

ЛД-16 ИИ

Federal State Budgetary Educational Institution of Higher Education «North-Ossetia
State Medical Academy» of the Ministry of Healthcare of the Russian Federation

Department of Biological Chemistry

METHODOLOGICAL INSTRUCTIONS FOR PERFORMANCE OF INDEPENDENT
(OUTSIDE) WORK

by Clinical Biochemistry (program partly delivered in English) the main professional
educational program of higher education - Specialist programs in the specialty 31.05.01

General Medicine approved on 24.05.2023

Vladikavkaz, 2023

Methodological materials are intended for extracurricular work of students 6 course
(12 semester) of the medical faculty of the Federal State Budgetary Educational
Institution of Higher Education FSBEI HE NOSMA MOH Russia in the discipline
Clinical Biochemistry

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**METHODOLOGICAL RECOMMENDATIONS FOR PERFORMING EXTRA-CURRICULUM INDEPENDENT WORK FOR THE LESSON
BY THEME: "Pathobiochemistry of the liver."**

Initial level of knowledge.

- Structural and functional levels of studying a sick organism
- The role of the liver in the regulation and maintenance of homeostasis
- Hypoxia and ischemia as trigger factors for the development of any pathological process
- Methods for laboratory diagnosis of hepatic pathology

The student must know:

1. Histoarchitectonics of the liver;
2. Liver functions;
3. The main symptoms and syndromes in liver diseases;
4. Characterization of enzymes and their subcellular localization;
5. Basic diagnostic biochemical tests of hepatic pathology

Main literature:

- 1 "BIOCHEMISTRY" Textbook for universities under the editorship of E.S. Severin .- M.GEOTAR -MED, 2003, p. -616-636
2. Berezov T.T., Korovkin B.F. Biological chemistry, Moscow, 1998.- p. - 427-438.
3. Biochemical foundations of pathological processes (under the editorship of E.S. Severin). M. Medicine, 2000, 304 p.
4. Clinical biochemistry (under the editorship of academician V.A. Tkachuk), M. GEOTAR-MED, 2002, pp. 116-122.

The student must be able to:

1. solve situational problems
2. write tests
3. explain the significance of enzymatic diagnostics in the pathology of visceral organs
- 4.

Additional literature :

1. Mac Murray U. Human metabolism. Moscow, 1980.
2. Veltishev Yu.V., Knyazev Yu.A. "Children's Metabolism". Moscow, 1983.

Task number 1. Fill the table.

Enzyme types	Titles
excretory	
Secretory	
Indicator :	
Cytoplasmic	
Mitochondrial	
Mitochondrial-cytoplasmic	

Task number 2. Fill in the table "Diagnostics of cholestasis".

The form	Indicators
cholestasis without jaundice	
Cholestasis without jaundice but with hepatocyte damage	
cholestasis with jaundice	
Cholestasis with jaundice and hepatocyte damage	

Task number 3. Fill in the table: "Diagnosis of liver diseases by enzymes."

Feature of the method	Enzymes
Base Enzyme	
Triple test	
4 enzyme test	
6 enzyme test	

Task number 4

1. Choose the correct answers.

In gemma synthesis :

- A The substrates are succinyl-CoA and glycine
- B The first heme synthesis reaction takes place in the mitochondrial matrix
- C Two molecules of 5-aminolevulinic acid condense to form porphobilinogen
- D Ferrochelatase attaches iron to porphobilinogen
- E 5-aminolevulinic synthase is a regulatory enzyme for heme synthesis

2. Choose the correct answers.

Porphyria :

- A Cause neuropsychiatric disorders
- B Accompanied by photosensitivity
- C May occur during treatment with drugs - inducers of the synthesis of 5-aminolevulinic synthase
- D Occur with avitaminosis B₆
- E They develop with genetic defects in the enzymes of heme synthesis.

3. Set the order of events.

In the process of assimilation of exogenous iron:

- A In the intestinal cavity, iron is released from salts of organic acids in food.
- B From the intestinal cells, iron enters the blood
- C In the cells of the intestinal mucosa, iron is included in the composition of ferritin
- D Ascorbic acid restores iron
- E Transferrin transports iron in the bloodstream

4. Set match :

- A Contains copper ion
- B Interacts with cell membrane receptors
- C Stores iron in cells
- D Is a heme containing protein
- E Localized in erythrocytes
 - 1) Transferrin
 - 2) ferritin
 - 3) Ferroxidase

5. Choose the correct answers.

Causes of iron deficiency anemia can be:

- A Recurrent bleeding

- B Pregnancy
- C Increased blood clotting
- D Operations on the digestive tract
- E Frequent childbirth

6. Complete the missing words.

Excess iron accumulates in cells as part of protein ... and this leads to ...

The accumulation of granules ... in the liver is accompanied by ..., in the pancreas - ..., in the myocardium -

7. Set match :

- A Associated with blood albumin
 - B Contains Fe^{3+}
 - C Conjugated with glucuronic acid
 - D Excreted from the body with urine
 - E Produced in RES cells
- 1) **direct bilirubin**
 - 2) **indirect bilirubin**
 - 3) **Urobilin**

Task number 5. Solve situational problems.

Situational task number 1.

Two newborns who were diagnosed with jaundice were prescribed phenobarbital by the doctor. In one child, after a few days, the condition improved and the symptoms of jaundice disappeared. Such treatment did not help the second child. Explain the results of treatment of children. For this :

- 1) describe the mechanisms of physiological jaundice in newborns
- 2) indicate how the concentration of bilirubin in the blood, stercobilinogen and urobilinogen in the feces and urine of sick children changes
- 3) list possible causes of jaundice in a second newborn

Situational task number 2.

When transfusing blood that is incompatible with the group or Rh factor, hemotransfusion shock can develop - a serious complication that threatens the health and even the life of the patient. one of the manifestations of this condition is yellowing of the mucous membranes and sclera of the eyes. Name this symptom and explain the mechanism of its occurrence in transfusion shock. For this :

- 1) explain what can happen to erythrocytes or transfusion of incompatible donated blood
- 2) indicate the concentration of which substance will increase in the patient's blood and write the scheme of its formation and catabolism to end products.

**METHODOLOGICAL RECOMMENDATIONS FOR PERFORMING EXTRA-CURRICULUM INDEPENDENT WORK FOR THE LESSON
BY THEME: "Pathobiochemistry of the liver. Jaundice"**

Initial level of knowledge.

- Anatomical and physiological features of the liver
- Methods for laboratory diagnosis of hepatic pathology
- The ratio of liver enzymes in normal and pathological conditions

The student must know:

6. the breakdown of hemoglobin and the formation of bile pigments;
7. transport of bilirubin in the blood;
8. detoxification of bilirubin in the liver ;
9. secretion of bilirubin into the intestine;
10. types of jaundice and their classification according to Bluger
11. diagnosis of jaundice

Main literature:

- 1 "Biochemistry" Textbook for universities under the editorship of E.S. Severin .- M.GEOTAR -MED, 2003, p. -616-636
2. Berezov T.T., Korovkin B.F. Biological chemistry, Moscow, 1998.- p. - 427-438.
3. Biochemical foundations of pathological processes (under the editorship of E.S. Severin). M. Medicine, 2000, 304 p.
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The student must be able to:

5. solve situational problems
6. write tests
7. explain the significance of enzymatic diagnostics in the pathology of visceral organs

Additional literature :

3. Mac Murray U. Human metabolism. Moscow, 1980.
4. Veltishev Yu.V., Knyazev Yu.A. "Children's Metabolism". Moscow, 1983.
5. V.P. Komov, V.N. Shvedova "Biochemistry" - M., DROFA - 2004. - P. 410 - 422.

Task number 1. Fill in the table: "The main disorders of bilirubin metabolism"

Stages of bilirubin metabolism	Causes of violations
Formation-decay of erythrocytes, degradation of hemoproteins	
Transport	
Absorption by the liver	
Conjugation	
Secretion into bile ducts	
Excretion	

Task number 2. Indicate the structural formula :

1. mesobilirubinogen
2. stercobilinogen (L -urobilinogen)
3. stercobilin (L -urobilin)

Task number 3. Specify the stages of heme catabolism:

1. in blood;

2. in the liver;
3. intestines;
4. urine, feces

Task number 4. Complete the chain task.

1. The ER cell heme oxygenase system converts hemoglobin into:

- A Bilirubin
- B Biliverdin
- C Verdoglobin
- D direct bilirubin
- E Urobilin

2. The reduction of this metabolite by NADPH-dependent reductase leads to the formation of:

- A Hemosiderin
- B direct bilirubin
- C Protoporphyrin
- D Bilirubin
- E stercobilanegna

3. The intermediate product of your choice enters the bloodstream and:

- A oxidized
- B recovering
- C conjugates with UDP-glucuronate
- D binds to albumin
- E interacts with transferrin

4. As a result of this, the following appears in the blood:

- A direct bilirubin
- B indirect bilirubin
- C stercobilinogen
- D urobilinogen
- E pyrroles

5. This substance enters the liver and:

- A restored by the microsomal oxidation system
- B hydrolyzed by microsomal hydrolases
- C conjugates with UDP-glucuronate
- D enters into the reaction
- E converted to bile acids

6. This reaction is catalyzed by :

- A ferrochelataze
- B biliverdin reductase
- C glucuronyltransferase
- D heme oxygenase
- E glutathione reductase

7. The selected enzyme catalyzes the reaction that produces:

- A urobilin
- B stercobilin

- C direct bilirubin
- D indirect bilirubin
- E protoporphyrin IX

7. This substance (choose the correct answers):

- A is non-toxic
- B enters the small intestine
- C is a conjugate with glucuronic acid
- D excreted from the body in urine and feces
- E dissolves well in water

Task number 5. Solve situational problems.

No. 1.

A 40-year-old woman has jaundice. The anamnesis does not include hepatitis contacts, recent travel abroad, injections or blood transfusions. The patient does not drink alcohol. In the past she was healthy, but in the last 18 months she suffered from intensifying itching. Your comments.

Laboratory data .

Total protein 85 g/l

Albumins 28 g/l

ALP 522 IU/l

Bilirubin 340 $\mu\text{mol/l}$

ASAT 98 IU/l

GGT 242 IU/l

No. 2.

A pensioner who previously worked in a bar turned to a family doctor with complaints of pain in the epigastric region that had continued for 3 months, radiating to the back and not associated with eating. He was prescribed antacids, but after 1 month he again went to the doctor with complaints of increased pain and weight loss. In the last week, his urine has become dark and his feces have become discolored. Examination revealed no abnormalities other than jaundice and signs of weight loss.

Laboratory data .

Total protein 72 g/l Ultrasound showed dilated bile

Albumins 40 g/l ducts. Barium sulfate load

ALP 510 IU/l

Bilirubin 380 $\mu\text{mol/l}$

ASAT 80 IU/l

GGT 115 IU/l

and subsequent examination revealed an indentation of the second segment of the duodenum with a mass that was determined to be carcinoma of the pancreatic head. Abdominal computed tomography also indicated the presence of a pancreatic tumor, which was confirmed by laparotomy. Your comments.

**Guidelines for performing extracurricular independent work for classes on the topic:
"Biochemistry and pathobiochemistry of the kidneys"**

Initial level of knowledge:

1. The structure and function of the kidneys.
2. The main processes of urination
3. Physical and chemical examination of urine.
4. Biochemical diagnosis of acute and chronic renal failure, laboratory signs.
5. Biochemical diagnosis of pyelo- and glomerulonephritis, laboratory signs
6. Biochemical diagnosis of urolithiasis, laboratory signs

<p><u>The student must know:</u></p> <ol style="list-style-type: none"> 1. Rules for obtaining urine sediment. Organized (cells, casts) and unorganized (salt crystals) urine sediment. 2. Clinical and diagnostic value of the general analysis of urine. 3. Rules for the collection and processing of urine according to the Nechiporenko method. 4. Evaluation of the concentration function of the kidneys in the sample according to Zimnitsky 5. Interpret laboratory results for the following conditions: <ul style="list-style-type: none"> • Acute and chronic renal failure, • pyelonephritis, • glomerulonephritis, • urolithiasis disease <p><u>The student may be able to:</u> Physical and chemical examination of urine using diagnostic test strips and reference physicochemical methods (determination of density, pH, detection and determination of the amount of protein, detection and determination of the amount of glucose, detection of ketone bodies, bilirubin, urobilin bodies, hemoglobin and myoglobin). Quantitative calculation of shaped elements according to the Nechiporenko method</p>	<p><u>Main literature:</u></p> <ol style="list-style-type: none"> 1. Menshikov V.V. Clinical laboratory analytics. Volume 1. Fundamentals of clinical laboratory analysis. M.: Agat-Med, -2002. 2. Mironova I.I., Romanova A.A., Dolgov V.V. General clinical studies: urine, feces, cerebrospinal fluid, ejaculate. - M.-Tver: LLC Publishing House "Triada", 2005. 3. Morozova V.T., Mironova I.I., Martsishevskaya R.L. Urinalysis (training manual). - M: RMAPO.1996. 4. Nazarenko G.I., Kishkun A.A. Clinical evaluation of laboratory results. – M.: Medicine, 2000. <p><u>Additional literature:</u></p> <ol style="list-style-type: none"> 1. Tits N.U. Encyclopedia of Clinical Laboratory Tests. - M .: Publishing house "Labinform", -1997. 2. Chirkin A.A. Clinical analysis of laboratory data. – M.: Med. lit., 2000.
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Tasks for work:

Fill in the table:

The reaction of urine in various types of pathology

Urine reaction	Clinical situations
sour	

alkaline	
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Types of proteinuria:

Bilirubin and urobilinoids in the urine in some types of pathology

No.	Bilirubin	Urobilinoids	Pathology
one	neg	Norm	
2	neg	↑	
3	neg	neg	
4	+	norm	
5	+	↑	
6	+	neg	

Biochemical changes in blood plasma in acute renal failure

promotion	decline

1. Urea, creatinine
2. Protons
3. Potassium, phosphates, magnesium
4. Uric acid, urates
5. Sodium
6. Bicarbonates
7. calcium

Exercise 1

Proteinuria can be an indicator of damage:

1. Glomerular kidney
2. Kidney tubules
3. urinary tract
4. organism
5. All of the above

Task 2

The cause of renal glucosuria is a violation of:

1. Reabsorption of glucose in the proximal tubule
2. Filtration of glucose through an intact renal filter
3. Reabsorption of glucose in the distal tubule
4. Secretion of glucose by the renal epithelium
5. All of the above

Task 3

When screening for kidney disease, it is desirable to determine in the urine all of the following parameters except:

1. Squirrel
2. myoglobin
3. erythrocytes
4. cylinders
5. Leukocytes

Task 4

Glomerular proteinuria can be observed with:

1. Glomerulonephritis
2. Systemic lupus erythematosus
3. Amyloidosis
4. hypertension
5. All of the above diseases

Task 5

With a three-glass sample, the presence of blood in the first camp indicates bleeding from:

1. Kidney
2. upper urinary tract
3. urethra
4. Bladder
5. Any of the above departments

Task 6

Urine acquires a fruity odor when:

1. Pyelonephritis
2. diabetic coma
3. congestive kidney
4. nephrotic syndrome
5. cystitis

Task 7

Increased turbidity of urine when heated indicates the presence of:

1. Uratov
2. Phosphates
3. Uric acid
4. cholesterol
5. All of the above

Task 8

1. Crystals found only in acidic urine
 2. Crystals found in acidic, neutral, alkaline urine
 3. Crystals found in neutral and alkaline urine
 4. Crystals found only in alkaline urine
- a) calcium carbonate, calcium carbonate, amorphous phosphates
- B) calcium oxalate
- D) acidic, urate ammonium
- D) urates, uric acid, hippuric acid

Task 9

1. Stratified squamous nonkeratinized
 2. Stratified squamous keratinizing
 3. renal epithelium
 4. transitional epithelium
 5. Columnar epithelium
- a) Proximal and distal nephrons, collecting ducts
- b) Renal pelvis, ureters, urinary bladder
- c) Large prostatic passages
- d) Urethra
- e) external genitalia

Task 10

1. Hemoglobinuria
 2. Myoglobinuria
- a) Plasma red color
- b) Plasma is not colored

- c) Cherry red urine
- d) Urine red to brown
- e) In the urine sediment, hemosiderin, erythrocytes, pigment cylinders are found
- f) There are no formed elements in the urine sediment

Task 1

Patient N, 18 years old, went to the doctor with complaints of edema on the face, lower extremities, headache, aching pain in the lower back, general weakness, the appearance of pink cloudy urine. He considers himself sick for 3 days, past illnesses: influenza, 2 weeks ago there was a sore throat
Objectively: temperature 37.7, general condition of moderate severity, face edematous, swelling on the feet and legs, pale skin, vesicular breathing, rhythmic heart sounds, muffled, emphasis 2 tones on the aorta. Pulse 84 per minute, rhythmic BP 165/100, tongue clean, abdomen soft, painless, Pasternatsky's symptom weakly positive on both sides.

Formulate and justify a preliminary diagnosis

Task 2

Patient B, 27 years old, went to the doctor with complaints of severe weakness, shortness of breath, facial swelling, and headache. At the age of 15, he suffered from acute glomerulonephritis, after which there were headaches, weakness, changes in the urine. Deterioration is associated with hypothermia
Objectively: temperature 37.2, general condition of moderate severity, dry skin, edematous face, swelling on the feet and legs, pale skin, vesicular breathing, rhythmic heart sounds, muffled, accent 2 tones on the aorta. Pulse 78 per minute, rhythmic BP 180/100, tongue covered with white coating, abdomen soft, painless.

Formulate and justify a preliminary diagnosis

Patient K, 8 years old, went to the doctor with complaints of severe pain in the lumbar region and the right half of the abdomen, radiating to the inguinal region and right thigh, notes the urge to urinate. A year ago there was a similar attack. They called an ambulance, gave injections, the pain disappeared, but after the attack there was red urine. Objectively: the temperature is 36.2, the general condition is moderate, the patient is restless, looking for a comfortable position to relieve pain. Pulse 76 per minute, rhythmic, BP 120/60, abdomen is soft, painful on palpation in the right half, Pasternatsky's symptom is positive on the right.

Formulate and justify a preliminary diagnosis

According to the clinical analysis of urine, make a diagnosis:

1. Quantity 100ml
2. Specific gravity 1015
3. Color straw yellow
4. Transparency transparent
5. Protein 0.05 g/day
6. Sugar -
7. Acetone -
8. Epithelium 1-2 in p/z
9. Leukocytes 0-1
10. Erythrocytes-
11. Cylinders-

12. salt-

13. Slime-

14. Bacteria-

15. Quantity 200ml

16. Specific gravity 1008

17. Color red

18. Transparency cloudy

19. Protein 2.05 g/day

20. Sugar -

21. Acetone -

22. Renal epithelium

23. Leukocytes 0-1

24. Erythrocytes - all

25. Hyaline cylinders with overlay of the renal epithelium, waxy

26. salt-

27. Slime +++

28. Bacteria-

29. Quantity 100ml

30. Specific gravity 10 28

31. Color milky white

32. Transparency cloudy

33. Protein 3.5 g/day

34. Sugar -

35. Acetone -

36. Renal epithelium

37. Leukocytes entirely

- 38. erythrocytes
- 39. Cylinders-
- 40. salt-
- 41. Slime-+++
- 42. Bacteria-+++

- 43. Quantity 70ml
- 44. Specific Gravity 1005
- 45. Color straw yellow
- 46. Transparency cloudy
- 47. Protein 4.5 gd
- 48. Sugar -
- 49. Acetone -
- 50. Renal epithelium
- 51. Leukocytes entirely
- 52. Erythrocytes-
- 53. Cylinders-1-2 leukocyte
- 54. Oxalate salts
- 55. Slime-++
- 56. Bacteria-+++
- 57. Quantity 150ml
- 58. Specific gravity 1030
- 59. color brown
- 60. Transparency cloudy
- 61. Protein 2, 5 g
- 62. Sugar -
- 63. Acetone -
- 64. Epithelium 1-2 in renal ps
- 65. Leukocytes entirely
- 66. Erythrocytes-

67. Cylinders - waxy

68. urate salts

69. Slime-++

70. Bacteria-+++

Guidelines for performing extracurricular independent work for a lesson on the topic:
"Biochemistry of blood"

Initial level of knowledge:

- Basic functions of blood
- The cellular composition of the blood
- Intercellular substance, its organic composition. The concept of blood serum
- Plasma proteins and methods for isolating plasma proteins
- Individual representatives of blood plasma proteins and their biological functions

The student must know:

- The total concentration of proteins in blood plasma, methods for determining
- The main fractions of proteins, their biological functions, concentration in the blood.
- Immunoglobulins, features of their structural organization, biological role.
- Changes in the quantitative and qualitative composition of blood plasma proteins (hypo- , hyper- , para-, dysproteinemia). Determination of the protein coefficient, its diagnostic value.
- Blood enzymes, their systematization, use in the diagnosis of diseases.
- Biochemical methods for diagnosing connective tissue diseases, myocardial infarction, acute inflammatory lung diseases
- Proteins of the "acute phase", their diagnostic value.
- Plasma lipoproteins, clinical significance, hyperlipoproteinemia .
- Marker proteins in oncopathology .

The student must be able to:

- Determine the concentration of total blood protein, interpret the results.
- Determine the protein coefficient, explain the diagnostic value.
- Explain the mechanisms of the appearance of "acute phase" proteins in the blood.
- Explain methods for determining transaminases . Calculate the De Ritis coefficient , and explain the diagnostic value.
- Determine CK in myocardial infarction.

Main literature:

- Nikulin B.A. "Manual on Clinical Biochemistry". Textbook, M GEOTAR Media, 2007, p. 135-143, pp. 44-46, pp. 41-42
- Clinical biochemistry. Under the editorship of acad . V.A. Tkachuk, M. GEOTAR Media, 2006, pp. 350-361
- A.A. Chirkin "Workshop on biochemistry" Textbook. Minsk LLC "New Knowledge", 2002.
- Mohammed M El- Nage , Malek Kamoun , Peter Wilding : A Guide to the Effective Use of Clinical Laboratory Tests, 2001.
- "Laboratory support for practical exercises in biochemistry" Guide to practical exercises. Edited by F.N. Gilmiyarova

Additional literature:

- Biochemical bases of pathological processes. Edited by E.S. Severina . M. Medicine, 2000, p. 304
- McMurray W. Human metabolism. Moscow, 1980

<ul style="list-style-type: none"> Interpret the results of biochemical analyzes of various diseases: myocardial infarction, acute viral lung diseases, connective tissue diseases. 	
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Tasks for work

To solve the tasks, it is necessary to use the plate: "Reference intervals for analyzes used in the study of heart pathology (myocardial infarction).

analyte	Reference interval
AST	0-36 U/L (37°C) [0.0-0.58 μ kat /L(37°C)]
QC	0-150 U/L (37°C) [0.0-2.5 μ kat /L(37°C)]
KK-MV faction	> 0.05 of 1.00 (> 5%)
LDG	50-150 IU/L (37°C) [0.82-2.66 μ kat /L(37°C)]
LDG ₁	0.15-0.4 from 1.0(15-40%)

Using the data in the table, solve the following problems:

- A 58-year-old man was experiencing severe chest pain and was examined 2 hours after the onset of pain. What laboratory tests will be most useful during the examination.
- Do these results indicate myocardial infarction?

1	QC (E/L)	AST (U/l)
2	90048	162
3	1548800	---

- A 65-year-old man was brought in with complaints of increasing chest discomfort. Laboratory results are shown below. Does he have a myocardial infarction?

Day	QC (E/L)	QC-MV (%)
1	fifteen	0
2	four	0
3	2	---
4	ten	---
5	ten	0
6	42	0

- A 30-year-old patient complained of flying pains in the joints, fever, weakness, shortness of breath. Objective research methods make it possible to pre-diagnose rheumatism. What methods of biochemical analysis will be adequate if the blood was taken on the second day of the disease.
- A 50-year-old patient complained of high fever, shortness of breath, chills, cough with mucopurulent sputum. Sick for the third day. A biochemical blood test revealed: an increase in the concentration of immunoglobulins, the appearance of C-reactive protein in the blood, a positive Hess test, which determines the concentration of sialic acids. Is it possible to assume an acute respiratory disease of the respiratory tract on the basis of objective data and positive blood biochemistry tests?

Add definitions:

The De Ritis coefficient is _____

The protein coefficient is _____

Proteins of the "acute phase" are _____

Solve test tasks:

1. Albumin makes up more than half of all blood serum proteins. Which of the following functions does it perform?

- Binds and transports endogenous metabolites

2. Participates in maintaining the osmotic pressure of the blood
3. Participates in immune processes
4. Transports many xenobiotics, including those from drugs.

2. In blood serum, unlike blood plasma, there is no:

1. fibrinogen
2. Albumen
3. Compliment
4. Kollecriin
5. Antithrombin

3. Blood plasma proteins include:

1. prostaglandins
2. tryptophan
3. Globulins
4. Scleroproteins
5. collagens

4. The fraction of α_1 and α_2 -globulins includes:

1. fibrinogen
2. Haptoglobin
3. α -macroglobulin
4. α -fetoprotein
5. Alkaline phosphatase

5. The composition of the β -globulin fraction includes:

1. fibrinogen
2. Lipoproteins
3. Immunoglobulin G
4. Transferrin
5. β_2 -macroglobulin

6. Dysproteinemia is:

1. Increase in total protein
2. Decrease in total protein
3. Decreased fibrinogen
4. Violation of the ratio of plasma protein fractions
5. All of the above is correct

7. Transferin is a globulin compound with:

1. Zinc
2. iron
3. sodium
4. Kolbalt
5. Potassium

8. The following blood proteins have antiprotease activity:

1. α_1 antitrypsin
2. α_2 macroglobulin
3. Antithrombin-3
4. All of the above
5. None of the listed

9. An increase in the serum activity of enzymes in pathology may be the result of:

1. Increases its synthesis
 2. Increasing the permeability of cell membranes and the destruction of cells synthesizing the enzyme
 3. Increased organ blood flow
 4. Cell edema
 5. All of the above factors
10. Acidosis is characterized by:
1. An increase in blood pH
 2. An increase in the concentration of OH^- blood
 3. Decreased blood pH
 4. A decrease in the concentration of H^+ in plasma
 5. Decreased blood lactate
11. Indicate the pattern of change in C - reactive protein under the following conditions:
- | | |
|--------------------------|--------------|
| A. myocardial infarction | A. rises |
| B. angina pectoris | B. Missing |
| C. Acute infections | C. Decreases |

**Guidelines for performing extracurricular independent work for classes on the topic:
 «Disorders of the hemostasis system. Coagulological syndromes»**

Initial level of knowledge:

1. Definition of the concept of "hemostasis";
2. Classification of diseases of the hemostasis system (hemostasiopathies)
3. Factors and mechanisms of vascular- platelet hemostasis, its disorders;
4. Etiology, pathogenesis, and manifestations of thrombocytopathy , thrombocytopenia , thrombocytosis and thrombocythemia ;
5. Causes of occurrence, mechanisms of development and manifestations of angiopathy ;
6. Factors and mechanisms of coagulation hemostasis, their violation (hemophilia A , B , C, parahemophilia);
7. Fibrinolysis disorders ; causes, mechanisms of development, manifestations; - causes, mechanisms of development and consequences of violations of the anticoagulant system of blood;
8. Etiology and pathogenesis of thrombotic syndrome; - etiology and pathogenesis of hemorrhagic syndrome; - etiology and pathogenesis of thrombohemorrhagic syndrome (DIC);
9. The main tests characterizing the state of coagulation and vascular- platelet hemostasis, their diagnostic value;
10. Principles of hemostasis correction;

<p><u>The student must know:</u></p> <ol style="list-style-type: none"> 1. The main links of hemostasis. 2. To study the causes, mechanisms and manifestations of the pathology of the blood coagulation and anticoagulation systems . 3. methods of biochemical diagnostics of violations of vascular - platelet and coagulation hemostasis and learn how to interpret the results of hemostasiological tests <p><u>The student may be able to:</u></p> <ol style="list-style-type: none"> 1. Use the acquired knowledge to analyze the pathobiochemical mechanisms of the occurrence and development of disorders of the hemostasis system 2. Use the acquired knowledge to evaluate the effectiveness of biochemical diagnostics and treatment for violations of vascular - platelet and coagulation hemostasis and learn how to interpret the results of hemostasiological tests 3. give a reasonable conclusion about the causes, type, mechanisms of violations of the hemostasis system in various forms of hemostasiopathies ; 4. explain the clinical manifestations accompanying the pathology of the hemostasis system presented in the tasks; 5. analyze indicators characterizing the vascular -platelet and coagulation mechanisms of hemostasis and, in combination with anamnestic, laboratory and clinical data, use them in solving situational problems 	<p><u>Main literature:</u></p> <ol style="list-style-type: none"> 1. Biological chemistry: textbook Berezov T.T.; Korovkin B.F. M.: Medicine, 2012 2. Biochemistry: textbook , ed. E.S. Severina M.: GEOTAR-Media, 2007 3. Clinical biochemistry: textbook . Manual , ed. V.A. Tkachuk M .: GEOTAR-Media, 2006,2008 4. Biochemical foundations of pathological processes: textbook . Manual , ed. E. S. Severina M. : Medicine, 2000 5. Handbook of clinical biochemistry for the system of postgraduate professional education : textbook . Special Nikulin B.A.M. : GEOTAR-Media, 2007 <p><u>Additional literature:</u></p> <ol style="list-style-type: none"> 3. Pathophysiology of metabolism: textbook . n special edition ed. V. N. Tsygan 4. Human biochemistry. In 2 tons under . r units L.M. Ginodman 5. Guide to practical 6. classes in biochemistry Aleinikova T.L., Rubtsova G.V., Pavlova N.A. 7. Biochemistry and Molecular Biology Elliot W., Elliot D. 8. Medical laboratory diagnostics: programs and algorithms : a guide for doctors , ed. A. I. Karpishchenko 9. Diagnosis and treatment of kidney diseases : a guide for doctors N.A. Mukhin and others. 10. Biochemical diagnosis (physiological role and diagnostic value of biochemical components of blood and urine) Borodin E. A., Borodina G. P. 11. Clinical Biochemistry Marshall W.J 12. Guide to laboratory studies in biological chemistry Zubairov D.M., Timerbaev V.N., Davydov V.S.
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Exercise 1

1. Prothrombin time is lengthened in the following cases:

- A. Congenital deficiency of factors II , V , VII , X D. Hypofibrinogenemia
B. Chronic liver disease E. All of the above are correct C. vitamin K deficiency

2. Prolongation of bleeding time is typical for :

- A. thrombocytopenia of various origins D. DIC syndrome
 B. thrombocytopathy E. all of the above are correct
 B. treatment with antiplatelet agents, aspirin, heparin
- 3. Prolongation of clotting time is observed in the following cases, except :**
 A. significant deficiency of plasma factors B. absence of antithrombin III
 (II, V, VIII, IX, X) D. treatment with heparin
 B. severe platelet factor 3 deficiency E. in patients with circulating anticoagulants
- 4. Fibrinolysis activation (euglobulin lysis time is reduced) is observed in the following cases:**
 A. DIC D. shock
 B. massive thrombosis E. all of the above cases
 B. surgery on the prostate, lung tissue
- 5. The test for fibrin degradation products (PDF) is positive at :**
 A. DIC - syndrome B. treatment fibrinolytic agents E. all of the above are incorrect
 B. massive thrombosis D. all of the above are correct
- 6 . Blood from a patient with mitral valve stenosis, the patient goes to a planned operation. The coagulogram showed: platelet count - normal, bleeding time - prolonged, ABP, APTT - prolonged, PT (LI), fibrinogen concentration, fibrinolytic activity, ethanol test, antithrombin III - normal. Violations are probably in the link of hemostasis:**
 A. thrombocyte -vascular and plasma G. anticoagulant
 B. external plasma D. equally probable in any of the listed links
 B. fibrinolysis
- 7. The patient presented in the test 8.67 needs to undergo additionally:**
 A. Determination of protein C D. Determination of platelet aggregation and adhesion
 B. Determination of the time of euglobulin lysis E. All of the above tests
 C. Determination of fibrinopeptides A and B
- 8. A patient with impaired vascular- platelet hemostasis has a factor VIII antigen deficiency and decreased platelet adhesion and aggregation to ristomycin . The patient is most likely to:**
 A. hemophilia A D. chronic recurrent DIC in the phase
 B. von Willebrand 's disease hypocoagulation
 C. Werlhof 's disease D. All of the above are possible
- 9. Antiphospholipid syndrome manifests itself:**
 A. formation of antibodies to phospholipids D. miscarriage B. repeated thromboses E. all of
 the above are correct C.
 having a lupus anticoagulant
- 10. Plasminogen in plasma is reduced with:**
 A. treatment fibrinolytics D. all of the above is correct
 B. severe liver pathology E. all of the above is incorrect C. DIC
- 11. High molecular weight kininogen in plasma is reduced with:**
 A. Chronic renal failure D. All of the above are true
 B. Liver cirrhosis E. All of the above are incorrect C. DIC

Task 2.

Task 1. Patient K., aged 27, self-medicated for a cold and fever. For three days he took acetylsalicylic acid in large doses. During the treatment, bleeding from the gums and nose appeared. Examination revealed petechiae on the legs. The number of platelets in the blood - $200 \times 10^9 / l$, bleeding time - 12 minutes, APTT - 36 s, PT - 12 s, blood clotting time - 10 minutes.

Make a conclusion about the type of violation of hemostasis. What is the mechanism of violations?

Task 2. A 23-year-old woman applied for emergency care due to swelling and pain in the left calf area.

Table 1. Dependence of the concentration of soluble fibrin -monomer complexes in the blood on the time of fibrin formation

Время, с	Концентрация РФМК, мг/100 мл	Время, с	Концентрация РФМК, мг/100 мл
5–6	28,0	24–25	9,0
7	26,0	26	8,5
8	24,0	27–28	8,0
9	22,0	29–31	7,5
10	21,0	32–33	7,0
11	19,0	34–36	6,5
12	17,0	37–40	6,0
13	16,0	41–45	5,5
14	15,0	46–54	5,0
15	14,0	55–69	4,5
16	13,0	70–87	4,0
17–18	12,0	88–120	3,5
19–20	11,0	свыше 120	3,0
21–23	10,0	—	—

Over the past few years, she regularly took contraceptives. Examination revealed swelling, erythema, hyperthermia, pain in the left calf. During the Duke test, the bleeding time is 4 minutes. The number of platelets in the blood - $220 \times 10^9 / l$, PT - 7 s, APTT - 20 s, blood clotting time - 6 min.

What is the cause and mechanism of impaired hemostasis?

Task 3. Patient S., 37 years old, is registered in the oncological dispensary for a tumor in the lung. She has been taking cytotoxic drugs for 2 years. Recently, the condition has been deteriorating. Nosebleeds, bleeding gums, petechial rashes on the skin appeared, signs of gastric bleeding were found. Blood analysis:

- hemoglobin content - 50 g/l;
- number of erythrocytes - $1.6 \times 10^{12} / l$;
- OKL - $2.7 \times 10^9 / l$;
- platelet count - $12 \times 10^9 / l$;
- APTT - 37 s;
- PV - 14 s;
- blood clotting time - 11 minutes;
- bleeding time (according to Ivy) - 10 min. What are the causes and mechanism of hemostasis disorders?

Task 4. A 7-year-old boy had acute rubella. By the end of the second week from the moment of illness, signs of gastric upset appeared. Massive bruises appeared on the body, in places of bruises. The

number of platelets in the blood - $30 \times 10^9 / l$, bleeding time (according to Duke) - 10 min, APTT - 35 s, PT - 14 s, blood clotting time - 11 min, retraction of the blood clot - 33%.

Make a conclusion about the type of violation of hemostasis. What is its mechanism?

Task 5. Patient U., 5 years old, was admitted to the surgical department of the hospital by ambulance due to incessant bleeding from a small wound of the hand. The knee joints are deformed and inactive. Bleeding time (according to Ivy) - 5 min, platelet count in blood - $180 \times 10^9 / l$, APTT - 48 s, mixed APTT - 38 s, PT - 13 s, blood clotting time - 16 min. The bleeding was stopped by a transfusion of fresh donated blood.

What disease can be assumed in this child?

Task 6. Patient N, 25 years old, has nosebleeds, uterine bleeding, bruises. The spleen is not enlarged. The number of platelets in the blood - $18 \times 10^9 / l$, APTT - 36 s, PT - 13 s, bleeding time (according to Ivy) - 18 minutes, blood clotting time - 10 minutes. In the bone marrow, the number of megakaryocytes is increased, naked nuclei of megakaryocytes are found. Reception of prednisolone normalized the content of platelets, but after its withdrawal the content of platelets decreased again.

What type of hemostasis is impaired in this patient? What disease can be assumed?

Task 7. Patient A., 18 years old, was brought to the gynecological clinic because of incessant uterine bleeding after an abortion performed a few hours ago. Objectively: the skin and mucous membranes are pale, the pulse is 125 per minute, weak filling, blood pressure is 85/45 mm Hg, breathing is shallow, consciousness is darkened. When examining the hemostasis system, it was found:

- blood clotting time - 25 minutes;
- Duke's test - 6 min;
- the content of fibrinogen in blood plasma - 0.3 g/l;
- activity of antithrombin III - 20%;
- the number of platelets in the blood - $90 \times 10^9 / l$.

What pathology of the hemostasis system do these data indicate?

Task 8. Patient E., 56 years old, was admitted to the therapeutic department of the hospital with complaints of general weakness, decreased ability to work, and frequently recurring nosebleeds. She has a history of chronic alcoholism. Objectively: yellowness of the skin and mucous membranes, enlargement of the liver and spleen. There are signs of ascites. The stool is discolored. The content of indirect bilirubin in the blood serum is $65 \mu\text{mol} / l$, direct bilirubin is $45 \mu\text{mol} / l$, the number of platelets in the blood is $250 \times 10^9 / l$, the Duke test is 3 minutes, the blood clotting time is 20 minutes, the content of fibrinogen in the blood plasma is 0.6 g/l, PV - 34 s.

What is the type and mechanism of hemostasis disorders?

Task 9. Patient V., aged 18, complains of prolonged and profuse menorrhagia, the appearance of small hemorrhages on the skin, and frequent nosebleeds. From the anamnesis it is known that some relatives of the patient had similar disorders. The Rumpel - Leede - Konchalovsky test is positive, the number of platelets in the blood is $230 \times 10^9 / l$, the average platelet diameter is increased to 7 microns,

the Duke test is 8 minutes. Special methods (test with ADP and epinephrine) revealed a violation of platelet aggregation. APTT and PT were within normal limits.

What is the type of hemostasis disorder?

Task 10. The mother of a 7-year-old patient S. addressed a doctor with complaints about the presence of frequent nosebleeds in the child, the appearance of bright red rounded formations on the nose and in the neck. When examining the coagulogram , no deviations from the norm were found, the number of platelets in the blood was $370 \times 10^9 / l$.

Make a reasoned conclusion about the type (mechanism) of hemostasis disorders.

Note. According to the mother of a sick child, his father, who died 6 years ago due to internal gastric bleeding, had similar disorders.

Task 11. After a major abdominal operation, the patient received 450 ml of canned blood. Soon he developed chills, pain in the lumbar region and chest, tachycardia, shortness of breath. The next day the condition worsened: BP - 80/40 mm Hg , pulse - 120 per minute, reddish urine. Spotted confluent hematomas appeared on the body, bleeding from the surgical wound occurred. The number of platelets in the blood - $30 \times 10^9 / l$, APTT - 44 s, mixed-APTT - 35 s, PT - 20 s, the content of RFMK - 8 mg/100 ml, blood clotting time - 17 min.

What type of hemostasis disorders is evidenced by clinical and laboratory data? What is the primary and main link in the pathogenesis of this condition?

Task 12. Patient M., aged 5, was admitted to a children's hospital with suspected enteritis. According to the mother, the child has frequent spontaneous nosebleeds, bloating and pain in the abdomen, frequent stools (semi-liquid, up to 8 times a day). Objectively: the skin and mucous membranes are pale, there are petechial hemorrhages in the buttocks and back, the liver and spleen are of normal size, the lymph nodes are normal, moderate flatulence. Results of the laboratory examination:

- hemoglobin content in blood - 60 g/l;
- number of erythrocytes - $3.0 \times 10^{12} / l$;
- the number of reticulocytes - 20%o;
- OKL - $11 \times 10^9 / l$;
- platelet count - $220 \times 10^9 / l$;
- bleeding time (according to Duke) - 3 minutes;
- blood clotting time - 15 minutes;
- PV - 32 s;
- the content of fibrinogen in blood plasma - 4 g/l.

What is the type of hemostasis disorder? Deficiency of what factors of hemostasis can occur in this child and why?

Note. Among the relatives of the patient, no one suffers from bleeding.

Problem 13. Patient S., 6 years old, was delivered to the hospital. The child complains of acute abdominal pain and vomiting. Objectively: the skin and mucous membranes are pale; in the head, hands, knee and ankle joints - hemorrhagic maculopapular rash; flatulence; vomit and feces mixed with blood. Two weeks

ago (according to the mother) the child for 5 days received the drug biseptol on a tablet (480 mg) 2 times a day for acute bronchitis (one tablet of biseptol contains 400 mg of sulfamethoxazole and 80 mg of trimethoprim). Laboratory examination did not reveal deviations of the main hemostasiological parameters from the norm.

The development of what disease can be assumed in this case? What additional examination should be prescribed to the patient?

Task 14. Since childhood, a patient has been bleeding from the gums, nosebleeds, bruises often appear on the skin. The number of platelets in the blood - $150 \times 10^9 / l$, Duke's test - 55 min, APTT - 46 s, PT - 12 s.

What is the type and mechanism of hemostasis disorders in this patient?

Task 15. Prematurely (on the 8th month gestation) of a girl born on the 2nd day after birth, bleeding from the umbilical cord and nasal mucosa developed, multiple hemorrhages appeared in the skin. When examining the hemostasis system, it was found:

- the number of platelets in the blood - $150 \times 10^9 / l$;
- Duke's test - 3 min;
- blood clotting time - 18 minutes;
- INR - 0.6.

What disorder of hemostasis takes place in this case? Deficiency of what factors of hemostasis can a child have? What is the mechanism of violations?

Guidelines for performing extracurricular independent work for classes on the topic:

Pathobiochemistry of carbohydrate metabolism.

Diabetes"

Initial level of knowledge:

7. The liver is the central metabolic organ for blood glucose homeostasis.
8. Formation and metabolism of the main hormones that regulate the metabolism of carbohydrates in the human body, pathobiochemical processes that occur when their metabolism is disturbed
9. The occurrence of acute and late complications of diabetes mellitus
10. Diagnosis algorithm for diabetes mellitus.

<p><u>The student must know:</u></p> <ol style="list-style-type: none"> 1. Biochemical parameters of carbohydrate metabolism are normal 2. Biochemical processes occurring in the body during the development of diabetes 3. The occurrence of acute and late complications of diabetes mellitus 4. Algorithm for diagnosing diabetes mellitus 5. List of basic biochemical tests. <p><u>The student may be able to:</u></p> <ol style="list-style-type: none"> 1. <u>the formation and metabolism of the main hormones that regulate the metabolism of carbohydrates in the human body, pathobiochemical processes that occur when their metabolism is disturbed;</u> 2. <u>definition of diabetes mellitus, types of its complications, key pathobiochemical processes involved in their formation;</u> 3. <u>main indicators and methods for diagnosing possible disorders of carbohydrate metabolism, possible errors in their determination using laboratory methods;</u> 4. <u>main indicators and methods for diagnosing possible disorders of lipid metabolism in diabetes mellitus;</u> 5. <u>main indicators and methods for diagnosing possible disorders of protein metabolism in diabetes mellitus;</u> 6. <u>main indicators and methods for diagnosing possible disorders of electrolyte metabolism in diabetes mellitus;</u> 7. <u>structure of screening for diabetes mellitus, algorithms for diagnosing diabetes mellitus, early diagnosis of glucose homeostasis disorders and complications of diabetes mellitus;</u> 8. <u>differences in pathobiochemical processes in type 1 and type 2 diabetes mellitus, their differential diagnosis;</u> 9. <u>pathobiochemical processes in acute complications (coma) of diabetes mellitus,</u> 	<p><u>Main literature:</u></p> <ol style="list-style-type: none"> 1. Biological chemistry: textbook Berezov T.T.; Korovkin B.F. M.: Medicine, 2012 2. Biochemistry: textbook , ed. E.S. Severina M.: GEOTAR-Media, 2007 3. Clinical biochemistry: textbook . n special edition ed. V.A. Tkachuk M .: GEOTAR-Media, 2006,2008 4. Biochemical foundations of pathological processes: textbook . n special edition ed. E. S. Severina M. : Medicine, 2000 5. Handbook of clinical biochemistry for the system of postgraduate professional education : textbook . Special Nikulin B.A.M. : GEOTAR-Media, 2007 <p><u>Additional literature:</u></p> <ol style="list-style-type: none"> 13. Pathophysiology of metabolism: textbook . n special edition ed. V. N. Tsygan 14. Human biochemistry. In 2 tons under . r units L.M. Ginodman 15. Guide to practical 16. classes in biochemistry Aleinikova T.L., Rubtsova G.V., Pavlova N.A. 17. Biochemistry and Molecular Biology Elliot W., Elliot D. 18. Medical laboratory diagnostics: programs and algorithms : a guide for doctors , ed. A. I. Karpishchenko 19. Diagnosis and treatment of kidney diseases : a guide for doctors N.A. Mukhin and others. 20. Biochemical diagnosis (physiological role and diagnostic value of biochemical components of blood and urine) Borodin E. A., Borodina G. P. 21. Clinical Biochemistry Marshall W.J 22. Guide to laboratory studies in biological chemistry Zubairov D.M., Timerbaev V.N., Davydov V.S.
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<u>differential diagnosis of coma in patients with diabetes mellitus;</u> 2. <u>a list of the main tests necessary for diagnosing diabetes mellitus and its complications;</u> 3. <u>principles of treatment of diabetes mellitus in accordance with the pathobiochemical processes that occur during its development, and monitoring the effectiveness of ongoing therapy, prevention of the development of late complications of diabetes mellitus;</u> 12. <u>modern tests for early laboratory diagnosis of diabetes mellitus (prediabetes , latent diabetes), prospects for their use in the clinic;</u> 13. <u>pathobiochemical changes in hypoglycemic conditions, their differential diagnosis;</u>	
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Exercise 1

- Select an effect that insulin does not have:
 - Stimulates aerobic glycolysis;
 - Inhibits the pentose cycle of glucose metabolism;
 - Synthesis of glycogen, protein, lipids;
 - Inhibits gluconeogenesis , glycogenolysis , lipolysis ;
 - Reduces blood glucose levels.
- The process of disintegration of proinsulin is disturbed when :
 - type I diabetes ;
 - type II diabetes ;
 - With type I and type II diabetes;
 - This process is not disturbed;
 - When type I diabetes is combined with hypertension.
- Choose the correct statement:
 - Amylin , a precursor of amyloid in β -cells, in NIDDM reduces glucose uptake by β -cells and suppresses insulin secretion;
 - Amylin , a precursor of amyloid in β -cells, in NIDDM increases glucose uptake by β -cells and suppresses insulin secretion;
 - Amylin , precursor of fibrous deposits in β -cells, when NIDDM reduces glucose uptake by β -cells and suppresses secretion insulin;
 - Amylin , a precursor of fibrous deposits in β -cells, when NIDDM increases glucose uptake by β -cells and suppresses secretion insulin;
 - Amylin , a precursor of amyloid in β -cells, reduces glucose uptake by β -cells and inhibits proinsulin secretion .

4. Select the processes that occur in the muscles during NIDDM:
pyruvate dehydrogenase activity increased due to competitive
the influence of free fatty acids, the concentration of which is significantly
increased.

pyruvate dehydrogenase activity reduced due to competitive
the influence of free fatty acids, the concentration of which is significantly
increased.

3-increased activity of glycogen synthetase , which reduces synthesis
glycogen from glucose in muscle tissue.

4-decreased activity of glycogen synthetase , which reduces the synthesis
glycogen from glucose in muscle tissue.

- A) 2;
- B) 2, 4;
- C) 4;
- D) 3;
- E) 1, 2.

5. Insulin suppresses, choose the wrong answer:

- A) Key enzymes of aerobic glycolysis;
- B) The breakdown of glycogen;
- C) Sorbitol shunt;
- D) Glucuronate pathway of carbohydrate metabolism;
- E) Synthesis of glycoproteins.

6. Pick the Wrong Characteristic of Glycosylated
hemoglobin:

- A) Formed with the help of oxidoreductase ;
- B) Very strongly binds oxygen;
- C) It is difficult to give oxygen to tissues;
- D) Promotes tissue hypoxia;
- E) Development of angiopathy .

7. Ketone bodies enhance:

1-Hyperglucosuria; 2-Hyponatremia; 3-hypocalcemia; four-
albuminuria; 5-Hypokalemia

- A) 2,5;
- B) 1, 2, 3;
- C) 2, 4;
- D) 3, 5;
- E) 1, 4.

8. Activation of the renin - angiotensin P-aldosterone system in DM
due to:

- A) Polyuria;
- B) loss of sodium;
- C) Decrease in the volume of circulating blood;
- D) Increase in the amount of extracellular fluid;
- E) Plays a significant role in the development of angiopathy .

9. In a 46-year-old patient, in June 2009, HbA1c was 4%, in
October of the same year, after examination, it turned out that HbA1C
is 11%, on the basis of which you suspect:

- A) type I diabetes ;
- B) type II diabetes ;

- C) Impaired glucose tolerance;
- D) This is a variant of the norm;
- E) Correct answers B and C.

Task 2.

1. Why should whole blood glucose be tested immediately after collection?
2. To prevent glycolysis and stabilize glucose in whole blood, the following must be added to the sample:
 - A. Heparin
 - B. Sodium fluoride
 - B. Sodium citrate
3. How glycation occurs proteins and what are the consequences of this?
4. The procedure for determining glycated hemoglobin may interfere with:
 - A. Hemolysis
 - B. Uremia
 - B. Stressful influences
 - D. Pregnancy
5. The level of _____ is a “mirror” of glycemia

A. Blood glucose	1. Last 1-3 weeks
B. Fructosamine	2. At the time of taking the material
B. Glycosylated hemoglobin	3. Last 2 months

Task 3.

1. _____ before the determination of glucose, it is necessary to exclude the intake of ascorbic acid and tetracycline antibiotics by the subject .
 - A. One day B. Two days C. Three days
2. Is it possible to determine the concentration of glucose in the blood by the orthotoluidine method in patients during and immediately after surgery, as well as in patients in the early postoperative period, if they were transfused with reopoliglyukin ?

Task 4.

1. A sick child with frequent diarrhea after taking milk food was admitted to the clinic. To make a diagnosis, a lactose tolerance test was performed. The concentration of glucose in the blood after 30, 60 and 90 minutes did not increase. Explain your results.

WHO Criteria for the Diagnosis of Diabetes Mellitus and Impaired Glucose Tolerance

Random glucose determinations (mmol /L)

Probable diabetes mellitus	Diabetes mellitus indeterminate	Diabetes is unlikely
Venous plasma ≥ 11.1	5.5 - <11.1	< 5.5
Deoxygenated blood ≥ 10.0	4.4 - < 10.0	< 4.4
capillary plasma ≥ 12.2	5.5 - < 12.2	< 5.5
capillary blood ≥ 11.1	4.4 - <11.1	< 4.4

2. If the patient's fasting blood glucose is normal and only reaches diabetic limits after 2 hours, the test should be repeated after : A. 4 weeks B. 6 weeks C. 8 weeks

3. Does the detection of autoantibodies to insulin, islet cells in people without IDDM symptoms, but with impaired tolerance, give grounds to start treatment in the preclinical period?

Task 5.

1. How does the nature of the glycemic curve in children depend on the type of carbohydrate used to perform the load (galactose, maltose, lactose, combined glucose and galactose)?
2. Can the nature of the glycemic curve reflect not only the state of carbohydrate metabolism, but also intestinal (cavity, membrane) digestion ?
3. Name promising biochemical tests for the diagnosis of diabetes mellitus and the nature of emerging metabolic disorders.

Guidelines for performing extracurricular independent work for classes on the topic: "Disorders of lipid metabolism"

Initial level of knowledge:

1. Classification of lipoproteins. Metabolism of lipoproteins.
2. Cholesterol , atherosclerosis and coronary heart disease. Dyslipoproteinemia . Hypercholesterolemia . Diagnostic criteria for hyperlipoproteinemias
3. Clinical significance of hypercholesterolemia
4. Biochemical basis for the development of atherosclerosis . Coefficient atherogenicity
5. Blood lipoprotein metabolism disorders (dyslipoproteinemia).

<u>The student should know:</u> Clinical and diagnostic significance of catabolic and anabolic processes in lipid metabolism.	<u>Main literature:</u> 1. Biological chemistry: textbook
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<p>2. Clinical aspects of lipid metabolism, intermediate products of their metabolism.</p> <p>3. Mechanisms of control and regulation in lipid metabolism.</p> <p>4. The main types of lipid metabolism disorders at the molecular genetic, cellular, organ, system and organism levels.</p> <p>5. Molecular mechanisms of the etiology and pathogenesis of the main disorders lipid metabolism.</p>	<p>Berezov T.T.; Korovkin B.F. M.: Medicine, 2012</p> <p>2. Biochemistry: textbook , ed. E.S. Severina M.: GEOTAR-Media, 2007</p> <p>3. Clinical biochemistry: textbook . n special edition ed. V.A. Tkachuk M .: GEOTAR-Media, 2006,2008</p> <p>4.Biochemical foundations of pathological processes: textbook . n special edition ed. E. S. Severina M. : Medicine, 2000</p> <p>5. Handbook of clinical biochemistry for the system of postgraduate professional education : textbook . Special Nikulin B.A.M. : GEOTAR-Media, 2007</p>
<p><u>The student may be able to:</u></p> <p>1. Use the acquired knowledge to analyze the pathobiochemical mechanisms of the occurrence and development of lipid metabolism disorders.</p> <p>2. Use the acquired knowledge to evaluate the effectiveness of biochemical diagnostics and treatment for lipid metabolism disorders.</p>	<p><u>Additional literature:</u></p> <p>23. Pathophysiology of metabolism: textbook . n special edition ed. V. N. Tsygan</p> <p>24. Human biochemistry. In 2 tons under . r units L.M. Ginodman</p> <p>25. Guide to practical</p> <p>26. classes in biochemistry Aleinikova T.L., Rubtsova G.V., Pavlova N.A.</p> <p>27. Biochemistry and Molecular Biology Elliot W., Elliot D.</p> <p>28. Medical laboratory diagnostics: programs and algorithms : a guide for doctors , ed. A. I. Karpishchenko</p> <p>29. Diagnosis and treatment of kidney diseases : a guide for doctors N.A. Mukhin and others.</p> <p>30. Biochemical diagnosis (physiological role and diagnostic value of biochemical components of blood and urine) Borodin E. A., Borodina G. P.</p> <p>31. Clinical Biochemistry Marshall W.J</p> <p>32. Guide to laboratory studies in biological chemistry Zubairov D.M., Timerbaev V.N., Davydov V.S.</p>

Exercise 1

1. Consequences of a lack of lipids in the body:
- 1) development of hypovitaminosis A , D, E, K;
 - 2) steatorrhea ;
 - 3) violation of the synthesis of prostaglandins and leukotrienes ;
 - 4) emaciation;
 - 5) development of hypovitaminosis A , D, B₁₂ and folic acid.
- A. 3, 4, 5. B. 1, 2, 3.

B. 1, 3, 4.

2. Hypercholesterolemia contributes to:

- 1) increased intestinal motility;
- 2) weakening of intestinal motility.

3. Hyperlipemia is observed when:

- 1) insufficient production of somatotrophic and adrenocorticotrophic hormones;
- 2) a decrease in the mobilization of fat from the depot;
- 3) lack of globulins in the blood;
- 4) increased intake of fatty acids from the blood into adipose tissue;
- 5) increase in the content of thyroxine and catecholamines in the body.

4. Lipotropic substances that prevent the development of fatty infiltration of the liver:

- 1) choline;
- 2) glutamine ;
- 3) methionine;
- 4) lipocaine;
- 5) histidine.

A. 2, 3, 4.

B. 1, 3, 4. C. 3, 4, 5.

5. Increased lipolysis occurs when :

- 1) gigantism ;
- 2) hyperthyroidism ;
- 3) hyperinsulinism ;
- 4) hypercortisolism ;
- 5) an excess of catecholamines.

A. 2, 3, 4. B. 2, 3, 5.

B. 1, 2, 5.

6. The development of atherosclerosis contributes to:

- 1) increase in HDL content and decrease in concentration LDL;
- 2) an increase in the content of LDL and a decrease in the concentration HDL.

7. Violation of digestion and absorption of fats in the intestine is facilitated by:

- 1) deficiency of pancreatic lipase;
- 2) decreased activity of lipoprotein lipase;
- 3) acholia;
- 4) hypercholia ;
- 5) excess calcium and magnesium in food.

A. 1, 3, 4. B. 2, 3, 5.

B. 1, 3, 5.

8. The consequences of obesity include:

- 1) increased fibrinolytic activity of the blood;
- 2) worsening of general hemodynamics;
- 3) difficulty in heat transfer;
- 4) development of immunosuppression;
- 5) an increase in the concentration of albumins.

A. 2, 3, 4. B. 1, 2, 3.

B. 2, 3, 5.

9. Depending on the distribution of adipose tissue, obesity is distinguished:

- 1) hypertrophic;
- 2) mixed;
- 3) android ;
- 4) constitutional;
- 5) pear-shaped.

A. 1, 3, 5. B. 2, 4, 5.

B. 2, 3, 5.

10. Depending on the etiology, obesity is distinguished:

- 1) cerebral;
- 2) exogenous-constitutional;
- 3) hypothalamic;
- 4) alimentary;
- 5) hormonal.

A. 2, 3, 5. B. 1, 4, 5.

B. 3, 4, 5.

Task 2.

Task 1. Patient A., aged 42, a mathematics teacher, complains of progressive obesity, shortness of breath, palpitations, fatigue, drowsiness, headaches, and menstrual disorders. Appetite is good. Eats a lot of flour and sweet dishes. Leads a sedentary lifestyle. Objectively: the patient has a hypersthenic constitution, height - 154 cm, body weight - 98 kg. There is a uniform distribution of subcutaneous adipose tissue. The boundaries of the heart are somewhat expanded, the heart sounds are weakened and muffled, blood pressure is increased (155/95 mm Hg), the pulse is increased to 97 per minute.

What disease (or syndrome) is observed in the patient? What are the mechanisms of recorded clinical manifestations?

Task 2. Patient E., aged 49, a researcher, complains of memory loss, dizziness, pain in the heart, shortness of breath during exercise. Considers himself ill for 3 years. Does not engage in physical labor and physical education, smokes. Meals include a large amount of meat and animal fats, few vegetables. Objectively: the patient is of medium height, hypersthenic, looks older than his years, muscle tone and skin turgor are reduced, heart boundaries are enlarged, muffled tones, pulse - 88 per minute, rhythmic, blood pressure - 140/90 mm Hg. ECG revealed signs of coronary insufficiency. The content of cholesterol and β -lipoproteins is sharply increased in the blood. The patient was prescribed physiotherapy exercises and a diet rich in vegetables and fruits, with a reduced calorie content and restriction of animal fats. In addition, it is recommended to introduce at least 20 g of natural vegetable oil into the daily diet.

What condition does the patient develop? What are the likely causes and consequences of hypercholesterolemia in this patient? Why is it recommended for a patient to eat vegetable oil, vegetables and fruits?

Task 3. A biochemical study of the blood of patient F., 45 years old, showed that the cholesterol content in the blood plasma exceeds the upper limit of normal. According to the patient, some time ago he underwent treatment at the endocrinology clinic for moderately severe hypothyroidism.

Is the patient at high risk of developing atherosclerosis? What is the mechanism of the relationship between hypercholesterolemia and hypofunction of the thyroid gland? What type of hyperlipoproteinemia should be expected in the patient?

Task 4. Patient V., aged 24, was admitted to the clinic in connection with complaints of pain in the region of the heart. The patient reported that he was diagnosed with exertional angina 1.5 years ago. The examination revealed atherosclerotic plaques in the coronary and cerebral arteries. The content of cholesterol, low density lipoproteins (LDL) and intermediate density (LDL) in the blood exceeds the norm several times. The patient underwent a liver biopsy, which revealed a decrease in the number of receptors

for LDL and LPPP.

What type of hyperlipoproteinemia does the patient have? Is there a link between a decrease in the number of LDL receptors and hypercholesterolemia ?

Task 5. Patient K., aged 61, suffers from arterial hypertension. In the last 1.5 years, she notes an increase in body weight, chilliness in the legs, numbness and pain in the calf muscles when walking, and then at rest. Three months ago, an erosion appeared in the lower third of the right shin, and then an ulcer, painless and not amenable to treatment. There is a constant elevated (up to 37.2-37.4 ° C) body temperature. In addition to the above complaints, at the doctor's appointment, the patient also complains of dry mouth, thirst, increased fluid intake (up to 4-5 liters per day), frequent profuse urination. Objectively: the skin on the legs is dry, pale, cold to the touch. Palpation of arterial pulsations in the popliteal fossa and on the foot

not defined. Blood test: elevated cholesterol, fibrinogen, thrombocytosis.

What forms of pathology (in addition to arterial hypertension) do the available clinical and laboratory data indicate? What are the causes and mechanism of development of the symptoms observed in the patient? Is there a pathogenetic relationship between the form of the pathology identified in the patient and the development of a leg ulcer?

Task 6. Patient S., 18 years old, went to the doctor with complaints of constant hunger for the last 6 months , rapid weight gain, fatigue and lethargy, dysmenorrhea. Objectively: height - 168 cm, body weight - 102 kg, pulse rate - 94 per minute, blood pressure - 130/86 mm Hg . In the blood, the content of triacylglycerols and LDL is increased, the concentration of insulin is at the upper limit of the norm, glucocorticoids are within the normal range. When collecting an anamnesis, it turned out that about six months ago, the girl received a head injury by slipping on the ice of the rink.

What additional research needs to be done? What is the presumptive diagnosis of the disease? What are the mechanisms of the observed clinical manifestations?

Task 7. Patient L., aged 28, suffers from chronic pancreatitis. Objectively: height - 162 cm, body weight - 45 kg, dry skin, eczematous areas on the hands and partially on the scalp. The patient complains of visual impairment, increased hair loss, brittle nails, and therefore began to eat calcium supplements, but did not observe any improvement.

What clinical data indicate a violation of lipid metabolism? What additional research needs to be done?

What are the main links in the pathogenesis of the observed pathology?

Task 8. Patient H., aged 21, suffers from coronary heart disease. Complains of weakness, paresthesia, increased drowsiness and dizziness, headache often occurs, accompanied by nausea, sometimes vomiting. Objectively: height - 164 cm, body weight - 107 kg, multiple xanthomas on the skin, enlarged liver, orange tonsils. The content of cholesterol in the blood plasma exceeds the upper limit of the norm several times.

What additional research needs to be done? What is the presumptive diagnosis of the disease? What are the causes and mechanism of development of the symptoms observed in the patient?

Task 9. Child S., 1 year 4 months old, was admitted to the clinic. During the initial examination marked mental retardation, malnutrition; according to the mother, the child often vomits, the appetite is poor, but the stool, despite this, is plentiful. Further examination revealed: the content of erythrocytes and hemoglobin in the blood is below normal, blurred vision, ECG - signs of arrhythmia.

What additional research needs to be done? What is the presumptive diagnosis of the disease? What are the main links in the pathogenesis of this disease?