

# MB-301 Genetic Engineering and Protein Engineering

## Section – I

- Unit - 1 Concepts and tools and technique for genetic engineering 15 hours
- 1.1. Concepts and application: Introduction to gene cloning; Application of Recombinant microorganisms; Application of transgenic Plant Technology; Application of animal cloning and Transgenic animal technology
  - 1.2. Enzyme used in genetic engineering: Restriction endonuclease; DNA Polymerase; Reverse transcriptase; RNA polymerase; Alkaline Phosphatase; Polynucleotide Kinase; DNA ligase; Deoxyribonuclease; Ribonuclease; Phosphodiesterase; Agarase; Uracil – DNA Glycoylase; Proteinase K; Lysosome; Topoisomerase
  - 1.3. Cutting of DNA: Host Controlled Restriction Modification system; Nomenclature of Restriction Endonuclease; Types of Restriction Endonuclease; Recognition sites; Cleavage by Restriction endonuclease; variants of Restriction Endonuclease; Application of Restriction Endonuclease
  - 1.4. Joining of DNA Fragments: Introduction; Ligation of DNA fragment using DNA ligase; ligation using homopolymer Tailing; Increasing versatility and Efficiency of ligation by modification of the Ends of Restriction Fragments; Ligation of PCR products
- Unit - 2 Vectors 15 hours
- 2.1 Plasmid as a vector: pSC101; pSF124; Col E1; pBR 322 series; pUCSeries; pGEM series; pET, pBAD,
  - 2.2 Bacteriophage as a vector: lambda phage; M13; Cosmid; Phagemids; Phasmids; Fosmid;
  - 2.3 Advanced vector: Shuttle vector; Expression vector; Advanced gene trapping vector; Specialized vector for making SS DNA; facilitate Purification of cloned product; promotes solubilization of expressed product; promotes export of cloned product; PAC, YAC, BAC, HAC;
  - 2.4 Other vectors : Chimeric vector; Gram negative bacteria other than E. coli as cloning vector; Gram positive bacteria as cloning vector; Plant and Animal Vectors; Fungi system other than yeast.

## Section - II

- Unit - 3 15 hours
1. Introduction of DNA in to Host : Introduction; Introduction of DNA in to bacterial cells; Introduction of DNA in to yeast cells; Genetic transformation of Plants; Introduction DNA in to insects
  2. Construction of Genomic and c DNA Libraries: Introduction; Genomic Library ; cDNA Library; PCR as an alternative to library Construction; Functional cloning; Positional cloning; Differential cloning
  3. Techniques for Selection, Screening and characterization of trans formants: Introduction; Selectable Marker gene; Reporter genes; Screening of clone(s) of interest; Nucleic Acid Blotting and Hybridization; Protein structure/ Function Fusion- based techniques
  4. Safety regulation related to genetic engineering: Introduction; National regulatory Mechanism for implementation of biosafety guideline for handling GMOs; Salient features , revised Guidelines for Research in transgenic Plant and risk assessment; regulation of Gm Plant; Regulation of stem Cell research and human cloning; Patenting for Molecular Biotechnology; Ethical issues
- Unit – 4 15 hours
1. Site directed mutagenesis; Concept tools, technique of and application
  2. Concept of protein engineering; Evolutionary Methods for Protein Engineering; Phage Display Systems for Protein Engineering; Cell Surface Display Systems for Protein Engineering; Cell-Free Display Systems for Protein Engineering;
  3. Protein engineering in basic and applied biotechnology; Enhanced recovery and folding of recombinant proteins using Fusion protein strategies; Protein engineering for affinity purification; Stabilization of industrial enzymes by protein engineering; Engineering of Therapeutic Proteins
  4. DNA Microarray technology: Concepts, tools and techniques, data generation and analysis, application; Microarrays for Bacterial Typing; Overview of protein Microarray technology

## List of Experiments

1. Isolation of genomic DNA from Bacteria
2. Isolation of genomic DNA from Plant
3. Isolation of genomic DNA from Blood
4. Isolation of genomic from fungi
5. Agarose gel electrophoresis and recovery of DNA from gel
6. Isolation of plasmid
7. RFLP
8. RAPD
9. PCR amplification
10. Cloning in bacteria
11. Transformation of plants
12. Protein denaturation and in vitro Protein folding
13. BT cotton testing

## List of Reference Books

1. Nicholl, An Introduction to Genetic Engineering
2. Reece, Analysis of Genes and Genomes
3. Primrose, Principle of gene Manipulation
4. Brown, Gene cloning and DNA Analysis
5. Howe , Gene Cloning and Manipulation
6. Wong , The ABC of gene cloning
7. Watson, Recombinant DNA genes and genomics
8. Budisa, Engineering the Genetic Code
9. Sheldon J. Park, Protein Engineering and Design
10. Allan Svendsen Enzyme Functionality Design, Engineering, and Screening
11. Lilia Alberghina Protein engineering in industrial Biotechnology by Lilia Alberghina
12. Joanna S. Albala, Protein Arrays, Biochips, and Proteomics The Next Phase of Genomic
13. Isaac, Discovery by Microarrays for an Integrative Genomics