

SECOND SEMESTER

BTPG06 Microbiology

Number of Hours / Week: 4

Credits: 4

Unit I

The historical foundations and development of microbiology. Microbial diversity - Prokaryotic and eukaryotic microbial diversity .The bacteria and the archaea. Principles of bacterial taxonomy Molecular methods in taxonomy. Morphology and structure of bacteria. Surface structures and inclusions of bacteria. Viruses- unique properties, morphology and structure. Virus, Viral replication. Viral diversity –bacterial, plant and animal viruses. Fungi – properties and classification.

Unit II

Factors influencing microbial growth. Environmental and nutritional factors. Nutritional types of bacteria. Microbial locomotion – flagellar motility, gliding motility and amoeboid motion. Chemotaxis, Phototaxis and other taxes. Cultivation of bacteria- culture media and methods. Measurement of bacterial growth. Bacterial growth curve. Binary fission, Growth cycle, Thermophiles, mesophiles, halophiles, psychrophiles. Continuous cultures. Maintenance and transport of cultures.

Unit III

Identification of bacteria. Staining reactions. Cultural, physiological and biochemical characteristics. Sterilisation – Principles and methods, physical and chemical methods. Disinfectants – modes of action. Testing of disinfectants. Antibiotics – mechanism of action. Drug resistance in bacteria. Antibiotic sensitivity tests.

Unit IV

Genetic materials in bacteria. Bacterial chromosome. Extrachromosomal genetic elements. Plasmid, Transposons. Mutation, DNA repair, Mutant selection. Mechanism of gene transfer – transformation, transduction and conjugation

Unit V

Microbial metabolism. Central pathways, Glycolysis, Pentose phosphate pathway, Entner Doudoroff pathway, TCA cycles, Electron transport chain, Aerobic and anaerobic respiration. Fermentation. Anaplerotic reaction. Peptidoglycan synthesis, Bacterial photosynthesis

Reference

1. Principles and practice of disinfection, preservation and sterilization – Russel AD et al, Blackwell scientific publications
2. Antimicrobial drug resistance, Bryan LE (Ed.), Academic press
3. Topley and Wilson's Principles of bacteriology, virology and immunology – Arnold – Heinemann.
4. Microbiology. Bernard D.Davis et al., Harper International Edition
5. Zinsser Microbiology. Printice Hall International Inc.
6. Manual of methods for General Bacteriology. Gerhardt P et al., (ED.). American Society for Microbiology
7. Microbiology concepts and applications. Pelczer Jr. Chan. Creig. Mc Graw Hill, Inc
8. Microbiology. Prescott, Harley and Klein wim C Brown publishers

BTPG07 Immunology

Number of Hours / Week: 4

Credits: 4

Unit I

Types of immunity. Innate and acquired. Mechanisms of innate immunity, Organs and cells with immune functions. Differentiation of Lymphocytes and lymphocyte maturation. Types of infections.

Unit II

Antigens, Antigenicity, Epitopes, Antibodies, Immunoglobulin – structure, classes and functions. Genetic basis of antibody diversity, Organization and Expression of Immunoglobulin Genes, V(D)J rearrangements; somatic hypermutation and affinity maturation Antigen- antibody interactions, Agglutination, Precipitation, immunodiffusion, Immunofluorescence, Complement fixation, Radioimmuno assay, ELISA, Western blotting, immunoelectrophoresis.

Unit III

Humoral and cell mediated immune response, Receptors on T and B cells , MHC, Antibody production, Primary and secondary immune modulation, Clonal selection theory, Monoclonal antibodies – production and application, Antibody engineering. Complement system, Complement activation and pathways, Biological effects of complements, Antigen processing and presentation, Activation of T-cells, T-cell function, Cytokines, Cell mediated immune response, CTL mediated, NK cells, ADCC

Unit IV

Immunology of organ and tissue transplantation, Allograft reaction and GVH reaction, Factors influencing allograft survival, Immunology of malignancy, Tumor antigens, Immune response in malignancy, Immunotherapy of cancer, ABO and Rh blood group system, Immunology of blood transfusion.

Unit V

Immunological Tolerance, Autoimmunity, Mechanisms of autoimmunization, Autoimmune diseases. Inflammation, Hypersensitivity – immediate and delayed reactions, Clinical types of hypersensitivity, Immunodeficiency diseases, Immunoprophylaxis, Vaccines: types of vaccines, DNA vaccine, recent trends in vaccine development.

Reference

1. Essential Immunology - Ivan M. Roitt and Peter J delves, Blackwell Publishing
2. Immunology - Thomas J. Kindt, Barbara A. Osborne, Richard A. Goldsby, and Janis Kuby, W H Freeman and Co.
3. Immunobiology - Charles A. Janeway Jr., Paul Travers, Mark Walport and Mark J. Shlomchik, Garland Publishing.
4. Essential Clinical Immunology – Helen Chappel and Mansel Haeney, ELBS/Blackwell Scientific Publications
5. Introduction to Immunology – John W, Kimball Maxwell, Mac Millan International Edition.
6. Text book of Microbiology – R. Ananthanarayanan and C K Jayaram Panicker. Orient Longman.

BTPG08 Molecular Biology

Number of Hours / Week: 4

Credits: 4

Unit-1

Organisation of genome: genes, related sequence, split gene concept, exons, introns, intergenic DNA-repetitive sequences-interspersed repeats-SINE, LINE transposons- types (IS elements, replicative transposons, retrotransposons) & significance, tandem repeats-micro, minisatellites

5

DNA Replication Models of DNA Replication, Conservative, Semiconservative and discontinuous, Messelson and Stahl experiment, Steps in initiation of replication, Enzymatic factors involved, Ori site, Okazaki fragments, Termination of replication, DNA polymerases in eukaryotes and prokaryotes, Klenow fragment, Primosome, SSB, Ligase, modes of replication, theta, rolling circle, d-loop replication, repetitive DNA sequences, end problem of replication, microsatellite, telomerase, Inhibition of replication. Role of enzymes in proof reading, Repair mechanisms: Excision Repair, BER, NER, mismatch repair, SOS repair, Recombination repair systems.

15

Unit-2

Process of transcription, promoters, Enhancers, stages in initiation, RNA polymerases in prokaryotes and eukaryotes, sigma factor in prokaryotes, elongation, Rho dependant and Rho independent termination, Transcription factors in Eukaryotes, CpG islands, Differences in transcription between prokaryotes and Eukaryotes, post transcriptional modifications, Polyadenylation, capping, r-RNA processing, Splicing-Spliceosome, lariat structure, Group I, II and III Introns, catalytic RNA Importance of ribozyme, properties, application, RNase P, RNase III, RNase H. monocistronic and polycistronic m-RNA, Joint transcript of r-RNA and t-RNA in prokaryotes and their processing, Transplicing, alternate splicing, inhibitors of Transcription, mRNA stability and degradation.

20

Unit 3

Process of translation. Stages in translation, genetic code, properties, wobble hypothesis, eukaryotes and prokaryotes ribosomes, m-RNAs, t-RNAs, aminoacyl t-RNA synthetases, protein

factors initiation complex, peptidyl transferase, releasing factors, differences between prokaryotic and eukaryotic systems, inhibition of translation. function, **10**

Unit4

Molecular mechanism of gene regulation in prokaryotes-Transcriptional regulation in prokaryotes; Inducible & repressible system,+ & -ve regulation; Operon concept, structure of operon, Lac, Trp, Ara operon, Catabolic repression, Attenuation.Multiple levels of eukaryotic gene regulation: Histone acetylation and deacetylases,methylation and demethylation, chromosome remodeling complex, Gene amplification,transcription level:differential transcription,Translational control, Intron splicing. Role of Hormones in gene regulation. **15**

Unit5

R.N Ainterference, Antisense RNA, SiRNA, MicroRNA, Ribozwitches & their applications; Telomerase structure and function, Nucleic acid as therapeutic agent, prions, prion disease in mammals – CJD, scrapie. Human genome project and its implications. **10**

Reference

- 1 REA's Problem Solvers in Genetics, Research Education Association,61, Ethel Roadwest, New Jersey
2. Modern Genetic Analysis, Griffiths, Lewontin, Gelbart, and Miller, Freeman's and Co, New York
3. Genes X: Benjamin Lewin
4. Cell and Molecular Biology by Gerald Karp, Academic Press
5. Genomes: T A Brown, John Wiley & Sons
6. Molecular Biology: David P Clark, Elsevier.
8. Principles of gene manipulation – Old, Twyman and Primrose
9. Gene cloning and DNA analysis – T. A. Brown
10. Genes-Benjamin Lewin

BTPG 09 Metabolism and Enzymology

Number of Hours / Week: 3

Credits: 3

Unit 1

Metabolism of carbohydrates: Glycolytic pathway, substrate level phosphorylation, oxidative phosphorylation, Electron transport chain: structural components of the chain, complexes, free elements; Chemiosmosis ATP synthesis: structural and functional properties of ATP synthesis; Inhibitor agents and decoupling agents of the respiratory chain and ATP synthesis; Regulation of glycolytic pathway, Gluconeogenesis and Glycogenesis. **10**

Unit II

Metabolism of Proteins, and nucleic acids: Synthesis of amino acids, degradation, deamination, transamination, urea cycle Synthesis of purines and pyrimidines, salvage pathway, degradation, regulation of pathways **10**

Unit III

Metabolism of lipids, Oxidation, synthesis of fatty acids, FAS, synthesis of cholesterol, degradation of cholesterol. **8**

Unit IV

Holoenzyme, apoenzyme, and prosthetic group; Interaction between enzyme and substrate- Features of active site, activation energy, Rate Enhancement Through Transition State Stabilization, Enzyme specificity and types; Enzyme Commission system of classification and nomenclature of enzymes. Measurement and expression of enzyme activity, Definition of IU, katal, enzyme turnover number and specific activity, Isolation of enzymes and the criteria of purity; Characterization of enzymes

Order of reaction, study of the factors affecting the velocity of enzyme catalyzed reaction- Derivation of Michaelis -Menten equation and K_m value determination and its significance, Definition of V_{max} value of enzyme and its significance, Lineweaver- Burk plot; Bi-substrate reactions: Classification, Reaction mechanisms; Allosteric enzymes: Examples, Sigmoidal Kinetics for Nonallosteric Enzymes. **14**

Unit V:

Enzyme inhibition and regulation: Reversible and irreversible – examples. Reversible-competitive, noncompetitive and uncompetitive inhibition; Structure—Activity Relationships and

Inhibitor Design; Tight Binding Inhibitors: Identifying Tight Binding Inhibition, examples; Time-Dependent Inhibition: examples; Distinguishing between modes of inhibitor interaction with enzyme Covalently modulated enzymes with examples of adenylation and phosphorylation; Zymogen form of enzyme and zymogen activation; Multienzyme complexes and their role in regulation of metabolic pathways; Allosteric regulation: example Aspartate transcarbamoylase, Isoenzymes- Lactate dehydrogenase and creatine phosphokinase. Application of enzymes: Industrial uses of enzymes: Diagnostic and therapeutic enzymes 12

Reference

1. Fundamentals of Enzymology: The Cell and Molecular Biology of Catalytic Proteins by Nicholas C. Price, Lewis Stevens, and Lewis Stevens (2000) Publisher: Oxford University Press, USA ISBN: 019850229X ISBN-13: 9780198502296, 978-0198502296
2. Enzyme Kinetics and Mechanisms by Taylor Publisher: Spring ISBN: 8184890478 ISBN-13: 9788184890471, 978-8184890471
3. Biochemistry (2004) by Donald Voet, Judith G. Voet **Publisher:** John Wiley & Sons
4. Enzyme Mechanism by P.K. Shivraj Kumar (2007) Publisher: RBSA Publishers ISBN: 8176114235 ISBN-13: 9788176114233, 978-8176114233
5. Biochemistry 6th Edition (2007) by Jeremy M. Berg John L. Tymoczko Lubert Stryer **Publisher:** B.i. publications Pvt. Ltd **ISBN:** 071676766X **ISBN-13:** 9780716767664, 978-716767
6. Principles Of Biochemistry, 4/e (2006) by Robert Horton H , Laurence A Moran, Gray Scrimgeour K **Publisher:** Pearson **ISBN:** 0131977369, **ISBN-13:** 9780131977365, 978-0131977365
7. Enzymes: Biochemistry, Biotechnology, Clinical Chemistry (second Edition) by Trevor Palmer, Philip Bonner (2007) Publisher: Horwood Publishing Limited ISBN: 1904275273 ISBN-13: 9781904275275, 978-1904275275

BTPG10 Laboratory Course-II

Number of Hours / Week: 4

Credits: 4

Microbiology and Immunology

- Microscopic examination of bacteria in living conditions
- Testing of motility
- Staining procedures- simple stain, differential staining- Gram staining, flagellar staining
- Sterilisation methods
- Cultivation of bacteria and fungi
- Study of cultural characteristics and biochemical reaction of bacteria
- Testing of disinfectants
- Antibiotic sensitivity tests
- Immunodiffusion in gel
- Serological tests for the diagnosis of microbial infections-RPR, RF, ASO.
- Agglutination and precipitation tests
- ELISA

Metabolism and Enzymology

- Estimation of enzyme activity ALP , SGOT, SGPT
- Determination of Km and Vmax
- Effect of pH, Effect of temperature on enzyme activity
- Enzyme inhibition studies- estimation of KI.
- Purification of the enzyme- Ammonium sulphate precipitation
A) Dialysis B)Gel Filtration C)Ion Exchange chromatography
D) PAGE/SDS - PAGE