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101: CELL BIOLOGY

UNIT I

1. Cell Membrane: Physicochemical Properties; Molecular Organization - asymmetric organization of lipids, proteins and carbohydrates; Biogenesis and Functions
2. Transport of Small Molecules Across Cell Membranes: Types and Mechanism
3. Active Transport by ATP-Powered Pumps: Types, properties and mechanisms
4. Transport of proteins into mitochondria and chloroplast

UNIT II

1. Transport of proteins into and out of nucleus
2. Transport of proteins into endoplasmic reticulum
3. Transport by vesicle formation: Endocytosis and Exocytosis
4. Molecular Mechanism of vesicular transport

UNIT III

1. Intracellular Digestion: Ultra structure and Functions of Lysosomes
2. Cell Motility and Shape I: Structure and Functions of Microfilaments
3. Cell Motility and Shape II: Structure and Functions of Microtubules and Intermediate Filaments
4. Intracellular communication through cell junctions: Occluding junctions, Anchoring Junction and Communicating Junctions.

UNIT IV

1. Molecular Mechanism of Cell-Cell Adhesion: Ca^{++} dependent cell-cell adhesion
2. Molecular Mechanism of Cell-Cell Adhesion: Ca^{++} independent cell-cell adhesion
3. Extra-cellular Matrix of Animals: Organization and Functions
4. Extra-cellular Matrix Receptors on Animal Cells: The Integrins

UNIT V

1. Cell Signaling: Signaling via G-Protein linked and enzyme linked cell surface receptors, MAP Kinase Pathways, Interaction and Regulation of signaling pathways
2. Eukaryotic Cell Division Cycle: Different Phases and Molecular Events
3. Control of Cell Division Cycle: In yeast and mammalian cells
4. Apoptosis: Phases and significance, Morphological and Biochemical changes associated with apoptotic cells, Apoptotic Pathways and regulators

Practical Exercises

1. Sub cellular fractionation
2. Chromosome Preparation: Mitosis - Onion root tip, rat/mouse cornea, rat/mouse bone marrow, human lymphocytes
3. Chromosome Preparation: Meiosis - Rat/mouse testis, Grasshopper testis
4. Polytene chromosome preparation from Drosophila salivary gland
5. Identification of tissue typing: Histological preparation of tissue
6. Identification of different biomolecules in different tissues by histochemical techniques

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7. Electron microscopy: Demonstration and good photographs for interpretation.

Reference Books

1. Molecular Biology of the Cell, Alberts, *et al*
2. Molecular Cell Biology, Lodish, *et al*
3. Working with Molecular Cell Biology: A study Companion, Storrie *et al*
4. Cell and Molecular Biology: Concepts and Experiments, Gerald Karp
5. The Cell: A Molecular Approach, G.M. Cooper
6. The Word of the Cell, Becker *et al*
7. Cell Proliferation and Apoptosis, Hughes and Mehnet
8. Essential Cell Biology, Alberts *et al*
9. Biochemistry and Molecular Biology of Plants, Buchanan *et al*
10. Harpers Biochemistry Murray *et al*

Note: All text books are of latest editions.

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102: BIOMOLECULES**UNIT I**

1. Carbohydrates : Structure, classification, properties and functions
2. Home and heteropolysaccharides : carbohydrate derivatives
3. Lipids : Classification, structure, properties and functions
4. Lipids with special biological functions

UNIT II

1. Amino acids : Structure, classification, abbreviations, properties and functions
2. Peptides and polypeptides
3. Synthesis of peptides and protein sequencing
4. Proteins : Properties, covalent structure, secondary, tertiary and quaternary structure

UNIT III

1. Enzymes : Classification, mechanism of action, allosteric enzymes, multienzyme complex
2. Enzyme kinetics : Basic concepts
3. Water soluble vitamins : Structure, distribution, interaction and biological functions (mechanism of action not included)
4. Fat soluble vitamins : Structure, distribution and functions

UNIT III

1. Nucleotides : Structure of purine and pyrimidine bases, nucleosides, nucleotides
2. DNA : Structure and Conformation
3. DNA : denaturation, degradation, modification, repair, recombination and rearrangement
4. RNA : Structure, types and functions

UNIT V

1. Animal hormones : Structure and biological roles
2. Plant hormones : Structure and biological functions
3. Plant phenolics: Classification and functions
4. Alkaloids : Classification and functions

Practical Exercises

1. Titration of amino acids
2. Colorimetric determination of pKa
3. Model building using space filling/ ball and stick models
4. Reaction of amino acids, sugars and lipids
5. Quantitation of proteins and sugars
6. Analysis of oils : iodine number, saponification value, acid number

Reference Books

1. Principles of Biochemistry by Nelson, Cox and Lehninger
2. Biochemistry by G.Zubay

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3. Biochemistry by Stryer
4. Biochemistry by Garrett and Grisham
5. Biochemical Calculations, Irwin H. Seigel, John Wiley and Sons Inc.
6. Biochemistry, DVoet and JG. Voet, J Wiley and Sons.
7. Biochemistry, D Freifilder, W.H. Freeman & Company.
8. Laboratory Techniques in Biochemistry and molecular Biology, Work and Work
9. A Biologist's guide to Principles and Techniques of Practical Biochemistry, Wilson & Goulding, ELBS Edition.

Note: All texts are of latest editions.

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103: MICROBIOLOGY

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UNIT I

1. Classification of Microorganisms: Basis of microbial classification, Haekel three kingdom, Whittaker's five kingdom concept.
2. Morphology and fine structure of eubacteria and archeobacteria cell wall, cytoplasmic membrane and other organelles.
3. Pure culture techniques and preservation methods.
4. Preparation of Culture media, microbial staining.

UNIT II

1. Sterilization: Physical and chemical methods
2. Microbial Growth: Bacterial growth curve, Mathematical expression, measurement of Growth and factors affecting growth
3. Microbial Nutrition: Nutritional classification of Microorganisms, common nutritional requirements, mode of nutrition, transport of nutrients across the bacterial membrane
4. Oxygen toxicity: Study of catalase, peroxidase, superoxide dismutase, mechanism of oxygen toxicity.

UNIT III

1. Virus: Types, Isolation, cultivation, identification and viral replication.
2. Structure and morphology of Bacteriophage, Lytic and lysogenic cycle.
3. Life cycle of DNA Viruses: SV40, RNA Viruses: Retroviruses
4. Cynobacteria : General account and their importance

UNIT IV

1. Infection and disease, types of Infection, Mechanism of pathogenicity
2. Bacterial Diseases: Staphylococcal and Clostridial food poisoning, Salmonellosis Shigellosis
3. Fungal diseases: Histoplasmosis , Aspergillosis
4. Viral diseases: Chicken pox, Hepatitis B, and Poliomyelitis

UNIT V

1. Mycoplasmas and diseases caused by them
2. Bacterial Recombination: Transformation, Conjugation, Transduction, Plasmids and transposons
3. Chemotherapeutic agents: Classification of antibiotics, Broad spectrum antibiotics Antibiotics from prokaryotes
4. Anti-fungal and antiviral antibiotics, mode of action of antibiotics and resistance to antibiotics

Practical Exercises

1. Preparation of liquid and solid media for growth of microorganisms.
2. Isolation and maintenance of organisms by plating, streaking and serial dilution methods. Slants and stab cultures. Storage of microorganisms
3. Isolation of pure cultures from soil and water.
4. Growth; Growth curve; Measurement of bacteria population by turbidometry

M. J. J. J.

