

Biochemistry

B.Sc. - IIIrd YEAR

PAPER- ~~XXXXXX~~ I

MOLECULAR BIOLOGY

i) Basic Concepts of Genetic Information

- a. Nucleic acids as genetic information carriers, experimental evidence e.g. bacterial genetic transformation, Hershey-Chase Experiment, TMV reconstitution experiment.
- b. Central dogma of molecular genetics – current version, reverse transcription and retroviruses.
- c. Primary structure of nucleic acids and their properties, salient features of eukaryotic, prokaryotic and viral genomes; highly repetitive, moderately repetitive and unique DNA sequences.
- d. Basic concepts about the secondary structures of nucleic acids, 5' → 3' direction antiparallel strands, base composition, base equivalence, base pairing and base-stacking in DNA molecule. T_m and buoyant density and their relationship with G-C content in DNA.

ii) Structural Levels of Nucleic Acids and Sequencing

- a. Secondary and Tertiary structure of DNA: Watson and Crick model, A, B and Z types of DNA; major and minor grooves, chirality of DNA, tertiary structure of DNA.
- b. Structures and properties of RNA: Classes of RNA, secondary and tertiary structures.
- c. Nucleic acid hybridization : Cot value and satellite DNA.
- d. Sequencing : Restriction and modification system; sequencing of DNA and RNA.

iii) DNA Replication

DNA replication in prokaryotes-conservative, semiconservative and dispersive types, experimental evidence for semiconservative replication. DNA polymerases, other enzymes and protein factors involved in replication. Mechanism of replication. Inhibitors of DNA replication.

iv) Transcription

Transcription in prokaryotes. RNA polymerase, promoters, initiation, elongation and termination of RNA synthesis, inhibitors of transcription. Reverse transcriptase, post-transcriptional processing of RNA in eukaryotes.

v) Translation and Regulation of Gene Expression

- a. Genetic code: Basic features of genetic code, biological significance of degeneracy. Wobble hypothesis, gene within genes and overlapping genes.

- b. Mechanisms of translation: Ribosome structure, A and P sites, charged tRNA, f-met-tRNA, initiator codon, Shine-Dalgarno consensus sequence (AGGA), formation of 70S initiation complex, role of EF-Tu, EF-Ts, EF-G and GTP, non-sense codons and release factors, RF1 and RF2.
- c. Regulation of Gene Expression in prokaryotes: Enzyme induction and repression, operon concept, Lac operon, Trp operon.

vi) Mutation and Repair

- a. Mutation: Molecular basis of mutation, types of mutation, e.g. transition, transversion, frame shift, insertion, deletion, suppresser sensitive, germinal and somatic, backward and forward mutations, true reversion and suppression, dominant and recessive mutations, spontaneous and induced mutations – Lederberg's replica plating experiment.
- b. Mutagenicity testing: Correlation of mutagenicity and carcinogenicity: Ames testing, Random and site-directed mutagenesis.
- c. DNA Repair: UV repair systems in *E. coli*, significance of thymine in DNA.

vii) Recombinant DNA Technology

Restriction endonucleases, brief discussion of steps in DNA cloning. Applications of recombinant DNA technology.

