



FIRST SEMESTER 2020-2021

Course Handout (Part II)

Date: 28.10.2020

Course No. : BIO G512
Course Title : **MOLECULAR MECHANISM OF GENE EXPRESSION**
Instructor-in-Charge : K. N. MOHAN
Lab Instructor : Anuhya Anne and Pranay Amruth Maroju

1. Course Description:

Prokaryotic and eukaryotic genomes and their topology: DNA - protein interactions; RNA transcription and transcriptional control; DNA replication; transcription in yeast; RNA processing; translation; mechanism of gene expression in pro and eukaryotes.

2. Scope & Objective:

The course is designed mainly to impart knowledge of molecular genetics, an essential requirement to understand and implement concepts of biotechnology. Primary objective of the course is to enable students understand the various regulatory mechanisms that affect gene expression, both at transcriptional and posttranscriptional level, across different model systems. Understanding these genetic regulatory mechanisms is key to understand regulation of various biological processes.

3. Text Book:

Gene XI by Benjamin Lewin; Pearson Education, 2011.

Reference Book:

Molecular Biology of Gene: Watson, Baker, Bell, Gann, Lavine & Losick (5th Ed).

Molecular Cell Biology: Harvey Lodish, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, David Baltimore, and James Darnell (2016) 8th edition, Macmillan learning

4. Course Plan:

Lect No	Learning Objective	Topics to be covered	Chap/Sec
1-3	Components of heredity and their properties	Properties and functions of DNA and RNA as hereditary components in different organisms	Text Book Chap. 1, 2
4-7	Organization of genes and genomes	Prokaryotic genomes: Organization of genes in bacterial and viral genomes Eukaryotic genomes: Organization of genes in yeast and higher eukaryotes, non-coding sequences and their importance	Text Book Chap. 4-8
8-11		Eukaryotic chromatin: Nucleosomes-10nm and 30nm structures, histone variants and their functional role, organization into mitotic chromosomes and banding patterns, Centromere and telomeres.	Text Book Chap. 9 & 10
12-18	Maintenance of the genome	DNA replication, recombination, repair and transposition	Text Book Chap. 11-17
19-28	Transcriptional	Prokaryotes: Transcriptional initiation, elongation	Text Book

	mechanisms	and termination. Eukaryotes: Transcriptional initiation, elongation, termination, RNA splicing and processing, mRNA stability, catalytic RNA	Chap. 19-23
29-31	Translation and genetic code	Translational mechanisms in prokaryotes and eukaryotes, nature of the genetic code	Text Book Chap. 24-25
32-37	Regulation of gene expression	Prokaryotes: Regulation of <i>lac</i> operon, regulation of <i>trp</i> operon, regulation of lytic and lysogenic phases in bacteriophages	Text Book Chap. 26-27
38-42		Eukaryotes: mechanisms transcriptional activation, epigenetic regulation and regulatory RNA, Gene regulation during development, Large-scale gene silencing, Techniques for Studying Chromosome interactions (3C/4C)	Text Book Chap. 28-30. Class Notes

Laboratory plan:

S. No.	List of experiments
1	DNA isolation from Human Blood
2	Restriction digestion analysis of Human DNA
3	Chromatin digestion and analysis from mammalian cells
4	Salt-fractionation of chromatin into active, silent and matrix associated regions
5	Analysis of DNA methylation by Combined Bisulfite Restriction Analysis (COBRA)
6	Relationship between DNA methylation, X-inactivation and dosage compensation
7	Study the effect of cytokine treatment on gene expression

5. Examination Scheme:

No	Evaluation Component	Duration	Date and Time	Weightage (%)	Remarks
1	Mid Sem	90min	28/12 9.00 - 10.30AM	25%	OB
2.	Practical components	Variable	-	15%	OB
3.	Continuous evaluation (quizzes, assignments, seminars, etc.)	Variable	During regular class hours or take home	30%	OB
4.	Comprehensive Examination	120 min	17/02 FN	30%	OB

CB: Closed Book exam OB: Open Book

6. Chamber Consultation Hour: To be announced in the class

7. Notices: Notices will be displayed on the Course Management System (CMS)

8. Make-up Policy: Make up will not be granted under any circumstance, barring hospitalization of the student himself/herself and that too with prior permission from the Instructor In-charge.

9. Academic Honesty and Integrity Policy: Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.



INSTRUCTOR-IN-CHARGE
BIO G512

