BACHELORS WITH BOTANY AS MAJOR (CT - III)

5th SEMESTER

BOT522J3: BOTANY _ PLANT MOLECULAR BIOLOGY

CREDITS: THEORY: 4; PRACTICALS: 2

COURSE OBJECTIVES

This course is to expose the students and make them understand the basic concepts in molecular biology, basic composition of nucleic acids, their structure and their mode of replication, conversion of genetic information coded in DNA to cellular macromolecules to the DNA structure, transcription in both prokaryotes and eukaryotes. It also familiarizes students with DNA damage and repair mechanisms, Different types of recombination models, transcription, RNA processing and Translation and regulation of Gene expression.

COURSE LEARNING OUTCOME

Successful completion of the Molecular Biology course will allow students to understand the chemical and molecular processes of life based on the genetic constituents of the cell. They will learn to Comprehend the properties of the heritable material along with all the enzymes involved for proper replication fidelity. Employ scientific methods and design the experiments along with interpreting biological data to communicate concepts of molecular biology to wider scientific community as well as general public.

UNIT: I

DNA STRUCTURE AND REPLICATION

DNA as genetic material, Double helical structure of DNA (Watson-Crick model), Various forms of DNA. DNA replication in Prokaryotes and Eukaryotes, DNA replication is semiconservative nature of DNA replication, Bidirectional Replication, The Geometry of DNA Replication, Enzymology of DNA replication, Discontinuous Replication, Events in the Replication Fork, Initiation of Synthesis of the Leading Strand, Termination of Replication, Methylation of DNA and Mismatch Repair, Replication of Eukaryotic Chromosomes. Fidelity of Replication.

UNIT II

DNA DAMAGE, REPAIR AND HOMOLOGOUS RECOMBINATION

DNA damage and repair: causes and types of DNA damage, mechanism of DNA repair: photoreactivation, base excision repair, nucleotide excision repair, mismatch repair, recombinational repair, nonhomologous end joining. Homologous Recombination: Mechanisms and Models for Homologous Recombination (Holliday Model).Transposable Elements: An Overview of Transposition, Insertion sequences, Types of bacterial Transposons, Transposition, Replication of a transposon in the course of transposition between two plasmids, The Co-integrate as an Intermediate in transposition of Tn3, Deletions and Inversions Caused by Transposons, Role of IS elements in Hfr Formation, Transposable Elements in Eukaryotes, Retroposons, Limitation of Transposition.

UNIT III

TRANSCRIPTION AND RNA PROCESSING

RNA structures and Types: Transcription in Prokaryotes: Prokaryotic RNA polymerases, role of sigma factor, promoter, initiation, elongation and termination of RNA chains. Transcription in Eukaryotes: Eukaryotic RNA

polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance, elongation and termination Splicing and processing: Processing of pre-mRNA: 5' cap formation, polyadenylation, splicing of tRNA precursors, splicing of rRNA precursors, Splicing without a protein enzyme.

UNIT IV

REGULATION OF GENE EXPRESSION AND TRANSLATION

Regulation of activity of Genes and Gene products in Prokaryotes: General aspects of Regulation, Operon concept (inducible and repressible system), Relative positions of Promoters and Operators, Genetic code and its characteristics. Prokaryotic and Eukaryotic Translation, Ribosome structure and assembly, charging of tRNA, Aminoacyl tRNA synthetases, Mechanism of initiation, elongation and termination of polypeptides, Fidelity of translation, inhibitors of translation, posttranslational modifications of proteins.

PRACTICALS

1. Preparation of solutions for molecular biology experiments
2. Isolation of DNA from plant
3. Agarose gel electrophoresis for isolated DNA
4. Demonstration of quantification of DNA by Spectrophotometry.
5. Quantitative tests of Lipids & their separation by thin layer chromatography (TLC).
6. Preparation of LB medium and raising E. Coli.

SUGGESTED READINGS

1) Watson J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., Losick, R. (2007). Molecular Biology of the Gene, Pearson Benjamin Cummings, CSHL Press, New York, U.S.A. 6th edition.
2) Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons Inc., U.S.A. 5th edition.
3) Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. Benjamin Cummings. U.S.A. 9th edition.
4) Russell, P. J. (2010). i-Genetics- A Molecular Approach. Benjamin Cummings, U.S.A. 3rd edition.
5) Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10th edition.