Federal State Autonomous Educational Institution of 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

Medical Enzymology

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

1. COURSE GOAL(s)

The goal of the course "Medical enzymology" is to acquire the knowledge about molecular mechanisms of functioning of biological systems and to form professional competence in matters of enzymopathology, enzyme diagnostics, and enzyme therapy.

2. REQUIREMENTS FOR LEARNING OUTCOMES

Mastering the course (module) "**Medical Enzymology**" is aimed at the development of the following competences /competences in part: PC-2.

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

Competence code	**Competence descriptor**	**Competence formation indicators** (within this course)
PC-2	Being able to examine a patient in order to determine a diagnosis	PC-2.2. Being able to make a preliminary diagnosis and make up a plan of laboratory and instrumental examinations of a patient.
		PC-2.3. Being able to refer a patient to a laboratory examination in case there are medical indications in accordance with the current procedures for the provision of medical care, clinical guidelines (treatment protocols) on the provision of medical care taking into account the medical care standards.

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***
PC-2	Being able to examine a patient in order to determine a diagnosis	General Surgery; Propaedeutics of internal diseases; Microbiology, virology; Immunology; *Molecular genetics in practical biology and medicine***; Pathophysiology, clinical	Surgical practice: Assistant surgeon; Assistant physician of the therapeutic profile: assistant physician. General medical practice: assistant doctor of a polyclinic; Obstetric and gynecological practice: assistant obstetrician; Obstetric and gynecological practice: assistant gynecologist; General medical practice:

		pathophysiology; Pathological anatomy, clinical pathological anatomy	Assistant pediatrician; Dermatovenerology; Neurology, medical genetics, neurosurgery; Ophthalmology; Faculty Surgery; Occupational diseases; Hospital therapy; Endocrinology; Outpatient therapy; Hospital surgery, pediatric surgery; Pediatrics; Obstetrics and gynecology; Anesthesiology, intensive care, intensive care; Oncology, radiation therapy; Otorhinolaryngology; Reproductive health; Traumatology, orthopedics; Faculty therapy; Maxillofacial surgery; General medical skills; Urgent conditions; Urology; Infectious diseases; Psychiatry, medical psychology; Allergology; Phthisiology; Endoscopic urology; Telemedicine; Clinical Dentistry; *Topical Issues of Neonatology***; Cardiology in Quests; Molecular genetic methods; Methods of microbiological diagnosis; Evidence-based medicine; Sectional course

* 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 "Medical Enzymology" is 2 credits (72 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
		6
Contact academic hours	***34***	***34***
Including:		

Type of academic activities		Total academic hours	Semesters/training modules
			6
Lectures (LC)		0	0
Lab work (LW)		0	0
Seminars (workshops/tutorials) (S)		34	34
Self-studies		*26*	*26*
Evaluation and assessment (exam/passing/failing grade)		*12*	*12*
Course workload	academic hours_	72	72
	credits	2	2

* To be filled in regarding the higher education programme correspondence training mode.

5. COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	Academic activities types
Module 1. Basic aspects of the enzyme used in medicine.	Topic 1.1. Medical enzymology. History of enzymology in the USSR/Russia. Basic aspects of the enzyme used in medicine.	***S***
	Topic 1.2. Mechanisms of enzymatic catalysis and regulation of enzyme activity.	***S***
	Topic 1.3. Engineering enzymology.	***S***
Module 2. Enzyme pathology.	Topic 2.1. Inborn errors of metabolism. General principles of diagnosis and treatment of congenital enzymopathies. The concept of orphan diseases.	***S***
	Topic 2.2. Congenital disorders of carbohydrate metabolism. Glycogenoses. Disorders of fructose and galactose metabolism. Hemolytic anemia (deficiency of glucose-6-phosphate dehydrogenase, pyruvate kinase).	***S***
	Topic 2.3. Lysosomal storage diseases.	***S***
	Topic 2.4. Congenital disorders of amino acid metabolism.	***S***
	Topic 2.5. Congenital disorders of the metabolism of steroid compounds and heme breakdown products.	***S***
	Topic 2.6. Disorders of ornithine cycle enzymes: clinical and biochemical correlations.	***S***
Module 3. Enzyme therapy	Topic 3.1. Enzymes for replacement therapy in pancreatic insufficiency.	***S***
	Topic 3.2. Thrombolytic enzymes and blood clotting factors.	***S***
	Topic 3.3. Enzymes for cancer therapy.	***S***
	Topic 3.4. Target enzymes for anti-inflammatory drugs.	***S***

Course module title	Course module contents (topics)	Academic activities types
	Topic 3.5. Target enzymes for the treatment of arterial hypertension and atherosclerosis.	***S***
	Topic 3.6. Tyrosine kinases regulating tumor progression as targets for chemotherapy of malignant diseases.	***S***

* - 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 academic activities	**Classroom equipment**	**Specialised educational / laboratory equipment, software, and materials for course study** (if necessary)
Seminar	An auditorium for conducting seminar-type classes, group and individual consultations, ongoing monitoring and intermediate certification, equipped with a set	Multimedia projectors and motorized screens NEC V 260X Projector, Motorized Screen for Master Control Projector 203X203.
Self-studies	An auditorium for students to work independently (can be used for seminars and consultations), equipped with a set of specialized furniture and computers with access to electronic informational educational system/	A set of specialized furniture, Software: Microsoft products (OS, office application package, including MS Office/ Office 365, Teams)

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

7. RESOURCES RECOMMENDED FOR COURSE STUDY

Main readings:

Electronic and printed full-text materials:

1. Baynes J. W. Medical Biochemistry. – 6th Edition; - London: Elsevier, 2022. – 744 p.
2. Nelson, D. L.; Cox, M. M.; Lehninger, A. L. Lehninger Principles of Biochemistry; WH Freeman: New York, 2021 (8^{th} Ed.).

Additional readings:

1. Principles of Medical Biochemistry 2nd ed./ Gerhard Meisenberg, William H. Simmons. - Mosby Elsevier, 2006.
2. Coleman Jan. Visual biochemistry / J. Kolman, K. Rem Color Atlas of Biochemistry. Thieme, 2012. – 3rd Edition, 506 p.
3. Berezov T.T., Chernov N.N. Kuznetsova O.M. Collection of biochemistry tests. – M. Publishing house "Orgservice-2000". --2011. - 60 p
4. Berezov T.T., Chernov N.N. Kuznetsova O.M. Collection of biochemistry tests. – M. Publishing

house "Orgservice-2000". -2011. - 60s.
5. Kuznetsova O.M., Smirnova I.P., Chernov N.N., Neborak E.V., Ivanova-Radkevich V.I., Lobaeva T.A. Practical guide to learning Biochemistry M.: Digitpress 2018.-64p.
6. Kuznetsova O.M., Berezov T.T., Chernov N.N. Laboratory Manual on Biochemistry. Part 1. -M.: DIGITPRESS. - 2017. -58 p.
7. Kuznetsova O.M., Berezov T.T., Chernov N.N. Laboratory Manual on Biochemistry. Part 2. -M.: DIGITPRESS. - 2018. -58 p.

Internet sources:

1. ELS RUDN and third-party ELS, to which university students have access on the basis of concluded contracts:

- Electronic library system RUDN – ELS RUDN http://lib.rudn.ru/MegaPro/Web
- ELS "University Library online" http://www.biblioclub.ru
- ELS Yurayt http://www.biblio-online.ru
- ELS "Student Consultant" www.studentlibrary.ru
- ELS "Lan" http://e.lanbook.com/

2. Databases and search engines:

- NCBI: https://p.360pubmed.com/pubmed/
- Rajkumar V, Dumpa V. Lysosomal Storage Disease. [Updated 2023 Jul 24]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK563270/
- Lewis T, Stone WL. Biochemistry, Proteins Enzymes. [Updated 2023 Apr 24]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK554481/
- Moriles KE, Azer SA. Alanine Amino Transferase. [Updated 2022 Dec 10]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK559278/
- Venkatesh P, Kasi A. Pancrelipase Therapy. [Updated 2023 Jul 17]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK534816/
- Farhana A, Lappin SL. Biochemistry, Lactate Dehydrogenase. [Updated 2023 May 1]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK557536/
- Ghodeif AO, Azer SA. Pancreatic Insufficiency. [Updated 2023 Jan 16]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK555926/
- LaPelusa A, Kaushik R. Physiology, Proteins. [Updated 2022 Nov 14]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK555990/
- Karnik NP, Jan A. Pancrelipase. [Updated 2023 Aug 22]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK534847/
- Saleem H, Simpson B. Biotinidase Deficiency. [Updated 2023 Feb 9]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK560607/

- Kothadia JP, LaFreniere K, Shah JM. Acute Hepatic Porphyria. [Updated 2023 May 1]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK537178/
- Adnan M, Puranik S. Hypertyrosinemia. [Updated 2022 Nov 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK578205/
- Jilani TN, Siddiqui AH. Tissue Plasminogen Activator. [Updated 2023 Feb 20]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2024 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK507917/
- Bulletin of the RUDN: access mode from the territory of the RUDN and remotely http://journals.rudn.ru/
- Scientific Library Elibrary.ru : access by IP addresses of the RUDN at: http://www.elibrary.ru/defaultx.asp
- ScienceDirect (ESD), "FreedomCollection", "Cell Press" ID "Elsevier". There is remote access to the database, access by the IP addresses of the RUDN (or remotely by an individual login and password).
- Google Academy (English Google Scholar) is a free search engine for full texts of scientific publications of all formats and disciplines. Indexes the full texts of scientific publications. Access mode: https://scholar.google.ru/
- Scopus is a scientometric database of the publishing house of the publishing house "Elsevier". Access to the platform is carried out by the IP addresses of the RUDN or remotely. http://www.scopus.com/
- Web of Science. Access to the platform is carried out by the IP addresses of the RUDN or remotely. http://login.webofknowledge.com/

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

1. The set of lectures on the course "Medical enzymology".
2. The laboratory workshop (if any) on the course "Medical enzymology".
3. The guidelines for writing a course paper / project (if any) on the course "Medical enzymology"..
4. ……

* 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 (PC-2) 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).

DEVELOPERS:

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