

Federal State Autonomous Educational Institution of Higher Education
«Peoples' Friendship University of Russia»

Medical Institute

Recommended MCSD

SYLLABUS
(STUDY GUIDE)

Subject

Biology

Recommended for the direction of training (specialty)

31.05.01 “General medicine”

Program (profile, specialization)

General medicine

1. The Aim of Discipline

Students' acquisition of knowledge and skills in the field of general biology, parasitology, classical, molecular, medical, and ecological genetics, which are necessary for the formation of the scientific worldview and practical activities of the physician.

2. Position of the discipline in the structure of the Educational program

Block 1 – Educational disciplines (modules), basic component.

Preceding and following disciplines forming competencies of the discipline are shown in table 1.

Table 1. Preceding and following disciplines forming the given competencies

No	Code of competence	Preceding disciplines	Following disciplines (discipline groups)
General professional competencies			
1	GPC-2 GPC-5		Anatomy, Histology, embryology, cytology, Microbiology, Virology, Normal physiology, clinical disciplines

Note: Biology is studied in the 1st year so there are no preceding disciplines in the table.

3. Requirements for the results of the discipline study

Discipline studying is designed to form the following competences shown in table 2:

Table 2. Formed competences

Competence	Competence name	Competence achievement indicators
GPC-2	Being able to monitor the effectiveness of preventive measures, healthy lifestyle formation and sanitary and hygienic education of the population	GPC-2.3 Being able to prepare an oral presentation or a printed text which promote a healthy lifestyle and increase the population's literacy concerning disease prevention issues.
GPC-5	Being able to assess morpho-functional, physiological conditions and pathological processes in the human body to solve professional tasks	GPC-5.1 Mastering the algorithm of clinical, laboratory and functional diagnosis when dealing with professional tasks. GPC-5.3 Being able to determine morpho-functional, physiological states and pathological processes of the human body.

In consequence of studying the discipline a student should:

Know:

1. Methods used in the modern biology.
2. Origin of life on Earth. The concept of the genetic, biochemical and structural unity of all living things. Achievements of modern Biology which is one of the basic disciplines in medical education.
3. The cell as a structural and functional unit of all living things. Characteristics of prokaryotes and eukaryotes. Cell theory. The flow of information, energy and matter in the cell.
4. Biological evolution. History of evolutionary ideas. The main points of the modern evolution theory. Microevolution as a process of formation of new species. Ways of speciation. Macroevolution as a process of formation of supraspecific taxa and its correlation with microevolution. Concepts of biological progress and regression. The population as an elementary unit of evolution. The gene pool, the genetic unity, and genetic heterogeneity of natural populations. Genetic equilibrium in populations.
5. The biological and social characteristics of human beings. The origin of man, biological and social factors of the human evolution. Main steps of the human evolution.
6. The diversity of living things. Classification of organisms. Unicellular and multicellular organisms. Taxa and their brief descriptions.
7. Forms of biotic interactions in the nature. The concept of parasitism as an ecological phenomenon. Types of parasitism. Relationships in the parasite-host system, adaptation to the parasitic way of life. Concepts of anthroponosis and anthroponosis. Infective routes, principles of prevention and control of human parasitic diseases.
8. Human parasites (classification, morphology, life cycle, diagnosis and prophylaxis), vectors, hosts and reservoirs of parasites.
9. Chromosomes, the concept of karyotype. Morphological types of human chromosomes. Autosomes and sex chromosomes.
10. Concepts of the gene, the genotype, the genome, the phenotype. The allelic and non-allelic, linked and non-linked genes. Pleiotropic and lethal genes. The concepts of penetrance and expressivity. Forms of gene interaction.
11. The life cycle, mitotic and meiotic cell division. The control of the cell cycle.
12. The history of genetics. The laws of heredity. Patterns of inheritance.
13. Nucleic acids as the genetic material. Evidence of a genetic role of DNA. The chemical structure of the monomers of nucleic acids. The primary, secondary and tertiary structure of DNA and RNA molecules. Denaturation and annealing of DNA.
14. DNA replication in prokaryotic and eukaryotic cells.
15. Transcription and translation. The processing of RNA molecules. Control of gene expression in prokaryotic and eukaryotic cells.
16. Organization of the genetic material of viruses, prokaryotes, eukaryotes. The chromosomal and extrachromosomal DNA. Mobile genetic elements in eukaryotes and prokaryotes. Plasmids.
17. Genetic engineering and cloning.

18. Forms of variability. Classification of mutations. Molecular mechanisms of gene mutations. The causes of mutations. Mutagens. The basic mechanisms of DNA repair.
19. Methods of human genetics. Hereditary diseases and their causes. Principles of diagnosis, treatment and prevention of hereditary diseases. Genetic counseling.
20. Ecological systems. Environmental factors, their impact on organisms and ecosystems in general. The doctrine of the biosphere. Changes in the biosphere caused by anthropogenic factors. Modern problems of the environmental protection.

Be able to do:

- use the methods of modern biology, taking into account their capabilities and limitations; Identify animal and plant cells and cell organelles;
- perform the experiment describing the permeability of the cell membrane;
- Identify the human parasites;
- determine the morphological types of chromosomes;
- analyze the results of crosses and solve genetic problems;
- carry out the polymerase chain reaction and analyze the results of the experiment;
- classify mutations;
- analyze the human karyotype;
- classify hereditary diseases;
- evaluate the risk of pathological trait in the offspring;
- analyze study books and scientific articles.

Have the skills in:

- microscopy for identification the human parasites;
- methods of human genetics;
- solving the case studies in medical parasitology and genetics.

4. Discipline hours and types of training activity

General labor intensity is 7 credit units

№	Type of academic load	Totally hours	Semesters	
			1	2
1.	Class exercises (academic hours)	170	85	85
	Including:			
1.1.	Lectures	17	-	17
1.2.	laboratory practicals	153	85	68
2.	Self-study work (academic hours)	82	23	59
3.	Total labor intensity (academic hours)	252	108	144
	<i>Total labor intensity (credit units)</i>	7	3	4

5. Content of the discipline

5.1. Content of the discipline units

№	Discipline unit	Content of the unit
1.	Introduction to Biology. The cell as a unit of life	Modern biology as a complex of sciences about living systems. The subject and tasks of medical biology. The main characteristics of living things, the levels of their organization. Methods of modern biology. The cell as a unit of life; the main points of the cell theory. Prokaryotic and eukaryotic cells; plant and animal cells; organelles, their structure and functions. The structure and functions of the cell membrane.
2	Genetic material. Structure and functions of nucleic acids.	Functions of nucleic acids, their location in the cell; the primary, secondary, and tertiary structure of nucleic acids. The genetic code. DNA replication in prokaryotic and eukaryotic cells. The principles of the polymerase chain reaction (PCR). Forms of variability. Classification of mutations. Gene mutations and their causes. DNA repair mechanisms. Solving of genetic problems.
3	Gene expression. Genomes of viruses, prokaryotes and eukaryotes	Structure of eukaryotic and prokaryotic genes. Synthesis of RNA molecules (transcription) in prokaryotic and eukaryotic cells. Processing of RNA molecules. Control of gene expression in prokaryotes and eukaryotes. Operons. Translation in prokaryotic and eukaryotic cells. Solving of genetic problems. Genetic material of viruses, prokaryotes and eukaryotes. Chromosomal and extrachromosomal DNA. Plasmids. Mobile genetic elements.
4	Cell division	The cell cycle, mitotic and meiotic cell division. The control of the cell cycle. Gametogenesis.
5	Concepts of genetics	Concepts of the gene, the genotype, the genome, the gene pool, the phenotype. The allelic and non-allelic, linked and non-linked genes. Pleiotropic and lethal genes. The concepts of penetrance and expressivity. Forms of gene interaction. The laws of heredity. Patterns of inheritance. Solving of genetic problems
6	Human Genetics and Medical Genetics	Introduction to Human genetics and Medical genetics. Man as an object of genetic research. Methods of Human Genetics (pedigree analysis, twin study, karyotyping, DNA analysis). Classification of hereditary diseases. The principles of diagnosis, prevention and treatment of human hereditary diseases. Introduction to the molecular basis of the gene therapy. Genetic counseling. Solving of genetic problems.
7	Evolution of the organic world.	Biological evolution. History of evolutionary ideas. The main points of the modern evolution theory.

	Anthropogenesis	Microevolution as a process of formation of new species. Ways of speciation. Macroevolution as a process of formation of supraspecific taxa and its correlation with microevolution. Concepts of biological progress and regression. The population as an elementary unit of evolution. The gene pool, the genetic unity, and genetic heterogeneity of natural populations. Genetic equilibrium in populations. Factors and main stages of the anthropogenesis.
8.	Medical Protozoology	Basic concepts and terms of medical protozoology. Characteristics of subkingdom Protozoa, phyla Sarcomastigophora, Apicomplexa, and Ciliophora. <i>Entamoeba histolytica</i> , <i>Lambliia</i> , <i>Trichomonas sp.</i> , <i>Trypanosoma sp.</i> , <i>Leishmania sp.</i> , <i>Plasmodium sp.</i> , <i>Toxoplasma gondii</i> , <i>Balantidium coli</i> (morphology, life cycle, infective route, diagnosis and prophylaxis). Study of micro-preparations.
9.	Medical Helminthology	Phylum Plathelminthes: classification and general characteristics. Class Trematoda and class Cestoda (<i>Fasciola hepatica</i> , <i>Opistorchis felineus</i> , <i>Clonirchis sinensis</i> , <i>Paragonimus westermani</i> , <i>Schitosoma sp.</i> , <i>Dipyllobothrium latum</i> , <i>Taenia solium</i> and <i>Taenia saginata</i> , <i>Hymenolepis nana</i> , <i>Echinococcus sp.</i>) Phylum Nemathelminthes: classification and general characteristics. Class Nematoda: (<i>Ascaris lumbricoides</i> , <i>Enterobius vermicularis</i> , <i>Trichocephalus trichiurus</i> , <i>Ancylostoma duodenale</i> , <i>Necator americanus</i> , <i>Strongyloides stercoralis</i> , <i>Trichinella spiralis</i> , <i>Dracunculus medinensis</i> , <i>Filariidae</i> family). Morphology and life cycle of the parasites, infective route, diagnosis and prophylaxis. Study of micro- and macro-preparations.
10.	Medical significance of arthropods	Phylum Arthropoda (general characteristics and classification). Class Crustacea (decapods and copepods). Class Arachnida (mites, ticks, spiders, scorpions), class Insecta (general characteristics, classification and medical significance).
11	Man and the Biosphere	Ecological systems. Environmental factors, their impact on organisms and ecosystems in general. The doctrine of the biosphere. Changes in the biosphere caused by anthropogenic factors. Tasks of modern genetics in conditions of environmental pollution with mutagens. Modern problems of the environmental protection. Genetic monitoring in human populations.

5.2. Units of the discipline and types of classes

№	Unit	Lectures	Practical classes and laboratory works		Self-study work	Totally
			S	LW		
1.	Introduction to Biology. The cell as a unit of life			7	2	9
2.	Genetic material. Structure and functions of nucleic acids.			15	6	21
3.	Gene expression. Genomes of viruses, prokaryotes and eukaryotes			23	7	30
4	Cell division			15	2	17
5	Concepts of genetics			25	6	31
6	Human Genetics and Medical Genetics	7		18	14	39
7.	Evolution of the organic world. Anthropogenesis	6			8	14
8.	Medical Protozoology	2		14	10	26
9.	Medical Helminthology			22	15	37
10.	Medical significance of arthropods			14	8	22
11	Man and the Biosphere	2			4	6
Totally		17		153	82	252

6. Laboratory work

№	unit	Lab work	Labor intensity (hours)
1.	Introduction to Biology. The cell as a unit of life	Microscopic examination of frog blood cells. Study of the cell membrane permeability.	7
2.	Genetic material. Structure and functions of nucleic acids.	Determination of the length and weight of the DNA molecule. Determination of the sequence of nucleotides in the DNA molecule. Determination of the sequence of nucleotides in the daughter DNA molecules after replication.	15

3.	Gene expression. Genomes of viruses, prokaryotes and eukaryotes	Determination of the amino acid sequence using information about the structure of nucleic acids. Determination of the primary structure and size of nucleic acids using information about the amino acid sequence.	23
4.	Cell division	Study of normal human karyotype. Study of mitosis in plant cells. Drawing up a scheme for meiotic cell division. The study of gametogenesis in mammals.	15
5.	Concepts of genetics	Solving of genetic problems.	25
6.	Human Genetics and Medical Genetics	Pedigree analysis. Polymerase chain reaction. Solving genetic problems.	18
7.	Medical Protozoology	Study of protozoan parasites.	14
8.	Medical Helminthology	Study of parasitic helminthes.	22
9.	Medical significance of arthropods	Study of arthropods that have medical significance.	14

7. Practical lessons (not provided)

8. Equipment and material support of the discipline:

- Microscopes
- Microslides
- Pictures
- Computers
- Multimedia projectors
- The PCR laboratory.

9. Academic support:

a) main literature

1. Klug W.S., Cummings M.R., Spencer C.A., Palladio M.A. Concepts of genetics. – Pearson Education International. – 2014.
2. Myandina G.I. Medical parasitology. – M.: PFU. – 2014.

b) additional literature

1. Общая генетика [Текст/электронный ресурс] = General Genetics. Manual for Graduate Students : Учебное пособие / Е.В. Романова, П.

Кезимана. - Книга на английском языке; Электронные текстовые данные. - М. : Изд-во РУДН, 2018. - 104 с.

2. Fletcher H., Hickey I. Genetics. – Garland Science. – 2013.
3. Lewin B. Genes. – Oxford University Press. – 2012.
4. Color Atlas of Genetics / Passarge Eberhard. - 4th edition, revised and update. - Stuttgart ; New York : Thieme, 2013.
5. Vogel and Motulsky's Human Genetics: Problems and Approaches / M. Speicher, Antonarakis S.E., Motulsky A.G. – Springer. – 2010.
3. Gardner A., Davies T. Human Genetics. – Scion Publishing Ltd. – 2009.
6. Storry B., Wong E., Walker R.A., Gillaspay G., Sible J., Lederman M. – Working with Molecular Cell Biology (Fifth Edition). – W.H. Freeman and Company, New York. – 2004.
7. Gangane S.D. Human Genetics (Second edition). - Elsevier. Reed Elsevier India Private Limited. – 2004.
8. Heelan J.S., Ingersol F.W. Essentials of Human Parasitology. – Delmar. Thomson Learning. - 2002.

10. Data bases, information, reference and search systems:

1. Educational portal of the PFUR - <http://web-local.rudn.ru/web-local/kaf/rj/index.php?id=6>
2. National Center for Biotechnology Information (NCBI) - www.ncbi.nlm.nih.gov
3. Royal Society of Chemistry <http://pubs.rsc.org/>
4. ScienceDirect - <http://www.sciencedirect.com>
5. Scientific electronic library: - <http://elibrary.ru>
6. Google Academy - <http://scholar.google.ru/>
7. Nature - <http://www.nature.com/siteindex/index.html>
8. OxfordJournals - <https://academic.oup.com/journals/>

11. Methodological recommendations on discipline study organization:

During lab classes and lectures corresponding topics are studied with the use of computers and multimedia projectors. For all classes and lectures Power Point presentations are prepared.

Before every class students must read the corresponding topic in the recommended main and additional text-books and try to answer questions for self-study control.

Self-study work is organized in the class rooms of the department where students may study topics with presentations prepared by the teachers.

Electronic study guides on some topics are also posted in the Internet on the site of the department:

<http://esystem.pfur.ru/>

Out-of-class self-study work includes:

- Learning topics with the use of text-books, study guides;
- Preparation for tests.

12. Evaluation instrument fund

Evaluation instrument fund for discipline “Biology” including a description of assessment scales, examples of written tests or other materials necessary for the assessment of knowledge, abilities, and skills are available for students at TUIS RUDN.

The program is compiled in accordance with the requirements of the FSES HE.

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