

RUDN University

Institute of Medicine

SUMMARY OF THE DISCIPLINE

Educational program

06.06.01 «Biological sciences»

Genetics: molecular basis of human hereditary diseases

Discipline	General Genetics
Number of credits (hours)	4 (144)
Content	
Units	Content of the units
Unit 1 Introduction to Genetics	Subject and tasks of Genetics. Fields of Genetics. Genetics in Biology and Medicine. The history of Genetics.
Unit 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. DNA polymerases and their characteristics. 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.
Unit 3 Gene expression	Structure of eukaryotic and prokaryotic genes. Synthesis of RNA molecules (transcription) in prokaryotic and eukaryotic cells. Processing of RNA molecules. RNA polymerases. Control of gene expression in prokaryotes and eukaryotes. Operons. Translation in prokaryotic and eukaryotic cells. The Central Dogma of Molecular Biology. Solving of genetic problems.
Unit 4 Genomes of viruses, prokaryotes and eukaryotes	Genetic material of viruses, prokaryotes and eukaryotes. Chromosomal and extrachromosomal DNA. Plasmids. Mobile genetic elements.
Unit 5	The life cycle, mitotic and meiotic cell division. The

Cell division	control of the cell cycle. Gametogenesis.
Unit 6 The laws of heredity	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.
Unit 7 Genetics of Populations	The population as an elementary unit of evolution. The gene pool, the genetic unity, and genetic heterogeneity of natural populations. Genetic equilibrium in populations. The Hardy–Weinberg Law. Solving of genetic problems.
Unit 8 Man and the Biosphere	The biological consequences of human impact on the biosphere. Medical aspects of environmental protection. Genetic monitoring in human populations.
Unit 9 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.

**Director of the program
Head of the Department
of Biology and General Genetics**



M.M. Azova

RUDN University

Institute of Medicine

SUMMARY OF THE DISCIPLINE

Educational program
06.06.01 «Biological sciences»
Genetics: molecular basis of human hereditary diseases

Discipline	Human hereditary diseases
Number of credits (hours)	4 (144)
Content	
Units	Content of the units
Unit 1 Introduction to Human Genetics	Subject and tasks of Medical Genetics. Genetics in Biology and Medicine. The history of Medical Genetics.
Unit 2 The object and methods of Medical Genetics	Man as an object of genetic research. Cytological basis of heredity. Methods of Human Genetics. Classification of human hereditary diseases.
Unit 3 Single gene diseases	Genetic diseases and their classification. Mutations as basis of hereditary disease. Most common single gene diseases
Unit 4 Chromosomal diseases	Chromosomes, the concept of karyotype. Morphological types of human chromosomes. Chromosomal diseases, their classification and causes. Mosaicism. Most common chromosomal diseases.
Unit 5 Multifactorial diseases	Multifactorial diseases and their causes.
Unit 6 Non-Mendelian inheritance	Cytoplasmic inheritance; Genomic imprinting; Trinucleotide repeat disorders.
Unit 7 Diagnosis, treatment and prevention of hereditary diseases	Principles of diagnosis, treatment and prevention of hereditary diseases. Genetic counseling.

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SUMMARY OF THE DISCIPLINE

Educational program

06.06.01 «Biological sciences»

Genetics: molecular basis of human hereditary diseases

Discipline	Methodology of scientific research
Number of credits (hours)	3 (108)
Content	
Units	Content of the units
Unit 1 Methodological basis of scientific knowledge and creativity	<p>The concept of scientific knowledge. The methods of theoretical and empirical research. The system analysis application in the study of complex and interrelated problems.</p> <p>The elements of theory and methodology of scientific and technical creativity.</p> <p>The classification of scientific documents and publications.</p> <p>The concept of a database, database management system, relational databases.</p> <p>The public system of scientific and technical information. The automated information and search engines.</p> <p>Work with information: searching, sorting, queries.</p> <p>Types of computer networks: local, corporate network. Network Architecture: router, gateway, service provider, server, modem, dedicated network. Addresses, IP-address. Web (World Wide Web or WWW), Web-pages. Home pages. Searching information on the WWW, search systems, browser (navigator) Mozilla Firefox. The Uniform Resource Locator (URL), keywords, types of information resources. Protocols HTTP, FTP, packets, checksum. Hypertext Markup Language (HTML). Medical Internet resources.</p> <p>E-mail, client and server e-mail services.</p> <p>The information classification; methods of structuring; information standards systems; standard HL7; standard DICOM; standards in genomics, proteomics, metabolomics.</p> <p>The methods describing and modeling of information processes in medical and diagnostic problems, in classification problems, in the study of population interactions, in the study and prediction behavior of the environment of living systems by the means of modern information technologies.</p> <p>Biological classifications and nomenclatures; the use of sequences to determine the phylogenetic interactions; determining the similarity of sequences using the network database; introduction to the protein structure; proteins classification; development and</p>

	<p>prediction of the protein structure; the concept of proteomics, genomics, metabolomics, polymorphisms, amplification and sequence; web-lemmas.</p> <p>The genome and proteome; genome sequences project; binding of the genome with cell type; human genome; genome evolution; genome comparison.</p> <p>Programming languages and tools; traditional algorithmic languages; script languages; specialized libraries for programming in the molecular biology; Java; HTML. Sequence database in the DNA; genomic database and genomic navigators; database of protein sequences; database of related proteins; data base of protein structures; protein structures classification; the problem of determining protein structures.</p>
<p>Unit 2</p> <p>Mathematical simulation in biology and medicine</p>	<p>The concept of model (simulation); kinds of models; implementation of mathematical «in silico » models; population simulation; growth models; models of ecological processes; imitation simulation; model elements and systems of animal organism.</p> <p>Simulation object. Formalization of tasks. Model of the person condition diagnostics, predictive model, model of conditions outcome, course of treatment, disease remission, epidemiological models etc.</p> <p>An interface, help system, integrated programming languages (macros).</p> <p>Methods for predicting medical and biological processes on the basis of medical and biological data; calculation methods of the main statistical characteristics of the experiments results; modern standard software for the automation of data processing: MathLab, Statistica, R, SAS.</p> <p>Managerial decision making information systems structure; ERP-system; statistical processing of the observations results by the computational data analysis systems.</p>

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SUMMARY OF THE DISCIPLINE

Educational program

06.06.01 «Biological sciences»

Genetics: molecular basis of human hereditary diseases

Discipline	Methods in Human Genetics
Number of credits (hours)	4 (144)
Content	
Units	Content of the units
Unit 1 Introduction to Human Genetics	Subject and tasks of Human Genetics. Genetics in Medicine. Man as an object of genetic research.
Unit 2 Pedigree analysis	Tasks of the method. Drawing up a family tree using the standard symbols. Patterns of inheritance. Solving of genetic problems.
Unit 3 Twin study	Tasks and importance of the method. Multifactorial diseases. Solving of genetic problems.
Unit 4 Karyotype analysis	Techniques of karyotyping and their tasks. Preparing karyotypes from mitotic cells. Banding techniques. Karyotype formula in health and diseases. Fluorescence in situ hybridization (FISH).
Unit 5 DNA analysis	Tasks of different methods. DNA and RNA extraction. The polymerase chain reaction. Gel electrophoresis. Types of the PCR. Restriction enzymes and their application. DNA sequencing. Southern and Northern blotting.
Unit 6 Biochemical techniques	Principles of biochemical diagnosing of human hereditary diseases.
Unit 7 Population study	Tasks of the method. Genetic equilibrium in populations. The Hardy–Weinberg Law. Solving of genetic problems.

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06.06.01 «Biological sciences»

Genetics: molecular basis of human hereditary diseases

Discipline	Molecular basis of heredity
Number of credits (hours)	4 (144)
Content	
Units	Content of the units
Unit 1 Introduction to Molecular Genetics	The subject and tasks of Molecular Genetics. Molecular Genetics in Biology and Medicine. The history of Molecular Genetics.
Unit 2 Genetic material	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. DNA polymerases and their characteristics. Telomeres and telomerase. Gene mutations and their causes. DNA repair mechanisms. Solving of genetic problems.
Unit 3 Gene expression. Transcription	Structure of eukaryotic and prokaryotic genes. Synthesis of RNA molecules (transcription) in prokaryotic and eukaryotic cells. RNA polymerases. Processing of RNA molecules in prokaryotic and eukaryotic cells. Solving of genetic problems.
Unit 4 Gene expression. Translation	Translation in prokaryotic and eukaryotic cells. The genetic code. Protein processing. The Central Dogma of Molecular Biology. Solving of genetic problems.
Unit 5 Control of gene expression	Control of gene expression in prokaryotes and eukaryotes. Control of transcription, translation, and processing.
Unit 6 Genomes of viruses, prokaryotes and eukaryotes	Genetic material of viruses, prokaryotes and eukaryotes. Chromosomal and extrachromosomal DNA. Plasmids. Mobile genetic elements in prokaryotic and eukaryotic cells.
Unit 7	Modern techniques of DNA analysis (PCR, gel

DNA analysis	electrophoresis, DNA restriction analysis, DNA sequencing, Southern blotting)
Unit 8 The gene therapy	The molecular basis of the gene therapy and genetic engineering.

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06.06.01 «Biological Sciences»

Genetics: molecular basis of human hereditary diseases

Discipline	English
Number of Credits (hours)	4 credits (144 hours)
Content	
Blocks	Content of the Blocks
Block 1 Summaries. Reviews. Precis-writing	Primary and Secondary Texts. Basic and Secondary Information. Scientific Text Compression. Summaries. Reviews. Precis-writing.
Block 2 Presentation of Scientific Research	Types of Scientific Texts. Terminology and Main Characteristics of Scientific Style in Russian and Foreign Languages. Scientific Syntax. References. Citing. Scientific Article. Presentation of Scientific Article.

Director of the programme



M.M. Azova

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Faculty of Humanities and Social Sciences*

DISCIPLINE ANNOTATION

Education Programs in all fields of postgraduate study

Discipline	History and Philosophy of Science
Total	4 credits (144 hours)
Contents	
Units	Topics
The subject and basic concepts of modern philosophy of science	Philosophy of science as the study of general laws of scientific knowledge in its historical development and changing socio-cultural context. The evolution of approaches to the analysis of science. Logical and epistemological approach to the study of science. Positivist tradition in the philosophy of science. Expansion of the field of philosophical issues in the postpositivistic philosophy of science.
Science in the culture of modern civilization	Traditionalist and technogenic types of civilizational development and their basic values. The role of science in modern education and the formation of personality. Functions of science in society.
The genesis of science and the main stages of its historical evolution	The culture of the ancient polis and the formation of the first forms of theoretical science. Antique logic and mathematics. Western and Eastern medieval science. The formation of experimental science in the new European culture. Background of the experimental method and its connection with a mathematical description of nature. Formation of science as a professional activity. The genesis of disciplinary organized science. Formation of technical sciences. The formation of social and human sciences.
The structure of scientific knowledge	The variety of types of scientific knowledge. Empirical and theoretical levels, the criteria for their distinction. Features of the empirical and theoretical language of science. The structure of empirical knowledge. Experiment and observation. Empirical dependencies and empirical facts. The structure of theoretical knowledge. Primary theoretical models and laws. Developed theory. Theoretical models. Foundations of science. Ideals and norms of research. Scientific picture of the world. Philosophical foundations of science.
Dynamics of science	The interaction of the foundations of science and experience, the formation of a new discipline. Formation of primary theoretical models and laws. The role of analogies in the theoretical search. Procedures to substantiate theoretical knowledge. The relationship of the logic of discovery and logic of justification.. Formation of a developed scientific theory. Problem

	situations in science. The development of science under the influence of new theories.
Scientific traditions and scientific revolutions. Types of scientific rationality	The interaction of traditions and the emergence of new knowledge. Scientific revolution as the restructuring of the foundations of science. Problems of typology of scientific revolutions. Intra-disciplinary mechanisms of scientific revolutions. Global revolutions and types of scientific rationality. Historical change of types of scientific rationality: classical, non-classical, post-non-classical science.
Features of the modern stage of development of science. Prospects for scientific and technological progress	Modern processes of differentiation and integration of sciences. Global evolutionism as a synthesis of evolutionary and systemic approaches. New ethical problems of science at the end of XX century. The problem of humanitarian control in science and high technology. Environmental and socio-humanitarian expertise of scientific and technical projects. Scientism and anti-scientism. Science and parasience. The role of science in overcoming contemporary global crises.
Science as a social institution	Scientific communities and their historical types. Science schools. Scientific training. Historical development of the methods of transmitting scientific knowledge. Science and economics. Science and power. The problem of state regulation of science.
Modern philosophical problems of the branch of science	In the areas of training postgraduate students

Author:

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SUMMARY OF THE DISCIPLINE

Educational programme

06.06.01 «Biological Sciences»

Genetics: molecular basis of human hereditary diseases

Discipline	Foreign Language
Number of Credits (hours)	5 credits (180 hours)
Content	
Blocks	Content of the Blocks
Block 1 Practical Course of English	Articles. Nouns. Adjectives. Numerals. Pronouns. Adverbs. Prepositions. Verbs: Regular and Irregular Verbs. Modal Verbs. Tenses: Present, Past, Future. Sequence of Tenses. Mood. Verbals: Infinitive, Gerund, Participle. Types of Sentences. Simple and Compound Sentences. Punctuation. Lexical Minimum: 5500 lexical units including 500 terminological units.
Block 2 Translation of Scientific Professional Literature	Scientific Style. Scientific Style in Natural Sciences. English for Academic Purposes. Translation Specificities of Terminology (Russian vs Foreign Languages). Adequacy and Equivalency in Translation of Scientific Articles. ICT in Translation.

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DISCIPLINE ANNOTATION


Education Programs in all fields of postgraduate study

Discipline	<i>Pedagogy of Higher Education</i>
Total	2 credits (72 hours)
Contents	
Units	Topics
Unit 1. Pedagogy of higher education as a field of study and academic subject area.	1. Pedagogy as a science, key concepts. Pedagogy of higher education in the system of pedagogical science. 2. Systems of higher education: comparative analyses. 3. Contemporary trends in higher education. Internationalization of higher education.
Unit 2. Didactics of higher education.	1. General aspects of didactic system. 2. Content of higher education (laws and regulations; main principles of selecting content). Curriculum and course syllabus. 3. Forms and methods of teaching. Lecture in modern higher education. Seminars, practical training, laboratory class. Project – working. 4. Students' individual work. 5. Interactive methods of teaching (discussions, case-study, training, professional simulation etc.). 6. ICT in modern higher education. 7. Monitoring and evaluation of academic performance. Point rating system.
Unit 3. Educational environment of modern university.	1. Faculty members' rights and responsibilities. Professional ethics. 2. Faculty interaction with students: case study. 3. Educational potential of extra-curricular activities.

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SUMMARY OF THE DISCIPLINE

Educational programme

06.06.01 «Biological Sciences»

Genetics: molecular basis of human hereditary diseases

Discipline	Russian as a Foreign Language
General labour intensity	4 credits (144 hours)
Content of the discipline	
Modules	Content of the Modules
Module 1 Medical Russian: Practical Course	<i>Communicative Morphology</i> : meanings of cases in medical discourse, Russian verb and its categories, word-formation, participle and verbal adverb as specific categories of the scientific style, participial constructions in medical discourse. <i>Communicative Syntax</i> : sentence models and their modifications, communicative organization of texts covering the following topic domains: <ul style="list-style-type: none">• Biological object and its characteristics.• Processes in human organism.• Human hereditary diseases.• Medical treatment of human hereditary diseases. <i>Lexical Minimum</i> : 5500 lexical units including 500 terminological units.
Module 2 Writing and Editing Dissertation	Scientific Style. Russian for Academic Purposes. Reading and reviewing research literature. Preparation of a manuscript: structure of a dissertation, its main components. How to prepare for oral defense of a dissertation.

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