MB: 201 MICROBIAL GENETICS AND MOLECULAR BIOLOGY

UNIT-I
1. Organization of genetic material in prokaryotes and eukaryotes.
2. Concept of gene, genome, genome size, C-value, and C-value paradox.
3. Nucleic acid as a genetic information carriers; experimental evidence.
4. Gene is a unit of mutation and recombination; molecular basis of mutations, physical and chemical mutagens, spontaneous and induced mutation, selection of mutant.

UNIT-II
1. Structure of DNA, super helicity of DNA, linking number, topological properties and role of topoisomerase. DNA denaturation and renaturation.
2. DNA damage and repair: types of DNA damage (deamination, oxidative damage, alkylation and pyrimidine dimer.), repair mechanism; mismatch repair, nucleotide excision repair, recombination repair, SOS repair.
3. DNA replication: general principle, various mode of replication, unwinding of DNA helix, continuous and discontinuous synthesis of leading and lagging strands.
4. Enzymes of DNA replication in prokaryotes and eukaryotes; DNA polimerases, DNA ligase, primase.

UNIT-III
1. Structural features of RNA (rRNA, tRNA, mRNA) and polycistronic and monocistronic RNA.
2. Transcription: general principle and processes of transcription; initiation, elongation and termination, types of RNA polymerases, inhibitors of RNA synthesis.
3. Control of Transcription by interaction between RNA polymerases and promoter region, use of alternate sigma factors, controlled termination; Rho dependent and Rho independent.
4. Post transcriptional modification, maturation and splicing of RNA transcripts, catalytic RNA.
UNIT-IV
1. Genetic code: nature of genetic code, codon, anticodon, wobble hypothesis.
2. Protein synthesis: steps, details of initiation, elongation and termination.
3. Inhibitors of protein synthesis: signal hypothesis.

UNIT-V
1 Regulation of gene expression: operon concept; regulatory and structural gene operator, promoter, repressor, induction and repression, positive and negative control.
2 Lac-operon, ara-BAD operon, trp operon, attenuation, mechanism of regulation of transcription.
3 Regulation of gene expression in eukaryotes: Britton and Davidson’s model of regulation involve HCP and NHCP and hormones.
4 Transposable elements.

Reference Books
5. Genomes by T.A. Brown, John Wiley and sons (Asia)PTE LTD, New York.
9. An Introduction to Genetic Analysis, Griffiths et al., W. H. Freeman
UNIT-I

1. History of immunology, development of immunology as discipline.

UNIT-II

2. Antigens- structure and properties, factors affecting the immunogenicity, properties of B and T- cell epitopes, haptens, mitogens, superantigen, adjuvants.
3. Antibody: structure, properties, types and function of antibodies, antigenic determinants on immunoglobulin; isotypes, allotypes, and idiotypes.
4. Molecular mechanism of antibody diversity and class switching.

UNIT-III

1. Major histocompatibility complex: organization of MHC genes, types and function of MHC molecules, antigen presentation, MHC polymorphism, MHC related diseases.
3. Cytokines: types, structure and functions, cytokines receptors, cytokine regulation of immune receptors.
4. Immune response to infectious diseases: viral infection, bacterial infection, protozoan diseases, helminthes related diseases.
UNIT-IV


3. Transplantation immunology: immunologic basis of graft rejection, clinical manifestation of graft rejection and clinical transplantation.


UNIT-V

1. Vaccines: Active and passive immunization, vaccine schedule, whole organism vaccine, subunit vaccine, vaccine, DNA vaccine, recombinant vaccine, subunit vaccines and anti-idiotypic vaccine.

2. Hybridoma technology: murine monoclonal antibody production, principle of selection, characterization and applications in diagnosis, therapy and basis research.

3. Antibody engineering: Chimeric and Humanized monoclonal antibodies.

4. Antigen-antibody interaction: avidity and affinity measurements, detection of antigen-antibody interaction by precipitation, agglutination, RIA, and ELISA.

Reference Books


UNIT-I
1. Bioenergetics and metabolism: Basic concepts.
2. First and second law of thermodynamics, concept of free energy, entropy and enthalpy.
3. High energy phosphate compounds, role of ATP, ATP cycle, structural basis of free energy change during hydrolysis of ATP.
4. Biological redox reactions, Biological reducing power and its role in biological system.

UNIT-II
2. Pentose phosphate pathway, E-D pathway, Kreb’s cycle and glyoxalate pathway.
3. Electron transport system in Mitrochondria, Electron carriers and multi-enzyme complex I to IV.
4. ATP synthesis: substrate level and oxidative phosphorylation and un-couplers, inhibitors of oxidative phosphorylation.

UNIT-III
3. Lipid biosynthesis: Biosynthesis of lipids and fatty acids, triglycerol and phospholipids and their regulation
4. Lipid Metabolism: Degradation of Lipids, oxidation of unsaturated, saturated, even and odd chain fatty acids, ketone bodies.

UNIT-IV
2. Catabolism of amino acids: Breakdown of aminoacids into six common intermediates and urea cycle and relationship with TCA cycle.
3. Nucleotide metabolism: Biosynthesis of purines and pyrimidines nucleotides by de novo and salvage pathways.
UNIT-V

2. Diazotrophs and Biochemistry of nitrogen fixation, Structure of nitrogenase complex
3. Regulation of nitrogenase complex by oxygen and combined nitrogen sources. 
4. Nif genes and their regulation.

Reference Books

MB: 204 BIOSTATISTICS, COMPUTER APPLICATION & BIOINFORMATICS

UNIT-I
1. Definition of statistics and scope of statistics in bio research.
2. Types of sampling methods, survey design, organization and graphical representation of data.
3. Measures of central tendency
4. Measure of dispersion, correlation, calculation of Karl Pearson’s coefficient of correlation, theory of multiple correction and property.

UNIT-II
1. Regression Analysis, linear regression, regression equation
2. Hypothesis testing: Types of hypothesis testing: t-test, 2 -test, and F -test.
3. Introduction of Design of Experiment (DOC) and factorial design.
4. Application of SPSS software.

UNIT-III
1. History & development of computer organization of a basic computer. computer application in molecular biology.
2. Number system, computer arithmetic & Boolean algebra.
3. Type of operating systems, DOS, WINDOWS & LINUX. Introduction to MS Office.
4. Basic concept of programming; algorithm, flow charts & introduction to computer languages, basic idea of internet. use of various software in microbiology.

UNIT-IV
3. Sequence Database: EMBL, DDBJ, GenBank, UniGen, PIR, SWISS-PROT and TrEMBL. Structure Database: PDB, CATH, DALI, SCOP.
4. Data mining tools: Modelling tools (Rasmol, SPDV, HyperChem), Data submission tools (Bankit, Sequin, Webin, Sukura, Spin, AutoDep).
UNIT-V


4. Proteomics: Proteome analysis, Tools for Protein sequence analysis and proteomics (PSI-BLAST, CD search, CDART), structure analysis (Cn3D, CD search).

References Books


8. Introduction to Bioinformatics by Teresa. K. Attwood and David J. Parry-Smith, Low Price edition, Pearson Education