MANGALORE UNIVERSITY

DEPARTMENT OF BIOSCIENCE

SOFT CORE COURSES

BSS404 ADVANCED CELL BIOLOGY

Course Outcomes:

Upon successful completion of the course, students will be able to:

- Gain a deep knowledge in Cell Biology and its biomedical relevance.
- Know how scientists develop hypothesis by learning various models for membrane structure.
- Explain the physiochemical properties of biological membranes with structural and functional insights.
- Understand the components of cell cycle control, mechanisms of cell division and cellular senescence.
- Know factors affecting the programmed cell death (apoptosis).
- Understand how cells communicate one another and role of various messenger molecules in signal transduction.

Unit I (13 hours)

Introduction to Cell Biology. Various models for membrane structure; Singer and Nicolson's model. Physicochemical properties of biological membranes – compositions, molecular organization, Membrane asymmetry – lipids, proteins and carbohydrates, lateral diffusion, membrane domains – caveolae, rafts. RBC as a Model membrane. Transport across biomembranes- Energetics of membrane transport, Donnan membrane equilibrium, simple diffusion, osmosis, facilitated diffusion and active transport. Carrier proteins, Ion channels (voltage gated and transmitter gated) Bacterial -K^+ leak channel, & aquaporin channel, Electrical properties of membranes- Membrane potential, Mechanisms of nerve conduction. Transmission across electrical and chemical synapse. Mechanisms of endocytosis and exocytosis.

Unit II (13 hours)

Components in cell cycle control - Cyclins, CDKs in yeast and mammalian cells. Check points in cell cycle. Mechanics of Cell Division- Different stages of mitosis. Cohesins and Condensins in chromosome segregation, Microtubules in spindle assembly, Structure of kinetochore, centrosome and its functions, Sister Chromatid separation. Cytokinensis role of actin & myosin in the generation of contractile ring. Meiosis – Significance. Chiasma formation - Synaptonemal complex. Recombination during meiosis - recombination nodules. Programmed cell death (Apoptosis): Mechanisms by internal signals and external signals, factors affecting apoptosis. Cell senescence.

Unit III (13 hours)

Various types of cell signaling-endocrine, paracrine, juxtacrine and autocrine; Signalling molecules – hormones, neurotransmitters, gases, lipids, peptides. Overview of classes of extra cellular (G-protein coupled receptors, Ion channel receptors, Tyrosine kinase linked receptors & Receptors with intrinsic enzyme activity (RTK) and Intracellular receptors (cytosolic and nuclear receptors). General mechanisms of signal transduction by G protein coupled receptors and receptor tyrosine kinase, Second messengers- Ca^{2+}, IP_3, DAG, cAMP & cGMP
– cellular effects. Signalling pathways in development and differentiation (overview). Cell– cell adhesion, cell junctions; Extracellular matrix, extracellular matrix receptors. Cell – cell and Cell – matrix interaction (Integrins and selectins and their interaction).

References:

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10. Lewin's Cells 2 nd edition, Editors Lynne Cassimeris, V.R. Lingappa, George Plopper, 2011, Jones and Bartlett publishers Sudbury Massachusetts, USA,.
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