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:

31.05.03 Dentistry

field of studies / speciality code and title

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

Dentistry

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 course Biology course is aimed at the development of the following competences (competences in part): GPC-8.

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

Competence code	**Competence descriptor**	**Competence formation indicators** (within this course)
GPC-8	Being able to use main physical and chemical, mathematic and scientific notions and methods when dealing with professional tasks	GPC-8.2 Applying basic fundamental physical and chemical knowledge to deal with professional tasks

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-8	Being able to use main physical and chemical, mathematic and scientific notions and methods when dealing with professional tasks	Mathematics, Physics	Physiotherapy of dental diseases, Obstetrics

* 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 5 credits (180 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		105	54	51
including:				
Lectures (LC)		17		17
Lab work (LW)				
Seminars (workshops/tutorials) (S)		88	54	34
Self-studies		39	36	3
Evaluation and assessment (exam/passing/failing grade)		36	18	18
Course workload	academic hours_	**180**	**108**	**72**
	credits	**5**	**3**	**2**

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	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	**Topic 2.1.** Structure and functions of nucleic acids. Genes. Genetic code Monomers of nucleic acid. Structure of nucleic acids. Types of RNA in the cell. Functions of DNA and RNA. Storage of hereditary information. Characteristics of the genetic code.	**S**
	Topic 2.2. DNA replication Flow of genetic information. DNA synthesis in vivo.	**S**
	Topic 2.3. Variability of living things. Chromosomal and gene mutations. DNA repair Concept of variability. Classification of variability. Mutations and their classification. Mutagens. Mechanisms of gene mutations. DNA repair in eukaryotic and prokaryotic cells.	**S**
Module 3 Gene expression. Organization of genetic material	**Topic 3.1.** Synthesis of RNA molecules in prokaryotic cells. Control of gene expression in prokaryotes. Operon Structural features of bacterial genes. Transcription in prokaryotic cells and its	**S**

	stages. Transcription factors in prokaryotes. Regulation of gene transcription in prokaryotic cells. Lac-operon.	
	Topic 3.2. Synthesis of RNA molecules in eukaryotic cells. Processing of RNA molecules Structural features of eukaryotic genes. Transcription in eukaryotic cells and its stages. Eukaryotic RNA polymerases. Transcription factors in eukaryotes. Maturation of primary transcripts in prokaryotes and eukaryotes. Splicing. Types and significance of splicing. Regulation of gene transcription in eukaryotic cells.	**S**
	Topic 3.3. Translation and its stages Polypeptide synthesis in prokaryotic and eukaryotic cells. Requirements for translation. Stages of translation. Translation factors. Regulation of translation. RNA interference	**S**
	Topic 3.4. Genetic material. Chromosomal and extrachromosomal DNA. Mobile genetic elements Genetic organization of DNA-containing and RNA-containing viruses. Nucleoid and plasmids of bacteria. Mobile genetic elements of prokaryotes. Chromosomal DNA of eukaryotes. Mitochondrial DNA. Mobile genetic elements of eukaryotes.	**S**
Module 4 Cytological Fundamentals of Organismal Growth and Reproduction	**Topic 4.1.** Structure of eukaryotic chromosomes. Karyotype. Genes Basic concepts of Genetics: chromosomes and their classifications. Karyotype. Allelic and non-allelic genes, linked and non-linked genes, linkage groups, multiple allelism, semi-lethal and lethal genes, genotype, genome, gene pool, phenotype, penetrance and expressivity, gene interaction.	**S**
	Topic 4.2. The cell cycle, mitotic cell division. 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 4.3. Meiotic cell division Characteristics of meiotic divisions. Crossing over.	**S**

	Significance of meiosis. Possible meiotic disturbances and their consequences.	
Module 5 Concepts of Genetics	**Topic 5.1.** Monohybrid cross. Law of segregation. Interaction of allelic genes Inheritance of autosomal allelic genes. Cytological basis of the law of segregation. Factors leading to non-Mendelian segregation patterns in monohybrid crosses. Interaction of allelic genes	**S**
	Topic 5.2. Dihybrid cross. Law of independent assortment. Interaction of non-allelic genes Inheritance of non-linked genes. Cytological basis of the law of independent assortment. Factors leading to non-Mendelian segregation patterns in dihybrid crosses. Interaction of non-allelic genes	**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. Genetic analysis Complete and incomplete linkage. Chromosomal theory of heredity. Cytological basis of linked gene inheritance.	**S**
Module 6 Human Genetics	**Topic 6.1.** Human genome. Characteristics of humans as an object of genetic research Human DNA organization. Human chromosomes and their characteristics	**LC**
	Topic 6.2. Chromosomal diseases Causes of chromosomal diseases. Examples.	**LC**
	Topic 6.3. Gene and multifactorial diseases Causes of genetic and multifactorial diseases. Classification of genetic diseases and examples.	**LC**
	Topic 6.4. Non-Mendelian diseases Mitochondrial diseases. Imprinting diseases. Diseases caused by expansion of nucleotide repeats.	**LC**
	Topic 6.5. Genetic engineering. Gene therapy Principles of treating hereditary diseases. Etiological treatment. Gene therapy.	**LC**

	Topic 6.6. Twin study Purpose, Capabilities and limitations of the twin method. Concordance and discordance. Role of the twin method in studying multifactorial traits in humans.	**S**
	Topic 6.7. Cytogenetic method Cytogenetic method: classical cytogenetics and molecular cytogenetic methods – their capabilities and limitations. Technique for preparing chromosome slides.	**S**
	Topic 6.8. Population study Significance of the population study for human genetics. Hardy–Weinberg law.	**S**
	Topic 6.9. Pedigree analysis Capabilities and limitations of the Pedigree analysis. Construction and analysis of pedigree charts.	**S**
	Topic 6.10. Methods of Molecular Genetics. Polymerase chain reaction Molecular genetic methods and their role in studying nucleic acid structure and gene expression. Gel electrophoresis, DNA sequencing, nucleic acid hybridization, DNA restriction. PCR, its stages, and application.	**S**
Module 7 Medical Parasitology	**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 Dysenteric amoeba: structure, life cycle, effects on the human body, diagnosis, prevention, geographic distribution.	**S**
	Topic 7.3. Giardia and trichomonads. Trypanosoma Giardia and trichomonads (intestinal and vaginal), Trypanosoma gambiense: structure, life cycle, effects on the human body, diagnosis, prevention, geographic distribution.	**S**
	Topic 7.4. Malaria plasmodia, Toxoplasma and Balantidium Malaria plasmodia, Toxoplasma and Balantidium: structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographic distribution	**S**

	Topic 7.5. Trematodes (flukes) Liver fluke, cat liver fluke (Opisthorchis), and Blood flukes (Schistosoma mansoni): structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical distribution.	**S**
	Topic 7.6. Tapeworms (cestodes) Broad fish tapeworm (Diphyllobothrium latum), Beef tapeworm (Taenia saginata), pork tapeworm (Taenia solium), and Echinococcus: structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical distribution.	**S**
	Topic 7.7. Roundworms (nematodes). Geohelminths Geohelminths: structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical distribution.	**S**
	Topic 7.8. Roundworms. Biohelminths Biohelminths: structure, life cycle, transmission, effects on the human body, diagnosis, prevention, geographical distribution.	**S**
	Topic 7.9. Crustaceans and arachnids Crustaceans and arachnids of medical significance: structure, life cycle, effects on the human body, geographical distribution.	**S**
	Topic 7.10. Insects Insects of medical significance: structure, life cycle, effects on the human body, geographical distribution.	**S**
	Topic 8.1. Synthetic theory of evolution Species and its criteria. Population as the elementary unit of evolution. Elementary factors of evolution.	**LC**
Module 8 Evolution of the organic world.	**Topic 8.1.** Synthetic theory of evolution Species and its criteria. Population as the elementary unit of evolution. Elementary factors of evolution.	**LC**

Module 9 Man and the Biosphere	**Topic 9.1.** 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)
Seminar	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 (342)	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 (GPC-8) 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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