

UNDERGRADUATE PROGRAMME IN BIOCHEMISTRY

Metabolism of Carbohydrates and Lipids

THEORY

- 1. Basic design of metabolism (3 lectures)**
Autotrophs, heterotrophs, metabolic pathways, catabolism, anabolism, ATP as energy currency, reducing power of the cell.
[Lehninger: Principles of Biochemistry (2013) Nelson and Cox, p501-504]
- 2. Glycolysis (4 lectures)**
Glycolysis - a universal pathway, reactions of glycolysis, fermentation, fates of pyruvate, feeder pathways for glycolysis, galactosemia.
[Lehninger: Principles of Biochemistry (2013) Nelson and Cox, p543-568]
- 3. Gluconeogenesis and pentose phosphate pathway (4 lectures)**
Synthesis of glucose from non-carbohydrate sources, reciprocal regulation of glycolysis and gluconeogenesis, pentose phosphate pathway and its importance.
[Lehninger: Principles of Biochemistry (2013) Nelson and Cox, p568-580, p601-612]
- 4. Glycogen metabolism (4 lectures)**
Glycogenesis and glycogenolysis, regulation of glycogen metabolism, glycogen storage diseases.
[Lehninger: Principles of Biochemistry (2013) Nelson and Cox, p612-626]
- 5. Citric acid cycle (6 lectures)**
Production of acetyl CoA, reactions of citric acid cycle, anaplerotic reactions, amphibolic role, regulation of citric acid cycle, glyoxalate pathway, coordinated regulation of glyoxalate and citric acid pathways.
[Lehninger: Principles of Biochemistry (2013) Nelson and Cox, p633-659]
- 6. Synthesis of carbohydrates (6 lectures)**
Calvin cycle, regulation of calvin cycle, regulated synthesis of starch and sucrose, photorespiration, C₄ and CAM pathways, synthesis of cell wall polysaccharides, integration of carbohydrate metabolism in plant cell.
[Lehninger: Principles of Biochemistry (2013) Nelson and Cox, p799-827]
- 7. Fatty acid oxidation (7 lectures)**
Digestion, mobilisation and transport of cholesterol and triacyl glycerols, fatty acid transport to mitochondria, β oxidation of saturated, unsaturated, odd and even numbered and branched chain fatty acids, regulation of fatty acid oxidation, peroxisomal oxidation, ω oxidation, ketone bodies metabolism, ketoacidosis.
[Lehninger: Principles of Biochemistry (2013) Nelson and Cox, p668-688, p864-874]

- 8. Fatty acid synthesis (4 lectures)**
 Fatty acid synthase complex. Synthesis of saturated, unsaturated, odd and even chain fatty acids and regulation.
[Lehninger: Principles of Biochemistry (2013) Nelson and Cox, p833-845]
- 9. Biosynthesis of eicosanoids, cholesterol, steroids and isoprenoids (4 lectures)**
 Synthesis of prostaglandins, leukotrienes and thromboxanes. Synthesis of cholesterol, regulation of cholesterol synthesis. Synthesis of steroids and isoprenoids.
[Lehninger: Principles of Biochemistry (2013) Nelson and Cox, p845-848, p859-864, p874-875; Textbook of Biochemistry with Clinical Correlations (2011) Devlin, p737-745]
- 10. Biosynthesis of membrane lipids (3 lectures)**
 Synthesis of membrane phospholipids in prokaryotes and eukaryotes, respiratory distress syndrome, biosynthesis of triacylglycerol, biosynthesis of plasmalogens, sphingolipids and glycolipids, lipid storage diseases.
[Lehninger: Principles of Biochemistry (2013) Nelson and Cox, p848-859; Textbook of Biochemistry with Clinical Correlations (2011) Devlin, p709-718, p729-737]
- 11. Starve-feed cycle (3 lectures)**
 Well-fed state, early fasting state, fasting state, early re-fed state, energy requirements, reserves and caloric homeostasis, five phases of glucose homeostasis.
[Textbook of Biochemistry with Clinical Correlations (2011) Devlin, p840-852]

Essential Readings

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13:978-1-4641-0962-1 / ISBN:10:1-4641-0962-1.
2. Textbook of Biochemistry with Clinical Correlations (2011) 7th ed., Devlin, T.M., John Wiley & Sons, Inc. (New Jersey), ISBN:978-0-470-28173-4.
3. Biochemistry (2012) 7th ed., Berg, J.M., Tymoczko, J.L. and Stryer L., W.H. Freeman and Company (New York), ISBN:10:1-4292-2936-5, ISBN:13:978-1-4292-2936-4.

PRACTICALS

1. Estimation of blood glucose.
2. Sugar fermentation of microorganisms.
3. Assay of salivary amylase.
4. Isolation of lecithin, identification by TLC, and its estimation.
5. Isolation of cholesterol from egg yolk and its estimation.