# 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.
This course includes 8 modules and 33 lectures. It is intended for graduate students mainly M.Sc. students (or 1st year Ph.D. students). Final year B.Sc. students may also find it useful.

**ABOUT INSTRUCTOR :**
**Work experience:**I am a Professor of Biochemistry, I.I.Sc. I also was Associate Professor and Assistant Professor of Biochemistry, and a Wellcome Trust International Senior Research Fellow in Biomedical Science in India, at I.I.Sc. Academic background:I did my 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. I 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. I did my B.Sc. from Devi Ahilya Vishwavidyalaya, Indore. Selected Awards: -The Wellcome Trust International Senior Research Fellowship in Biomedical Science in India, The Wellcome Trust, UK. 2001-2006 -Howard Hughes Medical Institute Research Associate at the Carnegie Institution, Baltimore, MD, USA. 1997-1999 -The Wisconsin Power and Light Foundation Fellowship in Cancer Research, Mc Ardle Laboratory for Cancer Research, UW-Madison, USA. -The Ravindra Nath Tagore Janm Shatabdi Gold Medal for First Rank among Bachelors degree candidates in all disciplines in the university, Devi Ahilya University, Indore, India -The Prerna Club Gold Medal for First Rank among women in B.Sc., Devi Ahilya University, Indore, India -Chintamani award for First Rank in the University for B.Sc., Devi Ahilya University, Indore, India. My general expertise is Molecular Genetics, Cell Biology and Biochemistry and my current research interests are Chromosome organization, Gene expression, post-translational modfications of proteins, Mitosis, and Cell Cycle. More information at: https://www.researchgate.net/profile/Shikha_Laloraya https://biochem.iisc.ac.in/shikha-laloraya.php

**COURSE PLAN :**

**Week 1:**
Lecture 1-Introduction to Cell Biology, Cell components, organization and processes - Part I
Lecture 2- Introduction to Cell Biology, Cell components, organization and processes -Part II
Lecture 3- DNA: The genetic material. Part I
Lecture 4- DNA: The genetic material. Part II

**Week 2:**
Lecture 5- Regulation of the cell cycle-Part I
Lecture 6- Regulation of the cell cycle-Part II
Lecture 7-Checkpoints: The DNA damage and DNA replication checkpoints.
Lecture 8- The Ubiquitin Proteasome system

**Week 3:**
Lecture 9- S-phase: Regulation of entry into S-phase and DNA Replication.
Lecture 10- DNA replication-Part I
Lecture 11- DNA Replication-Part II.
Lecture 12-DNA Replication-Part III.

**Week 4:**
Lecture 13- Mitosis-Part I

Lecture 14- Mitosis-Part II

Lecture 15- Cytokinesis

Lecture 16- Centrosomes In Development, Evolution And Disease

**Week 5:**
Lecture 17- Meiosis Part I

Lecture 18- Meiosis Part II

Lecture 19- Meiosis Part III

Lecture 20-Nuclear Organization

**Week 6:**
Lecture 21- Chromatin organization

Lecture 22- SMC proteins and chromosome organization Introduction

Lecture 23- SMC proteins & chromosome organization Real-Time imaging of DNA loop-extrusion by SMC complex.

Lecture 24- The cohesin complex and its functions-The mysterious biological function of chromosome loops

**Week 7:**
Lecture 25-Cell death, Aging and Senescence

Lecture 26- Apoptosis Part I

Lecture 27- Apoptosis Part II

Lecture 28-The Cancer Cell

**Week 8:**
Lecture 29-Cell diversity and properties of specialized cells-Budding yeast as a model system.

Lecture 30-The Plant Cell

Lecture 31-Stem cells Part I. Introduction.

Lecture 32-Stem cells Part II. Using gene-edited stem cells and live imaging to study cell biology.

Lecture 33-Nerve cells