

## **BIOPROSPECTING AND BIOMAGNIFICATION**

### **Unit-1**

Introduction; Bioprospecting concepts, drug discovery and product development; Bioprospecting sustainable development and environment. Merits of Bioprospecting. Limitation of Bioprospecting. Bioprospecting of bioactive proteins.

### **Unit II**

Biogeography, Mapping and Bio informatics of microbial and plant diversity: Ubiquitous dispersal of free living microorganisms. Microbial and plant endemism and biogeography. Microbial database and map server. Indigenous plants and evaluation of its biological activities. Traditional knowledge database.

### **Unit III**

Prospecting and conservation of microbial gene pool: Screening for bioactivity; Antimicrobials, Pharmacologically active agents of microbial and plant origin, Bioprospecting for industrial enzymes, plant growth promoting agents. Bioprospecting novel antifouling agents and anti biofilm agents from microbes. Extention and loss of evolutionary history.

### **Unit-IV**

Bioprospecting and biopiracy. Bioprospecting policy: legislation and regulation, Legal and political aspects; Patent law. Convention on biological diversity, Bioprospecting contracts. Assesment or situation analysis.

### **Unit-V**

Biomagnification: Introduction, process of biomagnifications, effects of biomagnification. Merits of Biomagnification. Vermitechnology: Role of earth worms in waste disposal and biomagnification of nutrients. Biomagnification and food-web accumulation, Biomagnification of inorganic chemicals, Biomagnifications of chlorinated hydrocarbons.

### **Books:**

Biotechnology Exploration ; Applying the fundamentals, JUDITH-A. SCHEPPLER, PATRICIA E. CASSIN AND ROSA M.GAMBIER 2000.

## ADVANCES IN GENETIC ENGINEERING

### Unit-I

Overview of restriction and Modification system, Cloning Vehicles, Plasmids-Host Range, Copy number control, insertional and replacement vectors, in-vitro packaging, Single strand DNA vector,-M13 Phage,Cosmids,Phasmids,PAC,BAC and YAC. Expression Vector-characteristics, RNA probe synthesis, High level expression of proteins, protein solubilization, purification and export.

### Unit-II

DNA library-types and importance,cDNA library,Conventional cloning strategies-Oligo dT priming,self priming and its limitations, Full length cDNA cloning-,Strategies for gDNA library construction,Chromosome walking, Blotting [Techniques,,Immunoscreeing,overview on microarray and its applications

### Unit-III

DNA sequencing-importance, Chemical and enzymatic methods,,Automated sequencing,Genome sequencing,-top down approach,bottom up approach

### Unit-IV

PCR-Principles and applications,Different types of PCR-Hot start PCR,TouchdownPCR,Multiplex PCR,Inverse PCR,Nested PCR,AFLP-PCR,Allele specific – PCR,Assembly PCR,Asymmetric PCR,LATE-PCR,,Cloning PCR,in-situ PCR,Long PCR,,Real –time PCR,SYBR Green assay,Taqman Probes,Molecular beacons,,Mutagenesis and chimeric protein engineeringby PCR,RACE,

### Unit-V

Introduction of foreign genes in to plant/animal cells and importance,,DNA Microinjection,Retroviral vectors,transfection of embryonic stem cells and recombination,transgenic plants and their importance,Ti plasmid,an overview of Gene therapy

### References:

- ,2003 Primrose,SB,Twyman R.H and Old R.W.Principles of Gene Manipulation.6<sup>th</sup> Edition,Blackwell Science2001
- Winnacker E.L. From Genes to clones:Introduction to Genr Technology,Panima
- Glick B.R. and Pastemak,J.J.Molecular Biotechnology:principles and Applications of Recombinant DNA.3<sup>rd</sup> Edition,ASM Press,2003
- Lemonie,N.R. and Cooper,D.N. Gene Therapy,BIOS 1996

# APPLIED MICROBIOLOGY

## Unit I

Biogeochemical: carbon cycle and role of microbes in carbon cycle, trophic relationships, mobilization and immobilisation of carbon with rhizosphere. Nitrogen cycle - mechanism of biological nitrogen fixation - ammonification - nitrification - denitrification and microorganisms involved in such processes. Phosphorous cycle, Sulphur cycle.

## UNIT II

Rural Biotechnology with special reference to Bio fertilizers, Biopesticides, Bio composting, Organic farming, Vermiculture. Use of microbes for improving soil fertility, reforestation of lands contaminated with heavy metals,

## Unit III

Microbial balance, Rhizosphere, Rhizoplane, Rhizospheric microorganism, Plant growth promoting rhizobacteria: direct and indirect effect, Mechanism of phosphate solubilization and phosphate mobilization, siderophore production, Nitrogen fixation - Free living and symbiotic nitrogen fixation. Biotechnological application in nitrogen fixation, Mixed Microbial Population: Neutralism, Mutualism, Commensalism and Amensalism. Antagonism, Utilization of mixed population. The history of microbial biotechnology, Microbial biodiversity

## Unit IV

Bioremediation, Bioaccumulation, Biomagnification, Biostimulation, Bioventing and Biomanipulation, Bio-mineralization: Microbial leaching and bio-mining, use of microbes in petroleum extraction, metals from solutions, desulfurization of coal, Biodegradation of chlorinated hydrocarbons and xenobiotic compounds, pesticides, soil spills, toxic and other industrial effluents, Waste water Treatment: Primary secondary and Tertiary treatment

## Unit V

Microbial pathogenicity: Toxins Characterization, Mechanisms of action, Antimicrobial chemotherapy, antibiotics, classification, mode of action antimicrobial resistance, Tests for sensitivity to antimicrobial agents - General considerations; Metabolic pathways and metabolic control mechanisms.

## Books:

1. Cockerham, Basic Environmental Toxicology (1994)
2. Evans, Environmental Biotechnology (Wiley 2003)
3. Alexander, N; Glazer & Hiroshi, Nikaido, W.H. Freeman & Co. 1995.

4. Hans-joachimjordening, Josef winter, Environmental Biotechnology-concepts & application, (2005).

## **ADVANCES IN BIOCOMPUTING**

### **UNIT-I**

Introduction to bioinformatics and data generation, Biological Database and its Types, Data storage and retrieval and Interoperability, Sequence Alignments and Visualization, Multiple sequence alignment and phylogenetic analysis, Gene expression and Representation of patterns and relationship, Primer designing.

### **UNIT-II**

Artificial Neural Networks, Genetic algorithm, Bayesian modelling, Monte Carlo Simulation Method, Markov Models and their application.

### **UNIT-III**

Structural Bioinformatics: Protein secondary structure predictions, Protein tertiary structure modelling, Modelling of protein-protein interactions, Protein folding, Molecule Dynamics of Protein, Molecular Docking of Protein, Small molecule and Nucleotide, Concepts of Force Field Gene Prediction, RNA prediction.

### **UNIT-IV**

System biology: Introduction, Associated disciplines, Interactomics (PPI), Fluxomics, Biomics, Metagenomics: Introduction, metagenome, shotgun metagenomics (pyrosequencing), Tool's in metagnomics, MEGAN, MG- RAST, and SEED, Application: Gene survey, Environmental genomes, Microbial diversity, Metabolic pathway database (KEGG pathway database), Concept of metabolome and metabolomics.

### **UNIT-V**

Chemo-informatics: chemo informatics tools for drug discovery, Chemical Structure Representation (SMILE & SMART), Chemical databases: CSD, ACD, WDI, Chem Bank, hazardous chemical database, PUBCHEM, Quantitative Structure Activity Relationship (2D & 3D), Combinatorial libraries & their design, High throughput screening, virtual screening, Lipinski's rule of five, Drug Discovery and design: Target identification, Target Validation, Lead Identification, Lead optimization, preclinical pharmacology & Toxicology.