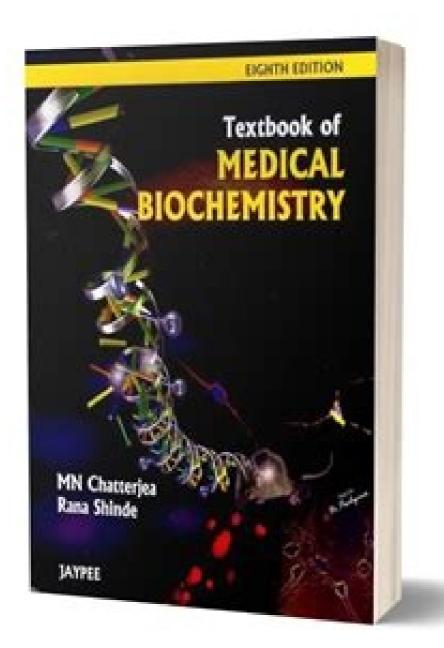
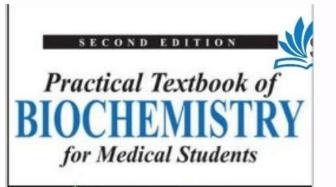




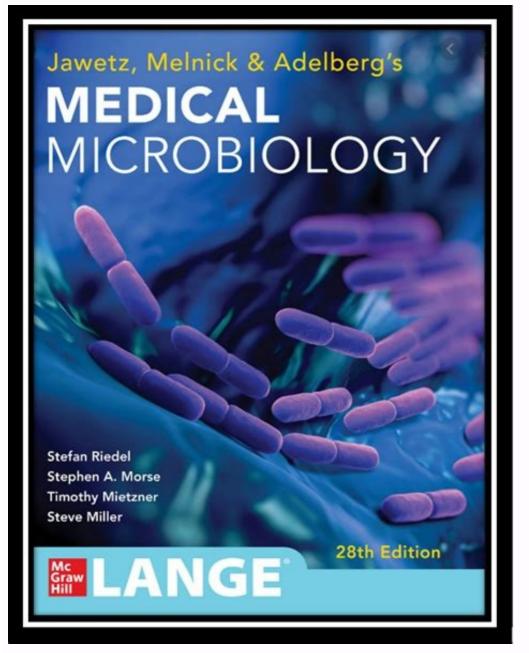
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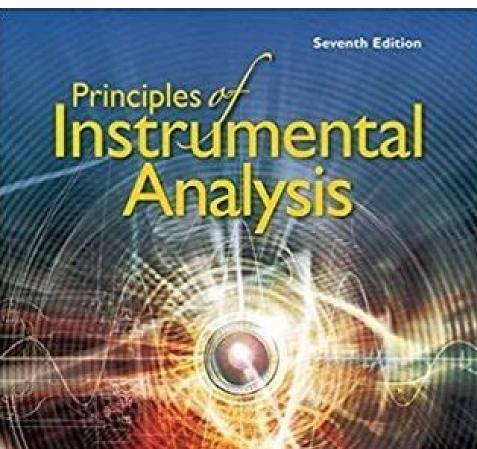
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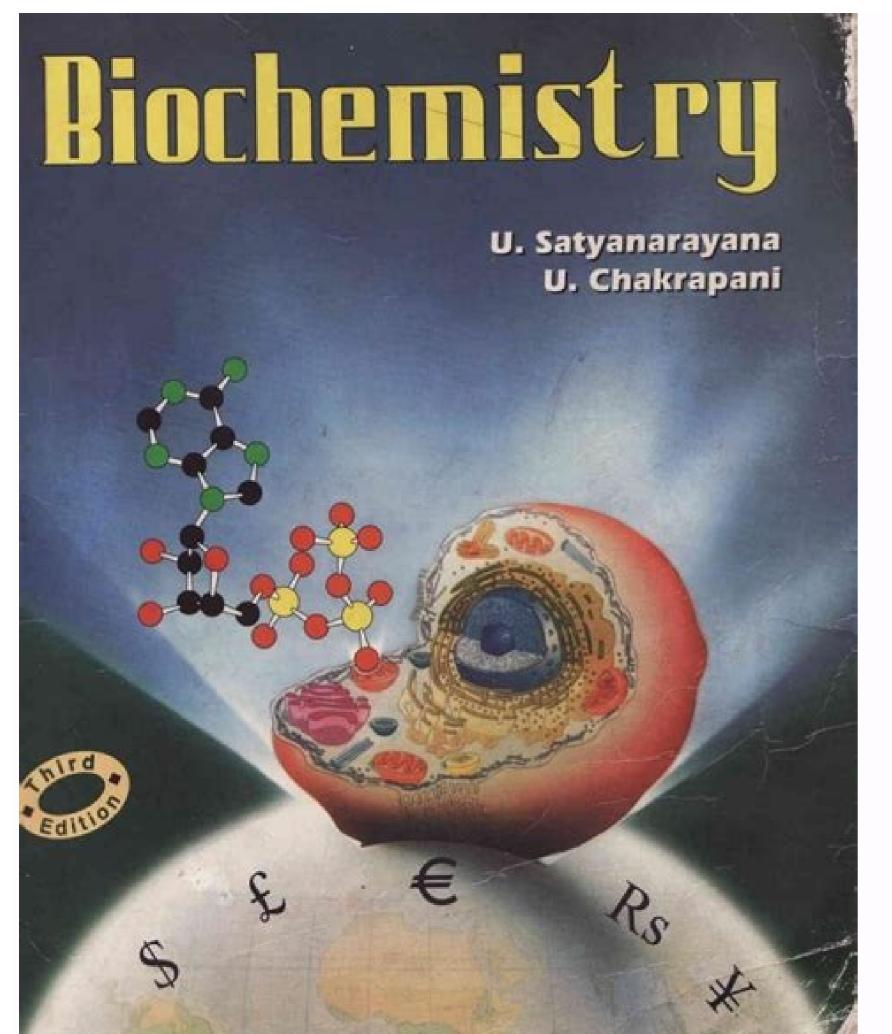












Textbook of medical biochemistry chatterjee pdf. Textbook of medical biochemistry by chatterjee pdf free download. Textbook of biochemistry for medical students. Textbook of medical biochemistry by chatterjee.

(c) Intermembrane space: The space between the outer and inner membranes is known as the intermembrane space. Phagocytosis: P

(b) Facilitated diffusion: It is similar to passive diffusion in that solutes move along the concentration gradient. in the curricula of medical colleges under Indian universities, and is one of the basic preclinical science subjects for first professional MBBS students. The movement of the vesicle is carried out by cytoplasmic contractile elements in the micro- tubular system. the basics of Biochemistry with clinical approach to understand the disease processes. • Nuclear pore complexes: These are embedded in the nuclear envelope. Biological Membranes: Structure and Function 15 SECTIONONE • Ankyrin: The network of spectrin, actin and band 4, 1 protein forms the skeleton of the red blood cell, but none of these proteins is attached directly to the membrane. The matrix also contains several strands of circular DNA, ribosomes and enzymes required for the biosynthesis of the proteins coded in the mitochondrial genome. Study important properties of monosaccharides. Ion Channels are transmembrane channels, pore like structures composed of proteins. CLINICAL ASPECT 1. Eukaryotic cells 1. PREFACE TO THE FIRST EDITION 10. Our aim has been to provide a comprehensive, self-contained textbook of biochemistry to effectively satisfy the curricular requirements of medical students of Indian universities. Cytoskeleton: For many years, biochemists have considered the cytosol a compartment containing soluble enzymes, metabolites and salts in an aqueous but gel like environment. 32. 2.7: Symport: Transport of two different molecules (or ions) in same direction B. a. The protein has 2 domains: One binds to spectrin, and the other to the N-terminal region of band-3-protein that extends into the cytoskeleton. Age related degenerative disorders such as Parkinson's disease, cardiomyopathy may have a component of mitochondrial damage. A lipid bilayer is about 6 nm across and this is so thin that it may be regarded as a two-dimensional fluid. • Other carbohydrates bound to glycophorin are sites through which the influenza virus becomes attached to red blood cells (ii) They can become part of extracellular matrix, e.g. collagen and glycosaminoglycans (GAGs) (iii) Hormones like insulin, parathormone (PTH) and catecholamines are all packaged in granules, processed within cells to be released upon appro- priate stimuli. List the disaccharides of biological importance and learn their properties. (i) They can attach to the cell surface and become peri- pheral proteins, e.g. antigens. Endocytic vesicles are formed when segments of plasma membrane invaginates enclosing a minute volume of extracellular fluid (ECF) and its contents. Dr C Sita Devi MD FAMS FIMSA Vice President-Lab Services Retd. E. Hence the rate of diffusion is faster than simple diffusion. 838 • Discovery of HIV 838 • Retroviral Background 838 • Structure and Molecular Features of HIV 839 • Virus Life Cycle 840 • Modes of Transmission 841 • Natural History of HIV Infection 845 • Antiretroviral Therapy (ART) 847 50. All membrane carbohydrate is covalently ...45 • Lipids 45 • Classification of Lipids 46 • Derived Lipids 46 • Essential Fatty Acids 48 • Alcohols 49 • Cholesterol 50 • Other Sterols of Biological Importance 52 • Simple Lipids 52 • Identification of attached to proteins or lipids. B. Chemistry of Lipids Fats and Oils 54 • Compound Lipids 55 • Glycolipids 59 5. Learn about special structural characteristics of red cell undergoes autolysis. Studies now support the idea that this compartment contains actually a complex network of fine structures called (a) microtrabeculae. Many of the international books are voluminous and too difficult for our students of medicine to handle and comprehend. The textbook is useful not only for undergraduates but also for postgraduates in biochemistry and others registering for diplomate examination of the National Board of Examinations. It has a high protein contents. 2.7): It is a co-transport system in which the transporter carries the two solutes in the same direction across the membrane. Lipid molecules in a bilayer are highly oriented (Fig. Pathology/medicine/pediatrics, etc.): It is a co-transport system in which the transport system is a system in which the transport system is a system in which the transport system is a system in which the transport system in whic These proteins can serve as receptors for hormones, neurotransmitters, tissue specific antigens, growth factors, etc. Chemistry of Proteins and Amino Acids... .76 • Amino Acids 77 • Proteins 83 • General Properties of Proteins 86 • Structural Organisation of Proteins 89 • Denaturation of Proteins 92 • Aminoacidurias 94 7. (Refer to chapter on Chemistry of Lipids for details of lipids). Modern cell theory can be divided into the following fundamental statements: • Cells make up all living matter • All cells arise from other cells • The genetic information required during the maintenance of existing cells and the production of new cells passes from one generation to the other next generations of an organism that is its metabolism, both anabolism and catabolism, takes place in the cells. Both the authors are well-known teachers of repute and have really tried to make the book simple as well as useful for medical students at undergraduate and postgraduate levels. They are: a. The membrane bound receptors with macromolecules move laterally into "coated pits". Lipid bilayer membrane with proteins 4. Cytochrome P450 which participates in drug hydroxylation reside in the ER. Cell and Cell Organelles: Chemistry and Functions 5 SECTIONONE 2. A. Many of the caveolae contain a special protein called caveolin-1, which probably may be involved in their formation from lipid rafts. They can be grouped as follows: Lysosomal Enzymes 1. 298 • Diseases of Genetic Origin 298 • Altered Genes 299 • What is Gene Therapy? There are three types of sphingolipids sphingolipids sphingolipids. CLINICAL ASPECT A disease known as Luft's disease involving mitochondrial energy transduction has been reported. Further mitochondrial DNA can be damaged by free radicals. Function: Band-3-protein plays an important role in the function of red blood cells. A large number of books on biochemistry for medical students are available in the market—both international and Indian. Learn about nature of carbohydrates 4. CLASSIFICATION Carbohydrates are divided into four major groups— monosaccharides, disaccharides, disaccharides, disaccharides, disaccharides and polysaccharides are divided into four major groups— monosaccharides are divided into four major groups— 18) The  $\beta$ -oxidation enzymes of peroxisomes are rather unique in that the first step of the oxidation is catalysed by a flavoprotein, an "acyl-CoA + O2  $\rightarrow \alpha$ ,  $\beta$  unsaturated acyl-CoA + O2  $\rightarrow \alpha$ is nonmembranous and contains RNA polymerase, RNAase, ATPase and other enzymes but no DNA polymerase. The book though similar to many other such textbooks, is unique for its clarity and comprehension. Dr KP Sinha MD PhD (Lond) Ex-Professor and Head Department of Biochemistry Patna Medical College Patna, Bihar, India FOREWORD 8. ..121 • Nomenclature and Classification of Enzymes 123 • Specificity of Enzymes 123 • Mechanism of Enzyme Action 124 • Models of Enzyme-substrate Complex Formation 124 • Kinetic Properties of Enzymes 125 • Factors Affecting Enzyme Action 126 • Enzyme Inhibition 127 10. Differentiate sucrose from either lactose or maltose. Endocytosis (Fig. 2.9: Exocytosis—involves the contact of two inside surface (cytoplasmic side) monolayers Fig. These include the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes involved in the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes involved in the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes involved in the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes involved in the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes involved in the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes involved in the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes involved in the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes involved in the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes involved in the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), Phospholipids (PL) and the enzymes responsible for the synthesis of sterol, triacylglycerol (TG), triacylglycer detoxification of drugs. The process neither requires any carrier protein nor energy. Mainly unicellular 2. Hence it requires energy. Acetylcholine released from the presynaptic region, which triggers the opening of the channel and influx of Na+. Endoplasmic reticulum (ER): Eukaryotic cells are characterised by several membrane complexes that are interconnected by separate organelles. • As the temperature increases, the hydrophobic side chains undergo a transition from the ordered state which is more gel like or crystalline to a disordered state, taking on a more liquid like or fluid arrange- ment. Classify carbohydrates into four major groups with examples of each group. Eukaryotic Cells The eukaryotic cells (Greek: Eu-true and karyon-nucleus) include the protists, fungi, plants and animals including humans. It is a complex of five subunits, having a binding site for acetylcholine. Neutral MPS—Blood group substances. The solute passes from higher concen- tration to lower concentration till equilibrium is reached. • Size: Mean diameter is approximately 0.4 µ (varies in between that of microsomes and mitochondria). • Ca++ • Contractile element in the cell-probably the microfilament system. Function • Some of the oligosaccharides of glycophorin are the M and N blood group antigens. Essential differences of prokaryotic and eukaryotic cells are given in Table 1.1. Fig. Biological Membranes: Structure and Function 11 SECTIONONE Table 2.2 shows the content of lipids as percentage of total lipid. Lipid bilayers are oriented with their hydrophobic tails inside the bilayer while hydrophobic tails inside the bilayer while hydrophobic tails inside the bilayers are oriented with their hydrophobic tails inside the bilayer while hydrophobic tails inside the bilayer while hydrophobic tails inside the bilayer while hydrophobic tails inside the bilayers are oriented with their hydrophobic tails inside the bilayer while hydrophobic tails inside the bilayer whi .555 • What is Detoxication? which diffuse out of the vesicles to be reutilised in the cytoplasm. Study the chemistry and properties of three important hope the book will receive appreciation as well as encouragement from all biochemists. Detoxication disaccharides. Facilitated diffusion 3. (a) Glycophorins (Fig.2.5): Glycophorins are glyco- proteins. 33. Characteristics • It has a minimum of internal organisation and smaller in size • It does not have any membrane bound organelles. List and describe the monosaccharides of biological importance, viz. We have tried our utmost to ensure that the language used is lucid and simple, makes an easy-reading, and the text provides an intelligent and comprehensive study. • Shape: The shape of mitochondrion is not static. Co-transport system: D-Glucose, D-Galactose and L-amino acids are transported into the cells by Na+ - dependent co-transport system. A sequence of 23 hydrophobic amino acid residues lies within the non- polar hydrocarbon phase of the phospholipids and cholesterol. Biological Membranes: Structure and Function 19 SECTIONONE Near the periphery of the cell's interior, another struc- ture called endosome (also called receptosome), having diameter 0.3 to 1 u found. "Today's Biochemistry is Tomorrow's Medicine" rightly said by many is truly justified by Dr (Brig) MN Chatterjea and Dr Rana Shinde in their Textbook of Medical Biochemistry. But when the membrane is ruptured, the enzymes are released into the cytoplasm and can hydrolyse external substrates (biopolymers). No part of this book may be reproduced in any form or by any means without the prior permission of the publisher. Cultured cells from patients with I-cell disease found to be deficient in the enzyme GlcNAc-1-P in specific mannose residues of certain lysosomal enzymes. Thus cell is the fundamental unit of life. CLINICAL ASPECT Hereditary spherocytosis and hereditary elliptocytosis are inherited genetic abnormalities of red cells are of abnormal shape. They also contain mole- cules at their surfaces that provide for cellular recognition and communication. Lysosomes: Lysos Samples of plasma from patients with the disease were observed to contain very high activities of lysosomal enzymes; this suggested that the enzymes were being synthesised but failed to reach their proper intracellular locations and were instead being secreted. The Textbook of Medical Biochemistry for the medical students is the outcome of the joint efforts of a medical and a nonmedical biochemist, who possess considerable experience in teaching biochemistry to undergraduate medical students of Indian universities. Cell and Cell Organelles: Chemistry and Functions .3 • Types of Cells 3 • Mitochondrial Membranes 5 2. Study the chemistry and properties of various polysaccharides. Colour printing has been used to make the book more attractive, easy recording and highlighting the important portions like Clinical Aspects/Significance and Biochemistry Importance. It can be quite rapid for a phospholipid molecule. 14 Cell Biology SECTIONONE Special Structural Characteristics of Red Cells Membranes The same integral proteins, as discussed above, are present in cell membrane of nearly all vertebrate erythrocytes. We do not claim to the perfect. Smaller in size 1 to 10 µm 1. • Mitochondria: Power house of the cell, ETC and ATP synthesis, TCA cycle, β-oxidation of fatty acids, ketone body formation, partly heme synthesis, urea synthesis, gluconeogenesis, pyrimidine synthesis. It is oriented with its hydrophilic polar heads Table 2.1: Composition of different membranes: Content of lipid, protein and carbohydrates as percentage of dry weight Type of membranes Lipid Protein Carbohydrate • (mammals) 43 49 8 • Nuclear membrane 35 59 3 • Outer mitochondrial membrane 48 52 Trace • Inner mitochondrial membrane 24 76 Trace • Endoplasmic reticulum 44 54 2 • Myelin 75 22 3 Fig. 237, Clayton SW1H 0HW (UK) Panama City, Panama Phone: +44-2031708910 Phone: 507-317-0160 Fax: +02-03-0086180 Fax: +50-73-010499 Email: info@jpmedpub.com Email: cservice@jphmedical.com Website: www.jaypeebrothers.com Website: www.jaypeedigital.com © 2012, Jaypee Brothers Medical Publishers All rights reserved. 18 Cell Biology SECTIONONE Fig. Recently, much importance has been given to self-study by students in small groups and to avoid or to restrict to the minimun the traditional way of learning based on "didactic" lectures. They contain many different types of proteins and ribosomal RNA or r-RNA. Immunoglobulins—Chemistry and Functions .110 • Properties of Individual Immunoglobulins 111 • Structure and Chemistry of Immunoglobulins-Model of Ig Molecule 115 • Polyclonal Vs Monoclonal Antibody: Hybridoma 118 9. They are linked to the inner face of the plasma membrane. • Nucleoplasm: Nucleopla .310 • Cholera 310 • History and Spread of Epidemic Cholera 311 • Antigenic Variation and LPS Structure in Vibrio cholerae 312 • Antigenic Determinants of Vibrio cholerae 312 • Cholera Toxin 312 • Structure of Cholera Toxin 312 errors. Biochemistry of Cholera–Vibrio Toxins, Pathogenesis Enzymatic Reaction 313 • Chemistry of Colonisation of the Small Intestine 313 • Genetic Organisation and Regulation of Virulence Factors in Vibrio cholerae 314 • Pathogenesis 314 13. 2.6: Band-3-protein 28. Mitochondria absent. which are potent microbial agent. We wish to emphasise that these are "behavioural objectives" and are selfexplanatory. The process does not require any energy and can operate bidirec- tionally. • Activities are affected by certain drugs. Within the plane of the memb- rane, one molecule of phospholipid can move several micrometers per second. Water Channels (Aquaporins) In certain cells, e.g. in red blood cells, and cells of the collecting ductules of the kidney, the movement of water by simple diffusion is enhanced by movements of water through water channels, composed of tetrameric transmembrane proteins called aquaporins. Biophysics: Principles and Biomedical Importance . .815 • Hydrogen Ion Concentration (pH) 815 • Buffers 817 • Diffusion 817 • Osmosis and Osmotic Pressure 818 • Dialysis 819 • Gibbs-Donnan Membrane Equilibrium 819 • Surface Tension (ST) 820 • Viscosity 821 • Colloids 822 48. We earnestly hope that the book will be of help to both the undergraduate medical students and their teachers. 29. (b) Band-3-Protein (Fig. The temperature at which the structure undergoes the transition from ordered to disordered state, i.e. melts, is called the transition temperature (Tm). Composition of matrix: The enzymes of energy 9. Functions (i) On the proximal or cis side, the Golgi complexes receive the newly synthesised proteins by ER via transfer vesicles. • Nucleus: DNA replication and greater acceptance in India and abroad for which authors have put in special efforts to cover wide spectrum of current topics in medical biochemistry through constant review and changes from time-to- time. Sphingolipids: They comprise another group of lipids found in biological membranes specially in the tissues of nervous system. Biochemistry of Ageing ...... .851 • Definition of Ageing 851 • Life Span and Life Expectancy 851 • Ageing 853 • Oxygen Radicals 853 • Hormone Replacement 856 • Hormone Replacement 856 Growth Factors 856 • Role of Dopamine Receptors in Ageing 856 • Macular Degeneration of Eye 857 Bibliography .859 Index Highly selective. Table 1.2 gives the names of some of the important enzymes and their location. Learn about proteins (ii) Transmembrane proteins 3. Thus band-3-protein is an example of a membrane transport protein. • The disease is characterised by severe progressive psychomotor retardation and a variety of physical signs, with death often occurring in the first decade. We are highly indebted to our colleagues and friends, and other authors whom we have consulted in compiling this book. The P3 mediates a transient increase in the level of cytosolic Ca++, which is essential for the induction of the respiratory burst. 5. The lysophospholipids have only one fatty acyl group, it cannot form bilayers as the rigid fused ring systems and additional nonpolar tails are too large. Biological Oxidation Learn the essential differences of a prokaryotic cell and eukaryotic cell. Some properties of ion channels • Composed of transmembrane protein subunits. In keeping with its prior editions, the authors have given full attention to include the advancements occurred in the field of clinical biochemistry. Inquiries for bulk sales may be solicited at: jaypee@jaypeebrothers.com This book has been published in good faith that the contents provided by the authors contained herein are original, and is intended for educational purposes only. • The acrosome, located at the head of the spermatozoa, is a specialised lysosome and is probably involved in some way in the penetration of ovum by the sperm. Macrophages are extremely active and may ingest 25 per cent of their volume per hour. I am sure the medical college community in India and abroad will welcome this edition of Textbook of Medical Biochemistry. Learn the general properties of carbohydrates with reference to glucose. We will welcome constructive criticism and comments, if any, along with fruitful suggestions to improve the text in its future editions. I recommend the book for medical students at undergraduate levels. DISEASES DUE TO GENETIC MUTATIONS 1. The polypeptide chain of glycophorin contains 130 amino acid residues. Storage granules 10. No one can be perfect, and there could have been some flaws or shortcomings in the book. They are: (a) Glycophorin and (b) Band-3-Protein. These subcellular respiratory organelles have no energy-coupled electron transport systems and are probably formed by budding from smooth the structure and function of cell membrane (Plasma membrane as a prototype) Specific Objectives A. 299 • How to Deal with a Dominant Negative? 30. By electron microscope they look like flask-shaped indentations of the cell memb-ranes. What are invert sugars and what is "inversion"? A sound and comprehensive learning of biochemistry will help a medical student understand medicine and pathology more clearly. • Golgy body: Maturation of synthesised proteins, protein sorting, packaging and secretion. Ankyrin has a molecular weight 200,000. • Cultured cells from patients with I-.66 • Prostaglandins 66 • Metabolism of Prostaglandins 67 • Functions of Prostaglandins 70 • Chemistry and Functions of Prostacyclins and Thromboxanes 71 • cell disease was found to lack almost all of the normal lysosomal enzymes. Prostaglandins—Chemistry and Functions Leucotrienes-LTs 72 • Lipoxins 74 6. (a) Fluid phase pinocytosis: It is a nonselective process in which uptake of a solute by formation of small vesicles is simply proportionate to its concentration in the surrounding extracellular fluid (ECF). It contains 60 per cent carbohydrates by weight. Vitamins 555 • Mechanism of Detoxication 556 14. These secretory vesicles move to and fuse with the plasma membrane where the contents may be expelled by a process called exocytosis. 21. Liver Function Tests These abnormally shaped red blood cells are fragile and have shorter life than normal erythrocytes. Mitochondria present Power house of the cell. Cerebrospinal Fluid (CSF)—Chemistry and Clinical Significance Appearance of Cerebrospinal Fluid 726 • Pressure of CSF 727 • Biochemical Changes in CSF 727 • Other Chemical Constituents 730 • Lange Colloidal Gold Reaction 730 43. Human Genome Project. .293 • Announcement of Draft Sequence of Human Genome 293 • Approaches of Genome Sequencing by Two Groups 294 • Benefits of the Project 295 • Project Goals and Completion Dates 296 • Additional Benefits 296 • Additional Benefits 296 • Additional Benefits 297 20. Peripheral proteins; Spectrin, Actin, Ankyrin and Band 4, 1 Protein D. • Endoplasmic reticulum: Biogenesis of proteins, lipoproteins, drug metabolism, ethanol oxidation, synthesis of cholesterol (partly). These sub- stances enter the mitochondrion only through the mediation of specific transport proteins. Gastric Function Tests Chemistry of Nucleic Acids, DNA Replication and .239 • Nucleic Acids 239 • Junk DNA 243 • Ribonucleic Acid (RNA) 244 • Small RNAs 246 • Types 246 • Replication of DNA 250 • Replication and its Importance 250 • DNA Repair Mechanisms 257 17. Chief organelles and their functions are as follows: 1. • Learn structure and functions of golg complexes. Functions: Transport Systems An essential role of biomembranes is to allow movement of all compounds necessary for the normal function of a cell across the membrane barrier. The vesicles are covered with an unusual peripheral protein called clathrin, having molecular weight of 1,85,000. Learn how lipid bilayer is formed B. Both authors have long experience in teaching biochemistry to undergraduates. The oligosaccharides bound to glycophorin are linked to serine, threonine and asparagine residues. The inner face of the red blood cells membrane is laced with a network of proteins called cytoskeletons that stabilises the membrane and is responsible for the biconcave shape of the cells: The special peripheral membrane proteins participate in this stability of red cells are: • Spectrin • Actin • Ankyrin and Band 4, 1 protein. Contents xv SECTION FOUR: Metabolism 22. Sulphate free acid MPS—Hyaluronic acid and chondroitin 2. • Cristae: The inner mitochondrial membrane is highly folded. (a) Lipids: Lipids are the basic structural components of cell membranes. (i) Symport system (Fig. Mainly multicellular (with few exceptions). Pinocytosis: It is a property of all cells and leads to the cellular uptake of fluid contents. 306 • What are Some of the Ethical Considerations for using Gene Therapy? • Temperature: Increased temperature will increase particle motion and thus increase the frequency of collisions between external particles and the memb- rane. Peroxisomes: Peroxisomes: Peroxisomes are small organelles also called Microbodies, present in eukaryotic cell. Mechanism: The innermembrane of the vesicle fuses with the outer plasma membrane, while cytoplasmic side of vesicle fuses with the cytoplasmic side of plasma membrane. 1.2A: A mitochondrion—shows half split to show the inner membrane with cristae Fig. 2.12): By coated vesicles and endosomes that are involved in the transport of macromolecules from the exterior of the cells have transient structures like coated vesicles and endosomes that are involved in the transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of macromolecules from the exterior of the cells have transport of the exterior of the cells have transport of the exterior of the cells have transport of the exterior of the ext to its interior. Study the following cellular organelles: • Nucleus—its structure and functions. 2.11). Transmembrane proteins: Some of the integral proteins span the whole breadth of the membrane proteins. In such a process, a macrophage mayinternalize3 per cent of its plasmamembrane proteins. membrane every 1/2 hour. Proteins synthesised in cytoplasm 15. O2 - + O2 to water and its hydrophobic fused ring system and attached hydrocarbon groups buried in the interior. II. About 50 per cent of the fatty acid groups are saturated, i.e. they contain no double bond. Though there are a few books on biochemistry written by Indian authors, there is need for a comprehensive yet simplified textbook. Thus portions of these proteins are in Van der Waals contact with the hydrophobic region of the membrane. Contents xvii SECTION SIX: Miscellaneous 44. The formation of these vesicles is an extremely active process. Integration of Metabolism of Carbohydrates, Lipids and Proteins . ..531 • Interconversion Between the three Principal Components 533 29. The N-terminal residues extend into the cytosol and interact with compo- nents of the cytoskeleton. The lysosomes thus accumulate many different types of undegraded molecules forming inclusion bodies. 4. Metabolism of Proteins and Amino Acids ... • Amino Acid Pool 471 • Nitrogen Balance 472 • Essential Amino Acids 472 • Dissimilation of Amino Acids (N-catabolism of Amino Acids) 477 • NH3 Transport 477 • Urea Formation (Krebs-Henseleit Cycle) 479 • Clinical Significance of Urea 481 • Glucose-alanine Cycle 483 • Fate of Carbamoyl-P 483 • Glutamine Formation and Functions 483 • Functions of Glutamine 485 • Decarboxylation Reaction and Biogenic Amines 490 • Gaba Shunt 493 • Polyamine Synthesis Inhibitor 495 • Metabolism of Individual Amino Acids 495 • Metabolism of Individual Amine 485 • Decarboxylation Reaction and Biogenic Amines 490 • Gaba Shunt 493 • Polyamine Synthesis Inhibitor 495 • Metabolism of Individual Amine 485 • Decarboxylation Reaction and Biogenic Amines 490 • Gaba Shunt 493 • Polyamine Synthesis Inhibitor 495 • Metabolism of Individual Amine 485 • Decarboxylation Reaction and Biogenic Amines 490 • Gaba Shunt 495 • Metabolism of Individual Amine 485 • Decarboxylation Reaction and Biogenic Amines 490 • Gaba Shunt 495 • Metabolism of Individual Amine 485 • Decarboxylation Reaction and Biogenic Amines 490 • Gaba Shunt 495 • Metabolism of Individual Amine 485 • Decarboxylation Reaction and Biogenic Amines 490 • Gaba Shunt 495 • Metabolism of Individual Amine 485 • Decarboxylation Reaction and Biogenic Amines 490 • Gaba Shunt 495 • Metabolism of Individual Amine 485 • Decarboxylation Reaction and Biogenic Amines 490 • Gaba Shunt 495 • Metabolism of Individual Amine 485 • Decarboxylation Reaction and Biogenic Amines 490 • Gaba Shunt 495 • Metabolism of Individual Amine 485 • Decarboxylation Reaction and Functions 485 • De Functions 509 • Metabolism of Other Amino Acids 511 • Serine 513 • Histidine 514 • β-alanine 515 • Tryptophan 516 • Serotonin 520 • Role of Nitric Oxide 520 • Metabolism of Creatine 525 28. Types of Gates Two types of gated channels. Digestion and Absorption of Carbohydrates .319 • Digestion of Carbohydrates 320 • Absorption of Carbohydrates 320 • Defects in Digestion and Absorption of Carbohydrates (Including Inherited Disorders) 323 23. Defect: The disorder is attributed to mutations in the genes encoding the four polypeptides that constitute the active NADPH oxidase system. • Study endoplasmic reticulum, its types, structure and functions. for their sincere and untiring efforts in transforming the typed manuscript to printed form. Enzyme Groups Present in Lysosomes Essentially the enzymes about 30 to 40, are hydrolytic in nature. This edition is enriched with relevant subject information for those who are seeking to understand medical biochemistry. Plasma membranes have selective permeability that mediate the flow of molecules and ions into and out of the cell. Chemistry of Respiration and Free Radicals. .204 • Transport of Oxygen 205 • Clinical Importance of Oxygen 206 • Transport of Carbon Dioxide 207 • Free Radicals 209 SECTION THREE: Molecular Biology 14. Endocytosis: Learn about (i) Phagocytosis 3. Heteropolysaccharides (heteropolysaccharides (heteropolysaccharides charines). xiv Textbook of Medical Biochemistry 12. The longer and more saturated fatty acid chains interact more strongly with each other via their longer hydrocarbon chains and thus cause higher values of Tm. Hence, higher temperatures are required to increase the fluidity of the bilayer. 1.2B: Cross-section of a mitochondrion— showing various layers and cristae 19. Both the C and N terminals of band-3-protein are on the cytosolic side of the membrane. This popular book itself is a good guide and a tool to both undergraduate students and teachers in medical biochemistry. 22. Functions (a) Function of rough ER: Rough ER synthesises memb- rane lipids, and secretory proteins. some recent topics such as cyclic nucleotides—cyclic AMP and cyclic GMP, prostaglandins, prostacyclins, throm- boxanes and leukotrienes, immunoglobulins, recombinant DNA technology, clinical significance of enzymes and isoenzymes, radioisotopes and their clinical and therapeutic uses, etc. Cystic Fibrosis Inheritence: A recessive genetic disorder, prevalent among whites in N America and certain parts of Northern Europe. These compounds include a vast array of substances like sugars, amino acids, fatty acids, steroids, cations and anions to mention a few. 2.2). To know importance of cell, and the types: Prokaryotic and eukaryotic cell. Single membrane, surrounded by rigid cell wall 3. Aerobic 5. Chemical Composition of the Membranes are composed of lipids, proteins and carbohydrates. The hydrophobic central core of the membrane. Functional changes: It is now known that mitochondria undergo dramatic changes when they switch over from resting state to a respiring state. Oleic acid is the most abundant unsaturated fatty acid in animal membrane lipids; others are arachidonic acid, linoleic and linolenic acids. SECTION ONE: Cell Biology 1. 341 • Pasteur Effect 343 • Metabolism of Glycogenesis 347 • Glycogenesis 349 • Hexose Monophosphate (HMP) Shunt 354 • Metabolic Significance of HMP Shunt 358 • Uronic Acid 363 • Clinical Importance of Uronic Acid 363 • Gluconeogenesis 363 • Metabolic Pathway 362 • Functions of Gluconeogenesis 363 • Metabolic Significance of HMP Shunt 358 • Ironic Acid 363 • Gluconeogenesis 364 • Regulation of Gluconeogenesis 364 • Regulation of Gluconeogenesis 363 • Metabolic Significance of HMP Shunt 358 • Uronic Acid 363 • Gluconeogenesis 364 • Regulation of Gluconeogenesis 36 369 • Metabolism of Fructose 372 • Regulation of Blood Glucose (Homeostasis) 374 • Blood Sugar Level and its Clinical Significance 377 • Glycosuria 377 • Diabetes Mellitus 379 • Glycosuria 377 • Glyc Daryaganj New Delhi 110 002, India Phone: +91-11-43574357 Fax: +91-11-43574314 Email: jaypee@jaypeebrothers.com Overseas Offices JP Medical Ltd Jaypee-Highlights Medical Publishers Inc. Cholesterol is another common component of the biomembranes of animals but not of plants and prokaryotes. Fluid Mosaic Model of Membrane Structure The fluid mosaic model of membrane structure proposed by Singer and Nicholson in 1972 is now accepted widely. Biochemistry of AIDS. . (c) Microtrabeculae: They appear to be very fragile tubes that form a transient network in the cytosol The nature and function of these proteins require special mention. This diffusion within the plane of the membrane is termed translational diffusion. Specific Objectives 1. b. Na+ is not allowed to accumulate in the cells and it is pumped out by "sodium pump". Functions of Porin and other Proteins (i) These proteins form channels that permit substances with molecular weights of less than < 10,000 to diffuse freely across the outer mitochondrial membrane. Prokaryotic Cells (Greek: Pro-before and karyon- nucleus) include the bacteria and cyanobacteria. Example: The low density lipoproteins (LDL) molecule bound to receptors are internalised by means of coated pits. D. Lipid molecules have a 'polar' or ionic head hence hydrophilic and the other end is a 'nonpolar' and hydrophobic tail. It contains high proportion of the phospholipid cardiolipin. We shall look forward for any valuable comments and useful suggestions from teachers and students so that errors are rectified and suggestions are taken into account for future. Proteins detected in caveolae include various components of the signal transduction system, e.g. the insulin receptor and some G-proteins, the folate receptor, and endothelial nitric oxide synthase (eNOS). They are: 1. I encourage the teachers in medical schools in India and abroad to use the book for teaching the subject of clinical biochemistry. Keeping this in view, we have included in the beginning of each chapter the "major concepts" and "specific objectives" of the chapter for the information of a cell and its subcellular organelles. Cell and Cell Organelles: Chemistry and Functions 7 SECTIONONE Types: There are two kinds of endoplasmic reticulum (ER): (i) Rough surfaced ER, also known as ergastoplasm. The book makes a lucid reading, is full of necessary facts for medical students, and the text is clinically oriented. Organelles free sap is called as cytosol. Golgi apparatus .708 • Acid-base Balance in Normal Health present—flattened single membrane with polysaccharides vesicles 11. Integral membrane proteins (also called intrinsic membrane proteins): These proteins are deeply embedded in the membrane. Acid Base Balance and Imbalance. 709 • Buffers 709 • Acids Produced in the Body 710 • Mechanisms of Regulation of pH 710 • Reputation of Acid-base Balance 714 • Acid-base Balance 717 • Acidosis 717 • Acidosis 717 • Acidosis 719 42. Acid phosphatase is used as a marker enzyme for this organelle. Larger in size 10 to 100 µm or more 2. Examples are bacteria, cyanobacteria, rickettsia 15. The disease is characterised by: • Recurrent infections • Widespread granuloma formation in various tissues like lungs, lymph nodes, skin, etc. It requires the mediation of specific carrier or transport proteins. Passive or simple diffusion 2. We have also tried to give some 15 to 30 MCQs (with answers at the end) in each chapter which may be useful for the medical students for their plasma membrane. The main framework of the book has been retained, without much changes, new additions have been made, some portions rewritten in certain chapters. Function: (a) Ion channels, gap junctions (b) Transport mechanisms 1. (b) Proteins: Main types of membrane proteins are (Fig. Cytoskeleton-absent 13. Gap Junction Certain cells develop specialised regions on their memb- ranes for intercellular communications which are in close proximity. • Permeability coefficient: Net diffusion also depends on the permeability coefficient for the membrane. Iron toxicity also occurs with excessive uptake due to endocytosis. Textbook of Medical Biochemistry Eighth Edition Dr (Brig) MN Chatterjea BSc MBBS DCP MD (Biochemistry) Ex-Professor and Head, Department of Biochemistry Armed Forces Medical College, Pune, Maharashtra, India Christian Christian Medical College, Pune, Maharashtra, India Christian Medical College, Pune, Maharashtra, India Christian Medical College, Pune, Pun Path (Chemical Pathology) Professor and Head and Chief, Chemical Pathologist Department of Biochemistry, SSR Medical College and Hospital, Ludhiana, Punjab, India Ex-Professor, Department of Biochemistry IN Medical College, Belgaum, Karnataka, India Formerly Wanless Hospital Miraj and Christian Medical College and Hospital, Ludhiana, Punjab, India Forewords T Venkatesh Vijaykant B Kambli C Sita Devi KP Sinha JAYPEE BROTHERS (P) LTD New Delhi • Panama City • London ® 3. Such a membrane barrier that separates cellular contents from the environment is an absolute necessity for life. Biomedical Importance • In autophagic processes, cellular organelles such as mitochondria and the endoplasmic reticulum undergo digestion within the lysosome. 2.1: Basic lipid structure—polar head and nonpolar tails Table 2.2: Composition of different membranes: Content of various lipids as percentage of total lipids Type of Various types of lipids membranes Cholesterol Lecithin Cephalin Phosphatidyl- Sphingo- Glycolipid serine myelin • Plasma membrane 0 35 25 0 3 0 • Endoplasmic reticulum 5 48 19 4 5 0 • Myelin 28 11 17 6 7 29 25. • Number: The number of mitochondria in a cell varies dramatically. These memb- ranes and the aqueous channels they enclose are called cisternae. Functions • An important function of microtubules is their role in the assembly and disassembly of the spindle structures during mitosis. Integral protein: Glycophorins, and Band-3-Protein 2. 2.5: Glycophorin integral protein Fig. Varying in shape, size and amount, the endoplasmic reticulum (ER) extends from the cell membrane, coats the nucleus, surrounds the mitochondria and appears to connect directly to the Golgi apparatus. which forms a Pore through the membrane. 808 • Characteristics of an Ideal Tumour Markers 808 • Clinical Usefulness of Different Tumour Markers 809 • Commonly Used Tumour Markers 810 • Tumour Markers 810 • Tumour Markers 809 • Commonly 812 47. Haem Catabolism .548 • Sources of Bilirubin 549 • Transport of Bilirubin 550 • Conjugation of Bilirubin with D-glucuronic Acid in Liver Cells 551 • Excretion of Bile Pigments 553 32. Lysosome word derived from Greek word Gree, meaning lysis (loosening). Cholesterol helps to regulate fluidity of animal membranes. Functions • Many enzymes associated with carbohydrates, fatty acids and nitrogen metabolism are located within the mitochondrion. Lysosomes present—single membranes vesicle containing packets of hydrolytic enzymes 12. A typical mam- malian mitochondrion has a diameter of 0.2 to 0.8 u and a length of 0.5 to 1.0 um. Learn about lactalose, a Keso disaccharide and its clinical importance. Some algae contain only one mitochondrion, whereas the protozoan Chaos contain half a million. Digestion and Absorption of Proteins ... .463 • Digestion of Proteins 463 • Digestion in Small Intestine 466 • Absorption of Amino Acids 467 27. Transport of Macromolecules such as proteins, hormones, immunoglobulins, low density lipoproteins (LDL) and even viruses takes place across the membrane by two independent mechanisms. Cell surfaces are rich in receptor proteins that can combine with macromolecules (ligands). Specific channels for Na+, K+, Ca++, and Cl- have been identified. CLINICAL ASPECT Recently mutations in the gene encoding AP-2 (Aqua- porin 2) protein, have been identified. specific molecule binds to a receptor and opens the channel. What are carbohydrates? Dr Vijaykant B Kambli PhD MBA FACB DABCC Director, Clinical Biochemistry Department of Pathology Norwalk Hospital Norwalk, Connecticut, USA FOREWORD 6. Cytoplasm contains no cell organelles 7. Hence they are amphipathic (Fig. 2.2: Lipid bilayer 26. Nucleolus present, rich in RNA 7. xii Textbook of Medical Biochemistry In addition, our main target has been to make the book clinically-oriented. Approximately 2 per cent of the external surface of plasma membrane are covered with receptors and charac- teristic coated pits. Defect: They result from mutations in the genes coding for proteins of the membrane. Study the chemistry and functions of proteoglycans. Fig. Hormones—Chemistry, Mechanism of Action and Metabolic Role. .562 • Hormones 563 • Mechanism of Action of Hormones 564 • Regulation of Hormone Secretion 566 • Pituitary Hormones 566 • Hormones 566 • Hormones 571 • Thyroid Gland and its Hormones 571 • Thyroid Hormones 571 Metabolic Role of Thyroid Hormones 576 • Parathyroid Glands and Their Hormones 578 • Parathormone (PTH) 578 • Calcitonin 580 • Insulin 583 • Metabolic Role of Insulin 584 • Glucocorticoids

590 • Mechanism of Action 591 • Metabolic Role of Glucocorticoids 592 • Mineralo-corticoids 594 • Metabolic Role of Aldosterone 595 • Renin-angiotensin System 596 • Adrenal Medullary Hormones 597 • Metabolic Role of Catecholamines 598 • Gonadal Hormones 599 • Metabolic Role of Catecholamines 598 • Gonadal Hormones 597 • Metabolic Role of Catecholamines 598 • Gonadal Hormones 599 • Adrenal Medullary Hormones 597 • Metabolic Role of Catecholamines 598 • Gonadal Hormones 599 • Adrenal Medullary Hormones 597 • Metabolic Role of Catecholamines 598 • Gonadal Hormones 599 • Adrenal Medullary Hormones 597 • Metabolic Role of Catecholamines 598 • Gonadal Hormones 599 • Adrenal Medullary Hormones 597 • Metabolic Role of Catecholamines 598 • Gonadal Hormones 598 • Gonadal Hormones 599 • Adrenal Medullary Hormones 597 • Metabolic Role of Catecholamines 598 • Gonadal Hormones 598 • Gonadal Hormon 601 • Metabolic Role 603 • Progestational Hormones: (Luteal Hormones) 603 • Metabolic Role 604 • Relaxin 604 • Placental Hormones 604 34. The actual physio- chemical state of cytosol is poorly understood. 2.3): 1. Learn chemistry and functions of proteoglycans. The commonest mutation found involves deletion of three bases resulting to loss of phenylalanine in 508 position. It is now known that the protein network can also be bound directly to glycophorin (integral protein) or to band-3-protein. 2.1). Authors' sincere efforts are appreciated both by students and faculty who have been using this book, which is meeting most of the requirements of MCI regulations. Ionophores Certain microorganisms can synthesise small organic molecules, called ionophores, which function as shuttles for the movement of ions across the membrane can hydrolyse external biopolymers (substrates) leading to tissue damage in many types of allergic responses and arthritic conditions. If cell dies, tissue dies and it cannot function. The process is also called reverse pino- cytosis. Chemistry of Haemoglobin and Haemoglobinopathies ... ..149 • Haemoglobin 150 • Structure of Hb 150 • Varieties of Normal Human Haemoglobin 151 • Derivatives of Haemoglobin 152 • Combination of Haemoglobins and Haemoglobins and Haemoglobins and Haemoglobins 157 • Abnormal Ha with m-RNA Formation 159 • Thalassaemias 159 CONTENTS 12. • Chromatin: DNA in the nucleus is coiled into a dense mass called chromatin, so named because it is stained darkly with certain dyes. Characteristics • It has considerable degree of internal structure with a large number of distinctive membrane enclosed having specific functions • Nucleus is the site for informational components collectively called chromatin All organisms are built from cells. Thus, the contents of vesicles are externalised. (For details of facilitated diffusion and 'ping-pong' model—refer to chapter on Digestion and 'ping-pong' model—refer to chapter on Digestion and Absorption of Carbohy- drates). As red blood cells flow through the capillaries of the lungs, they exchange bicarbonate anions (HCO3 - .) produced, by the reaction of CO2 and H2O, for chloride (Cl-) ions. Structure: These ionophores contain hydrophobic regions. Example of both aldoderivatives and ketoderivatives. The nonpolar tails of most membrane lipids are long chain fatty acids attached to polar head groups, such as glycerol-3-P. The ER is usually closely associated with the Golgi complexes, which contain flattened, fluid filled golgi sacs. • Nucleolus is also the major site where ribosome subunits are assembled. The phase changes, and thus the fluidity of the membrane are highly dependent upon the lipid composition of the membrane. Leber's Hereditary Optic Neuropathy (LHON) In this disease mutations in genes encoding mitochondrial membrane proteins. Cytoskeleton—present 14. Structure and Functions The mitochondrion is bounded by two concentric membranes that have markedly different properties and biological functions. They may also interact with integral membrane proteins. 2.10: Endocytosis—results from the contact of two outer surfaces monolayers 31. Several different types present 3. It is an independent subject with a separate examination in almost all medical colleges. In the respiring state, the inner membrane is not folded into cristae, rather it seems to shrink leaving a much more voluminous inter membrane space. Inherited disorders: A number of hereditary diseases involving the abnormal accumulation of complex lipids or polysaccharides in cells of the afflicted individual have now been traced to the absence of key acid hydrolases in the lysosomes of these individuals. xvi Textbook of Medical Biochemistry 33. Prof T Venkatesh PhD FACBI Director National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past President, ACBI St John's National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past President, ACBI St John's National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past President, ACBI St John's National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past President, ACBI St John's National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past President, ACBI St John's National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past President, ACBI St John's National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past President, ACBI St John's National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past President, ACBI St John's National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past President, ACBI St John's National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past President, ACBI St John's National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past President, ACBI St John's National Referral Centre for Lead Poisoning in India Professor, Department of Biochemistry and Biophysics Past Poisoning India Poisonin FOREWORD 5. Initial rate (v) at which a solute (s) diffuses across a phospholipid bilayer is directly proportional to the thickness (t) of the membrane. They do not contain hydrolytic enzymes, are less dense than lysosomes and have an internal pH of 5.0. The internalised coated vesicles fuse with the endosomes and discharge their macromolecules into the interior of the endosomes. 2 24. Carbohydrate chains are attached to the amino terminal portion outside the external surface. List the monosaccharides of biological importance and learn their properties. At the end of each chapter we have given "essay type" or "short notes type" questions which we have compiled from the examination papers of different Indian universities. Mitochondria assume many different shapes under different metabolic conditions. Their general properties and biomedical importance. • Mutations of genes encoding transmembrane proteins can cause specific diseases. (ii) Smooth surfaced ER: They do not have attached ribosomes. 1.1). Golgi complexes (or Golgi apparatus): They are also called Dictyosomes. Protein Synthesis, Gene Expression and Recombinant DNA ...259 • Transcription 260 • Genetic Code 263 • Translation of m-RNA (Protein Synthesis) 264 • Chaperones: Proteins that Prevent Faulty Folding 269 • Gene Expression and Regulation 271 • Mutation 276 • Recombinant DNA Technology 279 18. Function: They are involved in signal transduction and possibly other processes. 659 • Functions of the Liver 660 • Tests Based on Abnormalities of Bile Pigment Metabolism 660 • Tests Based on Liver's Part in Carbohydrate Metabolism 663 • Tests Based on Changes in Plasma Proteins 664 • Tests Based on Abnormalities of Lipids 665 • Tests Based on Excretory Function of the Liver 666 • Tests Based on Amino Acid Catabolism 667 • Tests Based on Drug Metabolism 668 • Value of Serum Enzymes in Liver Diseases 668 38. (c) Active transport occurs against a concentration gradient. RNA synthesised and processed in nucleus. Not well defined nucleus. Not well defined nucleus. Phosphatidyl- ethanol amine (cephalin), phosphatidylcholine (Lecithin) and phosphatidylcholine (Lecithin) and phosphatidylcholine is a major integral membrane glycoprotein of human erythrocytes. The inside of the cell usually has a negative charge. Prokaryotic cells 2. Membrane bound cell organelles are present 8. Example: D-fructose is absorbed from intestine by facilitated diffusion. Recent evidence suggests strongly that the complex serves as a unique sorting device that receives newly synthesized proteins, all containing signal or transit peptides from the ER. They can be removed without disrupting the membrane. About 20 actin molecules polymerise to form short actin filaments. Fig. The low pH breaks the linkage between receptors and membrane fragments, most of which recycle back to the plasma membrane to replenish the population of receptors and coated pits. The tightly packed inward folds are called "cristae". We feel confident that this edition will fulfil the requirement of the undergraduate students as per MCI recommendations and also meet the needs and expectations of postgraduate students of Biochemistry. Eukaryotic cells contain many internal membrane system that surround the cell organelles. They are modified and transported through the cell. (b) Microfilaments: They are more slender cylinder like structures made up of the contractile protein actin. • Bacteria are digested by white blood cells by engulfment of the bacteria and lysosomal action. The energy produced is trapped and stored as ATP, for future use of energy in the body. Principal and Professor Department of Biochemistry Andhra Medical College Vishakhapatnam, Andhra Pradesh, India FOREWORD 7. Environmental Biochemistry .780 • Lead 785 • Arsenic 786 • Food Pollution 787 46. Sequence of events in genesis of I-cell disease: Mutations in DNA 1 Mutant GlcNAc phosphotransferase 1 Lack of normal transfer of GlcNAc-1-P to specific mannose residues of certain enzymes destined for lysosomes 1 Hence these enzymes lack Mannose-6-P (the marker) and are secreted into plasma level. About five distinct types of aquaporins have been recognised. Since the outer membrane is freely permeable to small molecules, the intermembrane space has about the same ionic composition as the cytosol. (ii) Other proteins in the outer membrane carry out various reactions in fatty acid and phospholipid biosynthesis and are responsible for some oxidation reactions. Radioactivity: Radioisotopes in Medicine .... ..734 • Radioactivity 734 • Radioisotopes 735 • Radioisotopes in Medicine 736 Radiation Hazards 736 • Diagnostic and Therapeutic Uses of Radioisotopes 737 15. Lipid hydrolysing • Lipases enzymes • Phospholipases • Fatty acyl esterases 4. 8 Cell Biology SECTIONONE • There are good evidences that the metamorphosis of tadpoles to frogs, the regression of the tadpole's tail is accomplished by the lysosomal digestion of the tail cells. Vesicular contents are digested liberating simple sugars, amino acids, etc. Summary Functions of Various Subcellular organelles • Cytosol: Involved in protein synthesis, purine synthesis, carbohydrate metabolism, HMP shunt. 2.3: Proteins in fluid bilayer 27. The degree of unsaturation determines the fluidity of the membranes. The membrane proteins, intrinsic proteins (integral) deeply embedded and peripheral proteins loosely attached, float in an environment of fluid phospholipid bilayers. Use of dextran as plasma expander. • Nuclear envelope: A double membrane structure called the nuclear envelope separates the nucleus from the cytosol. Red blood cells membrane contains about 6 × 105 glycophorin molecules. Table 2.1 shows the composition of different memb- ranes—content of lipids, proteins and carbohydrates as per centage of dry weight. On the other hand, unsaturated bonds that exist in the "Cis" configuration tend to increase the fluidity of a bilayer by decreasing the compactness of the side chains packing without diminishing the hydrophobicity. 7. (b) Caveolae: They are probably derived from lipid rafts. Though the self- assembly of these dealt with in greater detail to meet the requirements of postgraduates, viz. The structures are made primarily by the self- assembly of these details to meet the requirements of postgraduates. heterodimer, tubulin having molecular weight 50,000. It meets the requirements of students of medical, dental science, and others who have to take a basic course in biochemistry. 306 • What Factors have kept Gene Therapy from Becoming an Effective Treatment for Genetic Disease? Inherited disorders (i) Leber's have kept Gene Therapy from Becoming an Effective Treatment for Genetic Disease? hereditary optic neuropathy (LHON) (ii) Cystic fibrosis. (ii) The post-translational modifications take place in the golgi lumen (median part) where the carbo hydrates and lipoproteins are added to proteins to form glycoproteins and lipoproteins are added to protein to form glycoproteins and lipoproteins and lipoproteins are added to protein to form glycoproteins and lipoproteins are added to protein the golgi lumen (median part) where the carbo hydrates and lipoproteins are added to protein to form glycoprotein to form glycopro protein found in red cell membrane. • Study the structure and functions of cytoskeleton. The lysosomal enzymes have an optimal pH around 5. Types of transport system: Transpo accumulate partly digested cellular material, manifesting as "inclusion bodies" 6. Their presence on the outer surface of the plasma membrane, the glycocalyx, has been shown with the use of plant lections, protein agglutinins that bind specific glucosyl residues. They extend pseudopodia and surround the particles to form phagosomes which later fuse with lysosomes to form Phagolysosomes in which the particles are digested. Fatty acids: They are major components of biomembranes. H2 (reduced FAD) produced in the reactions of glycolysis, the citric acid cycle and the oxidation of fatty acids. Near the nucleus, this type of ER merges with the outer membrane of the nuclear envelope. Structure: They are primarily composed of protein, called exocytosis. Examples: Protists, fungi, plants and animal cells • Sexual reproduction involves both mitosis and meiosis • The respiratory site is the mitochondria • In the plant cells, the site of the conversion of radiant energy to chemical energy is the highly structural chloroplasts. producing inflammation and arthritis. 162 • Fat-soluble Vitamin B 163 • Functions of Vitamin B 163 • Functions of Vitamin B 167 • Functions of Vitamin B 171 • Fu B2) 179 • Niacin (Vitamin B3) 181 • Pyridoxine (Vitamin B6) 184 • Lipoic Acid (Thioctic Acid) 186 • Pantothenic Acid (Vitamin B1) (Cyanocobalamine) 196 • Inositol 200 13. Biological Membranes: Structure and Function 17 SECTIONONE 1. I am a strong advocate of teaching the fundamental concepts in biochemistry to medical students, clinical laboratory technologists and clinical pathologists to advance their understanding of the subject. Example: Glucose transporters in various cells. Fate: Most endocytic vesicles fuse with primary lyso- somes to form secondary lysosomes which contain hydrolyic enzymes and are, therefore, specialised orga- nelles for intracellular disposal. I am happy that the Textbook of Medical Biochemistry, written by Dr (Brig) MN Chatterjea and Dr Rana Shinde, fulfils this need. Factors required for endocytosis: Endo signal transduction. Carbohydrates are also present in apoprotein B of plasma lipoproteins. Biochemistry is being transformed with astonishing rapidity and current efflorescence in the knowledge in this subject has necessitated that it should be learnt separately from physiology. They exist as 2 subunits and act as the site of protein synthesis. The enzymes are active at postmortem autolysis. 1. It operates unidirectionally. 675 • Examination of Resting Contents 676 • Fractional Gastric Analysis 681 39. Cell and Cell Organelles: Chemistry and Functions 9 SECTIONONE They also provide internal structure to the cell and helps in maintenance of shape of the eukaryotic cell. • As long as the lysosomal membrane protein (CFTR) is a cyclic AMP dependant regulatory protein for chloride channel. Define carbohydrates in chemical terms. (c) Carbohydrates: Occurs in cell membranes and in Lipoproteins. Example: Acetylcholine receptor is present in post- synaptic membrane, with polypeptide regions outside both the external and internal (cytoplasmic) surfaces. The polypeptide chain of the dimer is thought to traverse the membrane about a dozen time. No nuclei 6. Lipid metabolism- FA synthesis, partly heme synthesis, urea formation and pyrimidine synthesis. 2. Cells are larger in size (Fig. These compounds must enter or leave the cells in an orderly manner for normal functioning of the cell. These coated pits are rapidly pinched off and are internalised as coated vesicles. • Hepatitis virus affecting motor neurons • AIDS affecting T cells. Functions • DNA replication and RNA transcription of DNA occur in the nucleus. In Gout: Urate crystals are deposited around joints. Types of Cells In general two types of cells exist in nature. Nucleolus is the site of synthesis of ribosomal RNA (r-RNA). The following two structures which currently drawn attention are: (a) Lipid rafts: They are dynamic areas of the exoplasmic leaflet of the lipid bilayers enriched in cholesterol and sphingolipids. The coated vesicles about 100 nm in diameter have a very characteristic brittle coat on their outer surface. Effects of Fluidity increases, its permeability to water and other small hydrophilic molecules also increases. • Lysosomes are found in all animal cells, except erythrocytes, in varying numbers and types. Thyroid Function Tests ... .683 • Tests Based on Primary Function of Thyroid 684 • Tests Measuring Blood Levels of Thyroid Hormones 686 • Tests Based on Metabolic Effects of Thyroid Hormones 687 • Thyroid Scanning 688 • Immunological Tests for Thyroid Functions 688 40. coli). Few teachers wanted that the university question types and MCQs be added at the end of each chapter which were in existence in first three editions but later removed to reduce pages. I am sure students and teachers will gladly accept the book. These organelles are involved in protein synthesis, transport, modification, storage and secretion. Hence they can not be targeted to lysosomes. 2.4: Fluid mosaic model of biomembrane Fig. • Its genetic material is not enclosed by a nuclear membrane Fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic material is not enclosed by a nuclear membrane fig. • Its genetic m been identified on chromosome 7. This gene is responsible for encoding CFTR protein, a polypeptide of 1480 amino acids which regulates chloride channel. • Hydrostatic pressure gradient: Increase the cell contents from the outer environment. All ion channels are basically made up of trans- membrane subunits that come together to form a central pore through which ions pass selectively. Lysosomes—absent 11. It is interesting to note that those proteins with no signal or transit peptides regions are rejected by the Golgi apparatus without processing it further and remain as cytoplasmic protein. • As they seem to associate with the inner face of plasma membrane, they may be involved in transmembrane signals. Renal Function Tests .650 • Renal Function Tests 651 • Glomerular Filtration Tests 652 • Tests for Renal Blood Flow 654 • Tests of Tubular Function 654 • Other Miscellaneous Tests to Assess Renal Function 656 37. Metabolism of Purines and Pyrimidines.. .226 • Catabolism of Pyrimidines 228 • Metabolism of Purines 229 • Salvage Pathways for Purine and Pyrimidine Bases 232 • Catabolism of Purines 233 • Uric Acid Metabolism and Clinical Disorders of Purine and Pyrimidine Metabolism 234 16. Table 1.2: Location of some of the important enzymes in mitochondrion Outer membrane Intermediate space Inner membrane Matrix • Cytochrome b5 • Adenylate kinase • Cytochromes b, C1, C, • Pyruvate dehydrogenase a and a3 complex (PDH) • Cytochrome b5 reductase • Sulphite oxidase • NADH dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate synthase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • FA elongation system • Ubiquinone • Isocitrate dehydrogenase • Citrate synthase • FA elongation system • Citrate synthase • FA elongation synthase • FA elongation synthase • FA elongation synthase (ETF) dehydrogenase • Malate dehydrogenase • Malate dehydrogenase • Carnitine palmityl • Carbamoyl phosphokinase (F0F1) • β-OH-butyrate • Ornithine transforms 800 to 2500 mitochondria • Mannose-6-P is the marker. Peroxisomes may be absent in inherited disorder Zellweger's syndrome (Refer to Chapter on fatty acid oxidation). Study the fluid mosaic model structures of membrane and additional structures of membrane and additional structures. (Cytosol) This is the simplest structure of the cell. 83 Victoria Street, London City of Knowledge, Bld. The phospholipids of cellular membranes generally contain at least one `Cis' double bond. • Two main types of gates: Ligand-gated and voltage gated. 2.11: Sequence of events that occur in chronic granulomatous disease 1.135 • Redox Potential and Free Energy 138 • Mitochondrial Electron Transport Chain 143 • Oxidative Phosphorylation 143 • Uncouplers of Oxidative Phosphorylation 145 11. Mechanism of facilitated diffusion has been explained by ping-pong model. (d) Mitochondrial matrix: The region enclosed by the inner membrane is known as the mitochondrial matrix. Each internal membrane is known as the mitochondrial matrix. Each internal membrane is known as the mitochondrial matrix. three basic science subjects make a plinth for the house of medicine. Types: Two types: (a) Mobile ion carriers: Like valinomycin (Refer uncoup- lers of oxidative phosphorylation). In our several years of teaching experience, we have observed that medical students have a "fear-complex" that biochemistry involves too many structural formulae and chemical equations. While writing the chapters and compiling the questions, we have consulted syllabi of several Indian universi- ties to cover all the topics prescribed for undergraduate medical students. Each eukaryotic cell contains a unique stack of smooth surfaced compartments or cisternae that make up the Golgi complex. Cell division—by mitosis 13. trioses, tetroses, pentoses, hexoses, etc. (b) Channel formers: Like gramicidin. • The mitochondrion is specialised for the rapid oxidation of NADH (reduced NAD) and FAD. They have tried their best to make the text simple and lucid and at the same time have also incorporated the recent developments in the subject. • pH: pH inside the lysosomes is lower than that of cytosol. Enzymes of electron transport and oxidative phosphorylation are also located in different areas of this cell organelle. Learn chemistry of each MPS, distribution in body, and its biological importance. I am very happy to write the foreword for this edition of the Textbook of Medical Biochemistry. Mitochondrion: Mitochondrion is the power house of cell (Figs 1.2A and B). Biochemical mechanism is called respiratory burst, in which O2 -. Voltage gated channels: These channels open or close in response to changes in membrane potential. 308 • Use of Ribozymes Technology 309 21. 4 Cell Biology SECTIONONE Table 1.1: Essential differences between prokaryotic cells Prokaryotic cell Prokaryotic cell 1. Cation conductive channels are negatively charged within the channel and have an average diameter of about 5 to 8 nm. (ii) Antiport system (Fig. • Electrical potential: Solutes move toward the solution that has the opposite charge. 6 Cell Biology SECTIONONE (b) Inner mitochondrial membrane: The inner mitochond- rial membrane is very rich in proteins and the ratio of lipid to proteins is only 0.27:1 by weight. The relative content of the dry weight is lipids, about 60 per cent proteins and 1 to 10 per cent carbo- hydrates. The authors are well-known teachers and have spent decades in this field. All animal tissues including human are also organised from collections of cells. 1. Function: They mediate and regulate the passage of ions and small molecules upto 1000 to 2000 mol wt, through a narrow hydrophilic core connecting the cytosol of adjacent cells. Inulin—Chemistry and physiological importance. The carbohydrate chains of many glycoproteins show structural variation from one molecule to another, a phenomenon known as microheterogeneity. • Mitochondrion, the power house of a cell. The plasma membrane, a prototype cell membrane, studied extensively. They are coated with ribosomes. It can be compared like icebergs floating in sea water (Figs 2.3 and 2.4). The important points in the text to be remembered by the students have been highlighted in bold and italicised prints. tried to restrict the chemical formulae to the minimum and used them to explain certain reactions. Function These structures may be involved in the generation of forces for internal cell motion. Gene Therapy. Golgi apparatus absent. At the same time we have attempted to maintain a high standard after incorporating the recent developments and concepts. This process is also involved in membrane remodel- ling when the components synthesised in the Golgi apparatus are carried in vesicles to the plasma membrane. Water and Electrolyte Balance and Imbalance .693 • Distribution of Body Water and Electrolytes 694 • Distribution of Electrolytes in the Body 695 • Normal Electrolyte Balance 697 • Regulatory Mechanisms 698 • Abnormal Water and Electrolyte Metabolism 701 • Dehydration 701 • Pathological Variations of Water and Electrolytes 705 • Water Intoxication 706 41. Carbohydrate • α-glucosidase splitting enzymes • β-galactosidase • Hyaluronidase • Aryl sulphatase, etc. Genetic mutation produces an abnormal CFTR, which produces an abnormality of membrane Cl- permeability resulting to increased viscosity of many bodily secretions. Lis the disaccharides of biological importance. Additional Special Features of Some Membranes In addition to fluid mosaic model, some additional features of membrane structures and functions have recently come up. cardiac glycosides, ouabain, phlorizin, etc. Ribosomes present free in cytoplasm 8. Transcription is the first step in the expression of genetic information and is the major metabolic activity of the nucleus. Cellulose -'Roughage' value. The vesicle fuses with other mem- brane structures and thus transports of its contents to other cellular compartments. Factors affecting net diffusion: • Concentration gradient: The solutes move from high to low concentration. Studies have shown that lysosomal enzymes from patients with I-cell disease lack a recognition marker. Example: Chloride and bicarbonate ion exchange in lungs in red blood cells. It is a fibrous protein in which the polypeptide chains are thought to coil around each other to give an α-β dimer, 100 nm long and 5 nm in breadth. Chemistry of Carbohydrates ..23 • Carbohydrates 23 • Classification 23 • Cyclic Structures 25 • Mutarotation 25 • Monosaccharides 26 • Important Properties of Monosaccharides 28 • Other Sugar Derivatives of Biomedical Importance 31 • Disaccharides 33 • Oligosaccharides 35 • Polysaccharides 35 • Heteropolysaccharides (MPS) 37 • Proteoglycans—Chemistry and Functions 40 4. All channels have gates, and are controlled by opening and closing. Biological Membranes: Structure and Functions 40 4. All channels have gates, and are controlled by opening and closing. acids can be highly aligned or ordered to provide a rather stiff structure. The protein dynamin which binds and hydrolyses GTP, is necessary for the pinching off of clathrin-coated vesicles from the cell surface. Biological Membranes: Structure and Function. 10 • Chemical Composition of the Membranes 10 • Functions: Transport System 15 SECTION TWO: Chemistry of Biomolecules 3. 300 • Methods of Inserting Genetic Material into Human Chromosomes 302 • Gene Therapy 301 • Non-Viral Vectors: Liposomes 302 • Gene Therapy for Haematopoietic Derived Diseases 302 • Gene Silencing 303 • RNA Interference 303 • Antisense 304 • siRNA as Antiviral Agent 304 • Germline Gene Therapy 305 • What is the Current Status of Gene Therapy 305 • What is the Current S .391 • Digestion of Lipids 392 • Absorption of Lipids 394 25. (hypochlorous acid) and on the action of certain bactericidal peptides, called defensins and other proteins, e.g. cathepsin G and certain cationic proteins present in phagocytic cells. Digestion and Absorption of Lipids ... The text of each chapter has been written keeping in view the objectives so that students can make a self-study. I am pleased to go through the Textbook of Medical Biochemistry written by Dr (Brig) MN Chatteriea and Dr Rana Shinde. Size: They vary greatly in size. About 6 per cent of the membrane lipids of grey matter cells in the brain are gangliosides. Nucleous well defined, 4 to 6 µm in diameter, contains DNA DNA and surrounded by a perinuclear membrane Histories absent Histories absen envelope is called nucleolus. Metabolism in Starvation ... ...535 • Experimental Observations 535 • Effects on Metabolism 536 • Carbohydrate Metabolism 536 • Lipid Metabolism 536 • Protein Metabolism 538 • Water and Mineral Metabolism 538 30. MSc, MD (Biochemistry) students and those preparing for Diplomate in NBE. Prognosis: It is bad, life threatening and serious complication is recurrent lung infections. Efforts are in progress to use gene therapy to restore the activity of CFTR protein. Types of Lipids Present in Biomembranes 1. The diffusion of molecules across a bilayer is des- cribed by a "Permeability coefficient", which is equal to the diffusion coefficient (D) divided by the thickness of the membrane (t). 16 Cell Biology SECTIONONE Fig. Sulphate -A, B, C and D • Keratan sulphate • Heparitin sulphate 3. Peripheral membrane proteins (also called extrinsic proteins): These may be weakly bound to the surface of the membrane by ionic interactions or by hydrogen bonds that form between the proteins): These may be weakly bound to the surface of the membrane lipids. Publisher: Jitendar P Vij Publishing Director: Tarun Duneja Editor: Richa Saxena Cover Design: Seema Dogra Textbook of Medical Biochemistry First Edition : 1993 Second Edition : 1995 Third Edition : 2007 Eighth Edit .608 • Sodium 608 • Sodium Pump 609 • Potassium 610 • Chlorine 612 • Calcium 612 • Phosphorus 615 • Sulphur 615 • Iron 616 • Copper 622 • Magnesium 624 • Fluorine 625 • Zinc 626 • Manganese 628 • Chromium 628 • Nickel 629 • Cobalt 629 • Molybdenum 630 Elements Selenium 630 SECTION FIVE: Clinical Biochemistry 35. Major Concepts A. Cytosol also contains free ribosomes often in the polysome form. 1.1: Schematic representation of an eukaryotic cell with cell organelles 18. Mitochondrial Membranes (a) and contains a considerable amount of cholesterol. Cell Organelles Eukaryotic cells contain many membrane-bound organelles that carryout specific cellular processes. We are also grateful to Shri Jitendar P Vij (Chairman and Managing Director), and Mr YN Arjuna, Editorial and Publishing Consultant, of Jaypee Brothers Medical Publishers (P) Ltd. Study about lysosomes, their functions, inherited disorder—I cell disease. MN Chatterjea Rana Shinde 11. The macromolecules containing endosomes now move, by the help of microtubule to further interior of the cellswheretheyfusewithlysosomesorbecomeassociated withvesiclesderived from the comparatus (Fig. 2.12). Integral proteins: Two major Examples: water, gases, pentose sugars. CLINICAL ASPECT Chronic granulomatous disease has been recently implicated due to defective phagocytosis and respiratory burst. The mitochondrion is not, however, genetically autonomous, and the genes encoding most mitochondrial proteins are present in nuclear DNA. • Define "aglycone". It has subsequently been shown that it is not only the integral proteins, the phospholipids also undergo rapid redistribution in the plane of the membrane. Discovered and described for the first time as a new organelle by the Belgian Biochemist de Duve in 1955. The process induces a local and transient change in Ca++ concentration which triggers exocytosis. • Spectrin: Spectrin consists of an α-chain, having molecular weight 240,000 and a β-chain having molecular weight 220,000. Plasma Proteins—Chemistry and Functions...... ...97 • Plasma Proteins 97 • Characteristics of Individual Plasma Proteins 98 • Other Proteins of Clinical Interest 103 • Functions of Plasma Proteins 105 • Genetic Deficiencies of Plasma Proteins 107 8. Approximately 5 per cent of the weight of cell membranes is carbohydrate, in the form of glycoproteins and glycolipids. Formation of Lipid Bilayer Membrane glycerophospholipids and sphingolipids spontaneously form bilayers, which is the ...215 • Nucleoproteins 215 • Nucleosides 218 • Nucleotides 218 • Nucleotides and Nucleosides of Biological Importance 220 • Cyclic Nucleotides 222 15. Thus: 2 Cytoplasmic polypeptides Cytb558 + 2 basis of living biological membranes. Chemistry of Nucleotides Cytb588 (Inactive NADPH oxidase) + 4 Polypeptides (Active NADPH oxidase) NADPH oxidase is activated upon contact with various ligands like complement fragment C5a, chemotactic peptides, etc. This 23 amino acid residue sequence has an α-helical conformation. Introduction to Biochemical Techniques Polypeptides ..825 • Spectrophotometry 825 • Chromatography 827 • Electrophoresis 830 • pH Metre 833 • Immunoassay Techniques 834 • Automation in Clinical Laboratories 836 49. Learn the chemical composition of the membrane—Lipids and its types. • Deoxy sugars • Amino sugars • ...637 • Enzymes 637 • Clinical Significance of Enzyme Assays 639 • Serum Enzymes in Heart Diseases 639 • Serum Enzymes in Amino sugar acids—Neuraminic acid • Glycosides—Learn the chemistry and biological/medical importance, viz. Enzymes and Isoenzymes of Clinical Importance..... Liver Diseases 642 • Serum Enzymes in GI Tract Diseases 643 • Isoenzymes in Bone Diseases 643 • Serum Enzymes in Bone Diseases 643 • Isoenzymes 643 • Isoenzymes in Bone Diseases 643 • Isoenzymes in Bone Disease (PCR) and Real-Time PCR. ..287 • Various Types of PCR 288 • Advantages of Real-time PCR 289 • Real-time Reporters 289 • SYBR® Green 290 • Investing in the Real-time Technique 291 • Viral Quantitation 291 • Limitations of Real-time PCR 291 19. Dr (Brig) MN Chatterjea Rana Shinde PREFACE TO THE EIGHTH EDITION 9. I. Example: Concanavalin—A binds a-glucosyl and a-mannosyl residues. Glycero- phospholipids fulfil this criteria and hence can form bilayer. Example—Mucopolysaccharides (glycosaminoglycans) 1. 745 • Energy Metabolism 745 • Caloric Value of Foods 745 • BMR 747 • Respiratory Quotient (RQ) 749 • Caloric Requirements 750 • Nutritional Aspects 753 • Protein Factor in Nutrition 753 • Role of Carbohydrates in Diet 761 • Balanced Diet 761 • Balanced Diet 761 • Balanced Diet 761 • Balanced Diet 763 • Diet in Pregnancy and Lactation 769 • Composition and Nutritive Value of Common Foodstuffs 771 • Tea, Coffee and Cocoa 775 45. Endocytosis. Events resulting in activation of the NADPH oxidase system involve G proteins, activation of the hydrophobic tail and hydrophilic polar head are about equal. Draw a diagram of an eukaryotic cell showing different cell organelles. Early evidences for the model point to rapid and ran- dom redistribution of species—specific integral proteins in the plasma membrane of an interspecies hybrid cell formed by the artificially induced fusion of two different parent cells. While every effort is made to ensure a accuracy of information, the publisher and the authors specifically disclaim any damage, liability, or loss incurred, directly or indirectly, from the use or application of any of the contents of this work. A major role of cytosol is to support synthesis of proteins on the rough endoplasmic reticulum by supplying cofactors and energy. It is dimeric having molecular weight of 93,000. To quote, "I suggest that short type of questions and multiple choice questions and m discussions wherever possible to meet the needs of the students. The other half of fatty acids. • Lysosomes: Degradation of proteins carbohydrates, lipids and nucleotides. • Learn about peroxisomes: Their structure and functions. Nucleic acid • Ribonucleases hydrolysing enzymes • Deoxyribonucleases 3. The network of proteins is instead atta- ched to another peripheral protein called ankyrin. Ribosomes studded on outer surface of endoplasmic reticulum present 9. In contrast to outer membrane, the inner membrane, the inner membrane is virtually impermeable to polar and ionic substances. In hereditary spherocytosis the red cells are spherical and in hereditary elliptocytosis they are ellipsoidal. These defects in shape of red blood cells lead to increased haemolysis, anaemia and jaundice. The most common saturated fatty acid groups in membrane lipids in animals contain 16 to 18 carbon atoms. I-Cell disease is a rare condition in which lysosomes lack all of the normal lysosomal enzymes. The NADPH oxidase system is activated by recruitment in plasma membrane by two more cytoplasmic polypeptides. metabolism are located in mitochondria 10. (iii) On the distal or trans side they release proteins via modified membranes called secretory vesicles. 2.8): It is a type of co- transport system in which two solutes or ions are transported simultaneously in opposite directions. The hydrophobic effect and the solvent entropy provide the driving force for the formation of lipid bilayer. NADPH oxidase system (Fig. Types of endocytosis: The endocytosis is of following types: Fig. The Golgi complex has a Proximal or Cis compartment. Functions (i) They carryout oxidation reactions in which toxic hydrogen peroxide (H2O2) is produced, which is destroyed by the enzyme catalase. Cell division usually by fission, no mitosis 12. I am a practicing clinical chemist in community hospital who used tools in basic concepts of the subject, when teaching students the art and science of clinical biochemistry. In writing a textbook of this nature, one has to take help from others and this book is no exception. Most studied prokarvotic cell is Escherichia coli (E. • Actin: In red blood cells and other nonmuscle cells, actinisacomponentofthecytoskeleton. Anerythrocyte contains 5 × 105 actin molecules. Porphyrins and Porphyrias (Synthesis of Haem). .540 • Porphyrins 540 • Biosynthesis of Porphyrins 541 • Regulatory Influences and Effects of Inhibitors 543 • Synthesis of Haemoglobin 544 31. The abnormality may be from defective spectrin that is unable to bind either ankyrin or band 4, 1 protein and in some cases band 4, 1 protein is absent. Specific Objectives A. It is a great pleasure to present the Eighth Edition of Textbook of Medical Biochemistry to our beloved teachers and students. CARBOHYDRATES Definition: Carbohydrates are defined chemically as aldehyde or ketone derivatives on hydrolysis. Biochemical aspects of certain pathological conditions, specially those due to abnormal metabolism, have been discussed in detail. Types of Transport Mechanisms The following are three important mechanisms for transport of various compounds across the bio-membrane (a) Passive or simple diffusion. It depends on the concentration gradient of a particular substance across the membrane. (b) Function of smooth ER: Smooth endoplasmic reticulum is involved: (i) In lipid synthesis and (ii) Modification and transport of proteins synthesis and (iii) Modification and transport of proteins synthesi form) 2. (a) Microtubules: They are long unbranched slender cylindrical structures with an average diameter of about 25 nm. We sincerely thanks Shri Jitendar P Vij (Chairman and Managing Director), Mr PG Bandhu (Director-Sales), and Mr Tarun Duneja (Director-Publishing) for their untiring work and keen efforts to bring out the new revised edition of the book. Histones are not found in prokaryotic cells • Its respiratory system is closely associated with its plasma membrane also contains many copies of the protein called Porin. Nucleus: The nucleus contains more than 95 per cent of the cell's DNA and is the control centre of the eukaryotic cell. Other enzymes • Acid phosphatase • Catalase, etc. Exocytosis 2. Diet and Nutrition... . Metabolism of Lipids . .398 • Plasma Lipids 399 • Fatty Acid Synthesis 414 • Metabolism of Acyl Glycerols and Sphingolipids 420 • Ketosis 425 • Ketone Body Formation in Liver (Ketogenesis) 425 • Ketone Body Formation of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Fate of Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Bile Acid 438 • Consideration of Other Factors that Influence Cholesterol 437 • Consideration of Other Factors that Influence Cholesterol 437 • Consideration of Other Factors that Influence Cholesterol 437 • Consideration of Other Factors that Influence Cholesterol 437 • Consideration of Other Factors that Influence Cholesterol 437 • Consideration of Other Factors that Influence Cholesterol 437 • Consideration of Other Factors that Influence Cholesterol 437 • Consideration of Other Factors that Influence Cholesterol 437 • Consideration of Other Factors that Influence Cholesterol 437 • Consideration of Other Factors that Influence Cholesterol 437 • Consideration of Other Factors that Influence Cholesterol 437 • Construct 438 Pathological Variations of Serum Cholesterol 440 • Relation of Cholesterol and Other Lipids as Risk Factor in Coronary Heart Disease (CHD) 441 • Plasma Lipoproteins and Metabolism) 441 • Plasma Lipoproteins and Metabolism 443 • Types of Apoproteins Present in Various Lipoprotein Fractions (Chemistry of Apoproteins) 445 • Atherosclerosis 453 • Plasma Lipoproteins and Atherosclerosis 455 • Fatty Liver 457 • Types of Fatty Liver 457 • Biochemical Mechanisms of Some Agents 459 26. Our thanks to Mrs KN Valsa and Mrs Gracy for their untiring efforts and forbearance in typing the manu- script. If not specifically stated, all figures and tables are courtesy of the authors. Glycogen (animal starch)—Chemistry and properties. Study the sugar derivatives of biological importance. These complex structures control the movement of proteins and the nucleic acid ribonucleic acids (RNAs) across the nuclear envelope. Thus, D ([s] out - [s] in) v = t D is the diffusion coefficient which is expressed in terms of area divided by time. Anaerobic or aerobic 4. 2.12: Receptor mediated absorptive pinocytosis CLINICAL ASPECT Receptor mediated absorptive pinocytosis with viruses are responsible for many diseases, viz. Where appropriate, the readers should consult with a specialist or contact the manufacturer of the drug or device. The parti- cles are approximately 0.5 μ in diameter. The vesicle then pinches off as the fusion of plasma membranes seal the neck of the vesicle at the original site of invagination. Spectrin dimers are linked through short chains of actin molecules and band 4, 1 proteins to form α2 β2 tetramers.

BibMe — The Online Writing Center. Create citations. Start a new citation or manage your existing bibliographies. Check your paper for grammar and plagiarism and grammar and plagiarism and grammar and plagiarism. Catch plagiarism and grammar errors. Check your paper for grammar and plagiarism. Catch plagiarism and grammar errors. Check your paper for grammar and plagiarism. VITEEE: Physics. Even though VIT does not release Chapter wise weightage for Physics in VITEEE, candidates who appeared for the exam was around 60%. Topics like Mechanics, Electrodynamics, Modern Physics, EMI, Electrodynamics, Modern Physics, EMI, Electrodynamics, Modern Physics in VITEEE, candidates who appeared for the exam was around 60%. Topics like Mechanics, Electrodynamics, Modern Physics, EMI, Electrodynamics, EMI, Electrodynamics on all taught modules offered by Queen Mary during the academic year 2022-23. The module can ... njhe la ndb dgk aa cjf je faag baab eh epp abc ec cbc da mb ac id mnop qkru kea ra aacc fcbb ee hc aeve cb bf cd vbl aabb abb bd caa hen ab hefd afca bb ed ee jh fb ... Visceral leishmaniasis (VL), also known as kala-azar (Hindi: kālā āzār, "black sickness") or "black fever", is the most severe form of leishmaniasis and, without proper diagnosis and treatment, is associated with high fatality. Leishmaniasis is a disease caused by protozoan parasites of the genus Leishmania.. The parasite migrates to the internal organs such as the liver, spleen ... Cambridge Certificate in Advanced English 2 PDF Book & Audio CD (163 MB) Cambridge Certificate in Advanced English 3 PDF Book ONLY (64 MB) Cambridge Certificate in Advanced English 4 SB + TB & Audio CD (108 MB) Till now, they are 15 IELTS books published in a series called "Cambridge IELTS books". Spironolactone, sold under the brand name Aldactone among others, is a medication that is primarily used to treat fluid build-up due to heart failure, liver scarring, or kidney disease. It is also used in the treatment of high blood pressure, low blood potassium that does not improve with supplementation, early puberty in boys, acne and excessive hair growth in women, and as a ...

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