



CELL BIOLOGY: CELLULAR ORGANIZATION, DIVISION AND PROCESSES

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PRE-REQUISITES : Basic Molecular Biology, Genetics and Biochemistry. Especially basic structure and function of biomolecules including enzymes.

INTENDED AUDIENCE : Biology, Chemistry

COURSE OUTLINE :

This course focuses on cell organization, and the molecules and intracellular processes crucial for life and inheritance. A particular emphasis is on DNA transactions such as chromosome organization, replication, chromosome segregation, etc. Some examples of key discoveries in the field of cell cycle regulation, chromatin organization, and the dynamic processes and molecular machines involved in cell division will be discussed in detail. Other topics include Nuclear organization, Mitosis and Meiosis and cell death. In addition, cellular diversity will be discussed including selected specialized eukaryotic cells and their functions, cancer cells-how controls go wrong, and stem cells.

ABOUT INSTRUCTOR :

Prof. Shikha Laloraya is a Professor of Biochemistry, I.I.Sc. She also was Associate Professor and Assistant Professor of Biochemistry, and a Wellcome Trust International Senior Research Fellow in Biomedical Science in India, at IISc. She did her Ph.D. in Oncology, from the University of Wisconsin-Madison, U.S.A. and post-doctoral research at the Carnegie Institution of Washington, Dept. of Embryology, and the Howard Hughes Medical Institutes, in Baltimore, U.S.A. and obtained an M.Sc. degree from the Centre for Biotechnology, Jawaharlal Nehru University, and also studied Life Sciences at the School of Life Sciences, Devi Ahilya Vishwavidyalaya. She did her B.Sc. from Devi Ahilya Vishwavidyalaya, Indore.

COURSE PLAN :

Week 1: Lecture 1- Cell components and organization; macromolecules, membranes, organelles, and processes.

Lecture 2- DNA: The genetic material; Cell Cycle.

Lecture 3- Regulation of the Cell Cycle.

Week 2: Lecture 4- S-phase: DNA Replication and its regulation. Repair and recombination.

Lecture 5- Checkpoints: DNA Damage and DNA Replication checkpoints.

Week 3: Lecture 6- Chromosome reorganization during mitosis; The centrosome duplication cycle.

Lecture 7- The microtubule cytoskeleton; Spindle organization, assembly and dynamics.

Lecture 8- Molecular motors; Role of motor proteins in mitosis.

Week 4: Lecture 9- Mitotic checkpoints; Chromosome segregation and cell division.

Lecture 10- Meiosis

Week 5: Lecture 11- Cell death, aging and senescence.

Lecture 12- Chromatin organization

Lecture 13- SMC proteins and chromosome organization

Week 6: Lecture 14- The cohesin complex and its functions.

Lecture 15- Nuclear organization

Week 7: Lecture 16- Cell diversity and properties of specialized cells.

Lecture 17- The Cancer Cell

Lecture 18- Stem cells

Week 8: Lecture 19- Nerve cells

Lecture 20- The Plant Cell