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**BioCHEMISTRY EXAMINATION Syllabus**

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| **No** | **Themes** |
| 1 | PROTEINS – STRUCTURE AND FUNCTION.  Levels of the protein structure organization. Structure-function relationships in proteins. Globular proteins. Myoglobin and hemoglobin: structure, oxygen-binding. Allosteric effects of the affinity of hemoglobin to the oxygen. Hemoglobin variants and Hemoglobinopathies. Fibrous proteins. Collagen: structure, biosynthesis. Collagen diseases. Structure of Elastin. Role of α1-antitrypsin in elastin degradation. |
| 2 | ENZYMES.  Classification and nomenclature. Cofactors for the transport of electrons and protons. Cofactors for the transport of groups. Vitamins. Water-soluble vitamins: biologically active forms. Factors affecting reaction velocity: Effects of enzyme and substrate concentrations, рН and temperature to the speed of enzyme reaction. Regulation of enzyme activity. Inhibition of enzyme activity: reversible and irreversible. Allosteric enzymes. Isoenzymes. Enzymes in clinical diagnosis. |
| 3 | BIOENERGETICS AND BIOLOGICAL OXIDATION  Free energy. Standard free energy. Biological systems as open systems. High-energy compounds. ATP central role in the cell bioenergetics. Mitochondrial electron-transport (respiratory) chain. Synthesis of ATP by oxidative phosphorylation. Chemiosmotic hypothesis. Uncoupling agents. Inhibitors of the electron transport. Others electron-transport chains. Extra-mitochondrial oxidation. Oxidation in peroxisomes and endoplasmic reticulum. Cytochrome P450. Desaturase system. Free-radical oxidation. Antioxidant systems. |
| 4 | METABOLISM  Regulation. General principles of the cell-cell communication. |
| 5 | Carbohydrate metabolism.  Digestion and absorption of carbohydrates. Glycolysis. Substrate phosphorylation. Glycolysis under anaerobic conditions. Energy yield. Regulation. Glycolysis under aerobic conditions. Oxidative decarboxylation of pyruvate: pyruvate dehydrogenase complex. Regulation. Tricarboxylic Acid Cycle. Regulation. Shuttle mechanisms for the hydrogen transport in mitochondria. Pentose phosphate pathway of glucose degradation. Biological importance. Role of NADPH. Gluconeogenesis. Regulation. Enzyme defects in glycolysis and gluconeogenesis. Glycogenolysis and glycogenesis. Regulation. Glycogenogenoses. Blood glucose. Regulation by hormones. Hyperglycemia and hypoglycaemia. Fructose and galactose metabolism. Disturbances. Lactose synthesis. Glycoproteins and glucosaminoglycans. |
| 6 | LIPID METABOLISM.  Digestion and absorption of lipids. Transport forms of lipids in blood. Lipoproteins – metabolism. Lipolysis and lipogenesis. Regulation. Fatty acids – optimal source of energy. Ketogenesis and ketolysis. Ketoacidosis.  Biosynthesis of fatty acids. Cholesterol metabolism. Regulation. Importance of LDL and HDL for the cholesterol metabolism. Cholesterol as a source for compounds with important biological functions. Bile acids and bile salts. Enterohepatic circulation of bile acids. Steroid hormones. |
| 7 | PHOSPHOLIPIDS.  Phosphoglycerides and glycosphingolipids: forms, biosynthesis and degradation. Biological role. Eicosanoids. |
| 8 | PROTEINS. AMINO ACIDS metabolism.  Degradation of proteins. Intracellular degradation of proteins. Digestion of proteins. Absorption of amino acids. Catabolism of amino acids. Fate of amino acid nitrogen. Nitrogen metabolism products. Toxicity of ammonia and ways of disposal. Biosynthesis of urea. Decarboxylation of α-amino acids. Biogenic amines. Polyamines. Catabolism of the carbon skeleton of amino acids. Degradation of glucogenic and ketogenic and mixed type amino acids. Role of folic acid in amino acid metabolism. Metabolic defects in amino acid metabolism. Branched-chain amino acids metabolism. Conversion of amino acids to specialized products. Catecholamines. Thyroid hormones.Heme biosynthesis and degradation. Porphyrias and porphyrinurias. Bile pigments: Bilirubin metabolism. Jaundice. |
| 9 | NUCLEOTIDE METABOLISM.  Metabolism of purine nucleotides. Hyperuricaemia. Metabolism of pyrimidine nucleotides. Biosynthesis of 2′-Deoxyribonucleotides and thymidine triphosphate. |
| 10 | metabolism integration.  Well-fed and fasting state metabolism. Insulin and Glucagon. Diabetes Mellitus. |
| 11 | Nutrition.  Macro- and micronutrients. Calcium metabolism. Hormone regulation of the Ca2+ metabolism: parathyroid hormone, calcitonin. Iron metabolism. Metabolism of xenobiotics. Food additives and functional foods. |
| 12 | cell-cell communication.  Signal transduction by intracellular receptors and membrane receptors. Ion channel receptors. Transmembrane receptors with formation of secondary messenger molecules. Secondary messengers – forms, effector chains. Enzyme-linked membrane receptors. |
| 13 | Molecular biology.  Replication, Trascription, Translation – regulation. Regulation of cell cycle. Oncogenes and tumor-suppressor genes. Regulation of the gene expression. |

RECOMMENDED LITERATURE

1. Devlin T. Textbook of Biochemistry with clinical correlations. 5th Edition Wiley-Liss, 5 ed. 2001.

2. Marks, D., A. Marks, C. Smith. Basic Medical Biochemistry. A clinical oriented approach. Williams and Wilkins, 1996.

3. Chample P., R. Harvey, D. Ferrier. Lippincot’s Illustrated Reviews: Biochemistry. Lippincott Williams& Wilkins, 2005.

4. Murray, R., D. Granner, P. Mayes, V. Rodwell. Harper’s Biochemistry. Lange, 23, 24 or 25 ed.

5. David L. Nelson and Michael M. Cox. Lehninger Principles of Biochemistry, Worth Publishers, New York, 3 ed., 2000.

6. Alberts B., A. Johnson, J. Lewis, and M. Raff. Molecular Biology of the Cell. Garland Science, 5, 4 or 3-rd edition, 2002, 2003 or 2007.

7. Students' own lecture notes

SIGNED:

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