

## Program

**Introduction to Biochemistry.** Acid-base reactions. Buffer solutions and blood buffers. Weak interactions.

**Carbohydrates:** Monosaccharides: classification, configuration. Derivatives of monosaccharides. Disaccharides. Polysaccharides. Glycogen, Starch, Dextran, Cellulose. Glycosaminoglycans. Glycoproteins. Proteoglycans.

**Proteins:** Amino acids: structure and classification. Stereoisomerism. acid-base properties. peptide bond. Peptides. Protein: isoelectric point. primary, secondary, tertiary, quaternary. Nature of the chemical bond stabilizing such structures. Denaturation. Folding processes and misfolding related disease (prion proteins).

**Fibrous proteins:** Collagen, structure and function. Collagenopathies

**Respiratory proteins:** Heme. Myoglobin. Hemoglobin. Oxygen binding and its regulation. Hemoglobinopathies.

**Enzymes.** Catalysis concept.. Mechanisms of catalysis. Enzyme kinetics .Michaelis-Menten equation. Factors affecting enzyme activity. Inhibition of enzyme activity. Active sites and allosteric sites. Isoenzymes. enzyme cofactors. Vitamins as precursors of cofactors. Proteolytic enzymes (serine proteases, chymotrypsin). Factors of blood coagulation.

**Lipids.** Classification. Fatty acids. neutral fats. Phospholipids. Sphingolipids. Sterols. Fat-soluble vitamins: structure and function.

**Nucleic acids.** purine and pyrimidine bases. Nucleosides. Nucleotides.

**Bioenergetics.** Principles of thermodynamics. Redox reactions. "energy-rich" bonds. ATP.

**Biological membranes.** Composition and structure. Proteins and membrane lipids. Kinetics and mechanisms of transport across membranes. active transport systems.

**Metabolism of carbohydrates.** Digestion and absorption. Aerobic and anaerobic glycolysis. Fermentations. Glycolysis and cancer cells. Warburg effect. Glycogen synthesis and glycogenolysis. Pentose phosphate cycle. Gluconeogenesis. Krebs cycle.

**Electron transport and oxidative phosphorylation.** Components of the mitochondrial electron transport chain; their organization. ATP synthase. reactive oxygen species (ROS) and antioxidant cellular systems. Mitochondrial apoptosis and cytochrome

**Lipid metabolism.** Digestion and absorption. Bile salts. Lipid transport. Lipoproteins. Biosynthesis and catabolism of fatty acids. Ketogenesis. Cholesterol biosynthesis. CYP450 and metabolism of xenobiotic compounds.

**Amino acid metabolism.** Protein digestion. Transamination. Deamination. Decarboxylation. Neurotransmitters. urea cycle. Notes on the synthesis and degradation of heme.

**Hormones.** Structure and functions. mechanisms of action. Membrane receptors and intracellular receptors. Prostaglandins, thromboxanes and leukotrienes.

**Bone and calcification.** Metabolism of calcium and phosphorus. Structure of biological apatite. Mechanism of calcification and resorption. Collagen role. Molecular mechanisms of enamel formation. Amelogenins.

**Oral environment:** Saliva and its functions: inorganic constituents, organic constituents, salivary proteins. Gingival crevicular fluid: inorganic constituents, organic constituents. biochemical basis of caries.

Suggested Text Books:

Principles of Biochemistry: Lehninger (Ed. Zanichelli) Nelson & Cox

Fundamentals of Biochemistry (Ed. Zanichelli); Voet, Voet & Pratt