GENE EXPRESSION IN EUKARYOTES (LS637A)

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Course Description: This course is an intense study of the molecular basis of gene expression and regulation in eukaryotic organisms. It includes both traditional and modern views of gene expression, such as transcriptional and post-transcriptional regulation, chromatin remodelling, epigenetics, non-coding RNAs, and high-throughput methods for examining global gene expression. The course will bridge theory with recent research examples, giving the students a solid platform for a career in academic research or the biotechnology sector.

Course Objectives: By the end of the course, students will:

- Understand the structure and regulatory elements of eukaryotic genes.
- Comprehend the influence of chromatin structure and epigenetics on transcriptional control.
- Analyze the control of gene expression at the post-transcriptional and translational level.
- Become familiar with current methods for genome-wide expression studies including transcriptomics and proteomics.
- Recognize the significance of gene expression control and gene regulation in development, differentiation, and disease.

S. No	Topics	Faculty	Contact hours
1.	Overview of Eukaryotic Gene Expression and its regulation	PKG	1
2.	Eukaryotic gene structure; core promoters, and Regulatory Elements	PKG	3
3.	Nucleosome structure and genomic organization of chromatin	PKG	3
4.	Covalent Modifications of Chromatin and Their Impact on Gene Regulation	PKG	4
5.	Chromatin Remodeling Complexes in Gene Regulation	PKG	2
6.	Epigenome and epigenetic control of transcription	PKG	2
7.	Transcriptional Regulation: Activators, Repressors, and Co-regulators	PKG	2
8.	Control of gene expression by non-coding RNA	PKG	1
9.	Co-Transcriptional Processing Events: Splicing, Capping, and Polyadenylation	PKG	2
10.	Translational Regulation of Gene Expression	PKG	1
11.	RNA Processing and Post-Transcriptional Control Mechanisms	PKG	1
12.	Post-Translational Regulation of Gene Expression ● Ubiquitination and SUMOylation Pathways ● Nuclear-Cytoplasmic Transport and Protein Localization	PKG	3
13.	Global Analysis of Gene Expression Regulation • Transcriptome Profiling: Microarray, RNA-Seq, NET-Seq • Chromatin and Accessibility Profiling: ChIP-Seq, ATAC-Seq	PKG	4
14.	Proteomics in Gene Expression Studies • Introduction to Mass Spectrometry for Protein Identification and Functional Analysis	PKG	3

Suggested Reading:

1. Principles of Genome Analysis and Genomics: SB Primrose and R M Twyman
2. Molecular Biology of the Cell: Alberts et al. 7th Ed.
3. Genes XII by Lewin
4. Molecular Biology: Principles and Practice – by Michael M. Cox, Jennifer A. Doudna, Michael O'Donnell
5. Molecular Biology of the Gene – by James D. Watson et al.
6. Molecular Cell Biology – by Harvey Lodish et al.
7. Reviews/research articles.