M. Tech. Genetic Engineering (Full Time)
Curriculum & Syllabus (2009-2010)
### SEMESTER- I

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### SEMESTER- II

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### TOTAL CREDITS TO BE EARNED FOR THE AWARD OF THE DEGREE 70

### LIST OF CORE ELECTIVES *

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*Students must choose any one module only
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SEMESTER I

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Purpose:
To learn the fundamentals molecular genetics and its application in biology.

Instructional Objectives:
- Understand the relationship between classic all genetics and its genotype.
- Understand the central dogma of life.
- Understand the molecular genetics of model organisms and its application.

THEORY

FUNDAMENTALS OF GENETICS

GENOME ORGANIZATION
Genome organisation in prokaryotes and eukaryotes - DNA content and C-value paradox - methods to measure DNA content variation - Various types of DNA sequences – simple sequences, repetitive sequences, nonsense sequences, tandem gene clusters, satellites Variety of DNA structures: double helix, Z-DNA, B-DNA, Mechanism of DNA replication: prokaryotes and eukaryotes.

MECHANISM OF TRANSCRIPTION

MOLECULAR GENETICS OF PHAGE AND YEAST

MOLECULAR GENETICS OF DROSOPHILA

LABORATORY EXPERIMENTS
1. Analysis of genetic markers in bacteria
2. Measurement of growth rate; One step growth curve using a even phage
3. Induced mutagenesis and isolation of antibiotic resistant and auxotrophic mutants
4. Enrichment for antibiotic resistant and auxotrophic mutants
5. Genetic mapping by P1 transduction
6. Genetic mapping by conjugation
7. Isolation of specialized transducing phage
8. Transposon mutagenesis

TEXT BOOKS:
Purpose:
To learn the chemical basis of biological system.

Instructional Objectives:
- To teach chemistry of biomolecules
- To teach the structure and metabolism of biomolecules
- To teach principles of biological techniques used for analysis of biomolecules

THEORY

CHEMISTRY OF BIOMOLECULES
Weak interaction in aqueous system, Ionization of water, weak acids, and weak bases. Buffering against pH changes in Biological system. Henderson-Hasselbalch equation. First and second law of thermodynamics, Free energy change, enthalpy, entropy.

CARBOHYDRATES AND LIPIDS

PROTEINS AND ENZYMES

NUCLEIC ACIDS

ANALYTICAL TECHNIQUES
UV, Visible, IR and Mass Spectroscopy, NMR, X-Ray crystallography, ion exchange chromatography, affinity chromatography, gel filtration techniques, HPLC,GC, GC-MS, MS-MS, MALDI-ToF.

LABORATORY EXPERIMENTS
1. Determination of pKa of amino acid
2. Isoelectric focusing of proteins
3. Analysis of monomeric and multimeric forms of proteins
4. Enzyme kinetics
5. Enzyme inhibition kinetics
6. Protein purification using FPLC
7. HPLC
8. GC
9. TLC
10. Paper chromatography

TEXT BOOKS:

REFERENCES:

MANUALS:
Laboratory Manual

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Purpose:
To introduce the science of immunology and detailed study of various types of immune systems and methods used in immunology.

**Instructional Objectives:**
- To understand the basic concepts of immunology
- To know about transplantation immunology and auto immunity.
- To learn the methods used in immunology (immunotechniques)

**THEORY**

**CONCEPTS OF IMMUNOLOGY**
General principles of immune system, molecules, cells and tissues of immune system, primary and secondary lymphoid organs (thymus, bursa of fabricius, lymph nodes, spleen), B and T lymphocyte and their functions, lymphocyte cell mediated cytotoxicity.

**ANTIGENS AND ANTIBODIES**
Concepts of antigen, antigenic determinant, antigenicity, immunogen and immunogenicity, factors affecting antigenicity, hapten, carrier effect, cross reactivity, adjuvants, Freund’s adjuvants and its significance, immunoglobulin, structure of immunoglobulin, types and properties of immunoglobulin, theories of antibody formation, clonal selection, Ig genes, immunoglobulin synthesis and metabolism, and antibody diversity.

**HUMORAL AND CELL MEDIATED IMMUNITY**
MHC, MHC antigen- Class I, Class II, Class III, antigen presentation, MHC restriction, immune response gene, immune response, humoral and cell mediated immune response, BCR, TCR & generation of biodiversity, lymphocytes, T cells regulation, graft rejection.

**ANTIGEN-ANTIBODY REACTION**
Physico-chemical basis of Ag-Ab interaction, avidity, strength of binding between Ag and Ab and its measurement, detection of Ag-Ab interaction, precipitation, agglutination and complement fixation, complement system, and cytokines.

**IMMUNOTECHNIQUES**
One and two dimensional, single radial immuno diffusion, Ouchterlony immno diffusion, rocket immunoelectrophoresis, CIE, Graber and William technique, direct and indirect agglutination, ELISA, Direct, indirect and Sandwich immunofluorescence, hybridoma technology and monoclonal antibodies, Abezyme technique, Antiserum production, immuno histocompatibility, location of cells in tissues, immunoblotting, flow cytometry.
LABORATORY EXPERIMENTS

1. Antibody production
2. ELISA
3. Western blotting
4. Flowcytometry.
5. Single Radial Immuno Diffusion
7. Rocket Immunoelectrophoresis.
8. Counter-Current Immunoelectrophoresis.
9. Characterization of Immunoglobulins by SDS-PAGE

TEXT BOOKS:

REFERENCES:

MANUALS:
1. Laboratory Manual

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Purpose:
To learn physiology and microanatomy of human body

Instructional Objectives:
- To learn basic genetics in crosses
- To learn statistical techniques for genetic testing of simple crosses
- To learn statistical techniques for genetic testing of populations

THEORY

PATTERN OF INHERITANCE
Meaning of phenotype, genotype (homozygous, pure line, heterozygous, hybrid), dominant and recessive alleles. Mendel’s law of inheritance (Law of segregation and law of independent assortment)

ALLELIC RELATIONSHIPS
Single gene crosses (monohybrid cross, test cross, back cross), multi-gene crosses involving two or more genes, variations in allelic relationships, condiment alleles in complete dominance, lethal alleles.

STATISTICAL GENETICS OF SIMPLE CROSSES
Probability concepts, statistical distributions, normal distribution, binomial distribution, multinomial distribution, testing genetic ratios, chi-square test.

QUANTITATIVE GENETICS
Qualitative versus quantitative traits, normal distribution, average measurements of variability, standard deviation, coefficient of variation, variance, variance method of estimations the number of genes, types of
STATISTICAL GENETICS OF POPULATIONS
Heritability, meaning of variance components, genetic similarity of relatives (depression analysis, correlation analysis), mendelian population, Hardy-Weinberg equilibrium, calculating gene frequencies: Autosomal loci with two alleles, autosomal loci with multiple alleles, testing a locus for equilibrium.

TEXT BOOKS:

REFERENCES:

SEMESTER II

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Purpose:
To learn the molecular techniques that is required to be a successful genetic engineer of plants, animals and microorganisms.

Instructional Objectives:
- To learn the gene cloning methods in theory and practice
- To learn genetic engineering of living organism for human benefit

THEORY

GENETIC ENGINEERING TOOLS
History of genetic engineering, restriction, modifying and polymerase enzymes used in genetic engineering, vectors used in genetic engineering of microbes, plants and animals. Bacterial and yeast hosts used in cloning and expression. PCR, optimization of PCR, gene specific and degenerate primer design, automated DNA sequencing, pyrosequencing, high throughput sequencing.

CONSTRUCTION OF GENE LIBRARIES
Construction of cDNA library, PCR based cDNA library, subtractive cDNA library, normalized cDNA library, genomic DNA library, BAC library and YAC library.

GENE & PROMOTER ISOLATION
Screening the library by using probes, cloning of genes by PCR (gene specific and degenerate primers), nested PCR, 5’ and 3’ RACE-PCR, inverse PCR, hybrid PCR, TAIL PCR, differential display, positional cloning, promoter identification, promoter isolation by screening, promoter isolation by PCR, promoter deletion studies.

GENE CLONING AND MODIFICATION
Cloning methods using restriction and modifying enzymes, cloning in expression vector, cloning of PCR products, site directed mutagenesis.

GENETIC ENGINEERING OF LIVING ORGANISMS
Expression and purification of recombinant proteins in E.coli, yeast, insect cells, animal
cell lines, transgenic plants and transgenic animals.

LABORATORY EXPERIMENTS

1. Cloning using restriction enzymes
2. Cloning of PCR products
3. Cloning in expression vector
4. Induction of expression of recombinant protein
5. Purification of recombinant proteins using His Tag
6. Automated DNA sequencing

TEXT BOOKS:

REFERENCES:

MANUALS:

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Purpose:
To learn the structure and functions of the genomes together with the approaches to analyze the genomes and proteome.

Instructional Objectives:
- To know the computational approaches to analyze the genomes and proteome
- To understand genome maps and types
- To learn the basics of protein-protein interactions

THEORY

ORGANIZATION OF THE PROKARYOTIC AND EUKARYOTIC GENOMES
Genome maps and types; current sequencing technologies; partial sequencing; gene identification; gene prediction rules and software’s; Genome databases; Annotation of genome. Genome diversity; taxonomy and significance of genomes – bacteria, yeast, Caenorhabditis, Homo sapiens, Arabidopsis, etc.

MICROARRAY
Gene Expression, methods for gene expression analysis; DNA array for global expression profile; Types of DNA array, Array databases; Applications of DNA microarray – analysis of gene expression, differential gene expression under different conditions and during development of organisms.

HUMAN GENOME
Mapping of Human Genome; Construction of physical maps; Basics of radiation hybrid maps; Sequencing
of the entire human genome, annotation and analysis of genome sequences: sequence repeats, transposable
elements, gene structure, pseudogenes; Gene analysis; gene order; chromosome rearrangement;
compositional analysis; clustering of genes; composite genes. Implications of the Human Genome Project;

THE PROTEOME AND PROTEOME TECHNOLOGY

Introduction, Expression proteomics (express profile); Cell map proteomics; Protein separation technology
- 2D-Gel Electrophoresis, liquid chromatography, affinity chromatography (for cell map proteomics); mass
spectroscopy and its uses in protein identification; Forward and Reverse Proteomics

PROTEIN-PROTEIN INTERACTIONS

Yeast two hybrid, Co-Precipitation, Phage Display, Phylogenetic Profile, Domain fusion, Gene
Neighborhood, Gene Cluster, Mirror Tree, Analysis of genome wide Protein-Protein Interactions in yeast,
Genome wide yeast two hybrid analysis of other organisms, Protein fragment complementation assays.

LABORATORY EXPERIMENTS

1. 2D-Gel Electrophoresis of protein
2. Liquid chromatographic separation of protein
3. Affinity chromatography method
4. Detection of SNPs
5. DNA sequencing
6. Purification of protein using FPLC
7. Physical mapping of the genome
8. Gene structure and function prediction (Using Genscan,GenMark)
9. 3D and 2D database searching

TEXT BOOKS:
   Humana Press Inc, New Jersey, USA.
   Harbor Laboratory Press, New York.

REFERENCES:
   A.D. Baxevanis and B.F. Francis Ouellette, John Wiley & Sons, UK.

MANUALS:
1. Laboratory Manual

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Purpose:
To understand the mechanisms of control of gene expression.

Instructional Objectives:
- To learn basics of gene expression
- To learn transcriptional, translational, post-transcriptional and post-translational regulation of gene
  expression

THEORY

INTRODUCTION TO GENE EXPRESSION

Fine structure of gene, transcription and translation in prokaryotes and eukaryotes. Epigenetic regulation-
histone modifications – histones and 5srRNA gene – histones and class II genes – nucleosome positioning -
chromatin folding – remodeling – DNA methylation and imprinting.

TRANSCRIPTIONAL CONTROL OF GENE EXPRESSION

TRANSLATIONAL CONTROL OF GENE EXPRESSION

POST-TRANSCRIPTIONAL CONTROL OF GENE EXPRESSION

POST TRANSLATIONAL GENE REGULATION
Modification of amino acid side chains – phosphorylation – GTPase switch proteins – ligand or co-factor binding – interaction with other proteins – protein targeting : nuclear localization and nuclear export signal – protein stability and degradation

LABORATORY EXPERIMENTS
1. Assay for gene induction
2. Assay for gene repression
3. RNA isolation
4. Northern analysis
5. RT PCR
6. Real time PCR
7. S1 nuclease mapping
8. Restriction mapping
9. Primer extension assay
10. C. elegans model for RNAi

TEXT BOOKS:

REFERENCES:

MANUALS:
Purpose: Aims at providing an knowledge of various bioinformatics methods involved in sequence analysis and structure prediction

Instructional Objectives:
- To learn methods of sequence alignment
- To learn the methods of protein structure prediction and interaction analysis

THEORY

SEQUENCE ANALYSIS
Methods of sequence alignment: graphic similarity comparison; Dot plots; Hash tables; Scoring matrices – identify matrix, genetic code matrices (GCM); Substitution matrices, Mutation Data Matrices (MDM), Percentage accepted Mutation (PAM). Block Substitution Matrices (BLOSUM), mutation probability matrices; Sequence similarity searches and alignment tools – dynamic programming algorithms; Needleman-Wunch and Smith Waterman, Optimal global alignment and optimal local alignment;

SEQUENCE ALIGNMENT
Concept; Programmes (Dot matrix, Dot plot, Dynamic programming); Similarity Searches; Sequence repeats and inversion; Database searching (BLAST and FASTA). Multiple Sequence alignment (MSA) – significance; softwares (PIMA, Clustal, Pileup, ClustalW, Meme, MACAW)

PHYLOGENETIC ANALYSIS
Phylogenetics, cladistics and ontology; Phylogenetic representations – graphs, trees and cladograms; Steps in phylogenetic analysis; Methods of phylogenetic analysis – similarity and distance tables, distance matrix method; Method of calculation of distance matrix (UPGMA, WPGMA); The Neighbour Joining Method; The Fitch/Margoliash method; Character-based Methods – maximum parsimony, maximum likelihood; Phylogenetic softwares – PAUP, PHYLIP, MacClade.

PROTEIN STRUCTURE PREDICTION
Prediction of protein secondary structure from the amino acid sequence – Chou-Fasman methods, Neural network models, Nearest neighbor methods, Hidden markov model.

PROTEIN-PROTEIN INTERACTIONS
Prediction of three dimensional protein structure-comparative modeling, threading and ab initio method, Homology modelling

LABORATORY EXPERIMENTS
1. Sequence Analysis Packages – EMBOSS, NCBI ToolKit
2. Dynamic programming
3. Analysis of Biological Sequences: Basic Blast and Specialized Blast
4. FASTA
5. Multiple sequence alignment
6. MEME/MAST, eMotif, InterproScan, ProSite, ProDom, Pfam
7. Phylogenetic analysis – PAUP, PHYLIP, MacClade
8. Advanced Visualization Software and 3D representations
9. Coordinate generations and inter-conversions
10. Secondary Structure Prediction: Fold Recognition, ab initio (Rosetta Server), Homology based comparative protein modeling, Energy minimizations, Validation of models (WHATIF, PROSA, PROCHECK, VERIFY 3D), Protein Structure Alignment

TEXT BOOKS:
REFERENCES:

MANUALS:
1. Laboratory Manual

SEMESTER III
ELECTIVES- MODULE 1: HUMAN GENETICS

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Purpose:
To learn physiology and microanatomy of human body

Instructional Objectives:
- An appreciation of normal functioning and the structure of tissues and organs
- To learn the major elements and concepts that constitutes human physiology.
- To learn to correlate cell and organ system physiology with ultra structure

THEORY
INTRODUCTION AND PHYSIOLOGY OF CELLS

NERVOUS SYSTEM

CARDIOVASCULAR AND RESPIRATORY SYSTEMS

URINARY AND GASTROINTESTINAL SYSTEMS

ENDOCRINE AND REPRODUCTIVE SYSTEMS
Organization of Endocrine control – Endocrine regulation and growth – Thyroid, Adrenal, Pancreas and Parathyroid glands – Sexual differentiation – Male and Female Reproductive systems – Fertilization – Pregnancy and Lactation

TEXT BOOKS:

REFERENCES:
Purpose:
To learn about our system, what we inherit and how our system responds to disease and disorders.

Instructional Objectives:
- To learn the inheritance pattern in human
- To learn about the genome and its instability
- To learn the strategies of genome mapping
- To have an understanding of human pathology

THEORY

PEDIGREES AND ORGANIZATION OF THE HUMAN GENOME
Mendelian pedigree patterns - Complications to the basic pedigree patterns - Factors affecting gene frequencies - Nonmendelian characters - General organization of the human genome - Organization and distribution of human genes - Human multigene families and repetitive coding DNA - Extragenic repeated DNA sequences and transposable elements.

GENE EXPRESSION IN HUMANS
An overview of gene expression in human cells - Control of gene expression by binding of trans-acting protein factors to cis-acting regulatory sequences in DNA and RNA - Alternative transcription and processing of individual genes - Differential gene expression and DNA methylation - Long-range control of gene expression and imprinting - unique organization and expression of Ig and TCR genes

MUTATION AND DNA REPAIR
An overview of mutation, polymorphism, and DNA repair - Simple mutations - Genetic mechanisms which result in sequence exchanges between repeats- Pathogenic mutations - The pathogenic potential of repeated sequences - DNA repair.

GENOME MAPPING
Physical and transcript mapping - Genetic mapping of mendelian characters - Genetic mapping of complex characters – Human Genome projects - Identifying human disease genes

MOLECULAR PATHOLOGY

TEXT BOOKS:

REFERENCES:
Purpose:
To learn about pharmacogenomics principles, methods and applications

Instructional Objectives:
- To study about impact of polymorphism in human genome and applications.
- To know about functional analysis of gene variation and genotyping techniques
- To study about the pharmacogenomics application in diseases
- To learn how to manage the pharmacogenomic information

THEORY

INTRODUCTION TO PHARMACOGENOMICS
Pharmacogenomics: Historical perspectives and current status, Human Genome and Genomic Applications, Genetic Polymorphism of Metabolic Reactions, SNPs, Association Studies in Pharmacogenomics, Study on industries developing pharmacogenomic research.

FUNCTIONAL ANALYSIS OF GENE VARIATION
Transfection Assays With Allele-Specific Constructs: Functional Analysis of UDP-Glucuronosyltransferase Variants, CYP 2D6, CYP2C19 in drug metabolism, Snapshot of the Allele-Specific Variation in Human Gene Expression, Genome-Wide Analysis of Allele-Specific Gene Expression Using Oligo Microarrays, Roche Ampli Chip, HaploChIP: An In Vivo Assay.

GENOTYPING TECHNIQUES
Aspects Influencing Genotyping Method Selection, Denaturing HPLC for Mutation Detection and Genotyping, Pyrosequencing of Clinically Relevant Polymorphisms, Kinetic Fluorescence-Quenching Detection Assay for Allele Frequency Estimation, MALDI–TOF Mass Spectrometry, Fluorescence-Based Fragment Size Analysis, SNP Genotyping in DNA Pools, Genotyping of InDel Polymorphisms

PHARMACOGENOMICS IN PERSONALIZED MEDICINE
Pharmacogenomics of Cardiovascular Diseases, Pharmacogenomics of Cancer treatment, Pharmacogenomics of Neurodegenerative Diseases, Pharmacogenomics in Depression, Pharmacogenomics and Respiratory diseases, Pharmacogenomics in AIDS, Pharmacogenomics in Antibiotics.

MANAGEMENT OF PHARMACOGENOMIC INFORMATION
The Pharmacogenetics and Pharmacogenomics knowledge Base, Systems for the Management of Pharmacogenomic Information

TEXT BOOKS:

REFERENCES:
ELECTIVES- MODULE 2: PLANT GENETICS

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**Purpose:**
The goal of this course is to know and understand what it is to be a plant.

**Instructional Objectives:**
- Study anatomy and embryology of plants
- Study photosynthesis and respiration
- Study growth and development of plants
- Study the hormonal regulation of plant growth

**THEORY**

**PLANT ANATOMY**
Meristems and meristematic growth – anatomy of root, stem, leaf, flower, fruit and seed

**PLANT EMBRYOLOGY**

**PLANTS, WATER, AND MINERALS**
Whole Plant Water Relations - Plants and Inorganic Nutrients - Roots, Soils, and Nutrient Uptake - Transporter Systems - Translocation in the Phloem

**PHOTOSYNTHESIS AND RESPIRATION**

**LIGHT AND HORMONAL CONTROL OF PLANT GROWTH**

**REFERENCES:**

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**Purpose:**
To learn the principles and methods of conventional breeding and molecular breeding for crop improvement.

**Instructional Objectives:**
- To learn genes and genotypes as individual and n populations
- To learn the principles and methods of conventional plant breeding methods
- To learn about molecular markers and their use in molecular breeding

**THEORY**

**INTRODUCTION**
History of domestication and plant breeding. Current status of crop production and scope of crop
improvement by plant breeding. Structure of reproductive organs, reproduction by self pollination, cross pollination, apomixis and vegetative propagation. Phenotype, genotype, micro and macro environment, genotype environment interaction. Qualitative and quantitative traits.

**POPULATION GENETICS**

Genetic constitution of a population: Hardy-Weinberg equilibrium, factors affecting change in gene and genotypic frequency; Effects of mating systems, mutation, migration and selection. Continuous variation: Components of means: Additive and dominance components, non-allelic interactions, genotype x environmental interactions; Components of variance: Genetic and environmental components of variance.

**PLANT BREEDING METHODS**


**MOLECULAR MARKERS AND MAPPING**

Plant Genome-nuclear, chloroplast and mitochondrial genomes. Phenotypic versus molecular markers, different kinds of DNA markers for genome analysis (RFLP, RAPD, STS, SSR, AFLP, SNPs). Development of mapping population – RILs, NILs and DH lines- choice of mapping population. Molecular mapping.

**MOLECULAR BREEDING**


**TEXT BOOKS:**


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**Purpose:**

To learn the principles and practices of *in vitro* plant tissue culture and transformation to produced genetically modified plants

**Instructional Objectives:**

- To understand the biology of tissue culture, regeneration and transformation
- To practice different in vitro culture techniques and plant transformation
- To know the bisafety, ethics and regulatory systems related to transgenic plants

**THEORY**

**BASICS OF TISSUE CULTURE**

History of plant tissue culture and transformation; plant tissue culture: general techniques – sterilization techniques-tissue culture media–plant hormones and their functions in tissue culture.

**CELL, TISSUE AND ORGAN CULTURE**

Cell, callus and organ cultures establishment. *In vitro* Morphogenesis– organogenesis and embryogenesis and factors affecting morphogenesis *in vitro*.
**IN VITRO CULTURE METHODS AND APPLICATIONS**

Meristem culture, anther and pollen culture, ovary and ovule culture, embryo and endosperm culture, protoplast isolation, culture and fusion

**PLANT TRANSFORMATION**


Concerns with genetically modified plants (antibiotic marker, frankenstein food, super weeds, etc) and probable solutions. Indian regulatory systems for laboratory testing, field trail and commercial release of transgenic plants. Bioconfinement strategies for cultivated crops. Biosafety and ethics in generating genetically modified plants. Potential benefits of genetically modified plants

**LABORATORY EXPERIMENTS**

1. Stock and media preparation and sterilization
2. Callus culture
3. Suspension cell culture
4. Somatic embryogenesis
5. Protoplast culture
6. Transformation of Agrobacterium
7. Agrobacterium-mediated transformation of tobacco
8. Agrobacterium-mediated transformation of Arabidopsis
9. Biolistic transformation (transient)
10. Molecular and histochemical analysis of transgenic events

**TEXT BOOKS:**


**REFERENCES:**


**MANUALS:**

2. Laboratory Manual

**ELECTIVES- MODULE 3: MEDICAL GENETICS**

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Stem Cells: Definition, classification and sources, Blastocyst culture, Xeno-free derivation and Cryopreservation, Properties and application of Embryonic stem cells. Characterization of Human Embryonic stem cells.

Stem cells and their Developmental Potential, subcloning and controlled differentiation of human embryonic stem cells. in vitro and in vivo differentiation of human embryonic stem cells. Feeder free culture of human embryonic stem cells

Therapeutic cloning: Derivation and propagation of human embryonic stem cells by somatic cell nuclear transfer, Hurdles to improving the efficiency of Therapeutic cloning, Stem cells and translational medicine ethics.
Haematopoietic Stem Cells: Basic science to Clinical applications, Growth factors and the regulation of haematopoietic stem cells, Haematopoietic stem cells for gene therapy, Haematopoietic cells for leukaemia

Skeletal muscle stem cells, Liver stem cells, Tumour stem cells, Stem cell therapies in animal models: Their outcome and possible benefits in humans

TEXT BOOKS:
1. Stem Cells: From Bench to Bedside-Ariff Bongso, Eng Hin Lee
2. Stem Cells-C S Potten

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PURPOSE
To provide knowledge about biological aspects of cancer

INSTRUCTIONAL OBJECTIVES
To impart basic concepts of cancer biology, various stages in carcinogenesis, molecular cell biology of cancer, cancer metastasis, and cancer therapy.

Regulation of Cell cycle, Mutations that cause changes in signal molecules, effects on receptor, signal switches, tumour suppressor genes, Modulation of cell cycle-in cancer, Different forms of cancers, Diet and cancer.

Chemical Carcinogenesis, Metabolism of Carcinogenesis, Natural History of Carcinogenesis, Targets of Chemical Carcinogenesis, Principles of Physical Carcinogenesis, X-Ray radiation – Mechanism of radiation Carcinogenesis.


Clinical significances of invasion, heterogeneity of metastatic phenotype, Metastatic cascade, Basement membrane disruption, Three step theory of invasion, Proteinases and tumour cell invasion.

Different forms of therapy, Chemotherapy, Radiation Therapy, Detection of Cancers, Prediction of aggressiveness of Cancer, Advances in Cancer detection.

TEXT BOOKS:

REFERENCES:
PURPOSE
To develop the skills of the students in the area of Molecular Pathogenesis

INSTRUCTIONAL OBJECTIVES:
At the end of the course, the students would have learnt about Host Parasite interactions, Host defense mechanisms and molecular mechanisms involved in Pathogenesis of diseases caused by E.Coli and Vibrio Cholerae.

Historical perspective - discovery of microscope, Louis Pasteur's contributions, Robert Koch's postulates, early discoveries of microbial toxins, toxic assays, vaccines, antibiotics and birth of molecular genetics and modern molecular pathogenesis studies, Various pathogen types and modes of entry.

Attributes & components of microbial pathogenesis, Host defense: skin, mucosa, cilia, secretions, physical movements, limitation of free iron, antimicrobial compounds, mechanism of killing by humoral and cellular defense mechanisms, complements, inflammation process, general disease symptoms, Pathogenic adaptations to overcome the above defenses.

Virulence, virulence factors, virulence-associated factors and virulence lifestyle factors. Molecular genetics and gene regulation in virulence of pathogens like Vibrio Cholerae, E.coli, Shigella, Plasmodium, Influenza virus.

Virulence assays: adherence, invasion, cytopathic, cytotoxic effects. Criteria & tests in identifying virulence factors, attenuated mutants, molecular characterization of virulence factors, signal transduction & host responses

Classical approaches based on serotyping. Modern diagnosis based on highly conserved virulence factors, immuno & DNA-based techniques. New therapeutic strategies based on recent findings on molecular pathogenesis of a variety of pathogens, Vaccines - DNA, subunit and cocktail vaccines.

TEXT BOOKS

REFERENCES