

BT -601 – Immunotechnology

UNIT-I

Introduction to Immunology: Properties of immune response, Innate and acquired immunity, active and passive immunity.

Cells & Tissues of Immune System: Lymphocytes, Classes of lymphocytes, antigen presenting cells, NK Cells, Mast Cells, Dendritic Cell, Organs of the Immune System, Bone marrow, Thymus, Lymph node, Spleen, CALT, MALT.

UNIT-II

Molecular Immunology: - Molecular structure of antibody, Classification, Isotypes, Synthesis assembly and expression of immunoglobulin molecules, Nature of antigens, function and diversity, Generation of anti-body diversity.

Antigens: Different characteristics of antigens, mitogens, Hapten, Immunogen, Adjuvants.

UNIT-III

MHC: Discovery of MHC complex, Role of MHC, Structure of MHC molecule, Binding of peptides to MHC molecules, MHC restriction.

Effector Mechanism of Immune Response: Cytokines, T- cell receptors, cell activation, complement system, antigen processing and presentation, regulation of immune response.

UNIT-IV

Immunological Techniques:- antigen- antibody reactions, Immuno diffusion, immunoelectrophoresis, ELISA, RIA, fluorescence activated cell sorter.

UNIT-V

Applied Immunology:- Immune system in health and disease, autoimmunity, hypersensitivity, tumor immunity, tissue and organ transplant, Synthetic vaccines.

Hybridoma technology: - Fusion of myeloma cells with lymphocytes, production of monoclonal antibodies and their application.

Text / Reference books:

1. Kuby- Immunology (4th Edition) by R. A. Goldsby, T.J. Kindt, B.A. Osborne.
2. Essentials of Immunology (6th Edition): Ivan Riot- Blakswell Scientific Publications, Oxford, 1988.
3. Fundamentals of Immunology: Paul W.E. (Eds.) Raven Press, New York, 1988.
4. Antibodies A laboratory Manual: Harlow and David Lane (1988), Cold spring harbor laboratory.

BT -602 – Molecular Biology

UNIT-I

Structure and properties of nucleic acids: Models of DNA structure; RNA structure; Physical, Chemical, Spectroscopic Nuclear & Organelle genomes,
Genome Complexity: L C value paradox, cot analysis, Repetitive DNA, Satellite DNA, Pseudo genes, Synteny.

UNIT-II

Chromosome organization: Histones, Non-histones, Nucleosome, Chromatin, Chromosome structure in prokaryotes & eukaryotes,
Gene organization: Split Genes, Overlapping genes, Transposons & Retrotransposons, Gene clusters.

UNIT-III

DNA-Protein interaction: DNA- binding motifs, Methods of studying DNA – binding proteins,
DNA Replication: Models of DNA replication, Enzymology of DNA replication, The Replication process, Initiation, Elongation & Termination of replication; Telomeres.
Transcription and mRNA processing: Components of transcriptional machinery in prokaryotes and eukaryotes; Initiation, Elongation & Termination of transcription; Capping, Polyadenylation, Splicing, mRNA stability.

UNIT-IV

Translation: The Genetic code; tRNA & aminoacyl synthetases, Ribosomes, Translation process, Initiation, Elongation & termination of transcription; Capping, Polyadenylation, Splicing, mRNA stability.
Regulation of gene expression: General aspects of regulation prokaryotes & eukaryotes; The operon model, lac & trp operons; DNA methylation; Tissue-sp. & developmental stage sp. Expression of genes.

UNIT-V

Gene Mutation: Somatic vs germinal mutation, Mutant types, Selective Systems, Induction of mutation, Chromosomal mutations, Changes in chromosome structure mutation and cancer, Mutagens in genetic dissection, Mutation breedings, Molecular basis of gene mutations, Repair defects and human diseases, Recombination, Transposable genetic elements.
Molecular evolution: DNA based phylogenetic trees and their applications.

Text / Reference Books:

1. Gene VII by B. Lewin.
2. Essentials of molecular Biology, Malacinski and Freifelder Jones and Bartlett Publishers.
3. Genomes, T. A. Brown, John Wiley and Sons PTE Ltd.
4. Cell and molecular Biology, Concepts and experiments Gerald Karp, John Wiley and Sons.
5. The Cell - A molecular approach, Gm Cooper Asm Press.

BT -603 – Plant Tissue Culture

UNIT-I

History: Important events in the history of plant tissue culture.

Laboratory Requirements and General Techniques: Introduction, requirements, techniques.

Cellular Totipotency: Introduction, cyto-differentiation, orgemogenic differentiation, loss of morphogenic potential in long-term cultures, practical applications of cellular totipotency

UNIT-II

Tissue Culture Media: Introduction, media constituents, media selection, media preparation

Cell and Suspension Culture: Introduction, isolation of single cells, suspension cultures, culture of single cells, plant cell reactors, applications of cell culture.

Protoplast Culture: Protoplast isolation, culture and regeneration.

UNIT-III

Somatic Embryogenesis: Introduction, some examples of formatic embryogenesis, factors affecting somatic embryogenesis, induction and development, maturation

Haploid Production: Introduction, techniques, factor affecting androgenesis, ontogeny of androgenic haploids, plant regeneration from pollen embryos, gynogenesis, haploid production through diport hybridization idiptridization to raise homozygous diploids, applications, limitations.

Triploid Production: Introduction, callusing, histology and cytology of cells, organogenesis, applications of endosperm culture.

UNIT-IV

Embryo Culture: Introduction, techniques, culture requirements role of the suspensor in embryo culture, precocious germination, morphogenesis in the culture of seeds with partially differentiated embryos, micronugical experiments, embryo and seed culture of parasitic angiosperms, morphogenic potential of the embryo callus, practical applications.

In-vitro pollination and fertilization: Introduction, terminology, in vitro pollination, in vitro fertilization, applications.

UNIT-V

Micropropagation: Introduction, techniques, applications, production of pathogen free plants

Production of secondary metabolites: Introduction, strategies used to optimize product yield, commercial aspects

Germplasm Storage: Introduction, long-term storages, short or medium term storage

Text / Reference Books:

1. Experiments in Plant Tissue Culture by John H. Dodds & Lorin W. Robert.
2. Plant tissue Culture : Theory and Practice by S.S. Bhojwani and M.K. Razdan (1996) Elsevier, Amsterdam.
3. An Introduction to Plant Biotechnology by H C Chawla Oxford and IBH 2002

BT -604– Stem Cells in Health Care

UNIT-I

Introduction: Stem Cell Biology, Fate Mapping of Stem Cells

Stem Cell Pattern: Differentiated Parental DNA Chain Causes Stem Cell Pattern of Celltype Switching in *Schizosaccharomyces pombe*

UNIT-II

On Equivalence Groups and the Notch/LIN-12 Communication System,

Cell Cycle Control, Checkpoints, and Stem Cell Biology, Senescence of Dividing Somatic Cells

UNIT-III

The Drosophila Ovary: An In Vivo Stem Cell System

Male Germ-line Stem Cells

Primordial Germ Cells as Stem Cells, Embryonic Stem Cells, Embryonal Carcinoma Cells as Embryonic Stem Cells, Trophoblast Stem Cells

UNIT-IV

Hematopoietic Stem Cells: Repopulating Patterns of Primitive Hematopoietic Stem Cells, Molecular Diversification and Developmental Interrelationships, Hematopoietic Stem Cells: Lymphopoiesis and the Problem of Commitment Versus Plasticity, Hemangioblast

UNIT-V

Mesenchymal Stem Cells of Human Adult Bone Marrow

Stem Cells and Neurogenesis

Epidermal Stem Cells: Liver Stem Cells, Pancreatic Stem Cells, Stem Cells in the Epithelium of the Small Intestine and Colon

Text / Reference Books:

1. Developmental Biology, 6th Edition, Scott F. Gilbert
2. Hematology, William J. Williams, Ernest Beutler, Allan JU. Erslev, Marshall A. Lichtman
3. Molecular Biology of the Cell, 3rd Edition, Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, James D. Watson
4. Stem Cell Biology by Marshak, 2001, Cold Spring Harbar Symposium Publication.

BT -605– Food Biotechnology

UNIT-I

Historical Background: History of Microorganisms in food, Historical Developments.

Taxonomy, role and significance of microorganisms in foods. Intrinsic and Extrinsic Parameters of Foods that affect microbial growth.

UNIT-II

Microorganisms in fresh meats and poultry, processed meats, seafood's, fermented and fermented dairy products and miscellaneous food products.

Starter cultures, cheeses, beer, wine and distilled spirits, SCP, medical foods, probiotics and health benefits of fermented milk and foods products.

Brewing, malting, mashing, hops, primary & secondary fermentation: Biotechnological improvements: catabolic repression, High gravity brewing, B-glucan problem, getting rid of diacetyl. Beer, wine and distilled spirits.

UNIT-III

Nutritional boosts and flavor enhancers: Emerging processing and preservation technologies for milk and dairy products.

Microbiological Examination of surfaces, Air Sampling, Metabolically Injured Organisms, Enumeration and Detection of Food-borne Organisms. Bioassay and related Methods

UNIT-IV

Food Preservation, Food Preservation Using Irradiation, Characteristics of Radiations of Interest in Food Preservation. Principles Underlying the Destruction of Microorganisms by Irradiation, Processing of Foods for Irradiation, Application of Radiation, Radappertization, Radicidation, and Radurization of Foods Legal Status of Food Irradiation, Effect of Irradiation of Food constituents.

Storage Stability Food Preservation with Low Temperatures, Food Preservation with High Temperatures, Preservation of Foods by Drying, Indicator and Food-borne Pathogens, Other Proven and Suspected Food-borne Pathogens.

UNIT-V

Psychrotrophs, Thermophiles and Radiation-resistant Microorganisms, Characteristics and Growth of Thermophilic Microorganisms, Nature of Radiation Resistance in Microorganisms. Rheology of Food Production.

Consumer perspective and future of food biotechnology.

Text / Reference Books:

1. Modern Food Micro-Biology by James M. Jay, (2000), 6th edition, An Aspen Publication, Maryland, USA.
2. Food Microbiology: Fundamentals and frontiers by M.P. Doyle, L.R. Beuchat and Thoma J. Montville, (2001), 2nd edition, ASM press, USA.
3. Food Science and Food Biotechnology by G.F.G. Lopez & G.V.B. Canovas (2003), CRC Press, Florida, USA.