**"APPROVE "**

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**"\_\_\_\_" \_\_\_\_\_\_\_\_\_\_\_\_\_\_2023**

**Dean of the International Faculty D.Kh. Tursunov**

**CALENDAR AND THEME PLAN**

for 20 23 -202 4 academic year

Department: Medical and Biological Chemistry

Subject: Biochemistry

Faculty: Therapeutic, medical and preventive

Course: 2 semester: III

Number of allocated hours for this semester: 120

Lectures – 12 hours

Practical training - 38 hours

Laboratory classes - 10 hours

Independent education - 6 0 hours

Lecture classes

|  |  |  |  |
| --- | --- | --- | --- |
| No. | date | Title of the topic and issues covered | Watch |
| 1 | September 4 - 9 , 202 3 years | **Biological membranes. Biological oxidation.**1. Biological functions of the membrane
2. General properties of membranes
3. Transport of substances across biomembranes
4. membrane receptors.
5. Endergonic and exergonic reactions in living cells. macroergic compounds.
6. Components of the electron transport chain.
7. Mechanism of oxidative phosphorylation.
8. Respiratory system inhibitors
 | 2 |
| 2 | 1 1 - 16 September 202 3 years | **General pathways of catabolism. The exchange of carbohydrates.**1. General pathways of catabolism.
2. Oxidative decarboxylation of pyruvate.
3. Citric acid cycle (Krebs cycle) and their functions
4. Relationship of common catabolism pathways to the respiratory chain
5. Digestion and absorption of carbohydrates.
6. Synthesis and breakdown of glycogen, its physiological significance.
7. Glucose catabolism: aerobic, anaerobic, its physiological significance.
8. Regulation of gluconeogenesis and its significance
9. Regulation of blood glucose homeostasis.
 | 2 |
| 3. | October 16 - 21 , 202 3 years | **Biochemistry of lipid metabolism.**1. Lipid composition of body tissues, classification and structure of lipids
2. Lipid digestion
3. Importance of lipid resynthesis in the body.
4. Chylomicron formation and lipid transport
5. Reservation and mobilization of lipids, their regulation.
6. Synthesis and breakdown of fatty acids and its physiological significance.
7. Synthesis of cholesterol, metabolism and its regulation
8. Metabolism of complex lipids: synthesis and breakdown of phospho and glycolipids
9. Biochemical basis of lipid metabolism disorders: obesity, metabolic syndrome, atherosclerosis, gallstone disease, sphingolipidosis .
 | 2 |
| 4 | 23 -2 October 8 , 202 3 years | **Biochemistry of protein metabolism**1. The dynamic state of body proteins
2. Nitrogen balance
3. content in food
4. Biological value of proteins
5. Digestion of proteins
6. Biochemical mechanisms of digestive regulation: local hormones of the gastrointestinal tract.
7. Biochemical basis of gastrointestinal diseases.

8. Parenteral nutrition | 2 |
| 5 | 13 -1 November 8 , 202 3 years | **General and specific pathways of amino acid metabolism**1. *Common pathways of amino acid metabolism.*
2. *Transamination of amino acids, transaminases. Coenzyme function of vitamin B 6 .*
3. *Deamination of amino acids*
4. *decarboxylation of amino acids. Biogenic amines: formation and functions of histamine, seratonin , GABA and catecholamines*
5. End products of nitrogen metabolism: biosynthesis of ammonium salt and urea
6. *Hyperammonemia*
7. Exchange of individual amino acids
8. Violation of amino acid metabolism
 | 2 |
| 6 | December 4-9, 202 3 years | **Nucleotide exchange**1. Synthesis of purine nucleotides.
2. Catabolism of purine nucleotides.
3. Synthesis and degradation of pyrimidine nucleotides.
4. Biosynthesis of deoxyribonucleotides .
5. Coordination of the biosynthesis of purine and pyrimidine nucleotides, violations of their coordination (hyperuricemia, orataciduria).
 | 2 |
| **Total** | **12** |

Practical and laboratory classes

|  |  |  |  |
| --- | --- | --- | --- |
| No. | date | Lesson content | Watch |
| 1 | September 4-9, 2023 | **Introduction to metabolism. Biochemistry of nutrition.**1. Introduction to metabolism.
2. Stages of metabolism (digestion, absorption, intermediate metabolism, excretion of final products).
3. Anabolism and catabolism, their changes in ontogenesis.
4. Nutrition - as one of the stages of metabolism, age-related nutritional characteristics, milk biochemistry.
5. Basic principles of nutrient digestion. Functions of the main nutritional ingredients.
6. Replaceable and irreplaceable components of food, their age characteristics.
7. Metabolism, metabolic pathways, the concept of a metabolic map.
8. Catabolism and anabolism, methods for their study .

*CPC:*1. *15 dietary tables used in the clinic.*
2. *Features of metabolism in the age aspect.*
3. *Features of changes in anabolic and catabolic processes in ontogenesis.*
4. *Microelementoses.*
 | 2 |
| 2 | 1 1 -16 September 2023 | **Biomembranes. membrane receptors** . **Cell signaling pathways.**1. Biological membranes, structure and functions.
2. General properties of membranes: transverse asymmetry, fluidity and selective permeability.
3. Ways of transport of substances through biomembranes.
4. membrane receptors.
5. Transmission of signals through membranes.

*CPC:**1. The role of disruption of biological membranes in the development of pathological processes.* | 2 |
| 3 | September 18-23, 2023 | **Biological oxidation.**1. Energy exchange. The concept of biological oxidation.
2. The respiratory chain is the main pathway for the formation of ATP in the body.
3. Redox potential of electron carriers.
4. Phosphorylation of ADP ( substrate and oxidative phosphorylation).
5. Mechanism of oxidative phosphorylation.
6. Respiratory control, P/O index.
7. Respiratory chain inhibitors, uncouplers of oxidative phosphorylation; thermoregulatory function of tissue respiration.

*SRS:*1. *Regulation of energy exchange*
2. *Mitochondrial diseases.*
 | 4 |
| 4 | September 25-30, 2023 | **General pathways of catabolism** .1. Meaning of catabolism.
2. Oxidative decarboxylation of pyruvic acid .
3. Pyruvate dehydrogenase multienzyme complex.
4. Krebs cycle, its functions and regulation.

*SRS:*1. *Hypoenergetic states.*
 | 4 |
| 5 | October 2-7, 2023 | **Metabolism and functions of carbohydrates.**1. The main carbohydrates of food and the body, their role in the body.
2. Digestion of carbohydrates and absorption of their metabolites, age-specific features. Fermentation.
3. Milk intolerance.
4. Ways of using absorbed carbohydrates in tissues.
5. Synthesis and breakdown of glycogen in the liver and muscles.
6. Regulation of glycogen storage and breakdown. Phosphorylated and dephosphorylated forms of glycogen synthase and glycogen phosphorylase .

*CPC:*1. *Glycogen diseases (glycogenoses and aglycogenoses).*
2. *Structure, specificity and clinical significance of glucose transporters.*
 | 4 |
| 6 | October 9-14, 2023 | **Glucose catabolism and gluconeogenesis. Importance of the Pentose Phosphate Pathway**1. Aerobic glycolysis is the main catabolic pathway of glucose metabolism and its physiological significance.
2. Glycogenolysis .
3. Shuttle mechanism of hydrogen transfer from cytosol to mitochondria.
4. Anaerobic glycolysis, prevalence and significance. Alcoholic fermentation.
5. Gluconeogenesis. Measles and glucose- alanine cycles.
6. Key enzymes of glycolysis and gluconeogenesis and their regulation.
7. Pentose -phosphate pathway of glucose oxidation, significance.

*CPC:*1. *Regulation of glycolysis and gluconeogenesis in the liver.*
2. *Effect of catecholamines and glucocorticoids on carbohydrate metabolism*
 | 4 |
| 7 | October 16-21, 2023 | ***Fructose and galactose metabolism. Glucose homeostasis and regulation.***1. *metabolism , hereditary fructose and I in children*
2. *metabolism , hereditary galactosemia .*
3. *Regulation of blood glucose levels .*
4. *Glycoproteins and proteoglycans . General concepts about the carbohydrate part of these compounds.*

***Laboratory work: Determination of glucose in the blood with a glucometer.****CPC:*1. *Dysregulation of carbohydrate metabolism.*
 | 2 |
| 8 | October 23-28, 2023 | **Structure, function and lipid metabolism.**1. Lipid composition of food and organs and tissues of the body, classification of lipids, structure and their significance.
2. Digestion and absorption of lipids, their age-related features.
3. Bile acids, their role in the digestion and absorption of lipids.
4. resynthesis in enterocytes , chylomicron formation and transport.
5. Plasma lipoproteins, the significance of lipoprotein lipase .

*CPC:*1. *chronic hepatitis*
2. *Violation of lipid digestion in cholecystitis (steatorrhea).*
 | 2 |
| 9 | October 30 - November 4, 2023 | **Intermediate lipid metabolism.**1. Reservation and mobilization of lipids, their regulation.
2. Formation of lipids from carbohydrates.
3. Transport of fatty acids in the blood, their oxidation in tissues, significance.
4. oxidation of glycerol.
5. Synthesis of fatty acids and its regulation.
6. The main phospho - and glycolipids of the body, functions, synthesis and catabolism.
7. Synthesis and breakdown of ketone bodies

*CPC:*1. *Lipid peroxidation and damage to cell membranes .*
2. *α-oxidation of fatty acids, significance, their disorders.*
3. *ω-oxidation of fatty acids, significance, their disorders.*
4. *Ketonemia and ketonuria in fasting and diabetes mellitus*
 | 4 |
| 10 | November 6-11, 2023 | ***Metabolism of complex lipids. cholesterol metabolism. regulation of lipid metabolism.***1. *Sterols and sterides. Cholesterol, its significance, biological functions, age-related features.*
2. *Biosynthesis of cholesterol, its regulation.*
3. *Transport of cholesterol in the blood, the role of LCAT in lipoprotein metabolism.*
4. *Lipid reserve and mobilization disorders, obesity, age-related features.*
5. *Hypercholesterolemia, biochemical basis for the development of atherosclerosis.*
6. *Biochemical bases and treatment of cholelithiasis. principles of conservative treatment.*
7. *Normative values of lipid metabolism, age characteristics.*

***Laboratory work: Determination of cholesterol in blood serum.****CPC:*1. *Role of apo proteins in cholesterol transport.*
2. *Fatty hepatosis, obesity, hyperlipidemia, sphingolipidoses.*
3. *Dyslipoproteins nemia \_*
 | 4 |
| eleven | November 13-18, 2023 | **Protein digestion, amino acid absorption and tissue distribution.**1. The value of proteins in the body, nitrogen balance, the biological value of proteins. The dynamic state of body proteins, age-related features.
2. Digestion of proteins in the gastrointestinal tract, absorption of hydrolysis products.
3. Normal and pathological components of gastric juice. The role of gastric juice in the digestion of proteins.
4. Features of protein digestion in children, food allergies in children.
5. Rotting of proteins in the intestines, neutralization of their breakdown products
6. Species and tissue specificity of proteins, their changes in ontogenesis.

*CPC:**1. Clinical significance of determining the composition of gastric juice.**2. Biochemical features of the use of antacids in hyperacid conditions and gastric ulcer.**3. Parenteral nutrition, its clinical significance.**4. Biochemical basis for the development of acute pancreatitis and principles of treatment.* | 2 |
| 12 | 20 -25, 2023 | ***Common pathways of amino acid metabolism. Aminotransferases . \_ decarboxylation of amino acids.***1. *The fate of absorbed amino acids. Common pathways for the breakdown of amino acids.*
2. *Transamination of amino acids, transaminases. Coenzyme function of vitamin B 6 .*
3. *Deamination of amino acids, direct and indirect oxidative deamination .*
4. *Decarboxylation of amino acids, biological functions of biogenic amines, ways of their neutralization.*
5. *Histamine, its role in the development of inflammation and allergic reactions. Antihistamines.*

***Laboratory work: determination of transaminase activity in blood serum.****CPC:*1. *The clinical significance of determining the activity of transaminases.*
2. *Cathepsins , clinical significance.*
3. *Synthesis of neurotransmitters and their significance*
 | 4 |
| 13 | November 27-December 2, 2023 | **Neutralization of ammonia. Specific pathways of amino acid metabolism and hereditary disorders.**1. Ways of formation and neutralization of ammonia. Synthesis of urea and its connection with transamination reactions.
2. Violations of the synthesis and excretion of urea.
3. Hyperammonemia, main causes and complications. hyperammonemia in children with acute respiratory diseases.
4. The exchange of serine and glycine. Formation of one-carbon compounds.
5. Methionine exchange. Transmethylation reactions , participation in these reactions of methionine, folic acid and vitamin B 12 .
6. transmethylation reactions in the synthesis of adrenaline, creatine, choline, DNA methylation , neutralization of foreign compounds and hormones.
7. Metabolism of phenylalanine and tyrosine, hereditary diseases in children.

CPC:1. Deficiency of folic acid. Bactericidal *action of sulfanilamide preparations.* *2. Hereditary diseases of amino acid metabolism.**3. Types of hyperammonemia, clinical significance in diagnosis.* | 4 |
| 14 | December 4-9, 2023 | **Nucleotide exchange**1. Digestion of nucleoproteins. Functions of nucleotides.
2. Synthesis and breakdown of purine nucleotides, regulation.
3. Primary and secondary hyperuricemia, gout and its treatment with allopurinol.
4. Synthesis and decay of pyrimidine nucleotides, regulation.
5. Synthesis of deoxyribonucleotides, the role of thioredoxin.
6. Age-related features of nucleotide metabolism, diseases associated with impaired nucleotide metabolism.

CPC:1. Hyperuricemia: gout, xanthinuria, Lesch Nyhan syndrome, acquired hyperuricemia.
2. Formation of urate stones in the kidneys, principles of treatment.
3. Orotaciduria , causes, treatment with uridine .
 | 2 |
| 15 | December 11-16, 2023 | **Relationship between the metabolism of carbohydrates, lipids and amino acids**1. General scheme of catabolism of proteins, carbohydrates and lipids.
2. The fate of nitrogen-free amino acid residues, glycogenic and ketogenic amino acids.
3. Formation of glucose from amino acids and glycerin .
4. Synthesis of amino acids from lipids and carbohydrates.
5. Influence of insulin and cortisol on the metabolism of carbohydrates, lipids and proteins.
6. Metabolic disorders of carbohydrates, lipids and proteins in diabetes mellitus and starvation .

*CPC:*1. *Diabetes.*
2. *metabolic syndrome*
3. *Starvation.*
 | 4 |
| INTERMEDIATE CONTROL OF THE III SEMESTER . |
| **Total** | **48** |

Note: italics - laboratory studies and student's independent work

Head of the Department of Medical

and biological chemistry, candidate of medical sciences, associate professor D.Kh. Tursunov

Responsible for the educational process: M.S. Khaitov

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**"\_\_\_\_" \_\_\_\_\_\_\_\_\_\_\_\_\_\_2023**

**Dean of the International Faculty D.Kh. Tursunov**

**CALENDAR AND THEME PLAN**

for 20 23 -202 4 academic year

Department: Medical and Biological Chemistry

Subject: Biochemistry

Faculty: Therapeutic, medical and preventive

Course: 2 semester: I V

Number of allocated hours for this semester: 120

Lectures -12 hours

Practical training - 38 hours

Laboratory classes - 10 hours

Independent education - 6 0 hours

Lecture classes

|  |  |  |  |
| --- | --- | --- | --- |
| No. | date | Title of the topic and issues covered | Watch |
| 1 | February 5-10, 2024 | **Molecular biology.**1. Physico-chemical mechanisms of gene formation (Watson and Crick model).
2. Synthesis of DNA (replication).
3. Transcription, to ovalence modification of mRNA .
4. Genetic code
5. The main components of the protein synthesis system. Post-translational modification of the polypeptide chain .
6. Inhibitors of matrix biosynthetic processes.
7. Regulation of gene expression in prokaryotes and eukaryotes.
8. Mechanisms of genetic variability. Protein polymorphism, clinical significance
 | 2 |
| 2 | February 19-24, 2024 | **Mutations and carcinogenesis**1. DNA damage, mutation and repair.
2. hereditary diseases.
3. Application of DNA technologies in medicine.
4. Apoptosis.
5. Molecular mutations: substitution, deletion, inclusion of nucleotides.
6. Biochemical features of tumor cells.
7. Oncogenes, proto-oncogenes and suppressor genes.
8. Molecular mechanisms of neoplastic transformation.
9. invasion and metastasis. Diagnosis and basic principles of treatment of tumor diseases.
 | 2 |
| 3 | February 26-March 2, 2024 | **Biochemistry of blood and lymphatic system**1. The main functions of blood and the chemical composition of plasma.
2. Blood enzymes. kinin system. Acute phase proteins
3. The role of albumin in the distribution of water, the mechanism of edema development.
4. Features of the metabolism of phagocytic cells.
5. Maturation of erythrocytes, features of the structure and chemical composition, metabolic processes in erythrocytes.
6. Hemoglobin, oxyhemoglobin, carboxyhemoglobin, methemoglobin.
7. Transport of oxygen and carbon dioxide in the blood.
8. Iron exchange. Heme synthesis
9. Diseases of the hematopoietic system: anemia, porphyria, hemophilia
 | 2 |
| 4 | March 11-16, 2024 | **Biochemistry of the muscular and hematopoietic system**1. Major myofibrillar proteins: myosin, actin, actomyosin, tropomyosin, troponin.
2. Biochemical mechanisms of muscle contraction and relaxation.
3. Sarcoplasmic proteins: myoglobin, structure and functions.
4. Muscle extracts
5. Features of energy metabolism in muscles: creatine phosphate
6. Bichemical changes in muscular dystrophy and denervation.
7. Biochemical characteristics of the heart muscle, normal metabolic, physiological and regulatory processes. Secretory function of the heart muscle (eg, natriuretic peptides)
8. Endothelium and its features
 | 2 |
| 5 | April 1-6, 2024 | **Biochemistry of the gastrointestinal tract.**1. The chemical composition and functions of saliva, gastric juice, pancreatic juice, intestines and bile, their participation in metabolism. Regulation of the secretions of the gastrointestinal tract.
2. Synthetic and metabolic functions of the liver, gallbladder and bile ducts.
3. The role of the liver in the metabolism of carbohydrates, lipids and amino acids.
4. Synthesis of plasma proteins in the liver.
5. Neutralization of bilirubin. Direct and indirect bilirubin.
6. Jaundice and its laboratory diagnosis.
7. Syndromes of liver damage: cytolysis, cholestasis, mesenzymal inflammation and hepatocellular insufficiency.
8. Biochemical mechanisms of development of hepatic coma.
9. Neutralization of xenobiotics
 | 2 |
| 6 | April 15-20, 2024 | **Biochemistry of the endocrine system**1. Hierarchy of regulatory systems.2. Metabolism, levels of its control.3. The relationship of the endocrine and nervous systems.4. Changes in the concentration of hormones in the blood.5. Formation, transport and metabolism of hormones.6. Changes in the endocrine system in pathology. Hereditary/congenital metabolic disorders (eg, adrenal hyperplasia, diabetes).7. Metabolic disorders of control processes. Molecular mechanisms of endemic goiter and methods of its prevention. | 2 |
| **Total** | **12** |

Practical and laboratory classes

|  |  |  |  |
| --- | --- | --- | --- |
| No. | date | Title of the topic and issues covered | Watch |
| 1 | 5- 1 0 February 2024 | **Molecular biology. Gene expression: DNA structure, replication, transcription.**1. Physicochemical mechanisms of gene formation (Watson and Crick model).
2. DNA and heredity.
3. Replication and phases of the cell cycle.
4. Synthesis of DNA (replication): DNA polymerase; formation of genetic information by the sequence of nucleotides in a polynucleotide chain.
5. Post-replicative changes in the DNA molecule: methylation, telomerization and repair.
6. Structure and formation of a gene in chromosomes in prokaryotes and eukaryotes.
7. Recombination, transposons , plasmids and bacteriophages.
8. Transcription, covalent modification of mRNA.
9. Post-transcriptional changes in the RNA molecule.

*CPC:**1. Application of recombinant DNA in medicine.**2. Molecular mechanisms of antiviral and antitumor effects of drugs.**3. PCR diagnostics* | 2 |
| 2 | February 12-17, 2024 | **Broadcast. Regulation of gene metabolism**1. The genetic code and its composition .
2. The main components of the protein synthesis system.
3. Synthesis of the polypeptide chain in ribosomes. Post-translational modification of the polypeptide chain .
4. Inhibitors of matrix biosynthetic processes.
5. Regulation of gene expression in prokaryotes and eukaryotes.
6. Protein synthesis inhibitors.
7. Regulation of gene action and cellular differentiation in multicellular organisms, their role in ontogeny.

CPC:1. Protein synthesis inhibitors (drugs, bacterial toxins).2. Regulation of gene action and cell differentiation. | 4 |
| 3 | 19-24 February 202 4 years | **Cell biology (apoptosis and necrosis). Fundamentals of gene therapy.**1. DNA damage, mutation and repair.
2. Mechanisms of genetic variability.
3. Molecular mutations: substitution, deletion, inclusion of nucleotides.
4. hereditary diseases.
5. Application of DNA technologies in medicine.
6. Apoptosis.
7. Fundamentals of gene therapy.

*CPC:*1. *Clones, cloning and clinical significance.*
 | 2 |
| 4 | February 26 - March 2 , 2024 | **Oncogenesis.**1. Chemical carcinogenesis .
2. Biochemical features of tumor cells.
3. Oncogenes, proto-oncogenes and suppressor genes.
4. Molecular mechanisms of neoplastic transformation. Multistage theory of carcinogenesis.
5. invasion and metastasis.
6. Diagnosis and basic principles of treatment of tumor diseases.

*SRS:*1. *The role of tobacco benzo(a)pyrene in the development of neoplastic processes in the lungs.*
2. *Multiresistance of tumor cells to chemotherapy drugs.*
3. *Cytochrome P450 polymorphism and chemical carcinogenesis* .
 | 2 |
| 5 | March 4-9, 2024 |  ***Blood composition, plasma proteins, biochemistry of the lymphoreticular system.***1. *The main functions of blood and the chemical composition of plasma.*
2. *Proteins and enzymes of blood plasma . Proteins of the “Acute phase”.*
3. *The role of albumin in the distribution of water, the mechanism of edema development.*
4. *Formation of hematopoietic cells, functions, features of bone marrow cells.*
5. *RBC maturation, heme synthesis and its regulation.*
6. *Features of metabolic processes in erythrocytes.*
7. *Hemoglobin, oxyhemoglobin, carboxyhemoglobin, methemoglobin.*
8. *Transport of oxygen and carbon dioxide in the blood.*
9. *Lymphoreticular system, formation, functions and significance.*
10. *Basic functions of the immune system, chemical composition of lymph, age-related features.*
11. *Features of the metabolism of phagocytic cells.*

***Lab: Determination of serum albumin content blood.****CPC:*1. *Types and causes of anemia. Biochemical mechanisms of anemia development*
2. *Features of leukocyte metabolism*
 | 4 |
| 6 | 1 1 -16 March 2024 | **Iron exchange. Hemostasis**1. Iron exchange.
2. Buffer system of blood.
3. Hemostasis: Vascular-platelet hemostasis and coagulation hemostasis

4. Modern cellular theory of hemostasis, its stages (initiation, strengthening, distribution).1. The role of vitamin K in blood coagulation and fibrinolysis .

5. The value of vitamin K in the processes of blood coagulation and fibrinolysis.6. Blood coagulation systems. The Importance of Endothelial Factors7. Fibrinolytic and antifibrinolytic systems.*CPC:*1. *Mechanisms of development of respiratory and metabolic acidosis and alkalosis, diagnostic methods.*
2. *Hereditary diseases of blood coagulation.*
3. *Hereditary and acquired thrombocytopathy and thrombocytopenia.*
 | 2 |
| 7 | March 18-23, 2024 | **Biochemistry of connective tissue**1. Intercellular matrix, its composition and functions
2. Features of the amino acid composition of collagen, primary and spatial conformations of collagen.
3. Types of collagen, features of their structure and function.
4. biosynthesis of collagen. The role of vitamin C in the hydroxylation of lysine and proline , a manifestation of beriberi. Formation of collagen fibers.
5. collagen catabolism . regulation of collagen metabolism.
6. Diseases associated with impaired synthesis and breakdown of collagen.
7. Elastin, its structure, synthesis and catabolism.
8. Biological functions of glycosaminoglycans and proteoglycans (structural, protective, mechanical, binding, etc.).

*CPC:**1. Collagenoses , pathogenesis and diagnosis .**2. Use of glycosaminoglycans in medicine.* | 4 |
| 8 | 25-30- March 2024 \_ | **Biochemistry of the heart and muscles****1.** The peculiarity and differences in the structure of cardiomyocytes and vascular smooth muscles, the main proteins and the molecular structure of myofibrils.2. Biochemical mechanism of contraction and relaxation of cardiomyocytes and vascular smooth muscles, their differences, as well as the fact that contraction and relaxation are energy-intensive processes.3. Significance of the gradient of monovalent ions and calcium ions in the regulation of cardiomyocyte contraction and vascular smooth muscle.4. Extractive substances of muscle tissue, features of energy metabolism in muscles. Creatine phosphate. Causes of creatinuria in children.5. Biochemical features of the heart muscle, normal metabolic, physiological and regulatory processes.*6.* Diagnostic value of cardioselective proteins and enzymes.7. Secretory functions of the heart muscle (on the example of the natriuretic peptide of cells).8. Secretory activity of the endothelium, the significance of endothelial factors in the occurrence of cardiovascular diseases *.**CPC:*1. *Isoforms of creatine phosphokinase and the clinical significance of their determination.*
2. *Myopathies. Muscle denervation*
3. *3. Early and late biochemical diagnosis of myocardial infarction.*
 | 4 |
| 9 | April 1-6, 2024 | **Biochemistry of the gastrointestinal tract.**1. Composition and functions of saliva.2. Biochemical basis of taste. Biochemical control of appetite and hunger.3. Mechanism of hydrochloric acid synthesis, composition and significance of gastric juice.4. Composition and significance of pancreatic juice.5. Composition and importance of bile.6. Composition and functions of the intestinal fluid.7. Absorption of decay products of organic substances, water and salts in the intestine, its disorders.*CPC:*1. *Biochemical fundamentals of pancreatitis development, principles of diagnosis and treatment.*
2. *Malabsorption of waste products in the small intestine (celiac disease).*
3. *Functions of the large intestine, biochemical basis for the development of ulcerative colitis, Crohn's disease and familial polyposis.*
4. *The mechanism of action of drugs used for diarrhea and constipation.*
 | 2 |
| 10 | 8- 1 3 April 2024 | ***Biochemistry of the liver***1. *The role of the liver in the metabolism of carbohydrates, lipids, blocks and amino acids, age-related features.*
2. *Metabolism \_ hema , icterus and its types. Physiological and pathological jaundice in newborns.*
3. *Syndromes of liver damage: cytolysis, cholestasis, mesenzymal inflammation and hepatocellular insufficiency.*
4. *Biochemical mechanisms of development of hepatic coma.*

***Practical work: determination of bilirubin content in blood serum.****CPC:*1. *Differential diagnosis of jaundice.*
2. *Biochemical mechanisms of development of hepatic cell failure and hepatic coma, diagnostic methods.*
 | 4 |
| eleven | 1 5 -20 April 2024 | **Neutralization of toxic substances in the liver.***1.* Mechanisms of detoxification of toxic substances: microsomal oxidation, conjugation reactions.2. Detoxification of the liver from toxic products of amino acid metabolism (putrefaction) in the colon.3. Detoxification of normal metabolites, hormones and other substances in the liver, age-related features.4. Biotransformation of drugs, factors affecting it.5. Detoxification of ethanol in the liver.*CPC:*1. *Clinical application of inducers and inhibitors of cytochrome P450.*
2. *Polymorphism of the cytochrome P450 gene, the basis for the personification of treatment.*
3. *ethanol metabolism. Isoforms of the enzyme ALDH*
 | 2 |
| 12 | 22 - 27 April 2024 | **Biochemistry of physiologically active substances and the endocrine system**1. Physiologically active compounds, classification.
2. Physiologically active compounds of peptide nature (cytokines, growth factors, etc.).
3. Physiologically active compounds of amino acid nature, functions.

4. General aspects of management and hierarchy of management systems. The hypothalamic-pituitary system.1. Classification of hormones by chemical nature, biological functions and signal transmission mechanism.
2. The relationship of the endocrine and nervous systems, age-related features.
3. Synthesis and catabolism of steroid hormones.
4. Mechanism of action of sex hormones.

*CPC:*1. *Inactivation of hormones in the liver, clinical significance .*
 | 4 |
| 13 | April 29-May 4, 2024 | **regulation of metabolism. Functions of peripheral glands and their disorders**1. Management of the metabolism of carbohydrates, fats and amino acids by hormones, its dependence on age.2. Thyroid hormones, the effect of their deficiency on the growth and development of the body.3. Management of calcium-phosphate metabolism, causes of rickets in children.4. Management of water-salt metabolism, its dependence on age.5. Hormones of local action.*CPC:**1. Biochemical mechanisms of development of the metabolic syndrome and its complications .**2. Pathogenesis of endemic goiter and hypothyroidism, principles of treatment.* | 4 |
| 14 | May 6-11, 2024 | ***Biochemistry of the kidneys***1. *Mechanism of urine formation.*
2. *The role of the kidneys in maintaining acid-base balance.*
3. *The main functions of the kidneys are: filtration, reabsorption, secretion.*
4. *Features of metabolism in the kidneys in normal and pathological conditions .*
5. *General properties of urine, age features.*
6. *Chemical composition of urine.*
7. *Pathological components of urine.*

***Laboratory work: determination of normal and pathological components of urine using test strips in a urine analyzer.****SRS:*1. *The role of the kidneys in the regulation of calcium, phosphates and biocarbonates*
2. *Features of energy metabolism in the kidneys*
3. *Biochemical basis for the prevention of kidney stones*
 | 4 |
| 15 | May 13 -18 , 2024 | **Biochemistry of the central and peripheral nervous system.**1. Features of the functioning of the nervous system.
2. Structural components of tissues of the central and peripheral nervous system.
3. Features of metabolic processes in the cells of the nervous system.
4. Protein and lipid composition of the tissues of the nervous system.
5. Features of energy metabolism in the tissues of the central and peripheral nervous system.
6. Biochemical features of neurocytes and neuroglia.
7. Functional biochemistry of the nervous system : signal transmission through synapses , mediators .
8. Biochemistry of sensory systems.

SRS:*1. Biochemical foundations of the activity of sensory systems.**2. Biochemical basis of taste perception.**3. Biochemical ways to determine the mechanisms of diseases of the psyche and nervous system.* | 4 |
| INTERMEDIATE AND FINAL CONTROL FOR THE IV SEMESTER . |
| **Total** | **48** |

Note: italics – laboratory classes and independent student work

Head of the Department of Medicine

and biological chemistry, candidate of medical sciences, associate professor D.Kh. Tursunov

Responsible for the educational process: M.S.Khayitov