

16 Molecular Biology and Biotechnology

TRIMESTER WISE DISTRIBUTION OF COURSES

I TRIMESTER

	L	P
MBB 501 PRINCIPLES OF BIOTECHNOLOGY	4	0
MBB 502 FUNDAMENTALS OF MOLECULAR BIOLOGY	3	0
MBB 503 MOLECULAR CELL BIOLOGY	3	0
MBB 505 MOLECULAR GENETICS	3	0
MBB 507 IMMUNOLOGY AND MOLECULAR DIAGNOSTICS	3	0
MBB 510 BIOTECHNOLOGY LAB-1	0	3
MBB 691 SEMINAR	1	0

II TRIMESTER

MBB 504 PLANT TISSUE CULTURE AND GENETIC TRANSFORMATION	3	0
MBB 509 BIOINFORMATICS	3	1
MBB 511 BIOTECHNOLOGY-II	0	3
MBB 601 MOLECULAR BREEDING	3	0
MBB 602 GENOMICS	3	0
MBB 691 SEMINAR	1	0
MBB 701 ADVANCES IN PLANT MOLECULAR BIOLOGY	3	0

III TRIMESTER

MBB 506 BIOSAFETY, IPR AND BIOETHICS	2	0
MBB 508 INDUSTRIAL BIOTECHNOLOGY	2	0
MBB 512 BIOTECHNOLOGY LAB-III	0	3
MBB 691 SEMINAR	1	0
MBB 702 ADVANCES IN GENETIC ENGINEERING	3	0
MBB 703 ADVANCES IN MOLECULAR BREEDING AND GENOMICS	3	0
MBB 704 ADVANCES IN STRESS GENOMICS	3	0

Core Courses

M.Sc.: MBB 501, MBB 502, MBB 504, MBB 505, MBB 510, MBB 511, MBB 512, BIO 501, GP 500

Ph.D.: MBB 601, MBB 602

MOLECULAR BIOLOGY AND BIOTECHNOLOGY

Major Field : MBB for M.Sc. and Ph.D.

Minor Field : Ph.D. students shall take two minors (9 credits of course work in each) from any of the other fields outside his/her own. M.Sc. students shall take one minor (9 credits of course work) from any of the other fields outside his/her own discipline.

DESCRIPTION OF COURSES

MBB 501 PRINCIPLES OF BIOTECHNOLOGY

(3L+0P) I

Objective

To provide insight into basics and application of general biotechnology

Theory

UNIT I

The structure of DNA; Function of genes and genomes; Restriction enzymes and vectors; Methods of recombinant DNA technology; Nucleic acid hybridization; PCR and its applications;

UNIT II

Molecular markers and their applications; DNA sequencing;

UNIT III

Applications of gene cloning in basic and applied research; Genomics, transcriptomics and proteomics;

UNIT IV

Genetic engineering and transgenics, General application of biotechnology in Agriculture, Medicine, Animal husbandry, Environmental remediation, Energy production and Forensics;

UNIT V

Public perception of biotechnology; Bio-safety and bioethics issues; Intellectual property rights in biotechnology.

Suggested Readings

Molecular biology (2005) by David P. Clark.

Molecular biology of the Cell (2008) by Bruce Alberts.

Molecular biology and Biotechnology (2009) by John M. Walker, Ralph Rapley

Biotechnology: Expanding Horizons (2010) by B D Singh.

MBB 502 FUNDAMENTALS OF MOLECULAR BIOLOGY

(3L+0P) I

Objective

To provide insight into fundamentals of molecular biology and study of molecular cell processes

Theory

UNIT I

Historical development of molecular biology; Nucleic acids as genetic material; chemistry and structure of DNA and RNA,

UNIT II

Genome organization in prokaryotes and eukaryotes; Chromatin structure and function,

UNIT III

DNA replication; DNA polymerases, topoisomerases, DNA ligase; Reverse transcriptase,

UNIT IV

Transcription process; RNA processing; RNA editing; Ribosomes; Structure and function; Organisation of ribosomal proteins and RNA genes,

UNIT V

Genetic code; Aminoacyl tRNA synthases; Translation and post-translational modifications, Operon concept; Attenuation of *trp* operon

Suggested Readings

Molecular genetics by (1987) Stent and Calendar

Microbial Genetics (1994) by Stanley R. Maloy, David Freifelder, John E. Cronan

Essential molecular biology: a practical approach (2000) by T. A. Brown

Genes (2008) by B Lewine

Molecular biology of the cell (2008) by Bruce Alberts

Molecular Biology of the Cell (2002) by Julian Lewis

MBB 503 MOLECULAR CELL BIOLOGY

(3L+0P) I

Objective

To provide insight into fundamentals of cell structure, organization and function

Theory

UNIT I

General structure and constituent of cells; Similarities and distinction between plant and animal cells; Cell wall, cell membrane, cell surface related function.

UNIT II

Structure and function of major organelles: Nucleus, Chloroplasts, Mitochondria, Endoplasmic reticulum, Microbodies, Golgi apparatus, Vacuoles

UNIT III

Organelle genomes and their manipulation; Ribosome in relation to cell growth and cell division; Cyto-skeletal elements; Water, protein and ion transport;

UNIT IV

Trafficking of biomolecules, Cell division and regulation of cell cycle; Signal transduction mechanisms.

Suggested Readings

Molecular Cell Biology (2007) Bruce Alberts

Molecular Cell Biology & Solutions Manual (2007) by Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, et al.

Plant Physiology (2008) by Taiz and Zieger

Objective

To provide insight into principles of plant cell culture and genetic transformation

Theory

UNIT I

History of plant cell / tissue culture; Culture media; Various types of culture; Callus, suspension, nurse, root, meristem, *In vitro* differentiation, organogenesis, somatic embryogenesis; Molecular basis of plant organ differentiation;

UNIT II

Plant growth regulators; Mode of action, effects on *in vitro* culture and regeneration; *In vitro* storage organ formation;

UNIT III

Micropropagation; Anther / microspore culture; Somaclonal variation; *In vitro* mutagenesis, protoplast culture; Somatic cell genetics and somatic hybridization; Embryo culture/wide hybridization; *In vitro* fertilization; Unit V: *In vitro* germplasm conservation; Cryopreservation; Production of secondary metabolites through *in vitro* culture;

UNIT IV

Plant genetic engineering: Definition and scope, methods of plant transformation, vectors for plant transformation,

Unit V

Genetic and molecular analyses of transgenics, bioafety issues, testing of transgenics, regulatory procedures for commercial approval.

Suggested Readings

Plant Tissue Culture: Theory and Practice (1996) by Bhojwani and Razdan

Plant Tissue culture: A practical approach (1995) Dixon and Dixon

Plant Tissue Culture, Development, and Biotechnology (2010) by Robert N. Trigiano and Dennis J. Gray

Objective

To provide insight into molecular genetics of prokaryotes and eukaryotes organisms

Theory

UNIT I

Mendelian principles of inheritance, molecular genetic systems, genetic variation, mutation, physical, chemical and insertional mutagenesis, site-directed mutagenesis, recombination and repair,

UNIT II

Gene mapping and tagging, tag based gene isolation, fine structure analysis of genetic loci and complementation test, deletion mapping,

UNIT III

Organization of genes in prokaryotes and eukaryotes, gene and genome evolution, identification of cis-regulatory elements, transacting factors and regulation of gene expression at different levels,

UNIT IV

Deciphering of genetic code, gene-protein colinearity, gene-enzyme relationship, molecular gene concept. Plasmids and their inheritance

UNIT V

Introduction of genetic markers, classification and comparison of markers, basis of DNA polymorphism, principles & applications of genome mapping and DNA fingerprinting, genome analysis, classical and modern methods, principles of structural and functional genomic approaches.

Suggested Readings

Molecular Biology of the Cell (2008) by Alberts and Watson

Recombinant DNA (2006) by J Watson

Molecular Cell Biology (1999) by Lodish and Baltimore

Essential molecular biology: a practical approach (2000) by T. A. Brown

Molecular Biotechnology (2009) by Glick & Pasternack

MBB 506 BIOSAFETY, IPR AND BIOETHICS

(2L+0P) III

Objective

To provide insight into the biosafety aspects of GM crops and IPR related issues

Theory

UNIT I

Biosafety and Risk assessment issues; Health aspects; toxicology, allergenicity; Ecological aspects;

UNIT II

Regulations; National biosafety policy and law. The Cartagena Protocol on biosafety. The WTO and other international agreements; Cross border movement of germplasm; Risk management issues;

UNIT III

Monitoring strategies and methods for detecting transgenics; Risks, benefits and impacts of transgenics to human health, society and the environment; Bio-safety and bio-hazards; general principles for the laboratory and environmental bio-safety;

UNIT IV

Environment Impact Assessment; Gene flow in natural and artificial ecologies; Sources of gene escape; Ecological risks of genetically modified plants.

UNIT V

Implications of intellectual property rights on the commercialization of biotechnology products.

Suggested Readings

Theory of general ethics (2006) by Warwick Fox

Against Bioethics (2007) by J Baron

Bioethics and Biosafety (2008) by M K Sateesh

Bioethics (2008) by S. Ignacimuthu

Intellectual Property: Private Rights, the Public Interest, and the Regulation of Creative Activity (2007) by Shubha Ghosh; Richard S. Gruner; Jay P. Kesari; Robert I. Reis

MBB 507 IMMUNOLOGY AND MOLECULAR DIAGNOSTICS

(3L+0P) I

Objective

To provide insight into basic concepts of immunology, vaccine development, techniques for diagnostics and applications in agriculture and pharmaceuticals

Theory

UNIT I

History and scope of immunology; components of immune system: organs, tissues and cells,

UNIT II

Immunoglobulins chemistry, structure and functions; molecular organisation of immunoglobulins and classes of antibodies, antibody diversity; antigens, haptens, antigens- antibody interactions; immuno-regulation and tolerance; Allergies and hypersensitive response; immunodeficiency; vaccines;

UNIT III

Immunological techniques, Immunological application in plant science, monoclonal antibodies and their uses, molecular diagnostics.

UNIT IV

Introduction to the basic principles of molecular technology and techniques used in pathogen detection, Principles of ELISA and its applications in viral detection,

UNIT V

Basics and procedures of PCR, Real time PCR, PCR based and hybridization based methods of detection, microarrays based detection, multiplexing etc, detection of soil borne and seed born infections, transgene detection in seed, planting material and processed food, molecular detection of varietal impurities and seed admixtures in commercial consignments.

Suggested Readings

Kuby Immunology (2006) by Thomas J. Kindt, Barbara A. Osborne, and Richard A. Golds

Roitt's Essential Immunology (2006) by Peter Delves, Seamus Martin, Dennis Burton, and Ivan Roitt.

MBB 508 INDUSTRIAL BIOTECHNOLOGY

(2L+0P) III

Objective

To provide insight into the industrial application of biotechnology and development of various products in mass scale for broad applications

Theory

UNIT I

Introduction, scope and historical developments. Isolation, screening and genetic improvement (involving classical approaches) of industrially important organisms.

UNIT II

Primary metabolism products, production of industrial ethanol as a case study, Secondary metabolites, bacterial antibiotics and non ribosomal peptide antibiotics. Microbial enzymes, role in various industrial processes, production of fine chemicals for pharmaceutical industries. Bio-transformations, Bio-augmentation with production of vitamin C as a case study.

UNIT III

Bioreactors, their design and types. Immobilized enzymes based bioreactors. Microencapsulation technologies for immobilization of microbial enzymes. Industrial biotechnology for pollution control, treatment of industrial and other wastes, biomass production involving single cell protein.

UNIT IV

Bio-remediation of soil. Production of eco-friendly agricultural chemicals, bio-pesticides, bio-herbicides, bio-fertilizers, bio-fuels, etc. Recombinant DNA technologies for microbial processes.

UNIT V

Strategies for development of industrial microbial strains with scale up production capacities. Metabolic pathway engineering of microbes for production of novel product for industry.

Suggested Readings

Encyclopedia of industrial Biotechnology (2010) by M Flickinger

Manual of industrial Microbiology and Biotechnology (2010) by M.Demain

Industrial Biotechnology (2010) by Winsoetaert and Erick J Vandamme

Biofuels: Biotechnology, Chemistry, and Sustainable Development (2008) by David M. Mousdale

MBB 509 BIOINFORMATICS

(3L+1P) II

Objective

To provide information on basic principles of computational biology and statistical tools used for data analysis

Theory

UNIT I

Basic molecular biology; introduction to the basic principles of structure/function analysis of biological molecules; genome analysis; different types and classification of genome databases (e.g. HTGS, DNA, Protein, EST, STS, SNPs, Unigenes etc.)

UNIT II

Statistical Techniques: MANOVA, Cluster analysis, Discriminant analysis, Principal component analysis, Principal coordinate analysis, Multidimensional scaling; Multiple regression analysis; Likelihood approach in estimation and testing; Resampling techniques – Bootstrapping and Jack-knifing; Markov Models. Hidden Markov Models, Bayesian estimation and Gibbs sampling

UNIT III

DNA sequence retrieval system, various DNA and protein sequence file formats, Basic concepts of similarity searching and sequence alignments, pair wise and multiple sequence alignments, DNA sequence analysis, different gene prediction models and gene annotation tools,

UNIT IV

Protein sequence analysis and structure prediction, comparative genome analysis, phylogenetic analysis, gene expression analysis tools, programming languages and their applications in bioinformatics.

Practicals

Different types of databases and database search and retrieval, DNA and protein sequence analysis, Similarity searching and multiple alignments, Gene annotation, Phylogenetic analysis, Sequence analysis, Protein structure prediction, Analysis of microarray data, Programming languages in bioinformatics

Suggested Readings

DNA and protein sequence analysis. A Practical approach (1997) by Bishop M.J., Rawlings C.J. (Eds.)

Bioinformatics Basics: Applications in Biological Science and Medicine (2005) By Hooman Rashidi, Lukas K. Buehler

Bioinformatics in the Post-Genomic Era: Genome, Transcriptome, Proteome, and Information-Based Medicine (2004) By Jeffrey Augen

Frontiers in Computational Genomics (2003) Edited by: Michael Y. Galperin and Eugene V. Koonin

MBB 510 BIOTECHNOLOGY LAB-I

(0L+3P) I

Objective

To provide skills for routine and advanced experimentation techniques in plant molecular biology

Theory

UNIT I

Good lab practices, Growth of bacterial culture and preparation of growth curve

UNIT II

Biochemical techniques, Preparation of buffers and reagents, electrophoresis- agarose and PAGE (nucleic acids and proteins), Principle of centrifugation

UNIT III

Isolation of genomic and plasmid DNA from bacteria, Growth of lambda phage and isolation of phage DNA, Restriction digestion of plasmid and phage DNA

UNIT IV

Chromatographic techniques (TLC, Gel Filtration Chromatography, Ion exchange Chromatography, Affinity Chromatography)

Suggested Readings

Current Protocols in Molecular Biology (2002) Fred M Ausubel

Molecular Cloning: A Laboratory Manual (2001) J Sambrook

Objective

To provide hands on experience and skills in general molecular and biochemical laboratory techniques

Theory

UNIT I

Isolation of plant DNA, spectrophotometric and gel quantitation, restriction digestion, agarose gel electrophoresis, hybridization, autoradiograph development (conventional X-ray film and Phosphorimager) Dot blot analysis, Northern hybridization

UNIT II

Gene cloning and blue white selection.

UNIT III

PCR and optimization of factors affecting PCR., Synthesis and cloning of cDNA and RT-PCR analysis

UNIT IV

Western hybridization

UNIT V

Molecular markers (RAPD, SSR, AFLP etc) and their analysis

Suggested Readings

Methods in Biotechnology (2009) by John Walker

Protein Methods (1996) by Daniel M. Bollag, Michael D. Rozycki, Stuart J. Edelstein

Basic Methods in Protein Purification and Analysis: A Laboratory Manual (2008) Edited By Richard J. Simpson

Objective

To provide hands on experience in general laboratory techniques and high throughput data analysis

Theory

UNIT I

Real time PCR and interpretation of data

UNIT II

Case study of SSR markers (linkage map, QTL analysis etc), SNP identification and analysis

Unit III

Microarray studies and use of relevant software, Practical in the area of Proteomics (2D gels, mass spectrometry etc)

UNIT IV

RNAi (right from designing of construct to the phenotyping of the plant), Yeast 2-hybrid interaction

UNIT V

Immunology and molecular diagnostics: Ouchterlony double diffusion, Immunoprecipitation, Radial Immunodiffusion, Immunoelectrophoresis, Rocket Immunoelectrophoresis, Counter Current Immunoelectrophoresis, ELISA, Latex Agglutination, Immunohistochemistry

Suggested Readings

Current Protocols in Molecular Biology (2002) Fred M Ausubel

Molecular Cloning: A Laboratory Manual (2001) J Sambrook

Baxevanis, A. D. & Ouellette, B. F. F. (eds).. *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Methods of Biochemical Analysis*, (2001) vol. 43, 2nd ed., New York: John Wiley & Sons, Inc.

Gibas, C. & Jambeck, P.. *Developing Bioinformatics Computer Skills*. (2001) by Sebastopol, CA: O'Reilly & Associates, Inc

Handbook of Proteins: Structure, Function and Methods, (2008) by Michael M. Cox , George N. Phillips, Jr.

MBB 601 MOLECULAR BREEDING

(3L+0P) II

(Pre-requisite MBB 501)

Objective

To provide insight into principles of plant breeding using molecular techniques

Theory

UNIT I

Principles of plant breeding; breeding methods for self and cross pollinated crops; heterosis breeding; limitations of conventional breeding; aspects of molecular breeding;

UNIT II

Development of sequence based molecular markers - SSRs and SNPs; advanced methods of genotyping;

UNIT III

Mapping genes for qualitative and quantitative traits; QTL mapping using structured populations; AB-QTL analysis; association mapping of QTL; fine mapping of genes/QTL; map based gene/QTL isolation and development of gene based markers;

UNIT IV

Methods of assessing genetic diversity & germplasm characterization, DNA fingerprinting and its application

UNIT V

Allele mining by TILLING and Eco-TILLING; use of markers in plant breeding; Marker assisted selection (MAS) in backcross and heterosis breeding; transgenic breeding; foreground and background selection; MAS for gene introgression and pyramiding: MAS for specific traits with examples.

Suggested Readings

Molecular biology and genomics (2007) by Cornel Mülhardt

Essential molecular biology: a practical approach (2000) by T. A. Brown
Genomes (2006) By TA Brown
Plant Genotyping (2001) by R. J. Henry
DNA markers (1997) by G. Caetano Anolles and P. M. Gresshoff

MBB 602 GENOMICS

(3L+0P) II

(Pre-requisite MBB 501)

Objective

To provide insight into the functional aspects of cell function by studying the genome as a whole with special emphasis on structural and functional genomics

Theory

UNIT I

Structural genomics: large fragment genomic libraries, physical mapping of genomes, genome sequencing, sequence assembly and annotation, comparative genomics

UNIT II

Functional genomics: DNA chips and their use in transcriptome analysis, qPCR, SAGE, MPSS

UNIT III

Proteome analysis: protein structure and function, proteins as enzymes, protein purification, 2D mass spectrometry, metabolomics and ioinics, Application of genomics in crop improvement

Suggested Readings

Genomes (2006) by TA Brown

Evolutionary Genomics and Systems Biology (2010) by Gustavo Caetano

Principles of Gene Manipulation and Genomics (2006) by Sandy B. Primrose and Richard Twyman

New and Emerging Proteomic Techniques (2010) by D. Nedelkov and R. Nelson

Metabolomics: A Powerful Tool in Systems Biology (2009) by Jens Nielsen and Michael C. Jewett

Plant Metabolomics (2006) by Kazuki Saito, Richard A. Dixon and Lothar Willmitzer

MBB 701 ADVANCES IN PLANT MOLECULAR BIOLOGY

(3L+0P) II

(Pre-requisite MBB 501)

Objective

To provide in depth knowledge of recent developments of plant molecular biology and applications

Theory

UNIT I

Model Systems in Plant Biology (Arabidopsis, Rice etc.) Forward and Reverse Genetic Approaches.

UNIT II

Organization expression and, interaction of nuclear, mitochondrial and chloroplast genomes. Cytoplasmic male sterility.

UNIT III

Transcriptional and Post-transcriptional Regulation of Gene Expression, Isolation of promoters and other regulatory elements, RNA interference, Transcriptional Gene Silencing, Transcript and Protein Analysis.

UNIT IV

Plant Developmental Processes, ABC Model of Floral Development, Role of hormones (Ethylene, Cytokinin, Auxin and ABA, SA and JA) in plant development. Regulation of Flowering, Plant photoreceptors and light signal transduction, vernalization, Circadian Rhythms.

UNIT V

Abiotic Stress Responses: Salt, Cold, Heat and Drought.

UNIT VI

Biotic Stress Responses. Molecular Biology of Plant-pathogen Interactions, Molecular Biology of *Rhizobium* and *Agrobacterium*- Plant interaction. Role of programmed Cell Death in Development and Defense.

Suggested Readings

Plant Biotechnology: The Genetic Manipulation of Plants (2008) by Adrian Slater, Nigel W. Scott, and Mark R. Fowler

Plant Biotechnology and Genetics: Principles, Techniques and Applications (2008) by C. Neal Stewart Jr.

Molecular biology and biotechnology (2009) by John M. Walker, Ralph Rapley

Molecular biology: genes to proteins (2007) by Burton E. Tropp, David Freifelder

Plant Molecular Biology by Buchanan et al.

MBB 702 ADVANCES IN GENETIC ENGINEERING

(3L+0P) III

(Pre-requisite MBB 501)

Objective

To provide indepth knowledge of recent developments in recombinant DNA and genetic engineering

Theory

UNIT I

General Overview of Transgenic Plants; Case studies: Genetic Engineering of Herbicide Resistance, Transgenic Plants Resistant to Insects/pests,

UNIT II

Genetic engineering of abiotic stress tolerance, Engineering Food Crops for Quality, Genetically engineered pollination control, Induction of male sterility in plants.

UNIT III

Molecular Farming of Plants for Applications in Veterinary and Human Medicine systems: Boosting heterologous protein production in transgenics, Rapid production of specific vaccines, High-yield production of therapeutic proteins in chloroplasts;

UNIT IV

Recent developments in plant transformation strategies; Role of RNAi-based gene silencing in crop improvement; Regulated and tissue-specific expression of transgenes for crop improvement; Gene stacking; Pathway Engineering; Marker-free transgenic development strategies; High throughput phenotyping of transgenic plants; Field studies with transgenic crops;

UNIT V

Environmental issues associated with transgenic crops; Food and feed safety issues associated with transgenic crops; Risk assessment of transgenic food crops.

Suggested Readings

Principles of Gene Cloning (1994) by Old and Primrose

Molecular biology of the cell (2007) by Bruce Alberts

Principles of Gene Manipulation and Genomics by Sandy B. Primrose and Richard Twyman
(Paperback - Feb. 17, 2006)

MBB 703 ADVANCES IN MOLECULAR BREEDING AND GENOMICS

(3L+0P) III

(Pre-requisite MBB 501)

Objective

To provide indepth knowledge of recent developments in molecular breeding and genomics

Theory

UNIT I

Mapping genes and QTLs, statistical concepts in QTL mapping, high-throughput genotyping using automated platforms, genetic and physical mapping of genomes, study of population structure and kinship, association genetic analysis of QTL, case studies on QTL mapping using different approaches, map-based of cloning genes and QTLs – case studies

UNIT II

Marker assisted breeding (MAB): Principles and methods, marker assisted foreground and background selection, marker assisted recurrent selection, whole genome selection, case studies in MAS, requirement for successful marker assisted breeding, cost of MAB

UNIT III

Concepts and methods of next generation sequencing (NGS), assembly and annotation of NGS data, genome resequencing, DNA sequence comparison, annotation and gene prediction

Unit IV

Genome-wide insertion mutagenesis and its use in functional genomics, transcriptome profiling using microarrays and deep sequencing, study of methylome and its significance, proteome analysis using mass spectrometry, crystallography and NMR, analysis of proteome data, study of protein-protein interactions

UNIT V

Study of the metabolome, use of 1D/2D NMR and MS in metabolome analysis, multivariate analysis and identification of metabolite as biomarkers, study of ionome using inductively coupled plasma – mass spectroscopy (ICP-MS), correlating the data from genome, transcriptome, proteome, metabolome and ionome with phenome.

Suggested Readings

Proteome Analysis - David W. Speicher

Metabolomics: The Frontier of Systems Biology - M. Tomita and T. Nishioka

Molecular Biology and Genomics – C. Mulhardt

Genomes – T. A. Brown

Molecular Marker Systems in Plant Breeding and Crop Improvement - H. Lörz and G. Wenzel

Statistical Genomics - B. H. Liu

Plant Biotechnology and Genetics: Principles, Techniques and Applications (2008) by C. Neal Stewart Jr.

Molecular biology and biotechnology (2009) by John M. Walker, Ralph Rapley

Genomes (2006) by TA Brown

New and Emerging Proteomic Techniques (2010) by D. Nedelkov and R. Nelson

MBB 704 ADVANCES IN STRESS GENOMICS

(3L+0P) III

(Pre-requisite MBB 602)

Objective

To provide advanced knowledge on genomics with reference to abiotic and biotic stress resistance in plants

Theory

UNIT I

Stress resistance/tolerance genes from model plants such as *Arabidopsis* and rice, as well as from extremophiles; stress tolerance mechanisms.

UNIT II

Genomics: transcriptomes, small RNAs and epigenomes; functional genomics: transfer of resistance genes to model plants and validation of gene function

Unit III

Bioinformatics approaches to determine gene function and networks in model plants under stress

Suggested Readings

Current Review articles and research papers