Federal State Autonomous Educational Institution for Higher Education
PEOPLES' FRIENDSHIP UNIVERSITY OF RUSSIA NAMED AFTER PATRICE LUMUMBA
RUDN University

Institute of Medicine

(educational division (faculty/institute/academy) as higher education programme developer

COURSE SYLLABUS

BIOLOGY

course title

Recommended by the Didactic Council for the Education Field of:

31.05.01 General Medicine

field of studies / speciality code and title

The course instruction is implemented within the professional education programme of higher education:

General Medicine

higher education programme profile/specialisation title

2026

1. COURSE GOAL(s)

The goal of the course is to equip students with the knowledge and skills in the field of general biology, parasitology, classical, molecular, and medical genetics, which are necessary for the formation of the scientific worldview and practical activity of the physician.

2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the Biology course is aimed at the development of the following competences (competences in part).

Table 2.1. List of competences that students acquire through the course study

Competence code	**Competence descriptor**	**Competence formation indicators** (within this course)
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

3. COURSE IN HIGHER EDUCATION PROGRAMME STRUCTURE

The course refers to the core/variable/elective component of (B1) block of the higher educational programme curriculum.*

- \- Underline whatever applicable.

Within the higher education programme students also master other (modules) and / or internships that contribute to the achievement of the expected learning outcomes as results of the course study.

Table 3.1. The list of the higher education programme components/disciplines that contribute to the achievement of the expected learning outcomes as the course study results

Competence code	**Competence descriptor**	**Previous courses/modules***	**Subsequent courses/modules***

GPC-5	Being able to assess morpho-functional, physiological conditions and pathological processes in the human body to solve professional tasks	Chemistry	Biochemistry, Normal physiology; General surgery; Obstetrics and gynecology; Microbiology, virology; Oncology, radiation therapy; Pathophysiology, clinical pathophysiology; Microbiological diagnostic methods; Propaedeutics of internal diseases; Immunology; Pathological anatomy, clinical pathological anatomy; Radiation diagnostics; Medical elementology; Ophthalmology; Pharmacology; Anatomy; Topographic anatomy and operative surgery; Forensic Medicine; Medical forensics; Otorhinolaryngology; Pediatrics

* To be filled in according to the competence matrix of the higher education programme.

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course is 7 credits (252 academic hours).

*Table 4.1. Types of academic activities during the periods of higher education programme mastering (**full-time training**)**

Type of academic activities		Total academic hours	Semesters/training modules	
			2	3
Contact academic hours		170	85	85
including:				
Lectures (LC)		17	-	17
Lab work (LW)				
Seminars (workshops/tutorials) (S)		153	85	68
Self-studies		46	14	32
Evaluation and assessment (exam/passing/failing grade)		36	9	27
Course workload	academic hours_	**252**	**108**	**144**
	credits	**7**	**3**	**4**

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents		Academic activities types
Module 1 Introduction to Biology. The cell as a unit of life	**Topic 1.1.** Characteristics of Life. The cell as a unit of life	Cell: structure and functions. Structural features of prokaryotic and eukaryotic cells. Viruses.	**S**
Module 2 Genetic material. Structure and functions of nucleic acids	**Topic 2.1.** Structure and functions of nucleic acids	Monomers of nucleic acid. Structure of nucleic acids. Types of RNA in the cell. Functions of DNA and RNA.	**S**
	Topic 2.2. Genes and genetic code	Storage of hereditary information. Characteristics of the genetic code.	**S**
	Topic 2.3. DNA replication. PCR	Flow of genetic information. DNA synthesis in vivo and in vitro.	**S**
	Topic 2.4. Variability of living things. Gene mutations	Concept of variability. Classification of variability. Mutations and their classification. Mutagens. Mechanisms of gene mutations.	**S**
Module 3 Gene expression	**Topic 3.1.** Structure of prokaryotic genes. Synthesis of RNA molecules (transcription) in prokaryotic cells	Structural features of bacterial genes. Transcription in prokaryotic cells and its stages. Transcription factors in prokaryotes.	**S**
	Topic 3.2. Structure of eukaryotic genes. Synthesis of RNA molecules (transcription) in eukaryotic cells	Structural features of eukaryotic genes. Transcription in eukaryotic cells and its stages. Eukaryotic RNA polymerases. Transcription factors in eukaryotes.	**S**
	Topic 3.3. Processing of RNA molecules	Maturation of primary transcripts in prokaryotes and eukaryotes. Splicing. Types and significance of splicing.	**S**
	Topic 3.4. Translation in prokaryotic and eukaryotic cells	Polypeptide synthesis in prokaryotic and eukaryotic cells. Requirements for translation. Stages of translation.	**S**
	Topic 3.5. Control of gene expression in prokaryotes	Regulation of gene transcription in prokaryotic cells. Concept of operon.	**S**

	Topic 3.6. Control of gene expression in eukaryotes	Regulation of gene transcription in eukaryotic cells. Regulation of translation. RNA interference.	**S**
	Topic 3.7. Genetic material of viruses and prokaryotes	Genetic organization of DNA-containing and RNA-containing viruses. Nucleoid and plasmids of bacteria. Mobile genetic elements of prokaryotes.	**S**
	Topic 3.8. Genetic material of eukaryotes	Chromosomal DNA of eukaryotes. Mitochondrial DNA. Mobile genetic elements of eukaryotes.	**S**
Module 4 Cell division	**Topic 4.1.** Structure of eukaryotic chromosomes. Karyotype	Genetic organization of chromosomes. Basic concepts of Genetics: chromosomes and their classifications. Karyotype.	**S**
	Topic 4.2. Allelic and non-allelic genes. Types of gene interaction.	Allelic and non-allelic genes, linked and non-linked genes, linkage groups, multiple allelism, genotype, genome, gene pool, phenotype, gene interaction.	**S**
	Topic 4.3. Pleiotropic and lethal genes. The concepts of penetrance and expressivity.	Basic concepts of Genetics: penetrance and expressivity, pleiotropic effects, semi-lethal and lethal genes.	**S**
	Topic 4.4. The cell cycle, mitotic cell division. The control of the cell cycle	Modes of eukaryotic cell division. Mitotic cycle and its stages. Checkpoints. Role of cyclins and cyclin-dependent kinases in regulating the mitotic cycle.	**S**
	Topic 4.5. Meiotic cell division	Characteristics of meiotic divisions. Crossing over. Significance of meiosis. Possible meiotic disturbances and their consequences.	**S**
Module 5 Concepts of Genetics	**Topic 5.1.** Monohybrid cross. Law of segregation	Inheritance of autosomal allelic genes. Cytological basis of the law of segregation. Factors leading to non-Mendelian segregation patterns in monohybrid crosses.	**S**
	Topic 5.2. Dihybrid cross. Law of independent assortment	Inheritance of non-linked genes. Cytological basis of the law of independent assortment. Factors leading to non-Mendelian segregation patterns in dihybrid crosses.	**S**

	Topic 5.3. Genetics of sex determination. Sex-linked inheritance	Genetic mechanisms of sex determination. Sex-linked inheritance.	**S**
	Topic 5.4. Inheritance of linked genes	Complete and incomplete linkage. Chromosomal theory of heredity. Cytological basis of linked gene inheritance.	**S**
	Topic 5.5. Genetic analysis. Gene mapping	Principles of genetic analysis of eukaryotic and prokaryotic organisms. Role of test cross in constructing genetic maps of eukaryotic chromosomes. Genetic mapping for prokaryotes.	**S**
	Topic 5.6. Solving of genetic problems	Solving genetic problems involving different patterns of gene inheritance.	**S**
Module 6 Human Genetics	**Topic 6.1**. Human genome	Features of human DNA organization. Human chromosomes and their characteristics	**LC**
	Topic 6.2. Cytogenetic method. Twin study	Cytogenetic method: classical cytogenetics and molecular cytogenetic methods – their capabilities and limitations. Technique for preparing chromosome slides. Capabilities and limitations of the twin method. Role of the twin method in studying multifactorial traits in humans.	**S**
	Topic 6.3. Population study	Significance of the population study for human genetics. Hardy–Weinberg law.	**S**
	Topic 6.4. Pedigree analysis	Capabilities and limitations of the Pedigree analysis. Construction and analysis of pedigree charts.	**S**
	Topic 6.5. Methods of Molecular Genetics	Molecular genetic methods and their role in studying nucleic acid structure and gene expression. PCR, gel electrophoresis, DNA sequencing, nucleic acid hybridization, DNA restriction.	**S**
	Topic 6.6. Human heredity. Human hereditary diseases	The basis of hereditary pathology. The concept of mutational load. Classification of hereditary diseases. Chromosomal and	**LC**

		gene diseases	
	Topic 6.7. Non-Mendelian Inheritance. Non-Mendelian diseases	Mitochondrial diseases. Imprinting disorders. Diseases caused by expansion of nucleotide repeats.	**LC**
	Topic 6.8. The principles of diagnosis and prevention of human hereditary diseases	Prenatal and postnatal diagnosis of hereditary diseases. Approaches to prevention of hereditary diseases: primary, secondary, and tertiary prevention. Medical genetic counseling.	**S**
	Topic 6.9. Genetic engineering. Gene therapy	Principles of treating hereditary diseases. Etiological treatment. Gene therapy.	**LC**
Module 7 Medical Protozoology	**Topic 7.1.** Basic concepts of medical parasitology	Parasitism as a type of biotic interaction. Basic concepts of parasitology.	**LC**
	Topic 7.2. Dysenteric amoeba. Acanthamoeba	Dysenteric amoeba: structure, life cycle, effects on the human body, diagnosis, prevention, geographic distribution. Unicellular animals as facultative human parasites.	**S**
	Topic 7.3. Giardia and trichomonads	Giardia and trichomonads (intestinal and vaginal): structure, life cycle, effects on the human body, diagnosis, prevention, geographic distribution.	**S**
	Topic 7.4. Trypanosomes and leishmania	Trypanosomes (African and American) and leishmania: structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographic distribution.	**S**
	Topic 7.5. Malaria plasmodia and Toxoplasma	Malaria plasmodia and Toxoplasma: structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographic distribution.	**S**
	Topic 7.6. Balantidium	Balantidium: structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical	**S**

		distribution.	
Module 8 Medical Helminthology	**Topic 8.1.** Trematodes (flukes)	Liver fluke, cat liver fluke (Opisthorchis), Chinese liver fluke (Clonorchis), and lung fluke (Paragonimus): structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical distribution.	**S**
	Topic 8.2. Trematodes. Blood flukes	Blood flukes (Schistosoma): structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical distribution.	**S**
	Topic 8.3. Tapeworms I	Broad fish tapeworm (Diphyllobothrium latum): structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical distribution.	**S**
	Topic 8.4. Tapeworms II	Beef tapeworm (Taenia saginata), pork tapeworm (Taenia solium), and dwarf tapeworm (Hymenolepis nana): structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical distribution.	**S**
	Topic 8.5. Echinococcus and Alveococcus	Echinococcus and Alveococcus: structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical distribution.	**S**
	Topic 8.6. Roundworms. Geohelminths	Geohelminths: structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical distribution.	**S**
	Topic 8.7. Roundworms. Biohelminths	Biohelminths: structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical distribution.	**S**
	Topic 8.8. Ovohelminthoscopy	Methods for diagnosing helminthiases. Ovogelminthoscopy.	**S**

Module 9 Medical significance of arthropods	**Topic 9.1.** Crustaceans and arachnids	Crustaceans and arachnids of medical significance: structure, life cycle, effects on the human body, geographical distribution.	**S**
	Topic 9.2. Insects	Insects of medical significance: structure, life cycle, effects on the human body, geographical distribution.	**S**
Module 10 Evolution of the organic world	**Topic 10.1.** The main points of the modern evolution theory	Synthetic theory of evolution. Species and its criteria. Population as the elementary unit of evolution. Elementary factors of evolution.	**LC**
Module 11 Man and the Biosphere	**Topic 11.1.** Man and the Biosphere	Concept of the biosphere. Main pathways of anthropogenic pollution of biosphere components. Impact of anthropogenic environmental pollution on human health.	**LC**

* - to be filled in only for **full** -time training: *LC - lectures; LW - lab work; S - seminars.*

6. CLASSROOM EQUIPMENT AND TECHNOLOGY SUPPORT REQUIREMENTS

Table 6.1. Classroom equipment and technology support requirements

Type of classrooms	**Classroom equipment**	**Specialised educational / laboratory equipment, software, and materials for course study** (if necessary)
Specialized classroom	A classroom for seminars, individual consultations, current and mid-term assessment; equipped with a set of specialised furniture and machinery	A set of specialized furniture; whiteboard; technical means of multimedia presentations. Microscopes.
Self-studies	A classroom for independent work of students (can be used for seminars and consultations), equipped with a set of specialised furniture	A set of specialized furniture; whiteboard; technical means of multimedia presentations

* The premises for students' self-studies are subject to **MANDATORY** mention

7. RESOURCES RECOMMENDED FOR COURSE STUDY

Main readings:

1. Essential medical biology. V. 1 : Cell biology / N. V. Chebyhev, I.A. Berechikidze, S.M. Kuzin [и др.] ; Ed. by N.V. Chebyshev. - Книга на английском языке. - Moscow : Medical Informational Agency, 2020. - 113 p.
2. Essential medical biology. V.2 : Genetics / N. V. Chebyhev, S.H. Larina, E.S. Gorozhanina [и др.] ; Ed. by N.V. Chebyshev. - Книга на английском языке. - Moscow : Medical Informational Agency, 2020. - 112 p.
3. Essential medical biology. V. 3 : Human parasitology / N. V. Chebyhev, I.A. Berechikidze, G.G. Grineva [и др.] ; Ed. by N.V. Chebyshev. - Книга на английском языке. - Moscow : Medical Informational Agency, 2020. - 264 p.
4. Myandina G.I. Medical parasitology. – M.: PFU. – 2014. https://lib.rudn.ru:443/MegaPro/UserEntry?Action=Link_FindDoc&id=444651&idb=0

Additional readings:

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. Klug W.S., Cummings M.R., Spencer C.A., Palladio M.A. Concepts of genetics. – Pearson Education International. – 2014.
4. Lewin B. Genes. – Oxford University Press. – 2012.
5. Color Atlas of Genetics / Passarge Eberhard. - 4th edition, revised and update. - Stuttgard ; New York : Thieme, 2013.
6. Vogel and Motulsky's Human Genetics: Problems and Approaches / M. Speicher, Antonarakis S.E., Motulsky A.G. – Springer. – 2010.

Internet sources:

1. Electronic libraries with access for RUDN students:

- RUDN online library http://lib.rudn.ru/MegaPro/Web
- Scientific electronic library: - http://elibrary.ru
- EL "University Library Online" http://www.biblioclub.ru
- EL "Student Consultant" www.studentlibrary.ru
- EL "Lan" http://e.lanbook.com/
- EL "Yurayt" http://www.biblio-online.ru

1. Databases and search engines:

- National Center for Biotechnology Information (NCBI) - www.ncbi.nlm.nih.gov
- Google Academy - http://scholar.google.ru/
- SCOPUS http://www.scopus.com/

*Training toolkit for self- studies to master the course *:*

1. Biology workbook
2. Methodological recommendations on discipline study

* The training toolkit for self- studies to master the course is placed on the course page in the university telecommunication training and information system under the set procedure.

8. ASSESSMENT TOOLKIT AND GRADING SYSTEM* FOR EVALUATION OF STUDENTS' COMPETENCES LEVEL UPON COURSE COMPLETION

The assessment toolkit and the grading system* to evaluate the competences formation level (competences in part) upon the course study completion are specified in the Appendix to the course syllabus.

* The assessment toolkit and the grading system are formed on the basis of the requirements of the relevant local normative act of RUDN University (regulations / order).

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