

**OBJECTIVES:** To enable the students

- To understand the organization and function of DNA and RNA at molecular level.
- To comprehend the concepts of gene expression and regulation of gene expression.
- To understand the molecular basis of mutations.

**COURSE:**

**UNIT I: GENE & GENOME ORGANISATIONS**

1. Identification of DNA and RNA as genetic material; Structure of DNA by Watson & Crick model
2. Organization of nuclear genome – genes and gene numbers; Satellite DNA
3. Mitochondrial genome organization (Eg: Humans)
4. Chloroplast genome organization in plants.
5. Gene Families and clusters (Eg: Globin genes, histones).

**UNIT II: REPLICATION OF DNA**

1. DNA Replication – Models of DNA Replication semi-conservative, Proof of semi conservative replication.
2. Mechanism of DNA replication in Eukaryotes – linear method.
3. Enzymology of replication (DNA polymerase I, pol II and III, helicases, topoisomerases, single strand binding proteins, DNA melting proteins, primase).
4. Mechanism of DNA replication in prokaryotes
  - a. Rolling circle method
  - b. Theta mechanism
5. Gene mutations: Mutagenesis – Spontaneous and induced (chemical and physical) mutations; Natural and induction of mutations, point mutations, frameshift mutations, auxotrophic conditional and suppressor mutations.
6. DNA damage & repair: Light induced repair, Excision repair and Mismatch repair, Post replication repair, Rec gene and its role in DNA repair, SOS repair and SOS response.

**UNIT III: TRANSCRIPTION:**

1. Prokaryotic Transcription- Structure of prokaryotic RNA polymerase (core enzyme & holoenzyme, sigma factor), Exons, introns, Promoter (Pribnow box, -10, and -35 sequence), and Terminators; Transcription process.
2. Eukaryotic transcription
3. Post – transcriptional modifications (capping, polyadenylation, splicing & alternate splicing )
4. Poly and Mono cistronic mRNA.
5. Reverse transcription.

**UNIT IV: TRANSLATION:**

1. Genetic Code and its feature & Wobble Hypothesis. Structure of mRNA, tRNA.
2. Translation – Synthesis of polypeptides – Initiation, elongation and termination in prokaryotes.
3. Translation – Synthesis of polypeptides – initiation, elongation and termination in eukaryotes.

**UNIT V: REGULATION OF GENE EXPRESSION:**

1. Regulation of gene expression in Prokaryotes; Operon concept – Negative and positive control of the Lac operon, trp operon, Control of gene expression.
2. Regulation of gene expression in Eukaryotes

**REFERENCES:**

1. Cell and Molecular Biology by Robertis & Robertis, public. Waverly (2001) 8<sup>th</sup> Edition.
2. Molecular Biology of the Gene – By Watson, Hopkins, Goberts , Steitz & Weiner Publi. Pearson Education ( 2002)
3. Principles of Gene Manipulation – By R.W. Old ANA S.B.Primson Publi. Warosa 6<sup>th</sup> Edition (2003)
4. Molecular Biology & Biotechnol – By H.D. Kumar Publi. Vikas (2005)
5. Cell Biology & Genetics by Varma & Agarwal (2008-2009) S.Chand Publications.
6. Genome 3 – T.A Brown .

