

SEMESTER II : CORE COURSE - VI – METABOLISM AND REGULATION

Unit 1 Bioenergetics

Free energy and entropy. Phosphoryl group transfers and ATP. Enzymes involved in redox reactions. The electron transport chain– organization and role in electron capture. Oxidative phosphorylation- electron transfer reactions in mitochondria. F_1F_0 ATPase- structure and mechanism of action. The chemiosmotic theory. Inhibitors of respiratory chain and oxidative phosphorylation- uncouplers, ionophores. Regulation of oxidative phosphorylation. Mitochondrial transport systems- ATP/ADP exchange, malate / glycerophosphate shuttle.

Unit 2 Carbohydrate metabolism

Glycolysis and gluconeogenesis– pathway, key enzymes and co-ordinate regulation. Mechanism of pyruvate dehydrogenase multienzyme complex and the regulation of this enzyme through reversible covalent modification. The citric acid cycle and regulation. The pentose phosphate pathway. Metabolism of glycogen and regulation. Glycogen storage diseases. Blood glucose homeostasis– role of tissues and hormones.

Unit 3 Lipid metabolism

Lipogenesis. Control of acetyl CoA carboxylase. Role of hormones. Effect of diet on fatty acid biosynthesis. Regulation of biosynthesis of triacylglycerol, phospholipids and cholesterol. Metabolism of triacylglycerol during stress. α , β , γ , Oxidation of fatty acids– Role of carnitine cycle in the regulation of β -oxidation. Ketogenesis and its control. Lipoprotein metabolism exogenous and endogenous pathways.

Unit 4 Metabolism of amino acids, purines and pyrimidines

Overview of biosynthesis of nonessential amino acids. Catabolism of amino acid nitrogen– transamination, deamination, ammonia formation, the urea cycle and regulation of ureogenesis. Importance of glutamate dehydrogenase. Catabolism of carbon skeletons of amino acids– overview only. Disorders of amino acid metabolism– phenylketonuria, alkaptonuria and albinism only. Digestion and absorption of nucleoproteins, Metabolism of purines- de novo and salvage pathways for purine biosynthesis, regulation of biosynthesis of nucleotides. Purine catabolic pathway. Hyperuricemia. Metabolism of pyrimidines-biosynthesis and catabolism. Orotic aciduria.

Unit 5 Metabolic integration and hormonal regulation

Key junctions in metabolism– glucose-6-phosphate, pyruvate and acetyl CoA. Metabolic profiles of brain, muscle, liver, kidney and adipose tissue. Metabolic inter relationships in various nutritional and hormonal states– obesity, aerobic, anaerobic endurance, exercise, pregnancy, lactation, IDDM, NIDDM and starvation.

Books recommended

1. Stryer. Biochemistry. Freeman. 5th ed. 2002.
2. Murray et al. Harper's Biochemistry. 5th ed. Mc. GrawHill, 2000.
3. Nelson Cox. Lehninger's Principles of Biochemistry. 3rd ed. McMillan Worth, 2000.
4. Donald Voet, J.G. Voet, John Wiley, Biochemistry, 1995.
5. Kuchel and Ralston. Biochemistry. 2nd ed. Schaum's Outlines Mc Graw Hill, 1998.
6. Davidson and Sittman. Biochemistry NMS. 4th ed. Lippincott. Williams and Wilkins, 1999.
7. Campbell and Farrell. Biochemistry 4th ed. Brooks/Cole Pub Co. 2002.