and nymph of Taiga tick (Ixodes persulcatus);
2. Total microslide of Taiga tick (Ixodes persulcatus);
3. Total microslide of Dog tick (Ixodes ricinus);
4. Total microslide of Township mite (Ornithodorus papillipes);
5. Larva of Township mite (Ornithodorus papillipes) and nymph of Ixodes sp.;
6. Total microslide of Dermacentor pictus;
7. Mouthparts of Taiga tick (Ixodes persulcatus);
8. Mouthparts of Black beetle (Blatella germanica);
9. Total microslide of head lice (Pediculus humanus capitis);
10. Total microslide of body lice (P. humanus humanus);
11. Total microslide of pubis lice (Phtirus pubis);
12. Total microslide of human fleas (Pulex irritans);
13. Head of male and female of Genus Anopheles;
14. Head of male and female of Genus Culex;
15. Eggs, larva and pupa of Genus Anopheles;
16. Eggs, larva and pupa of Genus Culex;
17. The wings of Anopheles and Culex;
18. The mosquito (Culex pipiens pipiens);
19. The mail of Anopheles maculipenni;
20. Walking legs of the housefly (Musca domestica);
21. Mouthparts of the housefly (Musca domestica);
22. Total microslide of Bed bug (Cimex lectularius);
23. Mouthparts of the Bed bug (Cimex lectularius).

Outline for the identification of a microslide on Medical entomology
1. Name of microslide;
2. Diagnostic signs of the microslide;
3. Systematic position of parasitic animals (Phylum, Class, Order) in English and Latin;

4. Special characteristics of imago external structure: a) the body is segmented, b) number of pairs of limbs, c) kind of mouthparts, d) presence of wings;
5. Kind of postembryonic development (direct, indirect), metamorphosis (full, incomplete);
6. Medical significance.

There are some tasks for students' self-training to prepare for credit on medical parasitology. Students should do these tasks individually.

Multiple choice questions. List of control tasks on the topics: 1) Multiple choice questions; 2) silent drawing on all the topics studied; 3) silent microslide on parasitology; 4) a lecture question.

Questions of control works and lecture questions are in the Annex 2.

Review questions included in the summative assessment correspond to biology course outline and allow to clarify understanding of the studied material, promote cognitive and intellectual activities of students, reveal their ability to analyze the studied material, compare data and make conclusions.

5.4. List of Assessment Tools

Case study,
Multiple choice questions,
Credit on diagnostics of microslides,
Abstract,
Essay,
Business game,
Exam.

EVALUATION SCALE OF CASE STUDY(formative assessment)
5 points – the student gives complete answer for all questions of case tasks (86-100%), widely use information from basic and additional literature.
4 points – the student gives correct but not very detailed answer with minor errors for all questions (76-85%), useing information from basic and additional literature.
3 points – the student solves tasks correct but not all answer are correct (60-74%), misses details, making errors, uses information from basic literature.
2 points – the student solves correctly separate fragments of the tasks, doesn't answer all questions, makes errors, uses information from basic literature (36-59%).
1 point – the student demonstrates single fragments of knowledge, does not solve tasks at all (20-35%).
0 points – the student does not solve any task, gives wrong answers (0-19%).

EVALUATION SCALE OF THE MICROSLIDE DIAGNOSTICS
The marks are set on a 5-point scale and correspond to the number of correctly identified microslides. In case when rating system of the assessment is used, the mark may vary in the range of 10%. For example mark "4" range 76 to 85 points or % on 100 point scale. Students who fail to receive credit score must be retake the exams until receiving a satisfactory mark.

Evaluation of the answer
5 points – the student gives complete answer (86-100%) and identifies a microslide, does student individual work on identifying the microslide correctly, shows deep knowledge of the topic.
4 points – the student identifies a microslide and gives correct answers for all questions (76-85%), but makes a minor errors in the theoretical material or student individual work on a diagnostic microslide, demonstrates deep knowledge of the topic.
3 points – the student identifies a microslide, but answers incompletely (60-75% of the study material) or does gross errors in student individual work on a diagnostic microslide.
2 points – the student does not identify a microslide, answers 36-59% of the study material and does gross errors in student individual work on a diagnostic microslide.
1 point – the student does not identify a microslide, answers 20-35% of the study materials and does not do student individual work on a diagnostic microslide.
0 points – the student does not identify a microslide, answers less than 0-19% of the study material and does not do student individual work on a diagnostic microslide.

ABSTRACT EVALUATION SCALE
Maximum points – 50-39 – as "excellent"; 38-33 – "good"; 32-27 – "satisfactory".

Evaluation of the abstract
Mark "excellent" – all the requirements for writing and presentation of the abstracts: the problem is identified and its relevance is indicated, brief analysis of various points of view on the problem under consideration is made; personal position logically stated, correct answers on additional questions are given.
Mark "good" – primary requirements for the abstract and its presentation fulfilled, but there are some shortcomings: inaccuracies in the abstract, logical sequence of judgment is absent; incomplete answers on additional questions.

Mark “satisfactory” – there is a significant digression from the requirements for the abstract: the topic is described partially; mistakes in the content of the abstract or mistakes in answers on additional questions; no conclusion is made.
Mark “unsatisfactory” – the theme of the abstract is not disclosed, the problem is not understood for requirements task solving.

BUSINESS GAME EVALUATION CRITERIA: 1) mutual assistance in a group; 2) ability to communicate with colleagues; 3) ability to work with colleagues; 4) ability to meet the time when tasks solving; 5) ability to listen to the speaker's speech.
5 points – for tactful behavior in the game, some points may be added at the discretion of the facilitator and experts.

EVALUATING SCALE OF THE ORAL QUESTIONNAIRE
5 points – the answer is logically correct and complete without leading questions from the teacher, clear understanding of the questions; student works with basic and additional literature; attend all or most lectures; competently uses scientific and Latin terminology; individually solves learning tasks, focuses on basic theories, concepts.
4 points – the answer is incomplete and (or) inaccurate; the student gives right answers after additional, clarifying questions of the teacher; the student missed 3-4 lectures without a good reason; demonstrates knowledge of the basic literature for all sections of the program; reads and understands scientific literature using Latin terminology; correctly answers questions, knows how to solve standard tasks, navigate in the main theories.
3 points – the answer is incomplete and (or) inaccurate. The student cannot give correct answer, makes gross mistakes answering additional questions, does not use scientific terminology; unable to retell study material; cannot solve case tasks even with the help of the teacher; fragmentary knowledge of basic and additional literature.
2 points – the answer is absent or wrong in the theoretical parts, no practical part, the lecture course is skipped.

Oral answers are estimated in practical classes by 5 point system with account for completeness and consistency of the topic, as well as activity in the practical class.
Evaluation criteria for students’ knowledge and skills in the practical lessons on biology: 1) correctness and independence of the target definition of the work; 2) fully completed with consistent experiments and measurements; 3) individual rational selection and preparation of equipment for performance of work; 4) literacy, logical description of practical work course; 5) correctly formulated conclusions; 6) accurate and correct records keeping, filling out tables, drawing pictures and graphs, doing calculations; 7) observance of lab safety precautions.

EVALUATION SCALE OF THE PRACTICAL WORK
– high level – 86-100% (rating “excellent”, mark “5”),
– average level – 75-85% (rating “good”, mark “4”),
– base level – 60-74% (rating “satisfactory”, mark “3”),
– reduced level – 36-59% (rating “unsatisfactory”, mark “2”),
– low level – 26-35% (rating “badly”, mark “1”).

6. COURSE (MODULE) METHODOLOGICAL AND INFORMATIONAL SUPPORT

6.1. Recommended literature

6.1.1 Main literature

	Authors, compilers	Title	Publisher, year
Л1.1	Jane B. Reece … [et al.]	Campbell Biology: Concepts & Connections	Pearson ed, 2015
Л1.2	David Sadava ... [et al.]	LIFE: The Science of Biology	The Courier Companies, Inc.,2015
Л1.3	Apurba S. Sastry, Sandhya Bhat K.	Essentials of Medical Parasitology	Jaypee Brothers Medical Publishers, 2014

6.2. Online Resources

Э1	US National library of medicine	https://www.ncbi.nlm.nih.gov /pubmed/

6.3. List of information and educational technologies

6.3.1 Competence-oriented educational technologies

6.3.1.1	Traditional educational technologies are used for the organization of discipline study, targeted at giving knowledge and practical skills, provided to the students in a comprehensive form. Lecture material is given to the students using multimedia equipment. Explanatory is illustrative lecture, lessons, practical sessions refer to the traditional educational technologies.
6.3.1.2	Information educational technologies are used to: interactive classes, develop systematic thinking and ability to generate ideas to solve different case tasks. In accordance with the requirements of FSES 3++ HPE for the educational process active and interactive forms of learning are widely used: solution of case studies, developing education, explanatory-illustrative training, business and role-playing games, lectures with elements of discussion, constitute not less than 40% of classroom activities. Information educational technologies include 5 business games which refer to individual work, case tasks in practical classes.
6.3.1.3	Information educational technologies – independent use of computer equipment and Internet resources including video films for performance of tasks of practical training and indindividual work.

6.3.2 List of information reference systems and software

6.3.2.1	http://www.medlinks.ru/ - MedLinks.ru
6.3.2.2	http://elibrary.ru/defaultx.asp - Scientific electronic library
6.3.2.3	http://rmic.med.kg/ru/ - Republic medico-information center Bishkek city

7. COURSE (MODULE) LOGISTICS	
7.1	lecture rooms for 150 seats,
7.2	3 computer rooms for 30 seats with connection to the Internet,
7.3	3 practical classrooms for 14 seats each,
7.4	2 multimedia projectors,
7.5	wall-mounted screen,
7.6	32 light microscopes,
7.7	a set of macro and micro preparations, albums, photo albums, models and tables on the topic under study,
7.8	educational videos within the following sections: biology of development, medical parasitology, ecology and biosphere,
7.9	biological museum.

8. COURSE (MODULE) PROFICIENCY METHODICAL GLUIDELINES (FOR STUDENT)

Technological part of the discipline «Biology» is in Annex 1
Guidelines for individual work of students studying theoretical foundations of «Biology».

HOW STUDENTS SHOULD PREPARE FOR LECTURES
Lecture is the most important form of organization of educational process. It
- introduces new study material,
- explains educational elements which are difficult for understanding,
- systematizes study material,
- directs educational process.

The lecture is efficient if student prepares for it.
Preparation for the lecture by students implies the following steps:
- get familiar with the lecture subject (using the course schedule, lecturer's information),
- read the study material using textbook and learning guides,
- consider the place of study subject in your professional training,
- write basic terms,
- answer control question on lecture topics,
- make clusters,
- clarify the educational elements that are not clear for you,
- write down question which you should ask your lecturer during the lecture.

HOW TO TAKE LECTURE NOTES CORRECTLY
Lecture notes – taking is a creative process requiring certain knowledge and skills. Advice for taking lecture notes:
1. Don't try to write word for word everything what teacher says – it is impossible. If you do it and strive for it, there will be unfinished sentences and gaps in notes which break logical sequence of material and make your lecture notes useless. Learn to write only the most important things!
2. Learn to distinguish between main and secondary statements "by ear". But it doesn't mean that you should write only main statements and definitions because they will be incomprehensible without examples and illustrations. That's why facts and examples should be also written.
3. Notes should be brief, logically connected, represent some kind of detailed plan of the lecture.
4. If there are charts and tables in lecture, they should be written completely in copybook.
5. During lecture when teacher usually emphasizes a particular thought, statements, make corresponding descriptive statements in notes immediately. For this you can use not only various underlining and marking with different colors, but also various signs, for example: 1 – important, ? – check, specify, NB – pay attention.
6. Leave margins which can be used in future for comments, notes, additions, etc.
7. Use paragraphs for highlighting descriptive parts in notes.
8. Try to develop your own system of abbreviations for the most widespread words or substitute them with certain signs. It provides possibility to write less, to listen and think more.
9. Immediately after the lecture try to look through your notes and reconstruct gaps, write unfinished and finish highlighting of essential moments. It's important to stress that lectures do not contain the whole material of the study subject given for students to "memorize" it. First of all, it is "guide" for their further individual study and scientific work.

CRITERIA OF LECTURE EFFICIENCY:
- Scientific character, informational value, argumentative and reasonable content;
- Presence of outstanding convincing examples and facts;
- Use of topical form of exposition of material is preferred;
- Clear structure of content and logic of its delivery;
- lecturer's methodological literacy: 1) goal setting and issue actualization; 2) highlighting the main and secondary statements; 3) drawing conclusions; 4) use of feedback; 5) explanation; 6) introduction of new terms; 7) use of illustrative materials;
- emotionality of interaction between the lecturer and the audience, creation of conditions for activation of thinking, use of counter-intuitive techniques, novelty effect, interest, discussion elements, statement of research questions and involvement of students in

"laboratory" of scientific and clinical thinking.

LESSON № 1
THEME: The structure of light microscopes. Microscopy techniques.
THE OBJECTIVE: explore the structure of light microscope; learn the rules of microscopy and the technique of making temporary micro preparations.
The tasks:
Technological part of the discipline «Biology» is in Appendix 2
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- write basic terms,
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- emotionality of interaction between the lecturer and the audience, creation of conditions for activation of thinking, use of counter-intuitive techniques, novelty effect, interest, discussion elements, statement of research questions and involvement of students in "laboratory" of scientific and clinical thinking.

LESSON № 1
THEME: The structure of light microscopes. Microscopy techniques.
THE OBJECTIVE: explore the structure of light microscope; learn the rules of microscopy and the technique of making temporary micro preparations.
The tasks:
1) To be able to work with a light microscope under: a) low magnification –x8, b) large magnification –x40;
2) To be able to work with a hand lens;
3) To be able to make temporary micro preparations.

Introduction: one of the main study methods of biological objects is light microscopy that is why mastery of microscopy technique is required for: all subsequent courses on biology; training courses on histology, microbiology, pathological Anatomy, therapy, surgery and other disciplines; laboratory diagnosis of disease in medical practice;
The term “Biology” was proposed by J.B. Lamarck (1802). Biology is the theoretical basis of medicine. Ancient Greek physician Hippocrates believed that “it is necessary to understand the nature of every doctor”. All branches of theoretical and practical medical science use biological generalization. Theoretical studies conducted in various areas of biology, allow us to use the data obtained in the health professionals practice. The dependence of human health on the quality of the environment and lifestyle is not in doubt for neither the practitioners nor the Health organizers. The logical consequence of this is observed now greening medicine.
Knowledge and skills, which students receive during biology studying, facilitate the assimilation of educational material of many academic disciplines taught in medical school. This expands and deepens biological basis of prevention, diagnosis and treatment of human diseases.

Questions for self - assessment. A student should know: a) main parts of a light microscope, its purpose and structure; b) components of mechanical, magnifying and illuminating units; c) rules of working with a microscope; d) method of temporary slides preparation.

Educational questions:
1) Place and aims of biology in the system of medical training;
2) Scientific method – microscopy;
3) Methods of preparation of temporary slides.
4) Cell as an elementary unit of life. Study of structural components of a cell by examination of temporary and permanent slides.

Equipment: light microscope, Petri’s cup, glass slide and cover slip, bottle with distilled water, cotton wool, onion, human hair.
Permanent slides: cells of the thin inner epidermis of onion, frog skin cells, high and low epithelium.

Individual work: to study independently theoretical material using recommended literature.

INDIVIDUAL PRACTICAL WORK:
Work 1. The device is Compound Light Microscopes
Introduction. Microscope is an instrument with lenses for magnifying objects and revealing details invisible to the naked eye. Microscopes are fundamental biological tools. They extend our senses by enabling us to see things that our own senses could not otherwise detect. Types of microscopes include compound light microscopes, dissecting microscopes, and electron microscopes, but only the first two are used for view cells in a more natural. Simple light microscope uses a single lens, Compound one uses a set of lenses or lens systems.
Other scientific instruments used to extend our senses, in other words, to help us see, feel, hear, or otherwise sense things that our own senses are incapable of detecting, include telescopes (optical telescopes, radio telescopes, etc.), hand lenses, motion detectors, and amplifiers
Compound light microscope consists of: mechanical parts (used to support and adjust the parts), magnifying parts (used to enlarge the specimen), illuminating parts (used to provide light).
Mechanical parts base: Body Tube – attached to the arm and bears the lenses. Revolving (Rotating Nosepiece) – rotating disc where the objectives are attached. Arm (Neck) – curved slanted part which is held while carrying the microscope. Stage – platform where object to be examined is placed. Stage Clips – secures the specimen to the stage. Coarse Adjustment Knob – geared to the body tube which elevates or lowers when rotated bringing the object into approximate focus. Fine Adjustment Knob – a smaller knob for delicate focusing bringing the object into perfect focus.
Magnifying parts: Ocular (Eyepiece) – another set of lens found on top of the body tube which functions to further magnify the image produced by the objective lenses. It usually ranges from 5X to 15X. Objectives – metal cylinders attached below the nosepiece and contain especially ground and polished lenses. Low Power Objective (LPO) – gives the lowest magnification, usually 10x. High Power Objective (HPO) – gives higher magnification usually 40X or 60X. Oil Immersion Objective (OIO) – gives the highest magnification, usually 90X or 120X, and is used wet either with cedar wood oil or synthetic oil.
To calculate the total magnification of the image with each objective, use the following equation:

Total magnification = Magnification of ocular x Magnification of objective

For example: the ocular magnifys 10x and the objective magnifys 10x, for a total magnification of 100x.
Illuminating Parts: Mirror located beneath the stage has concave and plane surfaces to gather and direct light in order to illuminate the object. Lamp – a built in illuminator beneath the stage that may be used if sunlight is not preferred or is not available. Iris Diaphragm – regulates the amount of light necessary to obtain a clearer view of the object. Condenser – a set of lenses between the mirror and the stage that concentrates light rays on the specimen.

Work 1.1. Write the name of the microscope part next to the correct line in the picture.
Work 1.2. How to use of the compound light microscope:
1. Always carry the microscope by the arm with one hand and supporting the base with the other hand. Carry it close to your body.
2. Position the microscope so that the arm is facing toward you, and turn on the light. Be gentle.
3. Make sure that the low–power objective is in position when you start, after that use high–power objective (if it is necessary) and end with work low–power objective.
4. Place a slide on the microscope stage so that the specimen is in the field of view (directly over the light).
5. Move the stage as close to the low-power objective as it will go. Next, while you are looking through the eyepiece, slowly turn the coarse focus knob until the slide comes into focus. Since your specimen might not be centered on the slide, keep one hand on

the slide to move it while you are focusing. You will only see the movement through the eyepiece when the slide is nearly in focus.
6. Only after the specimen is in focus can the high-power objective be used (otherwise, the lens could hit the slide). Use only the fine focus knob when using the high-power objective.

WORK 2: Temporary micro preparations – Extraneous particles in a preparation.
Introduction. How to prepare a Wet Mount Side
Wet mounts are microscope slides that contain a specimen mounted in water. Glass Slide – thin flat piece of glass, typically 75 by 25 mm (3 by 1 inch) and about 1 mm thick, used to hold objects for examination under a microscope. A Cover Slip (or Cover Glass) is used to flatten the specimen and the water drop. This makes focusing easier, dampens vibrations, prevents fogging of lenses, and protects the high–power objective from touching the sample.
1. Obtain a clean microscope slide and cover slip. Hold cover slips only by the edges.
2. Add a small drop of water to the slide.
3. Place the specimen in the drop of water.
4. Hold the coverslip at an angle next to the drop of water and slowly lower it onto the water. This helps prevent air bubbles.

Work 2.1. Extraneous particles
On the middle of a Glass Slide put a drop of water, place in it some fibers of cotton wool and human hair, in the shape of a cross. Cover slide on the sample and examine the preparation under a microscope with low magnification. Moving the preparation put it so that the cross is in at the centre of the field of view.
Sketch and designate: 1) human hair, 2) fibers of cotton wool, 3) bubble of air.

WORK 3: Temporary micro preparations – Onion cells
The preparation is visible as a group of elongated, almost rectangular cells. Round-oval nucleus usually occupies a central position in the cell. Sometimes it is displaced to the shell and gets flattened shape
Sketch and designate: 2 – 3 cells, label: 1) cell wall, 2) cytoplasm, 3) nucleus.

WORK 4: Permanent slide – High and Low epithelium
Epithelium is the tissue forming the outer layer of the body surface and lining many hollow structures. Epithelium cells are the most numerous in the human body. You should pay attention to the shape of cells and their close contact. There are high (low) and narrow cylindrical cells. Each cell nucleus is observed, located closer to basal part of the cell. Notice the basal ends of the epithelial cells facing the connective tissue and disposed on the basal membrane. Opposite (apical) ends direct the lumen.
Cylindrical epithelium lines the wall of the stomach; mucus is produced by the glandular cells, which protect the mucosa from the effects of acid and digesting enzymes.
Examine under the high magnification of a microscope a cell, and label: 1) cell wall; 2) cytoplasm; 3) nucleus.

WORK 5: Permanent slide – Cells of a frog skin.
A frog's skin consists of flat epithelium. Polygonal cells with round vesicular nucleus are visible on a permanent stained slide. The cytoplasm uniformly fills the whole cell; plasmalemma is very thin and hardly differs. The shape of an animal cell is due to the mutual arrangement of cells.
Examine under the large increase of a microscope and label: 1) cell wall, 2) cytoplasm, 3) nucleus.

THE LITERATURE
1. Campbell M. R. Biology concepts and connections, University of California, Riverside, 2015, 11-th edition, P. 6-8.
2. Purves W.K., Sadava D., Orians G.H., Heller H.C. Life the science of biology, 2015, 11-th Edition, P. 1-4.
3. The lecture materials.

ANNEX 1

Technological chart of the discipline «Biology» of specialty of General Medicine

I semester

Name of discipline module (by number of credits in the semester minus on control work)	Control	Modules of study	credit minimum	credit maximum	Control Schedule (week of semester)
Module 1					
Biology of cell	Assessment of student's prior knowledge	Activity; attendance; to solve case study. Self-preparation for theoretical issues; filling in a workbook.	1	5	
Biology of development	Formative assessment	Activity; attendance; participation in students' research work; to solve of case study. Self-preparation for theoretical issues; records in a workbook. Designing tables and models.	3	5	
	Midterm examination	Multiple choice questions (MCQs). Review questions. Case study.	10	15	6
Module 2					
General and medical genetic	Formative assessment	Activity; attendance; participation in students research work; to solve of case study and genetic tasks. Self-preparation for theoretical issues; records in a workbook. Designing tables and models. Preparation for business games.	3	5	
	Midterm examination	Multiple choice questions (MCQs). Review questions. Solution of genetic tasks.	10	15	13
Module 3					
Medical protozoology	Formative assessment	Activity; attendance; participation in students research work. Self-preparation for theoretical issues; homework (description, drawings of the anatomy and parasite development cycles); preparation to practical classes. To solve of case study. Preparation for midpoint assessment (theoretical issues). Credit on microslides. Designing tables and models.	3	5	
	Midterm examination	Multiple choice questions (MCQs). Review questions. Case study.	10	20	17
TOTAL for semester			**40**	**70**	
Midpoint assessment (credit)			**20**	**30**	**18**
Midpoint assessment (exam)					
Summative assessment			**60**	**100**	

ANNEX 1

Technological chart of the discipline «Biology» of specialty of General Medicine

II semester

Name of discipline module (by number of credits in the semester minus on control work)	Control	Modules of study	credit minimum	credit maximum	Control Schedule (week of semester)
Module 4					
Medical helminthology	Formative assessment	Activity; attendance; participation in students' research work. Self-preparation for theoretical issues; homework (description, drawings of the anatomy and parasite development cycles); preparation for practical classes. To solve of case study. Preparation to interim assessment (theoretical issues). Credit on microslides. Designing tables and models.	3	5	
	Midterm examination	Multiple choice questions (MCQs). Review questions. Case study.	10	20	28
Module 5					
Medical entomology	Formative assessment	Activity; attendance; participation in students research work. Self-preparation to theoretical issues; to do homework (description, drawings of the anatomy and parasites development cycles); preparation to practical classes. To solve of case study. Preparation for midpoint assessment (theoretical issues). Credit on microslides. Designing tables and models.	3	5	
	Midterm examination	Multiple choice questions (MCQs). Review questions. Case study.	10	20	32
Module 6					
Phylogenesis systems and organs. Ecology.	Formative assessment	Activity; attendance; participation for students' research work. Self-preparation for theoretical issues; homework; preparation for practical classes. Solution of case study. Designing tables and models. Essay preparation and presentation.	4	5	
	Midterm examination	Multiple choice questions (MCQs). Review questions. Case study.	10	15	35
TOTAL for semester			**40**	**70**	
Mindpoint assessment (credit)					
Mindpoint assessment (exam)			**20**	**30**	**36**
Summarative assessment			**60**	**100**	

ANNEX № 2

Module questions of the subject: «Cell»

1. Levels of organization and qualitative peculiarities of living systems. Notion of biological system.
2. Definition of life. Integration and discretisation. Characters of alive.
3. Assimilation and disassimilation on the cellular level. Stages of disassimilation. Division of organisms on the groups according to the type of assimilation and disassimilation.
4. Microscope arrangement (illuminating, optic and mechanical parts).
5. History of cell discovery (R. Hooke, M. Malpighi, A. Grew, A. Leeuwenhoek).
6. Cell theory (M.Schwann, T. Schleiden, R.Virkhov), its main stages, statements and meaning for science and medicine development.
7. «Cell» notion. Prokaryotic and eukaryotic cells, their differences.
8. Structure of eukaryotic cell, components, their structure and functions.
9. Cytoplasm composition. Organoids and inclusions.
10. Similarities and differences of animal and plant cells.
11. Nuclear cell apparatus.
12. Mitosis and mitotic cycle of cell. Main phases of mitosis and their characteristic. Biological role of mitosis.
13. Cytology, methods of research.
14. Cell as open system.

Module questions of the subject: «Reproduction and embryogenesis»

1. Meiosis. Peculiarities of the first and second meiosis division.
2. Meiosis, its differences from mitosis and biological significance.
3. Reproduction – main feature of living. Asexual reproduction of monocellular organisms. Biological significance.
4. Sexual reproduction of protozoaires. conjugation and copulation.
5. Sexual reproduction of metazoans (with fertilization of without). Parthenogenesis, its kinds. Process of fertilization and its biological significance.
6. Spermatogenesis and ovogenesis. Periods and differences. Cytological and cytogenetic characteristic.
7. Ovum and semen structure. Types of ova in animals and human.
8. Fertilization, insemination, hormones regulation. Acrosomal and cortical reactions in fertilization.
9. Parthenogenesis. Forms and spread in nature. Sexual dimorphism: Morpho-physiological differences on secondary sexual characteristics.
10. Notion of ontogenesis, its types, periods and characteristic features in animal and human.
11. Criticism of preformism and epigenesis theories.
12. Stages of embryogenesis.
13. Segmentation, its characteristic in different animals. Types of blastula.
14. Gastrula, its structure and types, ways of formation.
15. Ways of mesoderm formation (teloblastic, enteroblastic).
16. Germinal layers (ecto-, endo – and mesoderm) and formation of organs systems in the process of organogenesis.
17. Provisional organs of embryo.
18. Critical periods of ontogenesis. Abnormalities and teratism.
19. Notion about of teratogenic factors.
20. Embryonic development disorder.
21. Neurohumoral regulation of growth and development of organism.
22. Postembryonic period, its characteristics and stages.
23. Gerontology and geriatrics. Theory of aging. Problems of longevity.
24. Embryonic development disorder.
25. Interrelation of social and biological periods.
26. Death, kinds.

Module questions of the subject: «Genetics»

1. Subject, tasks, methods of genetics. Stages of genetics development. Role of the Soviet scientists (N.I.Vavilov, N.K.Koltsov, A.R.Serebrovskiy, R.R.Chetverikov, R.N.Davidenkov) in development of genetics.
2. The first and second Mendel's laws. The law of gametes purity. Mendelian characters of human. Examples. Autosomal-dominant and autosomal-recessive types of inheritance.
3. The third Mendel's law. Cytological basics of Mendel's laws universality.
4. Allelic genes. Definition. Forms of interaction (dominancy – full and now full, superdominance, co-dominance, interallelic complementation and allele exclusion). Mechanisms of origin. Examples of signs in human.
5. Multiple allelism. Inheritance of blood groups. Inheritance of Rhesus factor. Rhesus incompatibility.
6. Polygenic inheritance. Forms of nonallelic genes interaction (complementarity, epistasis, polymery, pleiotropy). Examples.
7. The Morgan's law. Chromosome theory of heredity. Full and not full linkage of genes. The concept of chromosome genetic maps. Method of somatic cells hybridization and its application for mapping of human chromosome.

8. Chromosomal mechanism of sex inheritance. Cytogenetic methods of gender determination. Inheritance, sex linkage. Examples. Genetic mechanisms of sex determination. differentiation of sex signs in development. Prediction of sex.
9. Chromosome – structural components of nucleus. Structure, composition, function. Peculiarities of morphofunctional chromosome structure. Hetero- and euchromatin.
10. Structure and functions of DNA and RNA. Autoreproduction of DNA. Biological significance. Genetic code. Coding and realization of information in cell. Code system of DNA and protein.
11. Role of DNA and RNA in transfer of hereditary information. Main stages of protein biosynthesis: transcription, processing, transmission.
12. Qualitative and quantitative specific features of genes expression in signs: discretisation, specificity, penetration, expressivity, pleiotropy, polymery.
13. Classification of genes: genes of structural RNA synthesis, regulators. Genes' characteristics (discretisation, stability, lability, polyallelism, specificity, pleiotropy).
14. Fine structure of genes. Peculiarities of pro- and eukaryote. Concept of transcripton. Principles of gene activity regulation on the example of prokaryote (model of operone) and eukaryote.
15. Genotype, genom, phenotype, genofond. phenotype as the result of genetic information realization in conditions of environment.
16. Gene engineering. Biotechnology. Tasks, methods. Achievements, perspectives.
17. Inheritance and variability - fundamental properties of alive, their unity. Generals concepts of genetic material and its properties: storage, variability, reparation, transmission, realization of genetic information.
18. Modification variability. Norm of reaction, penetrance and expressiveness. Phenocopies. Adaptive character of modification. Role of heritage and human development environment. Genocopies.
19. Combinative variability, mechanisms of its origin. Significance of combinative variability in provision of genotypic variation of people. Types of heterosis (reproductuve, somatic and adaptational).
20. Mutational variability, classification of mutations according to the level of heritage material damage (genomic, chromosomal, genetic). Generative and somatic mutations.
21. Chromosome mutations: aberrations (inversion, deletion, deficiency, duplication, translocation), polyploidy, heteroploidy, mechanisms of their origin.
22. Genetic mutations, molecular mechanisms of origin, mutations frequency in nature. The Vavilov's law. Biological antimutation mechanisms.
23. Spontaneous and induced mutations. Their biological role. Factors of mutagenesis. Classification. Examples.
24. Methods of human heredity study. Family- genealogical, gemellary, biochemical, population statistical method, dermatoglyphics and their significance for medicine.
25. Cytological method of human chromosomal disorders diagnostics. Amniocenthesis. Karyotype and idiogram of human chromosome.
26. Hereditary diseases of human. Principles of treatment, methods of diagnostics and prophylaxis. Examples. Medical genetic counselling.

Module questions of the subject: «Protozoa»

1. General characteristic of Phylum protozoa. Morpho-physiological peculiarities of protozoa Phylum. Morpho-physiological peculiarities of Classes. Free living and parasitic representatives.
2. Dysenteric amoeba. Structure, difference from no parasitic amoeba. Life cycle of development. Diagnostics and prophylaxis of amebiasis.
3. Leishmania, cycles of development. Cutaneous, mucocutaneous and visceral leishmaniasis. Diagnostics, routs of infection and prophylaxis.
4. Trypanosoma. Morpho-physiological peculiarities. Life cycle of development. Diagnostics, Routs of infection and prophylaxis of trypanosomiasis.
5. Lamblia. Structure, life cycle, diagnostics and prophylaxis of lambliosis.
6. Trichomonads. Structure, life cycle of development, diagnostics, routs of infection and prophylaxis of trichomoniasis.
7. Toxoplasma. Structure, life cycle, diagnostics, routs of infection and prophylaxis of toxoplasinosis.
8. Malaria parasite, its forms, structure, life cycle in human body and mosquito. Routs of infection, diagnostics and prophylaxis of malaria.
9. Balantidium. Structure, life cycle, diagnostics, routs of infection and prophylaxis of balantidiasis.

Module questions of the subject: « Helminthology »

1. Phylum Flat worms. General characteristics. Origin. Medical significance.
2. Characteristics of Class flukes. Adaptation to parasitic way of life.
3. Liver fluke. Structure, life cycle, routs of infection, laboratory diagnostics, prophylaxis.
4. Cat fluke. Structure, life cycle, routs of infection, laboratory diagnostics, prophylaxis.
5. Lancet fluke. Structure, life cycle, routs of infection, laboratory diagnostics, prophylaxis.
6. Liver fluke, cat and lancet flukes. Structure, life cycle, routs of infection, laboratory diagnostics, prophylaxis.
7. Blood flukes. Structure, life cycle, routs of infection, laboratory diagnostics, prophylaxis. geographic range.
8. Pulmonary fluke. Structure, life cycle, routs of infection, laboratory diagnostics, prophylaxis.
9. Class Cestode. Medical significance of representatives.

10. Beef tapeworm. Structure, life cycle, routs of infection (difference from beef tapeworm), prophylaxis.
11. Pork tapeworm. Structure, life cycle, routs of infection, prophylaxis.
12. Human cysticercosis, routs of infection, diagnostics, prophylaxis.
13. Broad tapeworm. Structure, life cycle, routs of infection, laboratory diagnostics, prophylaxis.
14. Dwarf tapeworm. Structure, life cycle, routs of infection, laboratory diagnostics, prophylaxis.
15. Echinococcus and Alveococcus. Comparative analysis, structure, life cycle, routs of infection, laboratory diagnostics, prophylaxis.
16. Natural focal, transmissible helminthosis, methods of prophylaxis.
17. Nematode worms' type. Significance from the point of view of medical parasitology. Type characteristics on the example of genuine roundworms class. Concept of bio-, geo- and contact helminthes.
18. Pinworm. Structure, prevalence, life cycle, localization, routs of infection, laboratory diagnostics, prophylaxis, effect on the body.
19. Ascarid. Structure, prevalence, life cycle, localization, routs of infection, laboratory diagnostics, prophylaxis, effect on the body.
20. Whipworm. Structure, prevalence, life cycle, localization, routs of infection, laboratory diagnostics, prophylaxis, effect on the body.
21. Trichinella. Structure, prevalence, life cycle, localization, routs of infection, laboratory diagnostics, prophylaxis, effect on the body, natural reservoir of source of human infection.
22. Ancylostomatidae: ancylostome and Necator. Geographic range, life cycle, localization, routs of infection, laboratory diagnostics, prophylaxis, effect on the body.
23. Main methods of helminthosis control. Concept of dehelminthization and principle of devastation. Detection of helminth ova, main methods.
24. Diagnostic differences of helminth ova structure in human.

Module questions of the subject: «Arachnoenthomology»

1. Arthropods. General characteristics of the Phylum. Progressive features of structure, classification. Origin. Medical significance.
2. Gill-breathing subtype. General characteristics of Class crustaceans. Medical significance.
3. Subphylum Chelicerates. General characteristics of Class arachnidae. Main Classes. Medical significance.
4. Order Cockroaches: peculiarities of structure and medical significance.
5. Ticks. Morphological characteristics of the class.
6. Ticks - pathogenic organisms. Structure and life cycle of itch mite.
7. Ticks – vectors of transmissible disease in human and animals. Examples. Transovarial transmission of pathogen through ticks and its significance.
8. Insects. General characteristics of the Class. Development of insects. Complete and incomplete metamorphosis. Examples.
9. Order Lice: head, clothes, pubic. Their morphological differences, carried diseases. Pediculosis control.
10. Order Fleas: morphological peculiarities, reproduction, development and medical significance. Measures of fleas control.
11. General characteristics of Order Diptera and their characteristics.
12. Order Diptera. Morphological peculiarities of house fly as mechanical carrier of human diseases. Peculiarities of protection from flies.
13. Mosquitos. Morphological differences, Biology and significance in diseases distribution. Significance for medicine. Measures of protection from mosquitos.
14. Mosquito fleet. Their morphology, biology and significance in distribution of leishmaniasis and febriculosity.
15. Theory of natural focal diseases. Obligate - and facultative transmissional diseases. Examples.

Module questions of the subject: «Phylogenesis of systems and organs. Ecology»

1. Evolution of digestive organs in the vertebrated. Abnormalities in human.
2. Evolution of respiratory organs system in the vertebrated. Abnormalities in human.
3. Evolution of arterial branchial arches in the vertebrated. Significance of these data for understanding of vessels development abnormalities in the vertebrated.
4. Evolution of blood circulatory system in the vertebrated. Heart development. Abnormalities of human heart.
5. Main stages in Vertebrata. General evolutionary trends of urogenital system in Vertebrata (evolution of nephron, connection of eliminative and genital system of anamniotes and amniotes). Abnormalities of urogenital system development in human.
6. Development of brain in representatives of different Vertebrata classes. Human abnormalities.
7. Ecology as science (subject, methods, sections).
8. Organism and environment. Population and environment. Biogeocoenosis and ecosystem.
9. Environment as complex aggregate of abiotic, biotic and anthropogenic factors.
10. Influence of abiotic factors on the body.
11. Influence of biotic factors on the body. Forms if interactions between organisms and population.
12. The rule of ecological pyramid.

13. Ecology of human (subject, tasks, methods, linkage with other sections).
14. Biological and social aspects of population adaptation to the living environment.
15. Concept of ecological types of people, conditions of their formation in history of mankind.
16. Human as creative ecological factor.
17. Anthropogenous ecosystems.
18. Comparative analysis of skin coverings. Abnormalities.
19. Evolution of the framework of vertebrate animals (axial skeleton, skeleton of free limb). Abnormalities.
26. Theory of biosphere.
27. Structure and function of biosphere.
28. Evolution of biosphere.
29. Conversion of biosphere to noosphere.
30. Biotechnosphere.
31. Ways of ecological problems solution.
32. General problems of environment protection.
33. Animals and plants protection.
34. Protection of soil, air and water.
35. City and environment.
36. Ecological situation in Bishkek city.

Lecture questions of the subject: «Protozoa»

1. Notion and types of regeneration: reparative; physiological.
2. Ways of regeneration its significance.
3. Theories of regeneration.
4.Types of transplantation.
5. Methods of tissue incompatibility breaking in the process of transplantation.
6. Definition of parasitization.
7. Classification and origin of parasitization.
8.Factors of parasite effect on master's body.
9. Life cycles of parasites.
10. Transmissional, natural focal, parasitical, infectious diseases.
11. Biological principles of transmissions and natural-focal diseases control.
12. Transmissional and natural focal, parasitical and infectious diseases.
13. Structure of natural focus, its main components.
14. Concept of anthropogenesis and zoonosis.
15. Biological principles of transmissional and natural-focal diseases control.
16. Toxicity of animals as ecological phenomenon.
17. Origin of toxicity.
18. Human and toxic animals.
19. Characteristics of toxic animals by separate taxa.

Lecture questions of the subject «Helminthology»

1. Evolutional process.
2. History of evolutional ideas establishment.
3. Theory of evolution of Darwin.
4. Type - qualitatively new stage of evolution.
5. Microevolution and macroevolution.
6. Population – elementary unit of evolution.
7. Population: ecological, genetic morpho-physiological characteristics.
8. Hardy–Weinberg principle.
9. Primary evolutional phenomena-variation of population genofond.
10. Elementary evolutional material- hereditary variation.
11. Elementary factors of evolution.
12. Peculiarities of population structure of mankind.
13. Influence of mutagenesis, migration on genetic structure of people.
14. Influence of isolation and natural selection on genetic structure of people.
15. Concept of genetic polymorphism.
16. Adaptational and balanced polymorphism.
17. Genetic polymorphism and adaptation.
18. Genetic load.
19. Factors and scales of genetic polymorphism of mankind formation.
20. Problem of genetic load of mankind.
21. Frequency of hereditary diseases and liability to diseases.
22. Classification and systematics.

23. Monophyletic origin.
24. Origin of mono- and many-celled animals.
25. Origin of chordate and vertebrate animals.

Lecture questions of the subject: «Arachnoenthomology»

1. Biogenetic law.
2. Phylogenesis as process of ontogenesis evolution.
3. Concept of phylembryogenesis and cenogenesis.
4. Main trends of evolution.
5. Differentiation and integration in organs evolution.
6. Appearance and disappearance of biological structures in phylogenesis. Rudiments and atavisms.
7. Body as the whole in historical and individual development.
8. Materialistic and idealistic views on mankind.
9. Animal origin of mankind.
10. Qualitative differences of human from animals and its social origin.
11. Main stages of anthropogenesis.
12. Concept of races and specific unity of human.
13. Critics of social- Darwinism, anthroposociology and other biological concepts in human nature.