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| 4 th Semester | RBT4C001 | Cell and Molecular Biology | L-T-P 3-0-0 | 3 CREDITS |
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Module-I: CELL STRUCTURE AND FUNCTION OF THE ORGANELLES AND CHEMISTRY OF NUCLEIC ACIDS (10 Hrs.)

Prokaryotic, Eukaryotic cells, Sub-cellular organelles and functions. Principles of membrane organization membrane proteins, cytoskeletal proteins. Extra cellular matrix, cell-cell junctions. Introduction to nucleic acids: Nucleic acids as genetic material, Structure and physicochemical properties of elements in DNA and RNA, Biological significance of differences in DNA and RNA. Primary structure of DNA: Chemical and structural qualities of 3',5'-Phosphodiester bond. Secondary Structure of DNA: Watson & Crick model, Chargaff's rule, X-ray diffraction analysis of DNA, Forces stabilizes DNA structure, Conformational variants of double helical DNA, Hogsteen base pairing, Triple helix, Quadruple helix, Reversible denaturation and hyperchromic effect. Tertiary structure of DNA: DNA supercoiling.

Module-II: CELL DIVISION, CANCER, APOPTOSIS AND IMMORTALIZATION OF CELLS AND DNA REPLICATION & REPAIR(10 Hrs.)

Cell cycle – Mitosis, Meiosis, Molecules controlling cell cycle, cancer, role of Ras and Raf in oncogenesis and apoptosis. Stem cells, Cell culture and immortalization of cells and its applications. Overview of Central dogma. Organization of prokaryotic and eukaryotic chromosomes. DNA replication: Meselson & Stahl experiment, bi-directional DNA replication, Okazaki fragments, Proteomics of DNA replication, Fidelity of DNA replication, Inhibitors of DNA replication, Overview of differences in prokaryotic and eukaryotic DNA replication, Telomere replication in eukaryotes. D-loop and rolling circle mode of replication. Mutagens, DNA mutations and their mechanism, various types of repair mechanisms.

Module-III: TRANSPORT ACROSS CELL MEMBRANE AND SIGNAL TRANSDUCTION (08 Hrs.)

Passive and Active Transport, Permeases, Ion channels, ATP pumps. Na⁺ / K⁺ / Ca²⁺ pumps, uniport, symport antiporter system. Ligand gated / voltage gated channels, Agonists and Antagonists. Receptors – extracellular signaling, Cell surface / cytosolic receptors and examples, Different classes of receptors autocrine / paracrine / endocrine models, Secondary messengers molecules.

Module-IV: TRANSCRIPTION & TRANSLATION (10 Hrs.)

Structure and function of mRNA, rRNA and tRNA. Characteristics of promoter and enhancer sequences. RNA synthesis: Initiation, elongation and termination of RNA synthesis, Proteins of RNA synthesis, Fidelity of RNA synthesis, Inhibitors of transcription, Differences in prokaryotic and eukaryotic transcription. Basic concepts in RNA world: Ribozymes, RNA processing: 5'-Capping, Splicing-Alternative splicing, Poly 'A' tail addition and base modification. Introduction to Genetic code: Elucidation of genetic code, Codon degeneracy, Wobble hypothesis and its importance, Prokaryotic and eukaryotic ribosomes. Steps in translation: Initiation, Elongation and termination of protein synthesis. Inhibitors of protein synthesis. Posttranslational modifications and its importance. Prokaryotic gene regulation – lac and trp operon, Regulation of gene expression with reference to λ phage life cycle.

Module-V: TECHNIQUES USED TO STUDY CELLS

(07 Hrs.)

Cell fractionation and flow cytometry Morphology and identification of cells using microscopic studies like SEM, TEM and Confocal Microscopy. Localization of proteins in cells – Immunostaining.

Books:

1. Lodish, Harvey et al., “Molecular Cell Biology”, 7th Edition, W.H.Freeman, 2005.
2. Cooper, G.M. and R.E. Hansman “The Cell: A Molecular Approach”, VIIth Edition, ASM Press, 2007.
3. Friefelder, David. “Molecular Biology.” Narosa Publications, 1999
4. Weaver, Robert F. “Molecular Biology” IInd Edition, Tata McGraw-Hill, 2003