

MPY 201PBT - PHARMACEUTICAL ASPECTS OF MICROBIAL AND CELLULAR BIOLOGY

1. Bacteria, Fungi and Viruses :

Structure, Chemistry and Morphology, Cultural, Physiological and Reproductive features, Method of isolation. Cultivation and Maintenance, Nomenclature : Microbial taxonomy , new approach to taxonomy – comparison of bacterial genotypes by genetic analysis. General classification, Molecular and Genotypic taxonomy. Industrial important micro organisms including Actinomycetes with examples and uses. Application in fermentation industries.

2. Basic aspects of cell regulation :

Nutrition of micro-organism: substrate entry and translocation. Growth and death of micro-organism, Bioenergetics and metabolism: biochemical mechanisms of Secondary metabolism and its applications in fermentation industry.

3. Microbial Genetics :

Genetic organization of prokaryotic and eukaryotic cells; mutagenesis and repair mechanisms; types of mutants; application of mutagenesis in strain improvement; Mechanisms of antibiotic resistance and role of plasmids and bacteriophages – types, purification, transfer and applications. Transformation, Conjugation, Transduction, mutation and lysogeny.

4. Nucleic acids, the genetic code and protein synthesis :

Synthesis of DNA- polymerization of nucleotides into DNA-Basic chemical structure, replication and its role in protein Synthesis. of proteins – the roles of RNA in Translation (mRNA, and rRNA).

5. Manipulating cells in culture :

Growth of micro organisms in culture pertaining to Bacteria; Principles of microbial nutrition; physical and chemical environment for microbial growth; Batch, continuous and synchronous cultures; Stability and degeneration of microbial cultures. Growth of animal cells in culture; General procedures for cell culture; nutrient composition ; primary established and transformed cell cultures; applications of cell culture in Pharmaceutical industry and research.

Growth of Viruses in culture; Propagation and enumeration; applications of above techniques for antiviral screening.

6. Microbial Pathology and chemotherapy :

Identifying features of pathogenic bacteria, viruses and fungi, mechanism of microbial pathogenicity, etiology and pathology of common microbial diseases, currently recommended therapies for common bacterial, fungal and viral infection, mechanism of action of anti- microbial and possible sites for chemotherapy.

REFERENCES

1. General Microbiology : R.Y. Stanier.
2. Essential and applications of microbiology : Judy Kandal.
3. Microbiology: Pelczar, Reid and Chan.
4. Genetics of Antibiotic producing Micro-organisms : G. Sermonti.
5. Microbial Genetics: David Freifelder.
6. Topley & Wilson : Volumes I to IV.
7. Genes V and VI : Lewin Benjamin.
8. Virology : Fields.
9. Animal cell culture : Ian Freshney.
10. Immunology : Weir.
11. immunology : Ivan Roitt. Johnathan Bronstoff, David Male.
12. Medical Microbiology : Mackie and McCantney.
13. The Actinomycetes : Waksman SA.

MPY 202 PBT - BIOPROCESS TECHNOLOGY

1. Fermentation technology :

Basic principles in fermentation. **Rheological properties of fermentation systems and their importance in bioprocessing.**

Isolation, **Screening techniques : - primary and secondary screening.**

Application of industrially important microbes – primary and secondary screening maintenance of stock cultures, strain improvement for increased yield.

Fermentation kinetics: Reaction kinetics: Michaelis Menten constant and monod equation – derivations for biomass estimation; Lineweaver-Burke plot.

Scale up of fermentation process: Principles, theoretical considerations and techniques used; fermentation media, HTST sterilization- advantage and disadvantages, liquid sterilization techniques; Thermal death kinetics.

Computer control of fermentation processes: System configuration and applications. Optimization of fermentation parameters.

2. Cultivation system and Bioreactors :

Cultivation systems- closed semi-open and open systems; graphical plots representing the above systems; use of immobilized culture systems to prepare fine chemicals.

Detailed study of the design and operation of bioreactor, ancillary parts and functions; impeller design & agitation power requirements; on-line measurement and control of dissolved oxygen, carbon di-oxide, temperature, pH and foam.

Types of reactors- CSTR, tower, air-lift, bubble- column, packed bed, hollow fibre-configuration and applications.

3. Mass transfer and downstream processing :

Theory, diffusional resistance to oxygen transfer, oxygen requirements of microorganism, measurement of mass transfer coefficient and factors affecting them; effects of aeration and agitation on mass transfer, supply of air, air

compressing , cleaning and sterilization of air , air sampling and testing standards for air purity.

Downstream processing: Theory, equipment design and operation, methods, filtration, solvent extraction, chromatographic separation, crystallization, turbidity analysis and cell yield determination metabolic response assay, enzymatic assay, bioautography, techniques for disruption of cells for product recovery.

4. Bioprocessing of the following industrially important microbial metabolites :

Organic solvent : alcohol, butanol; Organic acids : Citric acid and lactic acid, Antibiotics : Penicillin, Streptomycin, Griseofulvin Cephalosporins, Amphotericin B, Rifampicin, Mitomycin – C. Vitamins: Vit. B12 and Riboflavin. Aminoacids: glutamic acid and Lysine. Nucleotides : Cyclic AMP & GMP.

Biosynthetic pathways for some secondary metabolites, microbial transformation of steroids and alkaloids.

REFERENCES

01. Industrial Microbiology: L.E. Casida.
02. Industrial Microbiology: B.M. Miller and W. Litsky.
03. Microbial Technology Vols I & II : H. Peppler.
04. Industrial Biotechnology : Vedpal S Malik and Padma Sridhar.
05. Biochemistry of Industrial Microorganisms, C Rainbow and AH Rose.
06. Biochemical Engineering : F.C. Webb.
07. Biochemical Engineering : R. Steel .
08. Biochemical Engineering Fundamentals: Bailey and Ollis
09. Current protocols in molecular biology, Vols I & II : F.M Asubel, John Wiley Publishers.
10. Biotechnology of antibiotics and other bioactive microbial metabolites : Gianuario Lancini and Rolando Lorenzetti.
11. Biological reaction engineering : IJ Dunn, E. Heinzle, J Ingham, J.E. Prenosil.
12. Bioreactor design and product yield: Butterworth and Heinemann.
13. Enzyme assays – a practical approach : Robert Eisinger and Michael J Danson.
14. Fermentation and biochemical engineering handbook : Henry C Vogel.

MPY 203 PBT - ADVANCES IN PHARMACEUTICAL BIOTECHNOLOGY

1. Enzyme Technology :

Classification, general properties of enzymes, dynamics of enzymatic activity, sources of enzymes, extraction purification: Applications pharmaceutical, therapeutic and clinical.

Techniques of immobilization of enzymes and their applications in the industry . Reactors for immobilized systems and perspective of enzyme endengineering.

2. Plant and Animal Biotechnology :

Plant tissue culture: phytochemicals from plant cell culture , mutagenesis technique in plant tissue culture.

Genetic engineering : Techniques of gene manipulation, cloning strategies, procedures, cloning vectors, expression vectors, recombinant selection and screening, expression in E.coli and yeast.

Site directed mutagenesis, Polymerase chain reaction, and analysis of DNA sequences.brief study on instrumentation aspect of Gel documentation system and PCR.

Gene library and cDNA.

Applicatons of the above techniques in the production of

- i) regulatory proteins interferon, interleukins etc.
- ii) Blood products – Erythropoitin.etc.
- iii) Vaccines – Hepatitis- B,
- iv) Hormones – Insulin.

Study on controlled and site specified delivery of therapeutic peptides and proteins through various routes of administration.

Production of useful proteins in transgenic animals and gene therapy. Signal transduction, oncogenes and their proteins. The human genome products and stem cell research-a brief study.

3. Immuno Biotechnology :

Hybridoma technology – fusion methods for myeloma cells and B lymphocytes, selection and screening techniques. Production and purification of monoclonal antibodies and their application in clinical diagnosis, immunotherapy and pharmaceutical research.

Current developments in immunotechnology diagnostic kits for identifying infectious diseases.

Vaccinology – Immunopotential, adjuvants, living and non-living antigen, newer delivery systems and naked DNA vaccines. New and improved vaccines against Hepatitis – A, Malaria, typhoid, experimental HIV-1 vaccines.

4. Microbial biotechnology :

Biotransformation for the synthesis of chiral drugs and sterols. Biodegradation of xenobiotics, chemical and industrial wastes. Production of single – cell protein.

5. Regulatory aspects:

Regulations governing the manufacturing of biological products.
Introduction to patent and secret process

REFERENCES

1. Biotechnology- The biological principles: MD Trevan, S Boffey, KH Goulding and P. Stanbury.
2. Immobilisation of cells and enzymes: Hosevear Kennady Cabral & Bicker staff.
3. Principles of Gene Manipulating: RW Old and S.B.Primrose.
4. Molecular Cell Biology: Harvey Lodish, David Baltimore, Arnold Berk, S Lawrence Zipursky, Paul Matsudaira, James Darnell.
5. Therapeutic Peptides and proteins; formulation, processing and delivery systems: Ajay K Banga.
6. Modern Biotechnology : S.B.Primrose.
7. Industrial Biotechnology: Vedpal S malik and padma Sridhar.
8. Immunology: Ivan Roitt, Jonathan Brostoff and David Male.
9. Gene transfer and expression protocols-methods in Molecular Biology, Vol. VII, Edit E.T.Murray.
10. Current protocols in Molecular Biology, vol. I & II : F.M. Asubel, John Wiley Publishers.
11. Current protocols in cellular Biology, Vol. I & II, John Wiley Publishers.
12. Cell Biology, VOL. I, II & III Edited by Julio E Celis.

MPY 204 PBT - MEDICINAL PLANT BIOTECHNOLOGY

1. Structural and molecular organization of Plant Cell. Method of Improving quality of crops & their application.

- a) Plant Breeding.
- b) Chemodemes.
- c) Hybridization.
- d) Mutation.
- e) Polyploidy.

1. Plant Tissue Culture

Types, Techniques & Application of Callus, Suspension, Haploid, Embryo, organ and Immobilized Culture. Organogenesis, Embryogenesis, Synthetic seed & Somaclonal variation. Micropropagation. Production of Secondary metabolites-Strategies involving use of Precursor, Growth regulators & Elicitors: Production of Shikonin. Hairy Root Culture & Multiple Shoot Culture & their Applications. Protoplast culture & Protoplast fusion. Biotransformation.

2. Germplasm Conservation .

IN-situ Conservation. *In Vitro* methods of Conservation.

3. Genae transfer in Plants.

- (i) Using vectors of *Agrobacterium*.
- (ii) DNA Mediated gene transfer-Elctroporation, Microprojectile, macro & Microinjection, Ultrasonication & Chemical mediated gene transfer.

Localization of transferred gene in genetically modified plants:

- Nucleic acid Hybridization.
- Use of Radioisotopes & Molecular markers.
- Auto Radiography.
- Electrophoresis.

4. Application of Transgenic Plants.

Resistance of herbicide. Resistance to insect, fungus & virus. Resistance to physiological stress. Production of Phytopharmaceuticals. Edible vaccine.

5. Gene Mapping & Molecular Maps of Plant Genomes.

- Plant Chromosome Analysis.
- Uses of PCR in gene mapping.
- Molecular Maps- RFLP, RAPD.
- Physical maps using in –situ hybridization.
- Immobilization of enzymes & its applications.
- Dedicated study of Plant enzymes – Papain & bromelain.

RECOMMENDED BOOKS:

1. Pharmaceutical biotechnology S.P Vyas and V.K. Dixit, CBS publishers and Distributors, 2001
2. Advanced methods in plant breeding & biotechnology by David R. Murray. CAB International panima book distributors. 1991.
3. Plant tissue culture by Dixon IRL Press Oxford Washingto DC, 1985.
4. Role of Biotechnology in Medicinal and Aromatic plants Vol I & II By Ifan A Khan and Atiya Khanum Ukaoz Publications. 1998.
5. Plant Chromosome analysis, manipulation and engineering by Arun And Archana Sharma 1st Edition Harwood Academic Publishers 1999.
6. Comprehensive Biotechnology by Murray Moo- Young Voll-IV Pergamon Press Ltd, 1985.
7. Transgenic Plants by R. Ranjan Agro botanica. 1999.

RECOMMENDED JOURNALS:

1. Journal of plant biochemistry and biotechnology.
2. Current Science.