

Course Code: ZOO 314
Number of Credits: 3 + 1
Effective from AY: 2020 -21

Course Title: Advanced Cell Biology

Prerequisite for the Course:	Basic understanding of different components and functions of the cell.	
Objectives:	3. To develop advanced concepts of structural and functional properties of cell and its components. 4. To understand dynamic functions associated with cell membrane and organelles.	
Content	Module 1 Cell membrane: Plasmamembrane Dynamics involved in Membrain fluidity (Paracrystalline state, Liquid-disordered state and Liquid-ordered state), Transbilayer movements, lateral movements, Membrane Rafts, Caveolins, cell-cell interaction, membrane fusions. Importance of Freeze-fracture microscopy and Fluorophore Photobleaching experiments to decipher membrane structure and dynamism. Nuclear transport: Passive Transport and selective energy dependant transport, Karyopherins (Importins and exportins), NLS and NES Module 2 Endomembrane system: Main Vesicular transport pathways (inward transport: Endocytotic pathway and Outward Transport: Secretory pathway) of endomembrane systems and transport proteins involved. Structural and functional Polarization of Golgi apparatus, Two models for cis to trans-Golgi progression (Cisternal Maturation Model and Vesicular transport model, three pathways of protein sorting at trans Golgi network: Signal mediated diversion to Lysosomes, Signal mediated diversion to regulated secretion, constitutive secretory pathways. LAMP and LIMP of Lysosomes and their significance. Synthesis, Structure and Functions of Ribosome and its subunits in Prokaryotes and Eukaryotes. Concept of LUCA in relation to Ribosomes. Module 3 Comparison of constitution of Cytoplasm, Cytosol and Nucleoplasm. Comparison of Organelle composition of Protein secreting and Steroid secreting Cells. Comparison of Cytoskeletal elements of Prokaryotes and Eukaryotes. Programmed and non-programmed Cell death and its types, Autophagy, Pyroptosis, Necroptosis, Parthoantos, Ferroptosis, Apoptosis and Necrosis. Extrinsic <i>versus</i> Intrinsic pathway of	07 hrs. 02 Hrs 03 Hrs 04 Hrs 06 hrs 02 Hrs 03 Hrs 04Hrs

	Apoptosis in Mammals. Cell signaling: General Principles, Specific responses to cell signaling (Survive, Grow+divide, Differentiate, Die) with example each, Feedback loops of signaling networks, adaptation to sensitivity to signaling. Overview of Receptors, Signaling transducers and second messengers. Module 4 Practicals: 1. Isolation of plasmamembrane from blood cells or from hepatocytes. 2. Cytoskeletal element staining using buccal epithelial cells. 3. Temporospacial patterns of apoptosis in chick embryos during the morphogenetic period of development.	05 Hrs 12 x 2 Hrs
Pedagogy:	Lectures/ tutorials/Group discussions/PBL/self-study	
Learning Outcome:	3. Understand the functions of the cell at the molecular level. 4. Gain insight into the most significant functional cellular machinery to expand understanding of biological disturbances.	
References /Reading	13. Alberts B, Johnson A, Lewis J, et al. Molecular Biology of the Cell, Taylor & Francis Group, New York, USA. 14. Lodish H, Berk A, Lawrence S, et al., Molecular Cell Biology, Freeman WH & Co. New York. 15. Watson JD, Beyker, Bell JD, et al., Molecular Biology of the Gene, Pearson Education, Delhi. 16. Bray BAD, Lewis J, Raff M, Roberts K and Watson JD, Molecular Biology of the Cell, Garland Publishing Co. Ltd. New York. 17. De Robertis EDP and De Robertis EMF, Cell and Molecular Biology Saunders College, Philadelphia Dowben RM, Cell Biology, Harper and Row Publ. London. 18. Nelson, D. L. and Cox, M. M. Lehninger Principles of Biochemistry. Seventh Edition (2017). Freeman WH and Co, USA	