

508. Genetics

Unit 1: TRANSMISSION GENETICS: Laws of segregation and independent assortment. Extensions to Mendelian principles – Codominance, Incomplete dominance. Epistatic interactions – Pleiotropy, Genomic Imprinting. Penetrance and Expressivity. Phenocopy, Sex-linked, Sex-limited and Sex-influenced characters. Autosomal and Sex-linked inheritance by Pedigree analysis in man. Inheritance of quantitative traits- Additive gene effect, Kernel colour in wheat.

Unit 2: CYTOGENETICS: Cell division- Mitosis and Meiosis. Structure and organization of chromosomes, karyotyping. Chromosomal abnormalities- Structural and Numerical and their genetic implications.

Unit 3: GENE MAPPING: Linkage and crossing over. Phases of linkage. Recombination frequency in Gene mapping. Two point and three point test crosses. Tetrad analysis in Neurospora.

Unit 4: EXTRA-CHROMOSOMAL INHERITANCE: Inheritance of mitochondrial and chloroplast genes. Maternal inheritance Eg. Leaf Variegation in *Mirabilis jalapa*, Petite mutants in yeast, Uniparental inheritance of chloroplast genes In *Chlamydomonas*.

Unit 5: GENETIC MATERIAL: DNA as genetic material, Griffith's experiment, Avery McLeod and McCarty's experiments, Watson and Crick model of DNA double helix, Polymorphic forms of DNA, Replicon, enzymes involved in DNA replication, origin of replication, replication fork.
RNA as genetic material-Tobacco Mosaic Virus.
Structure and replication of Retroviral genome.
Recombination - Homologous and Non-homologous recombination.

Unit 6: DNA DAMAGE AND REPAIR: Molecular basis of mutations - Transitions, Transversions, frame-shift mutations.
DNA repair mechanisms- Direct repair, Excision repair, Post - replication and Mis-match repair.

Unit 7: GENE EXPRESSION AND REGULATION: Transcription process in prokaryotes and eukaryotes. Gene regulation at transcription level.
Translation process in prokaryotes and eukaryotes. Gene regulation at translational level.

Unit 8: r-DNA TECHNOLOGY: Restriction enzymes, cloning vectors, construction of genomic and cDNA libraries, screening- Applications of r-DNA technology in medical, agricultural and industrial biotechnology.