BT V: Molecular Genetics

Marks 75 **Hours 45**

Objective:

To learn the Principles of Mendelian inheritance. To understand the Genome organization and gene regulation of Prokaryotes and eukaryotes.

Outcome:

Students will acquire the laboratory skills for the isolation if genetic material. They will learn the biochemistry of DNA and RNA. Students will analyze the gene interactions

Unit I:

Principles of Mendelian inheritance and Gene interactions: incomplete dominance, codominance, epistasis, complementary genes, duplicate genes, polymeric genes, modifying genes, lethal genes. Population and gene frequencies; The Hardy Weinberg Law. Genetic diseases due to defects in Autosome and Sex chromosomes. Gene transfer in Prokaryotes, Recombination.

Unit II:

Genome organization of Prokaryotes-Bacteria and virus system.

Genome organization of Eukaryotes- Structure and types of chromosome, heterochromatin, eu-chromatin, nucleosome. Variation in chromosome number, chromosome structure. Denaturation and Renaturation DNA, C-value paradox, Cot curve.

Unit III:

DNA as genetic material, Genome Replication in prokaryote & eukaryotes, enzymes involved, replication origin and replication fork, mechanism of replication, elongation and termination.

DNA damage and repair mechanisms. Homologous and site-specific recombination, transposition.

Unit IV:

RNA synthesis and processing, transcription factors and machinery, RNA polymerases, co and post transcriptional RNA processing. RNA transport, RNA Stability and Half-life period. Protein synthesis- Ribosome, Genetic code, t-RNA, initiation, elongation, termination of translation. Post translational modification of proteins.

Unit V:

Gene regulation in prokaryotes-operon concept, Lactose, Tryptophan and Arabinose. Role of cAMP and CRP in lac operon, trp operon. Catabolite repression. Gene regulation in eukaryotes at transcription and translation level. Regulation of gene expression in phages, viruses, role of chromatin in gene expression and gene silencing.

Reference Books-

1. Understanding DNA-The molecule how it works - Chris R. Calladine, Elsevier Pub.
2. Gene IX-Benjamin Lewin –Jones and Barrtlett Pub.
3. Principles of Genetics -Simmons and Snustad- Wiley International Pub.
4. Molecular Biology of the Gene -J.D. Watson-Pearson Pub.
5. The Biochemistry of Nucleic Acids -Adams, Knowler And Leader-Chapman Hall Pub.

6. Molecular Biology of the Cell -Lodish, Berk-Freeman Pub.
7. Developmental Biology -Scott F. Gilbert-Sinahauer associate Pub.
8. Developmental genetics-G.S.Miglani-I.K.InternationalPub.
9. Molecular Biology of the Cell- Albert Bruce- Garland Science Publication
10. Genome- T.A. Brown- John Wiley
11. Fundamentals of Cell and Molecular biology-Baig, Telang and Ingle-Amruta
12. Genetics a Molecular Approach- T.A Brown- John Wiley

Practical:

1. Problems based on Gene linkage, Sex linked inheritance and Crossing over.
2. Genetic recombination (conjugation, transformation, transduction) in bacteria
3. Study of mutations, Ames test
4. Study and isolation of mutants by Replica plate technique
5. Isolation of antibiotic resistant bacteria by gradient plate method
6. Study to mutation and repair in bacteria /yeast
7. Study of spontaneous mutation by Fluctuation test
8. Isolation of genomic DNA/RNA from bacteria, animal and plant cells.
9. Isolation of plasmid DNA /Phage DNA.
10. Spectroscopic analysis of DNA/ RNA
11. Agarose gel electrophoresis.
12. Study of in vitro transcription and translation