

Educational Objectives:

This course covers recent advances in the field of Molecular biology including the structure, function, and interaction of various proteins and nucleic acids. Furthermore some of research articles in the scientific literature that provide the discoveries and methods critical to modern molecular and cell biology will be reviewed during the course. Principles and practice of classical and molecular methods as applied to eukaryotic organisms; isolation and characterization of mutations; gene mapping; suppressor analysis; and, other techniques for studying chromosome structure, gene expression and developmental processes will also be covered in this course.

Course Outcomes:

- To allow students to think beyond the ordinary and learn advanced scientific techniques of molecular biology.
- Acquaint students with the most recent and evolving strategies of molecular biological research.
- Compare advanced techniques to old ones and offset the barriers set by the old.
- Improve the quality of indigenous research to bring it at par with the research of most advanced institutions/organizations.

Course Contents:

- Molecular structure and organization of Genes, Genome and Chromosomes
- Gene Transcription
- Regulation of Transcription Initiation, role of GTF and TSFs
- DNA Replication, Recombination (site specific and non-homologous)
- RNA Processing, Nuclear Transport, and Post-Transcriptional Control
- Control of Translation
- mRNA degradation and interference

- Molecular pathology
 - Molecular pathology: from gene to disease
 - Molecular pathology: from disease to gene
 - Molecular pathology of chromosomal disorders
- Studying human gene structure, expression and function using cultured cells and cell extracts
 - Studying gene expression using cultured cells or cell extracts
 - Identifying regulatory sequences through the use of reporter genes and DNA-protein interactions
 - Investigating gene function by identifying interactions between a protein and other macromolecules
- Genetic manipulation of animals
 - The creation and applications of transgenic animals
 - Use of mouse embryonic stem cells in gene targeting and gene trapping
 - Manipulating animals by somatic cell nuclear transfer.
- Gene Promoters

- Gene Enhancers
- Structure, function and regulation of chromatin network
- Linker proteins
- Histone proteins and the role acetylation and deacetylation in transcription.
- Models for Molecular Biology research and the rationale of using these models
 - *Arabidopsis thaliana*
 - *C. elegans*
 - Zebra fish
 - Drosophila
 - Small rodents (rats/mice)
 - Cell models like Chinese hamster ovary cells (CHO), HEK 293 and HeLa cells.

Recommended Books:

1. **Molecular Cell Biology** by Lodish, Molecular Cell Biology
2. **Human Molecular Genetics 2** by Tom Strachan & Andrew P. Read
3. **RNA and the Regulation of Gene Expression: A Hidden Layer of Complexity** by Kevin V. Morris The Scripps Research Institute, La Jolla, USA
4. **Genomic Technologies: Present and Future** by David J. Galas Keck Graduate Institute, Claremont, CA
5. **Molecular Biology of the Gene** by Watson, J. D., T. A. Baker, S. P. Bell, A. Gann, M. Levine, and R. Losick, Eds., (2003). (5th edition) New York, Benjamin Cummings
6. **Cell and Molecular Biology** by Gerald Karp.1996 John Willey and Sons, Inc. London.