

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

BANK OF ASSESSMENT TOOLS FOR DISCIPLINE
BIOLOGICAL CHEMISTRY – BIOCHEMISTRY OF ORAL CAVITY

Training program (specialty): 31.05.03 DENTISTRY

Department: Biochemistry named after G.Ya. Gorodisskaya

Mode of study: full-time attendance

Nizhniy Novgorod
2021

1. Bank of assessment tools for the current monitoring of academic performance, mid-term assessment of students in the discipline / practice

This Bank of Assessment Tools (BAT) for the discipline " Biological chemistry - biochemistry of oral cavity " is an integral appendix to the working program of the discipline " Biological chemistry - biochemistry of oral cavity ". All the details of the approval submitted in the WPD for this discipline apply to this BAT.

2. List of assessment tools

The following assessment tools are used to determine the quality of mastering the academic material by students in the discipline/ practice:

No.	Assessment tool	Brief description of the assessment tool	Presentation of the assessment tool in the BAT
1	Test №1 Test №2	A system of standardized tasks that allows you to automate the procedure of measuring the level of knowledge and skills of a student	Bank of test tasks
2	Control work	A tool of checking the ability to apply acquired knowledge for solving problems of a certain type by topic or section	Set of control tasks in variants
3	Case - task	A problem task in which the student is offered to comprehend a real professionally-oriented situation necessary to solve this problem.	Tasks for solving cases
4	Colloquium	A tool of controlling the mastering of study materials of a topic, section or sections of a discipline, organized as a class in the form of an interview between a teacher and students.	Questions on topics/sections of the discipline
5	Situational tasks	A method of control that allows you to assess the criticality of thinking and the degree of the material comprehension, the ability to apply theoretical knowledge in practice.	List of tasks

3. A list of competencies indicating the stages of their formation in the process of mastering the educational program and the types of evaluation tools

Code and formulation of competence*	Stage of competence formation	Controlled sections of the discipline	Assessment tools

<p>UC-1 Able to carry out critical analysis of problem situations based on a systematic approach, develop an action strategy.</p>	<p>Current, Mid-term</p>	<p>Section 1 Structural organization of proteins. Features of the functioning of oligomeric proteins. Enzymes - structural organization and functioning. Section 2 Energy metabolism. Section 3 Amino acid metabolism. Section 4. Biosynthesis of nucleic acids and proteins. Fundamentals of molecular genetics. Section 5.Nucleotide metabolism Section 6. Hormonal regulation of metabolism and body functions. Section 7. Carbohydrate metabolism. Section 8. Lipid metabolism. Section 9. Biochemistry of the liver. Inactivation of foreign substances in the body. Section 10. Biochemistry of connective tissue. Section 11. Biochemistry of mineralized tissues. Section 12. Biochemistry of oral cavity.</p>	<p>1,2,3,4 1,2,3,4 1,2,3,4 1,2 1,2 1,2 1,2,4 1,2,4 1,2,4 1,4,5 1,4,5 1,4,5</p>
<p>GPC-2 Capable analyze results own activities to prevent professional mistakes</p>	<p>Current, Mid-term</p>	<p>Section 1 Structural organization of proteins. Features of the functioning of oligomeric proteins. Enzymes - structural organization and functioning. Section 2 Energy metabolism. Section 3 Amino acid metabolism. Section 4. Biosynthesis of nucleic acids and proteins. Fundamentals of molecular genetics. Section 5.Nucleotide metabolism Section 6. Hormonal regulation of metabolism and body functions. Section 7. Carbohydrate metabolism. Section 8. Lipid metabolism. Section 9. Biochemistry of the liver. Inactivation of foreign substances in the body. Section 10. Biochemistry of connective tissue. Section 11. Biochemistry of mineralized tissues. Section 12. Biochemistry of oral cavity.</p>	<p>1,2,3,4 1,2,3,4 1,2,3,4 1,2 1,2 1,2 1,2,4 1,2,4 1,2,4 1,4,5 1,4,5 1,4,5</p>

* - not provided for postgraduate programs

4. The content of the assessment tools of entry, current control

Entry /current control is carried out by the discipline teacher when conducting classes in the form of: assessment tool 1, assessment tool 2, etc. (*list the forms, for example, control work, organization of a discussion, round table, abstract, etc.*)

Assessment tools for current control.

4.1. Assessment tool 1. Tests for the assessment of competence “UC-1, GPC-2”.

1. STRUCTURAL ORGANIZATION OF PROTEINS...

1. IRREVERSIBLE PROTEIN DENATURATION IS CAUSED BY:

1. Short-term exposure to acetone
2. Addition of strong acids
3. Boiling
4. Salts of alkali and alkaline earth metals

2. CONTACT SURFACES OF PROTOMERS IN OLIGOMERIC PROTEINS ARE:

1. Surface regions of protomers, between the amino acid residues of which predominantly covalent bonds are formed
2. Surface regions of protomers that are complementary to each other and form a large number of weak bonds
3. Surface sections of protomers, represented only by non-protein groups, due to which the contact of polypeptide chains is carried out
4. Fragments of polypeptide chains arranged in space in the form of β -structures.

3. ALL ENAMEL PROTEINS ARE EXCEPT:

1. Enamelins
2. Amelogenins
3. Phosphorine
4. Tuftelin

5. NUCLEOTIDE METABOLISM

1. URIC ACID IS FORMED IN THE BODY DURING DECAY

1. adenine
2. thymine
3. uracil
4. cytosine

2. HYPERURICEMIA IS OBSERVED WITH

1. Xanthine oxidase enzyme deficiency
2. increased activity of the enzyme adenylate cyclase
3. deficiency of the enzyme adenine phosphoribosyltransferase
4. deficiency of the enzyme pyruvate kinase

3. PATHOLOGY IN WHICH HYPERURICEMIA IS OBSERVED

1. gout
2. lactase deficiency
3. pneumonia
4. atherosclerosis

6. HORMONAL REGULATION OF METABOLISM AND BODY FUNCTIONS.

1. HORMONES OF PEPTIDE AND PROTEIN NATURE ARE

1. glucocorticoids and mineralocorticoids
2. epinephrine and norepinephrine
3. androgens and estrogens
4. glucagon and insulin

2. THE REGULATORY EFFECT OF THE ACTION OF HORMONES IS ASSOCIATED WITH

1. influence on domains in the active site of enzymes
2. change in the specificity of enzymes
3. influence on the activity of enzymes
4. change in the rate of enzyme synthesis in the cell

3. SECONDARY MEDIATORS OF HORMONES IN THE CELL ARE

1. calcium ions
2. cAMP
3. GDP
4. calmodulin

9. BIOCHEMISTRY OF THE LIVER.

1. THE LIVER IS CHARACTERIZED BY THIS FUNCTION:

1. metabolic
2. transport
3. vitamin C synthesis
4. immune

2. CHOOSE A PROCESS THAT TAKES PLACE ONLY IN THE LIVER:

1. synthesis of lipoproteins
2. synthesis of fatty acids
3. oxidation of ketone bodies
4. synthesis of ketone bodies

3. BILE ACIDS IN THE LIVER CONJUGATE WITH:

1. glycogen
2. proteases
3. amino acids
4. ethanol

10. BIOCHEMISTRY OF CONNECTIVE TISSUE.

1. AMINO ACID RESIDUES INVOLVED IN THE FORMATION OF DESMOSIN ARE:

1. oxyproline
2. alanine
3. arginine
4. lysine

2. HYDROXYLATION OF PROLINE IN COLLAGEN SYNTHESIS REQUIRES:

1. NADPH
2. NAD
3. ascorbic acid
4. alkaline phosphatase

3. CHOOSE THE POSTULATES CHARACTERIZING PROTEOGLYCANS:

1. Protein makes up 40-60% of the total weight
2. carbohydrate component is monosaccharide
3. carbohydrate component are heterogeneous oligosaccharide units of GAG
4. localization in the blood plasma

4.2. Assessment tool 2. A set of control tasks for the assessment of competence UC-1, GPC-5, GPC-10.

I. SECTION " STRUCTURAL ORGANIZATION OF PROTEINS...".

Card 1.

1. The concept of enzymes. Enzymes as catalysts. Differences between enzymes and inorganic catalysts. Simple and complex enzymes.
2. The active center of enzymes, its structure, areas of the active center. Features of the bonds involved in the formation of an active center.

Card 2.

1. Specificity of enzyme action, types of specificity, significance for the body.
2. Theories of the interaction between enzyme active center and substrate (Fischer and

Koshland theories).

II. SECTION "ENERGY METABOLISM".

Card 1.

1. The significance of the formation of NADH in the cycle of tricarboxylic acids.. Write reactions, specify enzymes, name vitamins included in the structure of cofactors.

2. Substrate level phosphorylation in the Krebs cycle. Define, write a reaction, name an enzyme. Explain the mechanism of substrate level phosphorylation.

Card 2.

1. Succinate dehydrogenase, its non-protein component. Write a structural formula for the part of the cofactor that transmits e⁻ and H⁺. Which vitamin is involved in the formation of the cofactor? Donor and acceptor of e⁻ and H⁺ for succinate dehydrogenase.

2. Distribute the redox pairs listed below according to the decrease in redox potential: NAD\NADH₂, fumarate/succinate, cyt. C Fe³⁺/ Fe²⁺, Co/ KoQH₂, FMN/FMNH₂, cyt. a Fe³⁺/Fe²⁺.

III. SECTION " AMINO ACID METABOLISM".

Card 1.

1. Enzymes of pancreatic juice, pro-enzymes, their activation. Place and specificity of action, hydrolysis products.

2. The biological role of free HCl (hydrochloric acid).

Card 2.

1. Characteristics of amino acids oxidative deamination, characteristics of oxidases..

Chemistry of oxidative deamination of glutamic acid. Characteristics of glutamate dehydrogenase.

2. Decarboxylation of amino acids in animal tissues. The name and characteristics of the enzyme. What are the decarboxylation products called? Write the reactions of histamine, serotonin and gamma-aminobutyric acid (GABA) formation and indicate their role in the regulation of body functions. The role of MAO and DAO in the inactivation of biogenic amines.

Card 3.

1. The participation of glutamic and aspartic acids in the reactions of temporary neutralization of ammonia in the cell. Products, their future fate.

2. List the compounds of residual blood nitrogen, indicate their origin. The value of residual nitrogen determination for the clinic. Causes of azotemia.

IV. SECTION " HORMONAL REGULATION OF METABOLISM AND BODY

FUNCTIONS ".

1. Hormones: concept of hormones, general characteristics of hormone action. Synthesis and transport of hormones. Characteristics of the receptors.

2. Classification of hormones by chemical nature, examples.

Card 2.

1. The membrane type of hormone action, cascade effect. Characteristics of the receptors. Mediators with membrane mechanism of action, examples of hormones.

2. Hormones with intracellular type of reception: physico-chemical properties, production sites, characteristics of receptors, mechanism of action, examples.

4.3. Assessment tool 3. Case – tasks for the assessment of competence " UC-1, GPC-2".

I. SECTION "CARBOHYDRATE METABOLISM".

Case 1.

The pentose phosphate pathway of glucose oxidation is extremely active in adipose tissue, liver, adrenal cortex, erythrocytes, lactating mammary gland. Explain why. To answer:

1. Give a general description of the pentose phosphate pathway of glucose oxidation (definition, localization, stages).

2. Write the reactions of the oxidative stage of this process, name the enzymes, explain the regulation.

3. Specify the ways of using the reduced form of coenzyme, the value of other products.

4. Using points 1-3, answer the general question.

Case 2. The patient went to the doctor with symptoms of increased hunger, fatigue, weakness. An examination of the pancreas revealed an insulinoma - a tumor of the beta cells of the islets. In the blood the glucose level was below normal. Explain the described symptoms. To answer:

1. Describe the structure of the insulin receptor and the mechanism of its action. Explain the regulation of membrane glucose transport and the main metabolic pathways of carbohydrate metabolism under the action of insulin, name the key enzymes of the processes.

2. What biochemical tests should be prescribed to confirm the diagnosis?

3. Will there be brain disorders in the future? Why?

4. Using points 1-3, answer general question.

II. SECTION "LIPID METABOLISM".

Case 1. After 16-24 hours' keeping in a fridge a cream-like layer appears on the surface of patient's blood. Biochemical analysis showed triglycerides concentration to be greatly elevated, cholesterol level being slightly increased. Clinical manifestations of atherosclerosis were not found. What type of hyperlipoproteinemia was found in the patient? What is the mechanism of lipid metabolism disorder development? To answer:

1. Define "dyslipoproteinemia".

2. What type of hyperlipoproteinemia is described in the case? What are the causes of this type of hyperlipoproteinemia?

3. Describe the structure of blood lipoproteins, types and functions of lipoproteins.

4. Which lipoproteins transport TAG in the blood? Write the reaction catalyzed by lipoprotein lipase. Which protein activates lipoprotein lipase?

Case 2. A 64-year-old man was admitted to the hospital due to complaints of pain in the heart area. The examination revealed atherosclerotic plaques in the coronary arteries and large cerebral vessels. The content of cholesterol in the blood, LDL and HDL in the blood plasma exceeds the norm by several times.

1. Write the equations of reactions of cholesterol synthesis. Specify the localization, regulation of the process.

2. Define and give examples of atherogenic and antiatherogenic lipoproteins. Name their functions.

4.4. Assessment tool 4. Colloquium for the assessment of competence " UC-1, GPC-2".

I. SECTION "PROTEINS. ENZYMES". QUESTIONS.

1. Amino acids as structural protein molecules. Their structure, properties. Classification of amino acids, examples. Nonessential and essential amino acids. The role of amino acids in the formation of native protein and the formation of intramolecular bonds.

2. Levels of structural organization of globular protein.

3. Enzymes, their molecular organization. Apoenzyme and cofactor (coenzyme and prosthetic group). Nomenclature and classification of enzymes. Vitamins and metal ions as cofactors of enzymes.

4. Fundamentals of enzymatic kinetics. Dependence of the enzymatic reaction rate on the substrate and enzyme concentration. Michaelis-Menten equation. Michaelis constant, its physical meaning. Substrate inhibition.

II. SECTION "ENERGY METABOLISM". QUESTIONS.

1. Modern understanding of biological oxidation. Characteristics of oxidoreductases involved in this process. Mitochondria as the center of tissue respiration, their role in the regulation of cell metabolism.

2. Structural organization of the respiratory chain. Redox potential is the factor determining the movement of electrons along the respiratory chain and energy formation.

3. Biological significance of tricarboxylic acid cycle, confirm by the reactions. Write reactions replenishing the citrate cycle.

4. Energy effect of pyruvic acid total oxidation to CO₂ and H₂O (confirm by chemical reactions).

III. SECTION "NUCLEOTIDE EXCHANGE". QUESTIONS.

1. Compounds that are sources of nitrogen and carbon atoms in the synthesis of purine and pyrimidine rings. Enzymes of ribonucleotides and deoxyribonucleotides synthesis as targets for the action of antiviral and antitumor drugs.

2. Ways of adenine and guanine reutilization in the process of nucleotide biosynthesis. Features of deoxyribonucleotide biosynthesis.

IV. SECTION «AMINO ACID METABOLISM» QUESTIONS.

1. Nitrogen balance of the body. Biological significance of proteins.
2. Digestion of proteins: digestion of proteins in the stomach, the conversion of the proenzyme into an enzyme, pepsin, the significance of the hydrochloric acid in the protein digestion, -digestion in the intestine by the action of pancreatic and intestinal juices enzymes (trypsin, chymotrypsin, carboxypeptidase A and B, elastase, aminopeptidase, dipeptidase).
3. Amino acids absorption from the intestine. Protein rotting in the gut. Parietal digestion.
4. Transamination of amino acids: donors and acceptors of NH₂ group, characteristic of transaminases (non-protein part structure, its relationship with vitamins, participation in transamination reactions), the biological significance of the process, the diagnostic value of transaminases determination.

V. SECTION " BIOCHEMISTRY OF ORAL CAVITY ". QUESTIONS.

1. The most important proteins of extracellular matrix: collagen and elastin. Post-translational modifications of collagen, the formation of fibrillar structures. The participation of vitamin C in the collagen synthesis.
2. Proteoglycans, their structure and functions. Inherited and acquired disorders of connective tissue protein metabolism.
3. Chemical composition of mineralized tissues. Apatites. The peculiarities of the structures and properties of different kinds of apatites.
4. The character of the mineral composition of tooth components (enamel, dentin, cementum).
5. The main bone and tooth proteins. Collagen. Processing of collagen.
6. Uncollagen proteins of bone tissue (proteoglycans, glycoproteins, osteocalcin, osteonectin. The specific bone enzymes.

4.5. Assessment tool 5. Tasks for the assessment of competence " UC-1, GPC-2".

SECTION «BIOCHEMISTRY OF ORAL CAVITY»

TASK 1.

Long-term improper use of chewing gum is known to be followed by atrophy of the salivary glands in patients (especially in children). How hypo- and hypersalivation can affect the condition of teeth and oral mucosa?

TASK 2.

Dentists consider that night snacking is harmful to the teeth, regardless of the composition of the food. How can we explain the tendency to deterioration of the teeth of those who like to have a snack at night?

TASK 3

For the treatment of stomatitis, drug Lysobact, containing lysozyme and vitamin B6 was prescribed to the patient. Justify the doctor's recommendation.

5. The content of the assessment tools of mid-term assessment

Mid-term assessment is carried out in the form of exam.

The content of the assessment tool (questions, topics of abstracts, round tables, etc.):

<https://sdo.pimunn.net/course/view.php?id=4662>

6. Criteria for evaluating learning outcomes

For the credit (example)

Learning outcomes	Evaluation criteria	
	Not passed	Passed
Completeness of knowledge	The level of knowledge is below the minimum requirements. There were bad mistakes.	The level of knowledge in the volume corresponding to the training program. Minor mistakes may be made

Availability of skills	Basic skills are not demonstrated when solving standard tasks. There were bad mistakes.	Basic skills are demonstrated. Typical tasks have been solved, all tasks have been completed. Minor mistakes may be made.
Availability of skills (possession of experience)	Basic skills are not demonstrated when solving standard tasks. There were bad mistakes.	Basic skills in solving standard tasks are demonstrated. Minor mistakes may be made.
Motivation (personal attitude)	Educational activity and motivation are poorly expressed, there is no willingness to solve the tasks qualitatively	Educational activity and motivation are manifested, readiness to perform assigned tasks is demonstrated.
Characteristics of competence formation*	The competence is not fully formed. The available knowledge and skills are not enough to solve practical (professional) tasks. Repeated training is required	The competence developed meets the requirements. The available knowledge, skills and motivation are generally sufficient to solve practical (professional) tasks.
The level of competence formation*	Low	Medium/High

* - not provided for postgraduate programs

For the exam (example)

Learning outcomes	Assessment of competence developed			
	unsatisfactory	satisfactory	good	excellent
Completeness of knowledge	The level of knowledge is below the minimum requirements. There were bad mistakes	The minimum acceptable level of knowledge. A lot of light mistakes were made	The level of knowledge in the volume corresponding to the training program. A few light mistakes were made	The level of knowledge in the volume corresponding to the training program, without errors
Availability of skills	Basic skills are not demonstrated when solving standard tasks. There were bad mistakes	Basic skills are demonstrated. Typical problems with light mistakes have been solved. All tasks have been completed, but not in full.	All basic skills are demonstrated. All the main tasks have been solved with light mistakes. All tasks have been completed, in full, but some of them with shortcomings	All the basic skills were demonstrated, all the main tasks were solved with some minor shortcomings, all the tasks were completed in full
Availability of skills (possession of experience)	Basic skills are not demonstrated when solving standard tasks. There were bad mistakes	There is a minimal set of skills for solving standard tasks with some shortcomings	Basic skills in solving standard tasks with some shortcomings are demonstrated	Skills in solving non-standard tasks without mistakes and shortcomings are demonstrated

Learning outcomes	Assessment of competence developed			
	unsatisfactory	satisfactory	good	excellent
Characteristics of competence formation*	The competence is not fully formed. The available knowledge and skills are not enough to solve professional tasks. Repeated training is required	The formation of competence meets the minimum requirements. The available knowledge and abilities are generally sufficient to solve professional tasks, but additional practice is required for most practical tasks	The formation of competence generally meets the requirements, but there are shortcomings. The available knowledge, skills and motivation are generally sufficient to solve professional tasks, but additional practice is required for some professional tasks	The formation of competence fully meets the requirements. The available knowledge, skills and motivation are fully sufficient to solve complex professional tasks
The level of competence formation*	Low	Below average	Intermediate	High

For testing:

Mark "5" (Excellent) - points (100-90%)

Mark "4" (Good) - points (89-80%)

Mark "3" (Satisfactory) - points (79-70%)

Less than 70% – Unsatisfactory – Mark "2"

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