**CALENDAR PLAN OF PRACTICAL EXERCISES IN BIOLOGICAL CHEMISTRY FOR 2020-2021 ACADEMIC YEAR FOR PEDIATRIC, MEDICAL-PEDAGOGICAL AND MEDICAL FACILITIES**

**III semester**

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| **No.** | **Date** | **The name of the laboratory work and its content.** | **Laboratory work for practical exercises in biochemistry.** |
|  |  | **DYNAMIC BIOCHEMISTRY**  **Topic: Subject and tasks of biochemistry. Metabolism.- 2h.**   Subject and tasks of biochemistry.   Familiarization with safety precautions   Familiarization with the provision of first aid.   Introduction to metabolism. Nutrition as an integral part of metabolism. Metabolic stages (digestion, absorption, intermediate exchange, excretion of end products).   Replaceable and irreplaceable food components.   Anabolism and catabolism. The concept of metabolism. |  |
|  |  | **Topic: Biomembranes, their functions and structure. Membrane receptors. Pathways of signal transmission into the cell. - 2h.**   Biomembranes, their functions and structure.   Transmembrane transport of substances. (diffusion, facilitated diffusion, active transport, symptom, antiport).   Membrane receptors. Signal transmission pathways into the cell. |  |
|  |  | **Theme. Biochemistry of milk. - 2h.**   Regulation of lactation, milk formation.   Composition of milk and its meaning.   Significance of colostrum.   Milk intolerance (lactosemia).   Determination of specific gravity of milk.   Determination of acidity of milk. | Laboratory work: Determination of the specific gravity of milk.  Determination of the acidity of milk. |
|  |  | **EXCHANGE OF ENERGY.**  **Topic. Energy exchange. - 2h.**   Energy exchange. The concept of biological oxidation.   Enzymes of biological oxidation.   Respiratory chain as the main pathway for the formation of ATP in the body.   Redox potential of electron carriers. |  |
|  |  | **EXCHANGE OF ENERGY.**  **Topic: Biological oxidation. Oxidative phosphorylation. Regulation of biological oxidation. - 2h.**   Phosphorylation of ADP (substrate and oxidative phosphorylation).   Respiratory control.   Phosphorylation coefficient.   Mechanism of oxidative phosphorylation.   Respiratory chain inhibitors and oxidation and phosphorylation uncouplers. |  |
|  |  | **EXCHANGE OF ENERGY.**  **Topic: General pathways of catabolism. - 2h.**   Significance of catabolism. Stages of catabolism   Oxidative decarboxylation of pyruvic acid, pyruvate dehydrogenase multienzyme system.   Krebs cycle, its regulation and function. |  |
|  |  | **EXCHANGE OF CARBOHYDRATES**  **Topic: The exchange of carbohydrates. Digestion, absorption of carbohydrates, synthesis and breakdown of glycogen. - 2 h.**   The main carbohydrates of food, the body. The value of carbohydrates for the body.   Digestion, absorption of carbohydrates.   The fate of the absorbed monosaccharides.   Synthesis and breakdown of glycogen, their regulation.   Phosphorylated and dephosphorylated forms of glycogen synthetase and phosphorylase (cascade mechanism of glycogen phosphorylase activation). |  |
|  |  | **EXCHANGE OF CARBOHYDRATES**  **Topic: Laboratory work: Quantitative determination of glucose in the blood by the glucose oxidase method (discussion of the theoretical part). - 2h.**  - Glycogenic diseases (glycogenoses and aglycogenoses), methods of their diagnosis.  - Lab. work: Quantitative determination of glucose in blood by glucose oxidase method (discussion of the theoretical part) | Laboratory work: Quantitative determination of glucose in blood by glucose oxidase method (manual) |
|  |  | EXCHANGE OF CARBOHYDRATES  Topic: Laboratory work: Quantitative determination of glucose in the blood by the glucose oxidase method (carrying out the practical part). - 2h. |  |
|  |  | **EXCHANGE OF CARBOHYDRATES**  **Topic: Glycolysis and its physiological significance, glucose biosynthesis, regulation of glycolysis and gluconeogenesis. - 2h.**   Anaerobic glycolysis, its distribution and significance.   Aerobic glycolysis is the main pathway of glucose catabolism and its physiological significance.   Shuttle mechanism of hydrogen transfer from the cytosol to mitochondria ..   Glycogenolysis.   Gluconeogenesis. Corey cycle, glycose-alanine cycle.   Key enzymes of glycolysis and gluconeogenesis and their regulation. |  |
|  |  | **EXCHANGE OF CARBOHYDRATES**  **Topic: Metabolism of fructose, galactose, hormonal regulation of carbohydrate metabolism. Pentose phosphate pathway glucose oxidation. - 2 h.**   Exchange of fructose and galactose. Hereditary fructosemia and galactosemia.   Pentose phosphate pathway of glucose oxidation and its significance.   Regulation of blood sugar, biochemistry of diabetes.   The effect of sugar load on blood sugar levels. |  |
|  |  | **EXCHANGE OF LIPIDS**  **Topic: Lipid metabolism and function, lipid digestion and absorption. - 2h**   Lipid composition of food, body tissues, their structure and function.   Digestion absorption of lipids.   Resynthesis of fats in the intestinal wall.   Bile acids, their role in the digestion and absorption of lipids.   Blood lipoproteins, their types, the role of lipoproteins in lipid transport.   Cascade mechanism of tissue lipase activation.   Oxidation of fatty acids and their physiological significance. |  |
|  |  | **EXCHANGE OF LIPIDS**  **Topic: Intermediate lipid metabolism. – 2 h**   Biosynthesis of fatty acids and its regulation.   Reservation and mobilization of fats, their regulation.  Synthesis and use of ketone bodies. |  |
|  |  | EXCHANGE OF LIPIDS  Topic: Exchange of complex lipids. - 2h.   Sterols and steroids. Cholesterol and its biological functions in the body.   Cholesterol biosynthesis, significance and regulation.   Transport of cholesterol in the blood and the importance of the enzyme LCAT in the transport of cholesterol. |  |
|  |  | EXCHANGE OF LIPIDS  Topic: Lipid metabolism disorders. - 2h.   Hyperlipidemia, obesity, sphingolipidosis, ketonemia, ketonuria biochemical basis of their development and treatment.   Cholelithiasis, biochemical bases of their development and treatment   Atherosclerosis biochemical basis of their development and treatment |  |
|  |  | PROTEIN EXCHANGE  Topic: Laboratory work: Method for determining the activity of aspartate aminotransferase and alanine aminotransferase in blood serum  (discussion of the theoretical part). Protein metabolism, digestion and absorption of proteins. –2h   Nitrogen balance and biological value of proteins.   Absorption and digestion of proteins in the gastrointestinal tract.   Normal and pathological gastric juice (according to T.L. Alenikova "Guide to practical exercises in biochemistry" pp. 160-165. Laboratory work No. 88.89)   Transamination, transaminases.  Coenzyme function of vitamin B6 | Laboratory work: Method for determining the activity of aspartate aminotransferase and alanine amine transferase in  serum.  (training manual) |
|  |  | Topic: Laboratory work: Methods for determining the activity of aspartate aminotransferase and alanine aminotransferase in blood serum (carrying out the practical part) – 2 h |  |
| 18. |  | PROTEIN EXCHANGE  Topic: General ways of amino acid metabolism. – 2 h.   Deamination of amino acids. Direct and indirect deamination.   Decarboxylation of amino acids, functions of biogenic amines and ways of their neutralization.   The role of histamine in the development of allergic and inflammatory processes. Antihistamines |  |
| Total: | |  | **36 hours** |

**Head of the Department, Professor Yuldashev N.M.**

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IV SEMESTER

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| No | Date |  | **Laboratory works** |
| 1. |  | PROTEIN EXCHANGE  Topic: Exchange of individual amino acids. –3h.  1. Exchange of glycine, methionine. Transmethylation.  2. Participation of methionine, folic acid and vitamin B12 in transmethylation reactions.  3. The importance of transmethylation in the synthesis of adrenaline, creatine, choline, DNA and the neutralization of foreign substances and hormones.  4. Exchange of phenylalanine and tyrosine.  5. Hereditary diseases of amino acid metabolism (phenylketuria, alkaptonuria, albinism, histidinemia, homocystinuria). |  |
| 2. |  | PROTEIN EXCHANGE  Topic: Laboratory work: Methods for the quantitative determination of urea in blood serum and urine by the enzymatic method. Ways to neutralize ammonia. - 4h.  1. Ways to neutralize ammonia. Synthesis of urea (ornithine cycle) and its relationship with transamination reactions  2. Violation of the excretion of urea from the body. Hyperammonemia, its causes and consequences. | Laboratory work: Technique for the quantitative determination of urea in blood serum and urine by the enzymatic method (manual) |
| 3. |  | EXCHANGE OF NUCLEOPROTHEIDS  Topic: Exchange of nucleoproteins. –3h.  1. Digestion and absorption of nucleoproteins.  2. Synthesis and degradation of purine nucleotides.  3. Primary and secondary hyperuricemia, gout and its treatment with allopurinol.  4. Synthesis of pyrimidine nucleotides.  5. Orotaciduria, its causes and mechanism of treatment with uridine. |  |
| 4 |  | MOLECULAR BIOLOGY  Topic: Molecular biology. Gene expression. The structure and biosynthesis of nucleic acids. Replication. - 3h  1. The structure of chromatin, ribosomes, nucleosomes and their importance in protein biosynthesis.  2. DNA and heredity, DNA biosynthesis (replication is a way of transferring genetic information). Replication steps. |  |
| 5. |  | MOLECULAR BIOLOGY  Topic: Molecular biology. Gene expression. The structure and biosynthesis of nucleic acids. Transcription. - 3h  1. RNA biosynthesis (transcription). Transcription as a way of forming DNA information in the form of RNA.  2. Acquaintance with the method of polymerase chain reaction (PCR). |  |
| 6. |  | MOLECULAR BIOLOGY  Topic: DNA damage and repair. Molecular mutations. -3h  1. DNA damage and repair  2. Apoptosis.  3. Molecular and chromosomal mutations (missense, deletion, nonsense, Down syndrome), the mechanism of their occurrence and repair.  4. Mutations of protein metabolism (hemoglobinopathy, familial hypercholesterolemia).  5. Autosomal recessive mutations (eg, phenylketonuria, hemoglobinopathy, thalassemia), and associated with the X chromosome (eg, Duchenne muscular dystrophy, hemophilia). |  |
| 7. |  | MOLECULAR BIOLOGY  Topic: Stages of protein biosynthesis. - 3h  1. Genetic code and its composition.  2. Stages of protein biosynthesis (initiation, elongation, termination.).  3. Adaptive function of tRNA.  4. Post-translational changes in proteins.  5. Inhibitors of protein synthesis.  6. Regulation of genes. The concept of an operon. |  |
| 8. |  | FUNCTIONAL BIOCHEMISTRY  Topic: Blood biochemistry. –3h.  1. The main functions of blood and their chemical composition.  2. Plasma proteins and their functions, determination of blood serum proteins by electrophoresis (albumin, globulins, transport proteins). The role of albumin in the distribution of water in the body. The mechanism of development of edema and shock.  3. Blood plasma enzymes (secretory, indicator and excretory).  4. Iron exchange, ferritin a**nd transferrin.** |  |
| 9. |  | FUNCTIONAL BIOCHEMISTRY  Topic: Blood biochemistry (continued). –3h.  1. Synthesis of hemoglobin and its regulation.  2. Blood coagulation system. The value of vitamin K in blood clotting.  3. The anticoagulant system of the blood. |  |
| 10. |  | FUNCTIONAL BIOCHEMISTRY  Topic: Laboratory work: determination of hemoglobin by photometric hemiglobin-cyanide method.-4 h. | Determination of hemoglobin by photometric hemiglobincyanide method  (Manual) |
| 11. |  | FUNCTIONAL BIOCHEMISTRY  Topic: Biochemistry of the liver. Neutralization of toxic substances in the body. –3h.  1. Ways to neutralize metabolites and foreign substances in the liver.  2. Microsomal oxidation and reactions  conjugation in the liver.  OB on topics: protein metabolism, nucleoprotein metabolism, molecular biology, blood biochemistry. |  |
| 12. |  | FUNCTIONAL BIOCHEMISTRY  Topic: Liver biochemistry (continued). –3h.  1. The role of the liver in carbohydrate metabolism.  2. The role of the liver in lipid metabolism.  3. The role of the liver in protein metabolism. |  |
| 13. |  | FUNCTIONAL BIOCHEMISTRY  Topic: Biochemistry of the liver.  Laboratory work: determination of bilirubin in blood serum. –4 hours.  1. Metabolism of heme, yellowness and its varieties. | Laboratory work: determination of bilirubin in blood serum (Manual). |
| 14. |  | FUNCTIONAL BIOCHEMISTRY  BIOCHEMISTRY OF THE ENDOCRINE SYSTEM  Topic: Regulation of metabolism and functions by hormones. - 3h.  1. General mechanisms of regulation, the hierarchy of regulatory systems.  2. The chemical nature of hormones, classification by biological functions and mechanism of action.  3. The relationship of the endocrine and nervous systems (hormones of the hypothalamus and pituitary gland).  4. Thyroid hormones.  5. Hormones of the adrenal cortex: gluco- and mineralocorticoids. |  |
| 15. |  | **FUNCTIONAL BIOCHEMISTRY**  **BIOCHEMISTRY OF THE ENDOCRINE SYSTEM**  **Topic: Regulation of metabolism and functions by hormones. –3h.**  1. Regulation of the metabolism of carbohydrates, lipids, amino acids by hormones.  2. Regulation of calcium and phosphate metabolism.  3. Regulation of water-salt metabolism.  4. Regulation of the reproductive system.  5. Local hormones: kinins, prostaglandins. |  |
| 16. |  | **FUNCTIONAL BIOCHEMISTRY**  **Topic: Biochemistry of urine. -3h**  1. The mechanism of urine formation.  2. Features of metabolism in the kidneys at  3. normal and pathological conditions.  4. Chemical composition and general properties of urine.  5. Pathological composition of urine.  6. Analysis of urine using PHAN test strips. |  |
| 17. |  | FUNCTIONAL BIOCHEMISTRY  Topic: Biochemistry of muscles and connective tissue-3h.  1. Basic proteins of myofibrils and their structure. Biochemical mechanisms of muscle contraction and relaxation.  2. Creatine phosphate and its meaning.  3. Biochemical changes in muscular dystrophies, creatinuria.  4. Collagen and elastin, their amino acid composition.  5. The role of ascorbic acid in the hydroxylation of lysine and proline. Avitaminosis C.  6. Glucosamines and proteoglycanlar, their significance and functions (supporting, protective, mechanical, binding, regulatory).  7. Oxyprolinuria in collagenoses. |  |
|  |  | **TOTAL** | **54 hours** |

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