

LSC 401 - CELL BIOLOGY

1. Evolution of the cell, From molecules to first cell, From Prokaryotes to eukaryotes, From single cells to multicellular organisms, Functional differentiation of cells/cell types
2. Cell Membrane structure, Lipid bilayer, Membrane proteins, Membrane transport of small molecules, Membrane transport of macromolecules and particles, exocytosis and endocytosis, Cell wall and cell structure of prokaryotes and eukaryotes.
3. Methods in cell biology: Light microscopy, Fluorescence microscopy, Confocal microscope, Phase contrast microscopy, Scanning electron microscope, Transmission electron microscopy Atomic force microscopy; Purification of cells and their parts, Cell separation and culture, Flow cytometry, Fractionation of cell contents, Cellular and molecular tracing with radioactive isotopes and antibodies.
4. The Cell nucleus, Morphology and functional elements of eukaryotic chromosomes, Chromosomal DNA and its packaging and organization, The complex global structure of chromosomes and functions, implications, Lampbrush Chromosomes, Polytene chromosomes, heterochromatin, centromere.
5. Organelles of the eukaryotic cell: The lysosomes, The peroxisomes, The Golgi apparatus, The endoplasmic reticulum.
6. Mitochondria and chloroplast, Structure of the mitochondria and chloroplast, Oxidation of glucose and fatty acids, Electron transport and oxidative phosphorylation, Chloroplast and photosynthesis.
7. Ribosome, Organelle biogenesis and protein secretion and synthesis, protein targeting of mitochondria, chloroplast, nucleus and peroxisome; Translational modification in the ER. Intracellular traffic, vesicular traffic in the secretory pathway, protein sorting in Golgi, traffic in the endocytic and exocytic pathways.
8. The cytoskeleton, the nature of cytoskeleton, Intermediate filaments, Microtubules, Action filaments, Cilia and centrioles, Organization of the cytoskeleton.
9. Cell growth and division, Overview of cell cycle and its control, The molecular mechanisms for regulating mitotic and meiotic events, Cell cycle control in mammalian cells, yeast and plant; Checkpoints in cell cycle regulation.
10. Cell adhesions, cell junctions and extracellular matrix, Cell-cell adhesion and communication, Cell matrix adhesion, Collagen, fibrous protein of the matrix, Non-collagen component of the extracellular matrix.
11. Cell to cell signaling, Overview of the extracellular signaling, Identification of cell surface receptors, G-Protein coupled receptors and their effectors, Second messengers, Enzyme – linked cell surface receptors, Interaction and regulation of signaling pathways.
12. Neurons and Muscles: Types and properties, Basics of transmembrane potential and excitability channels, Active and Passive, ligand-, ion-, voltage-gated channel and their biology. Neuronal receptor, Pre- and Post-synaptic biological actions, Axoplasmic flow, Growth, degeneration and regeneration of neurons, Cellular basis of memory, Basic techniques.

Suggested Readings

1. Molecular Biology of the Cell - by Alberts *et al.*
2. The Cell: A molecular approach - by Cooper and Hausman
3. Molecular Cell Biology - by Lodish *et al.*