FIRST SEMESTER 2021-2022
Course Handout (Part II)

Date: 01.08.2021

Course No. : **BIO G512**
Course Title : **MOLECULAR MECHANISM OF GENE EXPRESSION**
Instructor-in-Charge : **GIREESH T. MOHANNATH**

Instructors : **Gargi Prasad S., Neha Priyadarshini, Namita Pandey**

1. Course Description:
Prokaryotic and Eukaryotic genomes and their topology; DNA-protein interactions, RNA transcription and transcriptional control, translation, RNA processing, post-transcriptional control and other mechanisms of gene expression, gene rearrangement, epigenetics, nucleic acids as biomarkers.

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
Other literature shared throughout the course

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

19-27	**Transcriptional mechanisms**	Prokaryotes: Transcriptional initiation, elongation and termination. Eukaryotes: Transcriptional initiation, elongation, termination, RNA splicing and processing, mRNA stability, catalytic RNA	Text Book Chap. 19-23
28-30	**Translation and genetic code**	Translational mechanisms in prokaryotes and eukaryotes, nature of the genetic code	Text Book Chap. 24-25
31-35	**Regulation of gene expression**	Prokaryotes: Regulation of *lac* operon, regulation of *trp* operon, regulation of lytic and lysogenic phases in bacteriophages	Text Book Chap. 26-27
36-40		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	Plant DNA isolation
2	Chop-PCR using plant DNA
3	Study the effect of DNA damage on gene expression
4	Study the effect of cytokine treatment on gene expression

5. Examination Scheme:

No	Evaluation Component	Duration	Date and Time	Weightage (%)	Remarks
1	Mid Sem	90 min	21-10-2021 11 AM to 12:30 PM	25%	CB
2.	Practical components	variable	-	30%	OB
3.	Oral presentations	variable	-	15%	OB
4.	Comprehensive Examination	120 min	20-12-2021 10 AM to 12 PM	30%	CB

CB: Closed Book examination OB: Open Book examination

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 be granted only for valid reasons 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