



बिरसा मुंडा ट्रायबल यूनिवर्सिटी

Birsa Munda Tribal University

राजपिपला, जि० नर्मदा Rajpipla, Dist. Narmda

Established by Tribal Development Department, Govt. of Gujarat

School of Science

M.Sc. (Zoology) Programme

Subject Code & Name: - MS01CZOO02 – Cell and Molecular Biology

Teaching and Evaluation Scheme:

Teaching Scheme				Examination Scheme			
Credits				Component Weightage			
				Internal		External	
L	T	P	Total	TH	PWE	TH	PWE
4	--	--	4	50 %	--	50 %	--

Programme Name	M.Sc. Zoology
Semester	I
Course Code	MS01CZOO02
Course Title	Cell and Molecular Biology
Course Content Type (Th./Pr.)	Theory
Course Credit	4
Sessions+ Lab. Per Week	4
Total Teaching/Lab. Hours	60 Hours
* 2 Laboratory = 1 Session	

Learning Objectives

- To understand the structural and functional organization of cells.
- To study mechanisms of cell communication, cell cycle regulation, and cancer biology.
- To examine the molecular basis of DNA replication, transcription, translation, and protein processing.
- To understand gene organization and regulation of gene expression in prokaryotes and eukaryotes.

Prerequisites (if any)

- Basic knowledge of cell structure and function including prokaryotic and eukaryotic cells, biomolecules (carbohydrates, lipids, proteins and nucleic acids), genetics and molecular biology including DNA, RNA, genes and protein synthesis.

Learning Outcomes

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

1. Explain the structural organization of cells and the functions of cellular organelles, membranes and cytoskeletal components.
2. Describe cell signalling pathways, cell adhesion mechanisms and the molecular basis of cancer development.
3. Analyze the processes of DNA replication, transcription, translation and protein processing in living systems and to evaluate mechanisms regulating gene expression and understand chromatin organization and genome architecture.



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Detailed Contents		
UNIT	TOPIC/SUB-TOPIC	TEACHING HOURS
I	Cell Structure, Organization and Division Prokaryotic and eukaryotic cells Chemical composition and molecular organization of plasma membrane, Membrane models, Membrane transport mechanisms Cell Organization Ultrastructure and functions of: Nucleus and nucleolus, Endoplasmic reticulum, Golgi apparatus, Lysosomes, Mitochondria and Centrioles. Cytoskeleton Structure and functions of: Microtubules, Microfilaments, Centrosome, Cilia and flagella, Mitotic apparatus and chromosome movement Cell Cycle and Cell Division Phases of the cell cycle, Regulation and checkpoints of the cell cycle and Mitosis and meiosis	15
II	Cell Signalling, Cell Adhesion and Cancer Biology Cell Surface Receptors and Signal Transduction G-protein coupled receptors (GPCRs), Receptor tyrosine kinases (RTKs), Intracellular receptors, Signal transduction pathways and Second messengers Cell Junctions Tight junctions, Desmosomes, Hemidesmosomes, Gap junctions Cell Adhesion Molecules Cadherins, Integrins, Selectins, Immunoglobulin superfamily molecules Cancer Biology Types and characteristics of cancer, Oncogenes and proto-oncogenes, Tumor suppressor genes, Cell cycle dysregulation in cancer and Metastasis	15





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III	Molecular Basis of Gene Expression DNA Structure and Replication Types and forms of DNA, DNA replication and DNA damage and repair mechanisms RNA Synthesis and Processing Structure and functions of: mRNA, tRNA, rRNA RNA processing and transport, RNA polymerases, Transcription factors, Transcription activators and repressors Protein Synthesis and Processing Genetic code Translation: Initiation, Elongation and Termination Aminoacylation and aminoacyl-tRNA synthetases, Translational proofreading, Translational inhibitors, Post-translational modifications and Protein sorting and intracellular transport	15
IV	Gene Regulation and Chromosome Organization Regulation of Gene Expression Regulation in bacteriophages and viruses, Prokaryotic gene regulation, Eukaryotic gene regulation, Role of chromatin in gene regulation and Gene silencing mechanisms Organization of Genes Operon concept: Lac Operon and Tryptophan operon Interrupted genes and introns, Gene families Chromatin and Chromosome Structure Chromatin organization, Structure of chromosomes, Euchromatin and heterochromatin, Unique and repetitive DNA, Transposable elements (Transposons)	15

Text Book(s)

1. Cell Biology, Genetics, Evolution and Ecology by Verma & Agrawal
2. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology by Verma and Agarwal
3. Cell Biology by C. B. Powar, Himalaya Publishing House
4. Molecular Biology by P. K. Gupta, Rastogi Publications
5. Cell and Molecular Biology by De Robertis & De Robertis, Lippincott Williams & Wilkins
6. Cell Biology by Veer Bala Rastogi, MedTech Science Press





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Reference Books

1. Molecular Biology of the Cell by Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts & Peter Walter, Garland Science
2. Essential Cell Biology by Bruce Alberts, Karen Hopkin et al., Garland Science
3. Molecular Cell Biology by Harvey Lodish, Arnold Berk, Chris Kaiser et al., W. H. Freeman
4. Cell and Molecular Biology by Concepts and Experiments, Gerald Karp Wiley
5. Lewin's Genes by Jocelyn Krebs, Elliott Goldstein & Stephen Kilpatrick, Jones & Bartlett Learning
6. Molecular Biology of the Gene by James D. Watson, Tania Baker, Stephen Bell et al. Pearson
7. Genes XII by Benjamin Lewin, Jones & Bartlett Learning
8. Molecular Biology by David P. Clark & Nanette Pazdernik, Academic Press
9. Molecular Genetics of Bacteria by Larry Snyder & Wendy Champness, ASM Press
10. Genomes by T. A. Brown, Garland Science

Web Resources

1. Khan Academy – Biology (Cell Biology, Molecular Biology, Cancer): <https://www.khanacademy.org/science/biology>
2. LibreTexts – Cell and Molecular Biology: https://bio.libretexts.org/Bookshelves/Cell_and_Molecular_Biology
3. LibreTexts – Introductory and General Biology (Cell Biology chapter): [https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Introductory_Biology_\(CK-12\)/02:Cell_Biology](https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Introductory_Biology_(CK-12)/02:Cell_Biology)
4. OpenStax – Biology 2e (Free textbook): <https://openstax.org/books/biology-2e/pages/1-introduction>
5. NCBI Bookshelf – Molecular Biology of the Cell (Alberts): <https://www.ncbi.nlm.nih.gov/books/NBK21054/>
6. MIT OpenCourseWare – 7.06x Cell Biology: <https://ocw.mit.edu/courses/res-7-007-7-06x-cell-biology/>
7. Nature Scitable – Gene Expression and Regulation: <https://www.nature.com/scitable/topic/gene-expression-and-regulation-15/>
8. Nature Scitable – eBooks (Molecular Biology): <https://www.nature.com/scitable/ebooks/>
9. Amoeba Sisters – Cell Biology Videos (Cell Cycle, Cancer, Organelles): <https://www.amoebasisters.com/our-videos>
10. Crash Course Biology – YouTube (Cell Division, Gene Expression): https://www.youtube.com/playlist?list=PL8dPuuaLjXtPW_ofbxdHNciUoTRLPMgB
11. Inside Cancer – DNA Learning Center (Cancer Biology): <http://www.insidecancer.org>
12. Britannica – Cell Biology: <https://www.britannica.com/science/cell-biology>
13. Allen Cell Explorer – Educational Resources: <https://www.allencell.org/all-educational-resources.html>
14. Coursera – Molecular Biology & Cell Biology Courses (Free audit): <https://www.coursera.org/courses?query=molecular+biology>



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Required Software(s) (if any)

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Practical(s) (if any)

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L:: Lecture, T:: Tutorial , P::Practical

PWE::Practical Work Examination

(PWE includes Laboratory practical work, project work, viva simulation exercise work etc.)

