Federal State Budgetary Educational Institution of Higher Education
"Privolzhsky Research Medical University"
Ministry of Health of the Russian Federation

APPROVED
Vice-Rector for Academic Affairs
E.S. Bogomolova
31 August 2021

WORKING PROGRAM

Name of the academic discipline: **CLINICAL ASPECTS OF BIOCHEMISTRY**

Specialty: **31.05.01 GENERAL MEDICINE**
(code, name)
Qualification: **GENERAL PRACTITIONER**

Department: **BIOCHEMISTRY**

Mode of study: **FULL-TIME**

Labor intensity of the academic discipline: **36 academic hours**

Nizhny Novgorod
2021

The working program has been developed in accordance with the Federal State Educational Standard for the specialty 31.05.01 GENERAL MEDICINE
approved by Order of the Ministry of Education and Science of the Russian Federation No. 988 dated August 12, 2020.

Developers of the working program:
Full name, academic degree, title, position.

Erlykina E.I., Doctor of Biological Sciences, Professor, Head of the Department of Biochemistry named after G.Ya.Gorodisskaya.

Kopytova T.V., Doctor of Biological Sciences, Professor of the Department of Biochemistry named after G.Ya.Gorodisskaya.

The program was reviewed and approved at the department meeting (protocol No. 7 from 15.04.2021).
Head of the Department,
Doctor of Biological Sciences, Professor, _____ (Erlykina E.I.)
(signature)

15.04.2021

AGREED
Deputy Head of EMA ph.d. of biology _____ Lovtsova L.V.
(signature)

15.04.2021

1. The purpose and objectives of mastering the academic discipline clinical aspects of biochemistry (hereinafter – the discipline):

1.1. The purpose of mastering the discipline:

The purpose of mastering **the discipline**: participation in forming the relevant competencies UC-1.

1.2. Tasks of the discipline:

to form knowledge about the basic patterns of metabolic processes that determine the state of human health and adaptation at the molecular, cellular and organ levels of the whole organism, to apply the knowledge gained in solving clinical problems.

1.3. Requirements to the deliverables of mastering the discipline

As a result of completing the discipline, the student should

Know:

• structure and properties of the main classes of biologically important compounds, the main metabolic pathways of their transformation, the role of hereditary factors in the development of diseases

• the chemical and biological essence of the processes occurring at the molecular and cellular level

• general laws of metabolic processes of the human body, basic principles of biochemical methods of analysis in medicine.

Be able to:

• use educational, scientific, regulatory and reference literature, information resources

• use basic laboratory equipment and analyze biochemical analysis data

• determine the state of the human body, based on the interpretation of biochemical studies, identify signs of pathological processes.

Possess:

• analytical skills of working with information obtained from various sources

• basic information transformation technologies, medical and functional conceptual apparatus

• basic skills of interpreting the results of biochemical studies.

2. Position of the academic discipline in the structure of the General Educational Program of Higher Education (GEP HE) of the organization.

2.1. The discipline clinical aspects of biochemistry refers to the core part of Block 1 of GEP HE (Academic discipline index).

The discipline is taught in the third semester/2nd year of study.

2.2. The following knowledge, skills and abilities formed by previous academic disciplines are required for mastering the discipline:

1. biology,
2. physics,
3. medical informatics,
4. chemistry,
5. histology,
6. cytology and embryology,

7. normal anatomy,
8. normal physiology.

2.3. Mastering the discipline is required for forming the following knowledge, skills and abilities for subsequent academic disciplines:

1. pathophysiology,
2. clinical pathophysiology,
3. pharmacology,
4. microbiology,
5. virology,
6. immunology

3. Deliverables of mastering the academic discipline and metrics of competence acquisition

Mastering the discipline aims at acquiring the following universal (UC) or/and general professional (GPC) or/and professional (PC) competencies

№	Competence code	The content of the competence (or its part)	Code and name of the competence acquisition metric	As a result of mastering the discipline, the students should:		
				know	be able to	possess
1.	UC-1	Able to carry out critical analysis of problem situations based on a systematic approach, develop an action strategy	Knows: methods of critical analysis and evaluation of modern scientific achievements; basic principles of critical analysis Able to: gain new knowledge based on analysis, synthesis, etc.; collect data on complex scientific problems related to the professional field; search for information and solutions based on action, experiment and experience Has practical experience: researching the problem of professional activity using analysis, synthesis and other methods of intellectual activity; developing an action strategy to solve professional	the basic principles of biochemical processes of human activity in their integrity and interrelation	use the basics of biochemical knowledge about the composition and metabolism of organs and tissues to analyze their functions at the molecular level and the state of the body as a whole	ability to think abstractly, analyze, synthesize the information received

			problems			
2.						
3.						

4. Sections of the academic discipline and competencies that are formed when mastering them

№	Competence code	Section name of the discipline	The content of the section in teaching units
1	UC-1	Proteins. Enzymes.	Proteins. Proteomics is the science of studying the normal and pathological structure of proteins. Hereditary proteinopathies. Violations of folding processes. Conformational diseases. Enzymes. Vitamins: sources, daily requirement, biological role, symptoms of hypovitaminosis. Water-soluble vitamins as precursors of coenzymes. The chemical structure of fat-soluble vitamins and their biological role. Provitamins, active forms of vitamins A and D. Hypovitaminosis and hypervitaminosis, pathological manifestations in these conditions. Medications are enzyme inhibitors. Differences in the enzyme composition of organs and tissues. Changes in enzyme activity in various pathologies. Hereditary enzymopathies. Enzymodiagnostics is the determination of enzymes in the blood for the purpose of diagnosing diseases. The use of enzymes for the treatment of diseases and as analytical reagents in laboratory diagnostics.
2	UC-1	The metabolism of proteins and amino acids.	The biological value of proteins. Protein deficiency. Kwashiorkor. Causes of the breakdown of tissue proteins. Diagnostic value of biochemical analysis of gastric and duodenal juices. The use of protease inhibitors for the treatment of pancreatitis. The diagnostic value of determining the activity of transaminases. Formation of ammonia in the body and ways of its neutralization. Causes of hyperammonemia. Biochemical approaches to the treatment of hyperammonemia. Synthesis of creatine, creatine phosphate. The mechanism of occurrence of hereditary disorders of amino acid metabolism. Nitric oxide.
3	UC-1	Matrix syntheses.	Matrix biosyntheses as processes that ensure the transmission of genetic traits. Protein folding. Chaperones and small heat shock proteins. The concept of conformational diseases. Inhibitors of matrix biosynthesis. The use of matrix biosynthesis inhibitors as drugs. Genotypic heterogeneity of populations and protein polymorphism. Hereditary diseases on the example of sickle cell anemia, phenylketonuria, etc. Hereditary intolerance to food substances and medicines. Polymerase chain reaction as a method of diagnosis of diseases. DNA technologies in medicine. Gene therapy and cellular technologies.
4	UC-1	Biochemistry of hormones	Hormonal regulation as a mechanism of intercellular and inter-organ coordination of metabolism. Hormones of the hypothalamus, pituitary gland. The structure and biological role of vasopressin and oxytocin. Iodine-containing hormones, structure and biosynthesis. Metabolic changes in hyperthyroidism and hypothyroidism. Regulation of phosphorus-calcium metabolism, participation of parathyroid hormone and calcitonin, active forms of vitamin D. Pancreatic hormones. Changes in hormonal status and metabolism in diabetes mellitus. Insulin-dependent and insulin-independent diabetes mellitus. Peptides and hormones as medications. Hyper-hypoproduction of hormones.

5. Volume of the academic discipline and types of academic work

Type of educational work	Labor intensity		Labor intensity (AH) in semesters			
	volume in credit units (CU)	volume in academic hours (AH)				
Classroom work, including	1	22				
Lectures (L)	2	2				
Laboratory practicum (LP)*		20				
Practicals (P)						
Seminars (S)						
Student's individual work (SIW)		14				
Mid-term assessment						
credit/exam *(specify the type)credit*	1					
TOTAL LABOR INTENSITY	1	36				

6. Content of the academic discipline

6.1. Sections of the discipline and types of academic work

№	Name of the section of the academic discipline	Types of academic work* (in AH)					
		L	LP	P	S	SIW	total
1	Proteins. Enzymes	2	5			2	9
2	Protein and amino acid metabolism		10			6	15
3	Matrix syntheses		2			3	6
4	Biochemistry of hormones		3			3	6
	TOTAL						

* - L – lectures; LP – laboratory practicum; P – practicals; S – seminars; SIW – student's individual work.

6.2. Thematic schedule of educational work types:

6.2.1 Thematic schedule of lectures

№	Name of lecture topics	Volume in AH	
		semester 3	semester
1	Enzymes. Vitamins as cofactors of enzymes, their biological role. Hyper-hypo-vitamin deficiency. Reasons. Anti-vitamins. Regulation of enzyme activity. Drugs as enzyme inhibitors. Differences in the enzyme composition of organs and tissues. Organ-specific enzymes. Isoenzymes. Changes in enzyme activity in various pathologies. Hereditary enzymopathies. Enzymodiagnostics is the determination of enzymes in the blood for the purpose of diagnosing diseases. The use of enzymes for the treatment of diseases and as analytical reagents in laboratory diagnostics.	2	
	TOTAL (total - AH)	2	

6.2.2. The thematic plan of laboratory practicums (*if this type of classes is stipulated in the curriculum*): not provided by FSES

№	Name of laboratory practicums	Volume in AH	
		semester	semester
	TOTAL (total - AH)		

6.2.3. Thematic plan of practicals

№	Name of the topics of practicals	Volume in AH	
		semester 3	semester
1	Disorders in the structure of proteins as a factor in the development of proteinopathies and conformational diseases.	1	
2	Vitamins as cofactors of enzymatic reactions. Vitamins and anti-vitamins as medicines.	3	
3	Regulation of enzyme activity. Enzyme inhibitors as drugs. Clinical enzymology. Enzymopathy. Enzyme diagnostics and enzyme therapy.	3	
4	Protein digestion. Diagnostic value of biochemical analysis of gastric and duodenal contents. Interstitial transformations of amino acids. Hereditary disorders of amino acid metabolism. Nitric oxide. Violations of the synthesis and excretion of urea. End products of protein metabolism.	8	
5	Fundamentals of genomics and proteomics. DNA technologies. Fundamentals of gene therapy and cellular technologies.	2	
6	Biochemistry of hormones. Pathological conditions associated with hyper-hypoproduction of hormones.	3	
	TOTAL (total - AH)	19	

6.2.4. Thematic plan of seminars (*if this type of classes is stipulated in the curriculum):* not provided by FSES

№	Name of seminar topics	Volume in AH	
		semester	semester
	N/a		
	TOTAL (total - AH)		

6.2.5. Types and topics of student's individual work (SIW)

№	Types and topics of SIW	Volume in AH

		semester 3	semester
1	Work with literary sources	2	
2	Preparation for a practical lesson	2	
3	Preparation for the current control, work with electronic educational resources	4	
4	Preparation for intermediate certification	2	
5	Essay	4	
	TOTAL (total - AH)	14	

7. Types of assessment formats for ongoing monitoring and mid-term assessment

№	Semester No.	Types of control		Name of section of academic discipline	Competence codes	Assessment formats		
						types	number of test questions	number of test task options
1.		Current monitoring	Control of mastering the topic					
			Monitoring the student's individual work					
2.		Mid-term assessment	Exam/ Credit					

8. Educational, methodological and informational support for mastering the academic discipline (printed, electronic publications, the Internet and other network resources)

8.1. Key literature references

№	Name according to bibliographic requirements	Number of copies	
		at the department	in the library
1	Lippincott Illustrated Reviews: Biochemistry / E. E. Abali, S. D. Cline, D. S. Franklin, S. M. Viselli. - 8th ed. - Philadelphia : Wolters Kluwer, 2022. - XI, 625 p. : ill. - ISBN 978-1-975155-11-7.	1	
2	Lieberman, M. Marks'basic medical biochemistry : a clinical approach / M. Lieberman, A. Peet. – 5th ed. – Philadelphia : Wolters Kluwer, 2018. – 2327 p. – ISBN 9781496324818. – URL: https://www.pdfdrive.com/marks-basic-medical-biochemistry-a-clinical-approach-5th-edition-d158491166.html	1	
3	Lieberman, M. Marks, Basic Medical Biochemistry: a clinical	1	

	approach / M. Lieberman, A. D. Marks ; Lieberman, Michael ; Marks, Allan D. – 3 ed. – Philadelphia : Wolters Kluwer, 2009. – 1011 p. – ISBN 9781608313983.	

8.2. Further reading

№	Name according to bibliographic requirements	Number of copies	
		at the department	in the library
1	Baynes, J. W. Medical biochemistry / J. W. Baynes, M. H. Dominiczak ; Baynes, John W. ; Dominiczak, Marek H. – 2nd ed. – Philadelphia ; Edinburgh ; London : Elsevier Mosby, 2005. – XII, 693 p. – ISBN 9780723433415.	1	
2	Brownie, A. C. Medical biochemistry : a core text with self-assessment / A. C. Brownie, J. C. Kernohan ; Brownie Alexander C. ; Kernohan John C. – 2nd ed. – Edinburgh : Elsevier, 2005. – 319 с. : ил. мяг. – (Master medicine). – ISBN 0-443-10015-2.	1	
3	Chatterjea, M. Textbook of medical biochemistry / M. Chatterjea, R. Shinde ; Chatterjea MN ; Shinde Rana. – 4th ed. – New Delhi : Jaypee Brothers Medical Publishers (P) LTD., 2000. – 775 с. : ил. мяг. – ISBN 81-7179-782-2.	1	

8.3. Electronic educational resources for teaching academic subjects

8.3.1. Internal Electronic Library System of the University (IELSU)

№	*Name of the electronic resource*	*Brief description (content)*	*Access conditions*	*Number of users*
1	Manual on biochemistry. Part 1 / A. A. Anashkina, O. V. Barinova, E. I. Erlykina [et al.] ; Nizhny Novgorod State Medical Academy. – N. Novgorod : Publishing House of NizhSMA, 2016.	The given workbook is designed according to the curriculum on biochemistry for the foreign students of general medicine of Medical Higher Educational Institutions. It is intended to save the student's time and optimize their practical work.	Subscription	N\A
2	Glukhov, A. I. Biochemistry with exercises and tasks : монография / A. I. Glukhov, V. V. Garin ; Glukhov A. I. ; Garin V. V. – Москва : ГЭОТАР-Медиа, 2020. – 296 с. – ISBN 978-5-9704-5317-9.	The textbook written by the professors of the Biological Chemistry Department of the I.M. Sechenov First Moscow State Medical University (Sechenov University) approaches complicated modern scientific data about a molecular basis of the functioning of the organism in an intelligible form. This edition contains	Subscription	N\A

		illustrative material, test tasks and situational problems in each of 14 sections. All the problems proposed for the individual solution have "guiding" questions that help students to solve them. Most of these tasks are based on the questions covered in the special course "Biochemistry of connective tissue. Biochemistry of mixed saliva". The textbook is intended for medical students who specialize in Dentistry, and can be also used for studying biochemistry by the students of other specialties.		

8.3.2. Electronic educational resources acquired by the University

№	*Name of the electronic resource*	*Brief description (content)*	*Access conditions*	*Number of users*
1	International scientometric database "Web of Science Core Collection"	Web of Science covers materials on natural, technical, social, and humanitarian sciences; takes into account the mutual citation of publications developed and provided by Thomson Reuters; has built-in capabilities for searching, analyzing, and managing bibliographic information.	Access is free from PRMU computers [Electronic resource] – Access to the resource at: http://apps.webofknowledge.com	N\A

8.3.3 Open access resources

№	*Name of the electronic resource*	*Brief description (content)*	*Access conditions*
1	*PubMed (National Library of Medicine)*	*PubMed is a free resource supporting the search and retrieval of biomedical and life sciences literature with the aim of improving health–both globally and personally.* *The PubMed database contains more than 35 million citations and abstracts of biomedical literature. It does not include full text journal articles; however, links to the full text are often present when*	*Available to the public online free.*

		available from other sources, such as the publisher's website or PubMed Central (PMC).	

9. Material and technical support for mastering an academic discipline

9.1. List of premises for classroom activities for the discipline

1. 7 specially equipped classrooms equipped with laboratory tables, fume hoods for seminars and practical classes in the study of the discipline

2. 2 specially equipped scientific laboratories for the implementation of research work of students

9.2. List of equipment for classroom activities for the discipline

1. water baths, photoelectrocolorimeters, laboratory centrifuges, thermostats, spectrophotometers, ionomers, urine analyzers, laboratory utensils, tripods, sets of appropriate reagents, laboratory animals (white rats), scalpels, blades, tweezers, Petri dishes, flasks, test tubes, reagent bottles; filter paper;

2. multimedia complexes for lectures (laptop, projector, screen), televisions, laptop with multimedia set-top box, computers, printers, scanners, educational boards.

9.3. A set of licensed and freely distributed software, including domestic production

Item no.	**Software**	**number of licenses**	**Type of software**	**Manufacturer**	**Number in the unified register of Russian software**	**Contract No. and date**
1	Wtware	100	Thin Client Operating System	Kovalev Andrey Alexandrovich	1960	2471/05-18 from 28.05.2018
2	MyOffice is Standard. A corporate user license for educational organizations, with no expiration date, with the right to receive updates for 1 year.	220	Office Application	LLC "NEW CLOUD TECHNOLOGIES"	283	without limitation, with the right to receive updates for 1 year.
3	LibreOffice		Office Application	The Document Foundation	Freely distributed software	
4	Windows 10 Education	700	Operating systems	Microsoft	Azure Dev Tools for Teaching Subscription	
5	Yandex. Browser		Browser	«Yandex»	3722	
6	Subscription to MS Office Pro for 170 PCs for FGBOU VO "PIMU" of the Ministry of Health of Russia	170	Office Application	Microsoft		23618/HN10030 LLC "Softline Trade" from 04.12.2020

10. List of changes to the working program (to be filled out by the template)

Federal State Budgetary Educational Institution of Higher Education
"Privolzhsky Research Medical University"
Ministry of Health of the Russian Federation
(FSBEI HE "PRMU" of the Ministry of Health of Russia)

Department of
Name of the department

CHANGE REGISTRATION SHEET

working program for the academic discipline
NAME OF THE ACADEMIC DISCIPLINE

Field of study / specialty / scientific specialty: _____
(code, name)

Training profile: _____
(*name) - for master's degree programs*

Mode of study: _____
full-time/mixed attendance mode/extramural

Position	Number and name of the program section	Contents of the changes made	Effective date of the changes	Contributor's signature
1				

Approved at the department meeting
Protocol No. _____of _____20__

Head of the Department
_____ _____/_____
department name, academic title signature print name