MB2PG08 - METABOLISM AND ENZYMOLOGY

Number of Hours / Week: 3 Credits: 3

UNIT 1

Metabolism of carbohydrates: Glycolytic pathway, substrate level phosphorylation, significance of the mitochondrial respiratory chain and oxidative phosphorylation, Electron transport chain: structural components of the chain, complexes, free elements; Generation of the electrochemical proton gradient: Chemiosmosis ATP synthesis: structural and functional properties of ATP synthesis; Inhibitor agents and decoupling agents of the respiratory chain and ATP synthesis; Regulation of glycolytic pathway, Etner Dudoruff pathway, Gluconeogenesis and Glycogenesis. Synthesis of bacterial peptidoglycan, Bacterial photosynthesis- photosynthetic and accessory pigments

UNIT II

Metabolism of Proteins, lipids and nucleic acids: Synthesis of amino acids, degradation, deamination, transamination, urea cycle β oxidation, synthesis of fatty acids, FAS, synthesis of cholesterol, degradation of cholesterol. Synthesis of bacterial LPS, Synthesis of purines and pyrimidines, salvage pathway, degradation regulation of pathways, Fermentation

UNIT III

Enzymes and Enzyme kinetics : Holoenzyme, apoenzyme, and prosthetic group; Interaction between enzyme and substrate- Features of active site, activation energy, Rate Enhancement Through Transition State Stabilization, Enzyme specificity and types; Enzyme Commission system of classification and nomenclature of enzymes, Ribozymes, Abzymes. Coenzymes and their functions - NAD, $NADP^+$, FAD, FMN, lipoic acid, TPP, pyridoxal phosphate, biotin and cyanocobalamin measurement and expression of enzyme activity, enzyme assays. Definition of IU, katals, enzyme turnover number and specific activity, Isolation of enzymes and the criteria of purity; Characterization of enzymes

Order of reaction, study of the factors affecting the velocity of enzyme catalyzed reaction- Derivation of Michaelis -Menten equation and Km value determination and its significance, Definition of V_{max} value of enzyme and its significance, Lineweaver- Burk plot; Bi-substrate reactions: Classification, Reaction mechanisms; Using the King—Altman Method to Determine Velocity Equations; Allosteric enzymes: Examples, Effects of Co-operativity on Velocity Curves, Sigmoidal Kinetics for Nonallosteric Enzymes

UNIT IV

Enzyme inhibition and regulation: Reversible and irreversible – examples. Reversible-competitive, noncompetitive and uncompetitive inhibition; Graphic Determination of Inhibitor Type; Dose—Response Curves of Enzyme Inhibition; Mutually Exclusive Binding of Two Inhibitors; Structure—Activity Relationships and Inhibitor Design; Tight Binding Inhibitors: Identifying Tight Binding Inhibition, examples; Time-Dependent Inhibition: examples; Distinguishing between modes of inhibitor interaction with enzyme

Covalently modulated enzymes with examples of adenylation and phosphorylation; Zymogen form of enzyme and zymogen activation; Multienzyme complexes and their role in regulation of metabolic pathways; Allosteric regulation: example Aspartate trascarbamoylase, Isoenzymes-Lactate dehydrogenase and creatine phosphokinase

UNIT V

Application of enzymes: Immobilisation of enzymes, Industrial uses of enzymes: production of glucose from starch, cellulose and dextrans, use of lactase in diary industry, production of glucose fructose syrup from sucrose, use of proteases in food, leather and detergent industry. Diagnostic and therapeutic enzymes

Reference

1. Fundamentals of Enzymology: The Cell and Molecular Biology of Catalytic Proteins by Nicholas C. Price, Lewis Stevens, and Lewis Stevens (2000) Publisher: Oxford University Press, USA ISBN: 019850229X ISBN-13: 9780198502296, 978-0198502296
2. Enzyme Kinetics: A Modern Approach Book: Enzyme Kinetics: A Modern Approach by Alejandro G. Marangoni (2003) Publisher: Wiley-Interscience ISBN: 0471159859 ISBN-13: 9780471159858, 978-0471159858
3. Enzyme Kinetics and Mechanisms by Taylor Publisher: Spring ISBN: 8184890478 ISBN-13: 9788184890471, 978-8184890471
4. Enzyme Mechanism by P.K. Shivraj Kumar (2007) Publisher: RBSA Publishers ISBN: 8176114235 ISBN-13: 9788176114233, 978-8176114233
5. Enzymes and Enzyme Technology by Kumar (2009) Anshan Pub ISBN: 1905740875, ISBN-13: 9781905740871, 978-1905740871
6. Enzymes in Industry: Production And Applications by Aehle W (2007) Publisher**:** John Wiley & Sons Inc ISBN: 3527316892 ISBN-13: 9783527316892, 978-3527316892
7. Enzymes: Biochemistry, Biotechnology, Clinical Chemistry (second Edition) by Trevor Palmer, Philip Bonner (2007) Publisher: Horwood Publishing Limited ISBN: 1904275273 ISBN-13: 9781904275275, 978-1904275275
8. Lehninger Principles of Biochemistry, Fourth Edition by David L. Nelson Michael M. Cox Publisher: W. H. Freeman; Fourth Edition edition (April 23, 2004) ISBN-10: 0716743396 ISBN-13: 978-0716743392

19. E.S. West, W.R. Todd, H.S. Mason and J.T. van Bruggen, A Text Book of Biochemistry, Oxford and IBH Publishing Co., New Delhi, 1974

20. Biochemistry [with Cdrom] (2004) by Donald Voet, Judith G. Voet Publisher: John Wiley & Sons Inc ISBN: 047119350X ISBN-13: 9780471193500, 978-0471193500
21. Principles Of Biochemistry (1995) by Geoffrey L Zubay, William W Parson, Dennis E Vance Publisher: Mcgraw-hill Book Company – Koga ISBN:0697142752 ISBN-13: 9780697142757, 978-0697142757
22. Principles Of Biochemistry, 4/e (2006) by Robert Horton H , Laurence A Moran, Gray Scrimgeour K Publisher: Pearsarson ISBN: 0131977369, ISBN-13:9780131977365, 978-0131977365
23. Biochemistry 6th Edition (2007) by Jeremy M.berg John L.tymoczko Lubert Stryer Publisher: B.i.publicationsPvt.Ltd ISBN:071676766X ISBN-13: 9780716767664, 978-716767664
24. Biochemistry (2008) by Rastogi Publisher: Mcgraw Hill ISBN:0070527954 ISBN-13: 9780070527959, 978-0070527959