



Curriculum is based on the educational program «Medical Biology and General Genetics», approved 27.06.2023, registration # УД-091-026/2324/уч.; on the educational plan in the specialty 7-07-0911-03«Dentistry», approved 17.05.2023, registration # 7-07-0911-03/2324/mf/.

**COMPILERS:**

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**RECOMMENDED FOR APPROVAL:**

by the Department (name) of the educational institution «Belarusian State Medical University»

(protocol # 11 of 05.06.2023)

by the Scientific and Methodological Council of the educational institution «Belarusian State Medical University»

(protocol # 6 of 27.06.2023)

## EXPLANATORY NOTE

«Medical Biology and General Genetics» – the academic discipline of the natural science module, which contains systematized scientific knowledge about the structural and functional organization of living matter and about human being as its integral part in the aspect of the needs of modern medicine.

The aim of the discipline «Medical Biology and General Genetics» is the formation of basic professional competencies for diagnosis of hereditary and congenital disorders, parasitic diseases, their treatment and prevention.

The objectives of the discipline «Medical Biology and General Genetics» are to form students' scientific knowledge about:

basic concepts of cytology, molecular and cell biology, genetic engineering, genetics, developmental biology and evolutionary theory, parasitology and biosphere science;

mechanisms of storage and realization of genetic information in prokaryotes and eukaryotes; mechanisms of transgenesis and genomic editing; causes and mechanisms of development of hereditary, multifactorial and parasitic human diseases; genetic basis for realization of hereditary information in individual development;

the most important clinical manifestations of parasitosis, methods of diagnosis and prevention;

mutagenic, teratogenic and carcinogenic factors; natural and anthropogenic factors affecting human health;

skills and abilities necessary for:

solving cases in molecular biology, general and medical genetics, and parasitology;

calculating the frequencies of genes and genotypes in human populations using the Hardy-Weinberg law;

constructing and analyzing human pedigrees, making conclusions about the type of inheritance and the probability of giving birth to a sick child;

development of recommendations for the use of methods of prenatal diagnosis of human hereditary pathology.

The knowledge, skills, and abilities acquired during the study of the academic discipline «Medical Biology and General Genetics» are necessary for successful mastering of the following academic disciplines: «Histology, Cytology and Embryology», «Biological Chemistry», «Microbiology, Virology, Immunology», «Internal diseases», «Pediatrics», «Dermatovenerology», «Infectious Diseases», «Surgical Diseases», «Infectious Diseases».

Studying the educational discipline «Medical Biology and General Genetics» should ensure the formation of students' basic professional competencies:

BPC. Work with optical devices, compile a human (patient) lineage, solve problems in molecular biology, general and medical genetics.

**As a result of studying the discipline «Medical Biology and General Genetics» the student should**

**know:**

- position of human in the nature, its characteristics as a biological and social being, and his relationship with the environment;
- the processes of matter, energy and information flow in the cell;
- mechanisms of regulation of gene expression;
- methods of transgenesis, genomic editing and gene therapy;
- patterns of inheritance of normal and pathological traits in humans;
- main types of variability and their manifestations in humans;
- influence of genetic factors on human health;
- methods for diagnosing hereditary diseases;
- peculiarities of human reproduction and related bioethical problems;
- peculiarities of human embryonic and post-embryonic ontogenesis; biological aspects of aging and death;
- phylogenesis of human organ systems, mechanisms of ontophylogenetically determined defects;
- peculiarities of regeneration in humans; problems of organ and tissue transplantation;
- basics of homeostasis, biorhythmology and their medical aspects;
- biological and medical peculiarities of human ecology and valeology;
- forms of biotic relationships in nature; relationship of the parasite and the host at the organism and population levels;
- peculiarities of morphology, development cycles, ways of human infection, pathogenic effect of main parasitic protists, helminthes and arthropods; methods of diagnosis and prevention of diseases caused by them;
- the main groups of poisonous organisms;

**be able to:**

- solve case problems in molecular biology, general and medical genetics, parasitology;
- make recommendations for the use of methods of prenatal diagnosis of human hereditary pathology;
- calculate the frequencies of alleles and genotypes in human populations using the Hardy-Weinberg law;
- to carry out a comparative characterization of the structure, processes of vital activity, the role in nature of organisms belonging to different taxonomic groups;
- determine cause-and-effect relations between the structure, functions of cell organelles and diseases arising from their malfunctioning;
- apply knowledge about the main methods of diagnosis and prevention of diseases caused by parasitic protists, helminthes and arthropods in their professional activities;

**master:**

- skills of working with optical instruments (magnifying glass, light microscope);
- skills of constructing and analyzing human idiograms;

skills in constructing and analyzing human pedigrees, conclusions about the type of inheritance and the probability of giving birth to a sick child;  
 skills in diagnosing parasitological micropreparations;  
 skills of identifying Barr body.

**Total number** of hours for the study of the discipline is 108 academic hours. Classroom hours according to the types of studies: lectures – 10 hours (including 3 academic hours of supervised student independent work), laboratory classes - 57 hours, student independent work (self-study) – 41 hours.

Intermediate assessment is carried out according to the syllabus of the specialty in the form of examination (1<sup>st</sup> semester).

Form of higher education – full-time.

### ALLOCATION OF ACADEMIC TIME ACCORDING TO SEMESTERS OF STUDY

Code, name of the specialty	semester	Number of academic hours						Form of intermediate assessment
		total	in-class	including			out-of-class self-studies	
				lectures (including supervised independent work)	supervised student independent work	laboratory studies (practical classes and seminars)		
7-07-0911-03 «Dentistry»	1	108	67	10	3	57	41	Examination

## THEMATIC PLAN

Section (topic) name	Number of class hours	
	lectures	laboratory
<b>1. Molecular and Cell Biology</b>	<b>4</b>	<b>24</b>
1.1. Medical biology as a science, its role in the training of a physician. Subject matter, objectives and methods of cytology	-	3
1.2. Structural and functional organization of the cell	-	3
1.3. Structurally functional organization of the genome	-	3
1.4. Cell cycle	-	3
1.5. Mechanism of gene expression	2	3
1.6. Regulation of gene expression	2	3
1.7. Genomics. DNA analysis methods	-	3
1.8. Genetic engineering	-	3
<b>2. General and Medical Genetics</b>	<b>-</b>	<b>18</b>
2.1. The mechanisms of heredity	-	3
2.2. Genetic linkage. Biology and genetics of sex	-	3
2.3. Variability. Mutagenesis. Carcinogenesis	-	3
2.4. Population genetics	-	3
2.5. Human genetics	-	6
<b>3. Developmental Biology</b>	<b>4</b>	<b>6</b>
3.1. Reproduction of living matter	-	3
3.2. Ontogenesis in mammals and human	-	3
3.3. Biological basis of regeneration and transplantation	2	-
3.4. Evolution of organ systems in chordates	2	-
<b>4. Medical Parasitology</b>	<b>2</b>	<b>9</b>
4.1. General parasitology	-	3
4.2. Medical parasitology	-	6
4.3. Poisonous and venomous organisms	2	-
<b>Total hours</b>	<b>10</b>	<b>57</b>

## CONTENT OF THE EDUCATIONAL MATERIAL

### 1. MOLECULAR AND CELL BIOLOGY

#### 1.1. Medical biology as a science, its role in the training of a physician. Subject matter, objectives and methods of cytology

The nature of life, the role of proteins and nucleic acids in the organization of living systems. Organization levels of living matter. Human as a biological and social being. The role of biology in medical education.

Cytology. Methods of cytology (light microscopy, fluorescence microscopy, electron microscopy and histochemistry and immunohistochemistry, differential centrifugation, autoradiography, morphometry, etc.).

The method of light microscopy. The structure of light microscope. The instructions for working with a microscope.

Cell as the least structural and functional unit of life. General characteristics of viruses, prokaryotes and eukaryotes.

### **1.2. Structural and functional organization of the cell**

Models of plasma membrane. The structure, properties and functions of plasma membrane. Transport across the membrane: passive transport (simple diffusion, facilitated diffusion, osmosis), active transport (ion channels, their functions), endocytosis, exocytosis.

Cytosol. Cytoskeleton: microtubules, intermediate filaments, microfilaments. Vesicular transport. Nuclear localization signal.

Assimilation and dissimilation. Ribosomes. Endomembrane system (nucleus, endoplasmic reticulum, Golgi complex, lysosomes, peroxisomes, endosomes, vesicles).

Photosynthesis and chemosynthesis, fermentation and respiration. Stages of catabolism, mitochondria, enzymes of mitochondria.

Disorders caused by impairments of cellular activities (mitochondrial diseases, lysosomal storage diseases, peroxisomal disorders and prion diseases).

### **1.3. Structurally functional organization of the genome**

Organization of hereditary material in viruses, prokaryotes and eukaryotes. Organization levels of genetic material in eukaryotes (gene, chromosome and genome levels).

Gene organization level of hereditary material. The main functions of gene. Properties of genes. Structure of deoxyribonucleic acid (DNA). Watson and Crick postulates. Evidence for the role of DNA in the transmission of hereditary information (transformation and transduction). Ribonucleic acid (RNA) and its types.

Genome organization level of hereditary material. Chromosome organization level of hereditary material. DNA condensation in eukaryotes. Chromatin remodeling. Euchromatin and heterochromatin.

The structure and functions of nucleus.

Types of chromosomes. Rules of chromosomes. Karyotype and idiogram. Nomenclatures of human chromosomes.

Nuclear genes and cytoplasmic genes. Cytoplasmic inheritance.

### **1.4. Cell cycle**

The flow of genetic information in the cell. Semi-conservative mechanism of DNA replication. Replicon.

Cell cycle. Interphase. Types and types of cell division: binary fission of bacteria, amitosis, mitosis, endomitosis, polyteny.

Mitosis: characteristics of phases, distribution of genetic material, biological significance.

Meiosis: characteristics of phases, distribution of genetic material, biological significance.

Cell cycle regulators (cyclins and cyclin-dependent kinases). Cell proliferation and cell death. Necrosis and apoptosis. Caspases.

### **1.5. Mechanisms of gene expression**

The Central Dogma of Molecular Biology.

Genetic code and its properties.

Transcription. Transcription factors. Eukaryotic mRNA synthesis: primary transcript, pro-mRNA processing, splicing. Alternative splicing. Transcriptome. Reverse transcription.

Aminoacyl-tRNA synthetases. Translation: initiation, elongation and termination. Proteome. Metabolome.

Posttranslational modifications of proteins. Protein folding. Chaperones. Utilization of proteins in cell. Proteasomes. Ubiquitin.

### **1.6. Regulation of gene expression**

Housekeeping and tissue-specific genes. Human genome: protein-coding genes, RNA genes, non-coding sequences (repeats, introns, junk DNA). DNA transposons and retrotransposons.

Lac and trp operons. Polycistronic RNA.

Regulation of transcription in eukaryotes: preinitiation complex. Enhancers, silencers.

Epigenetic mechanisms of controlling gene expression: histone modifications, cytosine methylation, CpG-islands, regulatory systems of non-coding RNA.

International human genome research projects: Human genome, ENCODE, Roadmap.

### **1.7. Genomics. DNA analysis methods**

Analysis of genetic material. Methods of DNA analysis: gel electrophoresis, restriction analysis, hybridization of nucleic acids, DNA microarrays.

Polymerase chain reaction (PCR), reaction components, stages of the method. PCR variants: qPCR, RT-PCR (reverse transcription), nested PCR, multiplex PCR, methylation-sensitive PCR.

DNA sequencing: Sanger sequencing, next generation sequencing (NGS): pyrosequencing, nanopore sequencing, bisulfite sequencing.

### **1.8. Genetic engineering**

Aims, objectives and stages of genetic engineering. Methods allowing to obtain genes for transgenesis. Recombinant DNA. Construction of vectors, their types: plasmids, cosmids, viral and phage vectors, phasmids, shuttle vectors.

Introduction of recombinant DNA into a recipient cell. Selection of transformed cells. Selective and reporter genes.

Biotechnology and its significance in medicine. Genetically modified organisms (GMO). Food products containing GMOs.

## **2. GENERAL AND MEDICAL GENETICS**

### **2.1. The mechanisms of heredity**

Genetics. The subject, methods and tasks of Genetics. Hybridological analysis.

Monohybrid crossing. Hypothesis of Purity of Gametes. Test cross. Backcrossing.

Polyhybrid cross. Limitations of Mendel's laws. Pleiotropy.



Intra-allelic interaction (complete and incomplete dominance, superdominance, codominance and allelic exclusion). Multiple alleles. Inheritance of blood groups (ABO, MN, Rh).

Inter-allelic interaction (complementary gene action, inhibitory gene action, polymeric gene interaction and position effect). Bombay blood group.

## **2.2. Genetic linkage. Biology and genetics of sex**

T. Morgan's experiments. Complete and partial genetic linkage. Crossing over and recombination of traits. Autosomal and gonosomal linkage groups. Basic provisions of chromosomal theory of heredity. Genetic and cytological chromosome maps.

Sex as a biological trait. Sex-limited, sex-influenced, sex-linked and holandric inheritance.

Determination and development of sex in ontogenesis. Peculiarities of sex determination in humans: physical, intermediate and socio-psychological determinants. Genetic mechanisms of gonadogenesis in humans. Barr body, Mary Lyon's hypothesis of X chromosome inactivation.

Disruption of sex formation in humans. Ethical aspects associated with sex, disorders of sex development, sex change and transsexualism.

## **2.3. Variability. Mutagenesis. Carcinogenesis**

Variability. Types of variability. Phenotypic plasticity. Morphosis. Phenocopies. Medical aspects of phenotypic plasticity.

Genotypic variability. Combinative variability and its mechanisms. Genetic variation caused by mutations. Causes of mutations: Replication errors, unequal crossing over, mutagens. Mechanisms of mutagenesis. Genocopies. Physical, chemical and biological mutagens. Supermutagens. Genetic hazards of environmental pollution with mutagens. Classification of mutations.

Genome stability and DNA repair. Types of DNA repair: excision repair, double-strand break repair, direct reversal repair. Antimutagens. Medical aspects of DNA repair.

Carcinogenesis. Oncogenes and tumor suppressor genes.

## **2.4. Population genetics**

Population. Ecological and genetic characteristics of populations. Gene pool. Ideal population. Hardy-Weinberg equilibrium. Factors disturbing Hardy-Weinberg equilibrium. Natural selection. Mutations. Migration. Genetic drift, founder effect, bottleneck effect. Non-random mating, inbreeding, assortative mating, inbreeding coefficient.

Population structure of humanity. Large populations, demes and isolates. Peculiarities of gene pool of isolates. Effects of elementary evolutionary factors on human populations.

Human genetic polymorphism, its biological, medical and social aspects. Genetic burden, its biological essence and medical significance.

## **2.5. Human genetics**

Current tasks of human genetics. Human being as a specific object of genetic analysis.

The main methods human genetics: pedigree analysis, twin study, cytogenetic techniques, the methods of population genetics, biochemical diagnostic techniques, the methods of molecular genetics.

Methods used for diagnosis of numerical and structural chromosomal abnormalities: karyotyping, SKY, FISH and SNP array-based karyotyping.

Rapid diagnostic tests: Guthrie bacterial inhibition assay, detection of sex chromatin.

Neonatal screening of monogenic disorders. Screening programs in the Republic of Belarus.

Methods of prenatal diagnosis of hereditary pathology (alpha-fetoprotein test, ultrasonography, chorionic villus sampling (CVS), amniocentesis, placentocentesis, cordocentesis and fetoscopy). Prenatal screening in the Republic of Belarus. Ethical aspects of prenatal diagnosis. National policy on induced termination of pregnancy.

Genetic counselling. Indications for direction to genetic counseling.

Diagnosis, prognosis and calculation of genetic risk. The Addition and Multiplication Rules of Probability, Bayes' theorem, calculation of prior and posterior probability. Assessing the severity of medical and social consequences of hereditary pathology. Ethical and legal aspects of genetic counseling. Medical and family secrecy.

### **3. DEVELOPMENTAL BIOLOGY**

#### **3.1. Reproduction of living matter**

Reproduction of living things. Sexual and asexual reproduction, their forms and biological roles. Hermaphroditism and dioeciousness. Lateral gene transfer.

Ovogenesis and spermatogenesis in humans. Regulation of gametogenesis. Characteristics of human gametes. Insemination. Peculiarities of fertilization in humans.

Assisted reproductive technologies (ART) in overcoming infertility in humans: artificial insemination; in vitro fertilization (IVF) and its variations (intracytoplasmic sperm injection (ICSI), oocyte donation; surrogacy; assisted hatching; cytoplasmic transfer).

Preimplantation genetic diagnosis. Medical research using human embryos, and associated ethical problems.

#### **3.2. Ontogenesis in mammals and human**

Periodization of ontogenesis. Determination of phenotype by genetic and environmental factors in ontogenesis.

Prezygotic period of ontogenesis. Prenatal period of ontogenesis. Genetic control of prenatal development. Significance of ooplasmic segregation, totipotency of zygote, selective gene expression. Interactions between parts of developing embryo. Embryonic induction, positional information of embryonic cells.

Critical periods of human prenatal ontogenesis, teratogenic factors.

Genomic imprinting. Diseases of genomic imprinting.

Periodization of postnatal ontogenesis in humans. Genetic control of postnatal ontogenesis. The influence of external and internal factors on postnatal ontogenesis. Growth and development of the organism and their regulation. Acceleration. Human constitution and habitus. Critical periods of postnatal ontogenesis.

Molecular and genetic basis of aging. Gerontology and Geriatrics. Clinical and biological death. Resuscitation and its biological aspects. Moral and ethical problems of euthanasia.

### **3.3. Biological basis of regeneration and transplantation**

Regeneration. Physiological regeneration as a mechanism maintaining homeostasis. Classification of cells according to their regenerative ability.

Reparative regeneration, its types and mechanisms. Regulation of regeneration. Importance of regeneration for biology and medicine. Regenerative medicine.

Transplantation. Types of transplantation: autotransplantation, allotransplantation, homotransplantation and xenotransplantation. Tissue incompatibility. Immunological mechanisms of tissue incompatibility and ways to overcome it. HLA system.

Cultivation of cells and tissues outside human body, tissue preservation. Stem cells. Cell lines in biological and medical experiments. Artificial organs. Cultivation of human organs in animals and decellularization, therapeutic cloning, 3D-bioprinting.

Ethical and legal aspects of transplantation: death certificate, concept of brain death, donation and its commercialization.

### **3.5. Evolution of organ systems in chordates**

Ontogenesis and phylogenesis. Von Baer's Law. Recapitulation. Biogenetic law. The concept of cenogenesis and palingenesis. The teaching of A. N. Severtsov on phyllembryogenesis. Correlations in the course of individual development.

Evolution of integumentary, skeletal, nervous, circulatory, respiratory, digestive, urinary and reproductive systems of chordates. Malformations of human organ systems which can be explained by the evolution of these systems.

## **4. MEDICAL PARASITOLOGY**

### **4.1. General parasitology**

Parasitism as an antagonistic form of symbiosis. Parasitocoenosis. Microbiome. Medical parasitology, its goals and objectives. Classification of parasitic diseases.

Classification of parasites. Classification of hosts.

Characteristics of the parasite-host system. Transmission routes of parasites. Pathogenic action and specificity of parasites. Morphophysiological and biological adaptations of parasites. Responses of the host organism to the invasion of parasites. Parasitic system.

### **4.2. Medical protistology**

Phylum *Sarcomastigophora*, class *Zoomastigota* (*Giardia duodenalis*, *Trichomonas vaginalis*), class *Sarcodina* (*Entamoeba gingivalis*, *Entamoeba histolytica*).

Phylum *Apicomplexa*. *Plasmodium spp.*, *Toxoplasma gondii*.

Laboratory diagnosis of the diseases caused by pathogenic protists. Prevention of protozoan diseases.

Phylum *Platyhelminthes*, class *Trematoda* – *Opisthorchis felineus*, class *Cestoda* - *Taenia solium*.

Phylum *Nemathelminthes*, class *Nematoda* - *Ascaris lumbricoides*, *Enterobius vermicularis*.

Methods of diagnosis of intestinal and tissue helminth infections of humans. Prevention of helminth infections.

The concept of natural focal diseases.

Phylum *Arthropoda*. Class *Arachnida* – *Sarcoptes scabiei*. Class *Insecta* – lice (*Anoplura*).

Control of parasitic arthropods. Prevention of parasitic and vector-borne diseases.

### **4.3. Poisonous and venomous organisms**

Poisonousness and venomousness is a universal phenomenon in living nature. The concept of poisons, venoms and toxins. Classification of poisonous and venomous animals.

Poisonous animals of the phylum: *Coelenterata*, *Arthropoda* and *Chordata* (*Chondrichthyes*, *Osteichthyes*, *Amphibia*, *Reptilia*).

Physiological characteristics of the toxins of invertebrates (jellyfishes, spiders, hymenopterans), their effect on humans; first aid and prevention of bites and stings.

Physiological characteristics of the toxins of vertebrates (fishes, amphibians, reptiles), their effect on humans; first aid and prevention of bites and stings and poisonings.

Poisonous mushrooms and plants, their characteristics.

The value of poisonous and venomous organisms as a source of materials for pharmacy and medicine.

## ACADEMIC DISCIPLINE CURRICULAR CHART

Section, topic #	Section (topic) name	number of hours			Self-studies	Form of control
		lectures	supervised student work	laboratory		
<b>1<sup>st</sup> semester</b>						
<b>1.</b>	<b>Molecular and Cell Biology</b>	<b>4</b>	<b>1</b>	<b>24</b>	<b>13</b>	
1.1	Medical biology as a science, its role in the training of a physician. Subject matter, objectives and methods of cytology	-	-	3	1	Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, the work with optical instruments (microscope, magnifying glass)
1.2	Structural and functional organization of the cell	-	-	3	1	Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, solving the problems in molecular biology
1.3	Structurally functional organization of the genome	-	-	3	1	Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, making human idiograms and their analysis
1.4	Cell cycle	-	-	3	1	Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, solving the problems in molecular biology
1.5	Mechanism of gene expression	2	0,5	3	2	Interview, test, accounts of home practical exercises with

						oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, solving the problems in molecular biology
	Gene expression. Epigenetics	2	0,5	-	1	Reports, electronic tests, conference presentations, publication of articles, reports
1.6	Регуляция экспрессии генов у прокариот и эукариот	-	-	3	2	Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, solving the problems in molecular biology
1.7	Genomics. DNA analysis methods	-	-	3	2	Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, solving the problems in molecular biology
1.8.	Genetic engineering	-	-	3	2	Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, solving the problems in molecular biology, conference presentations, publication of articles, reports
<b>2.</b>	<b>General and medical Genetics</b>	-	-	<b>18</b>	<b>13</b>	
2.1	The mechanisms of heredity	-	-	3	2	Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, solving the problems in the inheritance of normal and pathological traits
2.2	Genetic linkage. Biology and genetics of sex	-	-	3	2	Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, solving the problems in the inheritance of X linked genes, detection of Barr body
2.3	Variability. Mutagenesis. Carcinogenesis	-	-	3	2	Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises

							with oral defense, electronic test, electronic workshop, solving the problems in the inheritance of normal and pathological traits
2.4	Population genetics	-	-	3	2		Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, solving the problems in calculation of allele and genotype frequencies using Hardy-Weinberg law
2.5	Human genetics	-	-	3	2		Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, conference presentations, publication of articles, reports, compiling and analysis of pedigrees
	Colloquium in molecular biology and genetics	-	-	3	3		Interview, test, control questioning, electronic test
3.	<b>Developmental biology</b>	4	1,5	6	6		
3.1.	Reproduction of living matter	-	-	3	2		Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop
3.2.	Ontogenesis in mammals and human	-	-	3	2		
3.3	Biological basis of regeneration and transplantation	2	1	-	1		Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, conference presentations, publication of articles, reports
3.4	Evolution of organ systems in chordates	2	0,5	-	1		Reports, electronic tests
4.	<b>Medical parasitology</b>	2	0,5	9	9		
4.1	General parasitology	-	-	3	2		Interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop
4.2	Medical parasitology	-	-	6	4		
	Medical parasitology I	-	-	3	2		Interview, test, accounts of home practical exercises with

						oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, solving the cases in the disease caused by parasitic protists
	Medical parasitology II	-	-	3	2	interview, test, accounts of home practical exercises with oral defense, accounts of classroom practical exercises with oral defense, electronic test, electronic workshop, conference presentations, publication of articles, reports
4.5	Poisonous and venomous organisms	2	0,5	-	3	Reports, electronic tests Examination
	<b>Total number of hours</b>	<b>10</b>	<b>3</b>	<b>57</b>	<b>41</b>	



**INFORMATION AND INSTRUCTIONAL UNIT****LITERATURE****Basic (relevant):**

1. Бутвиловский, В.Э. Медицинская биология и общая генетика для иностранных студентов, обучающихся по специальности «Стоматология» =Medical Biology and General Genetics for foreign students studying in the specialty «Dentistry» : курс лекций. / В. Э. Бутвиловский [и др.]. – Минск : БГМУ, 2019. – 104 p.

**Additional:**

2. Biology for international students studying «Dentistry» : training and methodological aid. – Minsk : BSMU, 2017. – 136 p.

3. Medical biology : practical book for the students studying in the specialty «Dentistry» : practical book/ V. E. Butvilovsky [et al.]. – 2<sup>nd</sup> edition, corrected – Minsk : BSMU, 2018 – 84 pages.

4. Medical biology : methodological recommendations for the students studying in the speciality «Dentistry» V. E. Butvilovsky [et al.]. – Minsk : BSMU, 2018. – 43 pages.

5. Medical biology : textbook / Yu. I. Bazhora., R. Ye. Bulyk, M. M. Chesnokova [et al.]. – Vinnytsia : Nova Knyha, 2018. – 448 pages.

**METHODOLOGICAL RECOMMENDATIONS FOR THE ORGANIZATION AND PERFORMANCE OF STUDENT INDEPENDENT WORK IN THE ACADEMIC DISCIPLINE**

The time for independent work can be used for:

preparation for lectures and classes;

preparation for colloquia, credits and examinations in the discipline;

preparation of thematic reports and presentations;

performing practical tasks;

making an abstract of educational literature;

making reviews of scientific literature in a given topic;

compiling of informative and demonstration materials (posters, tables and etc.);

compiling a thematic selection of literary sources, Internet sources.

**METHODOLOGICAL RECOMMENDATIONS FOR THE ORGANIZATION AND PERFORMANCE OF SUPERVISED STUDENT INDEPENDENT WORK IN THE ACADEMIC DISCIPLINE**

Main forms of supervised student independent work:

presentation of reports;  
 studying topics and problems that have not been discussed at the lectures;  
 computer testing;  
 preparation and presentation of abstracts;  
 preparation of didactic materials;

Control of supervised student independent work is carried out in the form of:  
 test paper;

final class, colloquium in the form of an oral interview, written work, testing;  
 discussion of abstracts;  
 defense of educational assignments;  
 assessment of an oral reply to a question, presentation, report or problem solving;  
 checking up abstracts, written reports, accounts, prescriptions;  
 individual interview;

**LIST OF AVAILABLE DIAGNOSTIC TOOLS**

The following forms are used for competences assessment:

**Oral form:**

interviews;  
 conference reports.

**Written form:**

tests;  
 control questioning;  
 reports;  
 article/report publications;  
 the work with optical instruments (microscope, magnifying glass);  
 solving the problems in molecular biology;  
 making human idiograms and their analysis;  
 solving the problems in the inheritance of normal and pathological traits;  
 solving the problems in the inheritance of X linked genes, detection of Barr body;  
 solving the problems in calculation of allele and genotype frequencies using Hardy-Weinberg law;  
 compiling and analysis of pedigrees.

**Oral-written form:**

accounts of classroom practical exercises with oral defense;  
 accounts of home practical exercises with oral defense;  
 examination.

**Technical form:**

electronic tests;  
 electronic workshops (practicals).

### LIST OF AVAILABLE TEACHING METHODS

Traditional method (lecture, laboratory practicals);

Active (interactive) methods:

- Problem-Based Learning (PBL);
- Team-Based Learning (TBL);
- Research-Based Learning (RBL).

### LIST OF PRACTICAL SKILLS

1. Work with optical instruments (magnifying glass, light microscope).
2. Solution of problems in molecular biology.
3. Solving problems on genetic patterns of inheritance of normal and pathological traits, sex-linked inheritance.
4. Drawing up and analyzing pedigrees: determining the type of disease inheritance, establishing the genotypes of all members of the pedigree.
5. Determining the genetic risk of having a child with a hereditary pathology.
6. Solving problems to calculate the frequencies of genes and genotypes in human populations according to the formula of the Hardy-Weinberg law.
7. Construction and analysis of human karyotype.
8. Solving the problems in parasitology.
9. Diagnosis of micropreparations of parasites.

### LIST OF EQUIPMENT USED

Teaching aids, computers, computer networks, multimedia equipment, TV sets, light microscopes, electronograms, chemical reagents, spatulas, slides and covers, filter paper, magnifying glass, micropreparations, macropreparations.

### LIST OF LECTURES

1. The flow of genetic information through the cell.
2. Gene expression. Epigenetics.
3. Regeneration and transplantation.
4. Poisonous and venomous animals.
5. Congenital malformations in the context of the evolution of organ systems.

### LIST OF LABORATORY STUDIES

1. Medical biology as a science, its role in the training of a physician. Subject matter, objectives and methods of cytology.
2. Structural and functional organization of the cell.
3. Structurally functional organization of the genome.
4. Cell cycle.
5. Mechanism of gene expression.
6. Regulation of gene expression.
7. Genomics. DNA analysis methods.
8. Genetic engineering.
9. The mechanisms of heredity.

10. Genetic linkage. Biology and genetics of sex.
11. Variability. Mutagenesis. Carcinogenesis.
12. Population genetics.
13. Human genetics.
14. Colloquium in molecular biology and genetics.
15. Reproduction of living matter.
16. General parasitology.
17. Medical parasitology I.
18. Medical parasitology II.
19. Poisonous and venomous organisms.

**PROTOCOL OF THE CURRICULUM APPROVAL  
BY OTHER DEPARTMENTS**

Title of the discipline requiring approval	Department	Amendments to the curriculum in the academic discipline	Decision of the department, which designed the curriculum
1. Bioorganic Chemistry	The department of Bioorganic Chemistry	No suggestions for changes in the content of the curriculum for the discipline	(protocol # 11 of 05.06.2023);
2. Human morphology	Human morphology	No suggestions for changes in the content of the curriculum for the discipline	(protocol # 11 of 05.06.2023);
3. General Dentistry	The department of General Dentistry	No suggestions for changes in the content of the curriculum for the discipline	(protocol # 11 of 05.06.2023);

## COMPILERS/AUTHORS:

Head of the Department of Biology of the educational institution «Belarusian State Medical University», Ph.D., associate professor

V.V.Davydov

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L.M.Sychik

Curriculum content, composition and the accompanying documents comply with the established requirements.

Dean of the Medical Faculty for International Students of the educational institution «Belarusian State Medical University»

26.06. 2023

O.S.Ishutin

Methodologist of the educational institution «Belarusian State Medical University»

26.06. 2023

S.V.Zaturanova