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

2025

1. COURSE GOAL(s)

The discipline "Medical enzymology" is included in the program of the specialty "Medical business" in the direction of 31.05.01 "Medical business" and is studied in the 6th semester of the 3rd year. The discipline is implemented by the Department of Biochemistry named after Academician T.T. Berezov. The discipline consists of 3 sections and 15 topics and is aimed at studying the molecular mechanisms of enzymopathology, enzyme diagnostics, and enzyme therapy.

The purpose of mastering the discipline is to acquire the knowledge about the molecular mechanisms of functioning of biological systems and the formation of professional competence in matters of enzymopathology, enzyme diagnostics, and enzyme therapy.

2. REQUIREMENTS FOR LEARNING OUTCOMES

Development of the discipline "**Medical Enzymology**" suggests the formation of the following competences: 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 conduct an examination of the patient in order to establish a diagnosis	PC-2.2 is able to formulate a preliminary diagnosis and draw up a plan for laboratory and instrumental examinations of the patient; PC-2.3 is able to refer a patient for a laboratory examination if there are medical indications in accordance with the current procedures for providing medical care, clinical recommendations (treatment protocols) for providing medical care, taking into account the standards of medical care.

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

Code	Name of competence	Previous disciplines/modules, practices*	Subsequent disciplines/modules, practices*
PC-2	Being able to conduct an examination of the patient	General Surgery; Propaedeutics of	Surgical practice: Assistant Surgeon;

	in order to establish a diagnosis	internal diseases; Microbiology, virology; Immunology; *Molecular genetics in practical biology and medicine**;* Pathophysiology, clinical pathophysiology; Pathological anatomy, clinical pathological anatomy	Assistant physician of the therapeutic profile: assistant physician of the therapist; General medical practice: assistant physician at a polyclinic institution; Obstetric and gynecological practice: obstetrician's assistant; Obstetric and gynecological practice: gynecologist's assistant; General medical practice: 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; *Current issues of neonatology**;* *Topical Issues of Neonatology**;* Cardiology in quests; Molecular genetic methods; Methods of microbiological diagnostics; Evidence-based medicine; Sectional course;

* - it is filled in in accordance with the matrix of competencies and educational plan of the EP of HE

** - elective disciplines /practices

4. COURSE WORKLOAD AND ACADEMIC ACTIVITIES

The total workload of the course 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
In-class learning (total, hours)	***34***		***34***
Lectures (LC)	0		0
Laboratory 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**

5 COURSE CONTENTS

Table 5.1. Course contents and academic activities types

Course module title	Course module contents (topics)	Academic activities types
Module 1 Key aspects of the use of enzymes in medicine	1.1 Medical enzymology. History of enzymology in the USSR/Russia. Key aspects of enzyme use in medicine. Enzymes, coenzymes, vitamins. Biological catalysts: ribozymes and enzymes. Chemical structure of enzymes. The active site, its adsorption and catalytic sites. Coenzymes – the concept of their functional role and chemical diversity. Classification and nomenclature of enzymes. Isoenzymes and their role in enzyme diagnostics. Immobilized enzymes. The use of enzymes in medicine. Vitamins – Essential factors of human nutrition. Distribution of vitamins in nature. Chemical nature of vitamins, pictures of hypo- and hypervitaminosis in the body. Classification of vitamins. Concept of antivitamins. Characteristics and formulas of individual water-soluble vitamins B1, B2, pantothenic acid, PP, B6, B12, H (biotin), folic acid, C. Coenzymes - derivatives of vitamins. Functional role of coenzymes. Fat-soluble vitamins A, D, E, K. Enzyme activity, units of measurement. Kinetics of enzymatic catalysis. Regulation of enzymatic activity. Enzyme inhibitors: irreversible and reversible; competitive and non-competitive (allosteric). Use of inhibitors in medicine. Reversible enzyme inhibition as a mechanism of action of most drugs.	S
	1.2 Enzyme diagnostics. Clinical significance of enzyme markers included in the blood biochemistry tests Clinical significance of enzyme markers ALAT, ASAT, CPK, ALP, AlP, amylase, and elastase in various pathologies. Relationship between the level of increased enzyme activity in blood plasma and the severity of organ damage.	S
Module 2 Enzymopathology	2.1 Inborn errors of metabolism. General principles of diagnosis and treatment of congenital enzyme deficiencies. Concept of orphan diseases. Concept of neonatal screening.	S
	2.2 Congenital disorders of the urea cycle Hyperammonemia; Citrullinemia, type I; Arginase deficiency	S
	2.3 Inborn errors of AA metabolism Classical phenylketonuria and other types	S
	2.4 Lysosomal storage diseases Sphingolipidoses (Gaucher disease, Krabbe disease, Niemann- Pick disease, etc.). Mucopolysaccharidoses.	S
	2.5 Congenital disorders of lipid metabolism Primary carnitine deficiency; medium-chain acyl-CoA dehydrogenase deficiency; long-chain acetyl-CoA dehydrogenase deficiency (very long-chain acyl-CoA dehydrogenase deficiency (VLCAD)); mitochondrial trifunctional protein deficiency; carnitine palmitoyltransferase deficiency type I; carnitine palmitoyltransferase deficiency type II; carnitine/acylcarnitine translocase deficiency	S
	2.6 Congenital disorders of carbohydrate metabolism Glycogenosis. Fructose and galactose metabolism disorders. Hemolytic anemia (glucose-6-phosphate dehydrogenase, pyruvate kinase	S

	deficiency).	
	2.7 Inborn errors of metabolism associated with the synthesis and breakdown of heme. Porphyrias. Kirgler-Najjar syndrome, Dobin-Johnson syndrome. Gilbert syndrome	S
Module 3 Enzyme therapy	3.1 Enzymes for replacement therapy in pancreatic insufficiency The use of proteolytic and lipolytic enzymes in the treatment of congenital/acquired pancreatic insufficiency	S
	3.2 Thrombolytic enzymes and coagulation factors The blood clotting process as a cascade of enzymatic reactions, thrombolytic enzymes. Therapeutic use of thrombolytic enzymes.	S
	3.3 Therapeutic enzyme preparations for the treatment of cancer. Enzymes as targets for anticancer drugs. Enzymes that deplete the AMC pool in tumor cells. Asparaginase as an antitumor enzyme. L-AMC oxidases of various origins. Methionine gamma-lyase. Nucleotide metabolism enzymes as targets for Anticancer drugs. Polyamine metabolism enzymes as targets for the development of anticancer drugs.	S
	3.4 Target enzymes for anti-inflammatory drugs Cyclooxygenases and phospholipases: biological role, isoforms, intracellular and tissue distribution. Selective and non-selective cyclooxygenase inhibitors.	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. Material and technical support of the discipline

Type of academic activities	**Classroom equipment**	**Specialised educational / laboratory equipment, software, and materials for course study** (if necessary)
Seminar	An auditorium for laboratory work, individual consultations, routine monitoring and interim certification, equipped with a set of specialized furniture and equipment	Multimedia projectors and motorized screens, computer/notebook
Self-studies	An auditorium for self-learning work of students (can be used for laboratory classes and consultations), equipped with a set of specialized furniture	A set of specialized furniture, Software: Microsoft products (OS, office application package, including MS Office/ Office 365, Teams),

* - the audience for independent work of students must be specified!

7. RESOURCES RECOMMENDED FOR COURSE STUDY

Main readings:

1. Nelson David L., Cox Michael M. Lehninger Principles of Biochemistry: - 8th ed. - Holtzbrink(MPS)/MPS, 2021. - 1328 p.
2. Baynes J. W. Medical Biochemistry. - Third Edition; - London: Elsevier, 2009. - 653 p.
3. El-metwally, Tarek H.; El-Senosil, Yakout A. Medical Enzymology: A Simplified Approach (Biochemistry Research Trends) - Nova Science Pub Inc, 2011. – 154 p.

Additional readings:

1. Principles of Biochemistry 4nd ed./ Lehninger, A.L., Nelson, D.L., Cox, M.M..- Worth Publishing, 2004.
2. Principles of Medical Biochemistry 2nd ed./ Gerhard Meisenberg, William H. Simmons. - Mosby Elsevier, 2006.
3. Berezov T.T., Chernov N.N. Kuznetsova O.M.Collection of biochemistry tests. – M. Publishing house "Orgservice-2000". --2011. - 60 p
4. T.T. Berezov and B.F.Korovkiv. Biochemistry. – M., Mir Publishers. -1992. -515 p.
5. Berezov T.T., Chernov N.N. Kuznetsova O.M. Collection of biochemistry tests . – M. Publishing house "Orgservice-2000". -2011. - 60s.
6. T.T. Berezov and B.F.Korovkiv. Biochemistry. – M., Mir Publishers. -1992. -515 p.
7. 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.
8. Kuznetsova O.M., Berezov T.T., Chernov N.N. Laboratory Manual on Biochemistry. Part 1. -M.: DIGITPRESS. - 2017. -58 p.
9. Kuznetsova O.M., Berezov T.T., Chernov N.N. Laboratory Manual on Biochemistry. Part 2. -M.: DIGITPRESS. - 2018. -58 p.

Resources of the Internet information and telecommunication network:

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/
- 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/

Educational and methodological materials for independent work of students during the development of the discipline/ module:*

1. A course of lectures on the discipline "Medical enzymology".
2. Methodological guidelines for the implementation and registration of control and self-work on the discipline "Medical enzymology"

* - all educational and methodological materials for independent work of students are placed in accordance with the current procedure on the discipline page in the TUIS!

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