

**DISCIPLINE SPECIFIC CORE COURSE – (DSC-15)
GENE EXPRESSION AND REGULATION**

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Gene Expression and Regulation (BCH-DSC-503)	4	2L	0	2P	Class XII with Science and Biology	NIL

Learning Objectives

The objective of the course is to introduce to the students the basic knowledge about how genes are transcribed and how translation takes place in prokaryotes and eukaryotes and how these processes are regulated, so that students can apply this knowledge in enhancing their analytical and problem-solving skills.

Learning outcomes

After completion of this course, learners will be able to:

1. Analyse the processes of transcription and translation in prokaryotes and eukaryotes
2. Discuss the features of the genetic code and various experimental approaches used to crack the code
3. Perform estimation of RNA by orcinol method
4. Discuss the molecular basis of RNA processing and RNA splicing
5. Perform isolation of RNA from bacteria and plant cells
6. Evaluate the various ways in which transcription and translation are regulated

SYLLABUS OF DSC-15

BCH-DSC-503 : GENE EXPRESSION AND REGULATION SEMESTER - V

2.2 Course Contents

Theory (2 credits)

Total Hours: 30

Unit I: Transcription in Prokaryotes and Eukaryotes

(10 Hours)

Transcription cycle in bacteria, Sigma factor, bacterial promoters and RNA Polymerases, various stages of RNA synthesis- initiation, elongation and termination, rho-dependent and rho-independent termination. Introduction of basal eukaryotic transcription machinery: three classes of eukaryotic RNA polymerases – I, II and III, and their respective promoters. Details of transcription by RNA polymerase II, features of RNA polymerase II core promoters. Inhibitors of eukaryotic and prokaryotic transcription and their applications.

Unit II: RNA Processing

(4 Hours)

Various types of mRNA processing- polyadenylation and capping, brief overview of rRNA and tRNA processing. Chemistry of RNA splicing, the spliceosome machinery, group I and group II introns, alternative splicing.

Unit III: Translation

(7 Hours)

Salient features of the genetic code, triplet nature, degenerate, wobble hypothesis, codon usage bias. Experimental approaches used to decipher the genetic code. Messenger RNA, transfer RNA, charging of tRNA. Structure of the ribosome. Three stages of translation-initiation, elongation and termination in prokaryotes and eukaryotes.

Unit IV: Regulation of gene expression

(9 Hours)

Concept of operons, regulatory proteins, activators, repressors, DNA binding domains, regulation of *lac* and *trp* operon, riboswitches. Eukaryotic gene regulation by chromatin remodelling, regulation of galactose metabolism in yeast, action of enhancers and insulators, working of activators and repressors, synthesis and mechanism of action - siRNA and miRNA.

2.3 Practical (2 Credits)

Total Hours: 60

1. Quantitative estimation of RNA by Orcinol Method
2. Extraction of total RNA from bacteria /yeast
3. To study growth curve and diauxic growth curve in *E. coli*
4. To study inducible promoter activity by reporter assay
5. To study the effect of inhibitors on protein synthesis
6. DNA Footprinting (Dry Lab)

2.4 Essential readings:

1. Nelson, D.L. and Cox, M.M (2017) *Lehninger: Principles of Biochemistry* (7th ed.) W.H. Freeman & Company (New York), ISBN:13: 9781464126116 / ISBN:10-1464126119.
2. Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M. and Losick, R. (2008) *Watson: Molecular Biology of the Gene* (7th ed.), Cold Spring Harbor Laboratory Press, Cold spring Harbor (New York), ISBN:0-321-50781 / ISBN-13: 9780321762436

Suggested readings:

1. Lewin, B., Krebs, J.E., Kilpatrick, S.T., Goldstein, E.S., (2018) *Lewin's Gene X* (10th edition). Bartlett Learning publishers, LLC, ISBN: 978-0-7637-6632-0.

3. Keywords

RNA, Transcription, Translation, Genetic code, Gene expression, Operon

Note: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.