

BIOCHEMISTRY
Course Structure – at a Glance

CODE	COURSE TITLE	CREDITS
BIOCHEM 501*^	BASIC BIOCHEMISTRY	2+1
BIOCHEM 502*	INTERMEDIARY METABOLISM	2+1
BIOCHEM 503*	ENZYMولوجY	2+1
BIOCHEM 504	MOLECULAR BIOLOGY	2+1
BIOCHEM 505*	BIOCHEMICAL TECHNIQUES	1+2
BIOCHEM 506	IMMUNO CHEMISTRY	2+1
BIOCHEM 507	PLANT BIOCHEMISTRY	3+0
BIOCHEM 508	ANIMAL BIOCHEMISTRY	3+0
BIOCHEM 509	FOOD AND NUTRITIONAL BIOCHEMISTRY	2+1
BIOCHEM 510	CARBON AND NITROGEN METABOLISM	2+1
BIOCHEM 591	MASTER'S SEMINAR	1+0
BIOCHEM 599	MASTER'S RESEARCH	20
BIOCHEM 601**	ADVANCED ENZYMOLOGY	2+0
BIOCHEM 602**	ADVANCED MOLECULAR BIOLOGY	3+0
BIOCHEM 603	BIOCHEMISTRY OF BIOTIC AND ABIOTIC STRESS	3+0
BIOCHEM 604**	CURRENT TOPICS IN BIOCHEMISTRY	1+0
BIOCHEM 605	FUNCTIONAL GENOMICS AND METABOLOMICS	3+0
BIOCHEM 606	BIOMEMBRANES	2+0
BIOCHEM 607**	ADVANCED TECHNIQUES IN BIOCHEMISTRY	0+2
BIOCHEM 691	DOCTORAL SEMINAR I	1+0
BIOCHEM 692	DOCTORAL SEMINAR II	1+0
BIOCHEM 699	DOCTORAL RESEARCH	45

*Compulsory for Master's programme;

** Compulsory for Doctoral programme

^ Open for PG students of other discipline

Minor Departments

9

Plant Physiology

Plant Molecular biology and Biotechnology

Supporting Departments**5**

Microbiology

Statistics & Mathematics

Soil Science

Non credit compulsory courses

CODE	COURSE TITLE	CREDITS
PGS 501	LIBRARY AND INFORMATION SERVICES	0+1
PGS 502	TECHNICAL WRITING AND COMMUNICATION SKILLS	0+1
PGS 503 (e-course)	INTELLECTUAL PROPERTY AND ITS MANAGEMENT IN AGRICULTURE	1+0
PGS 504	BASIC CONCEPTS IN LABORATORY TECHNIQUES	0+1
PGS 505 (e-course)	AGRICULTURAL RESEARCH, RESEARCH ETHICS AND RURAL DEVELOPMENT PROGRAMMES	1+0
PGS 506 (e-course)	DISASTER MANAGEMENT	1+0

Objective

To provide elementary knowledge/overview of structure and functions and metabolism of biomolecules.

Theory**UNIT I**

Scope and importance of biochemistry in agriculture; Fundamental principles governing life; structure of water; acid base concept and buffers; pH; hydrogen bonding; hydrophobic, electrostatic and Van der Waals forces; General introduction to physical techniques for determination of structure of biopolymers.

UNIT II

Classification, structure and function of carbohydrates, lipids and biomembranes, amino acids, proteins, and nucleic acids.

UNIT III

Structure and biological functions of vitamins, enzymes classification and mechanism of action; regulation, factors affecting enzyme action. Hormones animal plants and insects, Fundamentals of thermodynamic principles applicable to biological processes, Bioenergetics.

UNIT IV

Metabolism of carbohydrates, photosynthesis and respiration, oxidative phosphorylation, lipids, proteins and nucleic acids. DNA replication, transcription and translation; recombinant DNA technology

Practical

Preparation of standard and buffer solutions, Extraction and estimation of sugars, Amino acids, Estimation of Proteins by Lowry's method, Estimation of DNA and RNA by diphenylamine and orcinol methods, Estimation of Ascorbic acid, Separation of biomolecules by TLC and Paper chromatography.

Suggested Readings

Conn EE & Stumpf PK. 1987. *Outlines of Biochemistry*. John Wiley.

Metzler DE. 2006. *Biochemistry*. Vols. I, II. Wiley International.

Nelson DL & Cox MM. 2004. *Lehninger Principles of Biochemistry*. 4th Ed. MacMillan.

Voet D, Voet JG & Pratt CW. 2007. *Fundamentals of Biochemistry*. John Wiley.

Objective

To teach metabolic pathways, their regulation and engineering, and methods used in their elucidation.

Theory

UNIT I

The living cell a unique chemical system, Introduction to metabolism, methods of studying metabolism, transport mechanism, bioenergetics, biological oxidation, signal transduction.

UNIT II

Catabolic and anabolic pathways of carbohydrates, lipids, regulation and their metabolic disorders. Energy transduction and oxidative phosphorylation.

UNIT III

General reactions of amino acid metabolism, Degradative and biosynthetic pathways of amino acids and their metabolic disorders. Sulphur metabolism, Metabolic engineering concepts.

UNIT IV

Compartmentation of metabolic pathways, metabolic profiles of major organs and regulation of metabolic pathways.

Suggested Readings

Berg JM, Tymoczko JL, Stryer L & Clarke ND 2000. *Biochemistry*. 5th Ed.

WH Freeman & Co.

Metzler DE. 2006. *Biochemistry*. Vols. I, II. John Wiley.

Voet D, Voet JG & Pratt CW. 2007. *Fundamentals of Biochemistry*. John Wiley.

Zubey GL. 1998. *Biochemistry*. 4th Ed. WCB London.

BIOCHEM 503

ENZYMOLGY

2+1

Objective

To impart knowledge about the catalytic role of enzymes, their structure, physico-chemical, kinetic and regulatory properties and mechanism of action.

Theory

UNIT I

Introduction and historic perspective, Enzyme nomenclature and classification, enzyme compartmentalization in cell organelles, isolation and purification of enzymes, measurement of enzyme activity. ribozymes, isozymes, abzymes,

UNIT II

Enzyme structure, enzyme specificity, active site, active site mapping, mechanism of enzyme catalysis. cofactors, coenzymes- their structure and role.

UNIT III

Enzyme kinetics, enzyme inhibition and activation, multienzyme complexes, allosteric enzymes and their kinetics, regulation of enzyme activity.

UNIT IV

Isolation and purification of enzymes, Applications of enzymes in chemical and food industry, enzyme immobilization, biosensors and clinical applications of enzymes.

Practical

Enzyme assay by taking any model enzyme like alpha-amylase or acid phosphatase, isolation and purification of any model enzyme like alpha amylase or acid phosphatase, study of the effect of enzyme and substrate concentrations and determination of K_m and V_{max} , determination of pH and temperature optima and effect of various inhibitors, determination of the pH and temperature stability of enzyme.

Suggested Readings

Bergmeyer HU. 1983. *Methods of Enzymatic Analysis*. Vol. II. Verlag Chemie, Academic Press.

Dixon M, Webb EC, Thorne CJR & Tipton KF. 1979. *Enzymes*. 3rd Ed. Longman.

Maragoni AG. 2003. *Enzyme Kinetics - A Modern Approach*. John Wiley.

Palmer T. 2001. *Enzymes: Biochemistry, Biotechnology and Clinical Chemistry*. 5th Ed. Horwood Publ.

Price NC & Stevens L. 2003. *Fundamentals of Enzymology*. Oxford Univ. Press.

Wilson K & Walker J. (Eds.). 2000. *Principles and Techniques of Practical Biochemistry*. 5th Ed. Cambridge Univ. Press.

BIOCHEM 504

MOLECULAR BIOLOGY

2+1

Objective

To provide knowledge regarding genes, their functions, expression, regulation and transfer in heterologous systems.

Theory

UNIT I

Historical development of molecular biology, nucleic acids as genetic material, chemistry and structure of DNA and RNA, Genome organization in prokaryotes and eukaryotes, chromatin structure and function.

UNIT II

DNA replication, DNA polymerases, topoisomerases, DNA ligase, reverse transcriptase, repetitive and non-repetitive DNA, satellite DNA; transcription process, RNA editing, RNA processing.

UNIT III

Ribosomes structure and function, organization of ribosomal proteins and RNA genes, genetic code, aminoacyl tRNA synthases' inhibitors of replication, transcription and translation; translation and Post translational modification; nucleases and restriction enzymes, regulation of gene expression in prokaryotes and eukaryotes, molecular mechanism of mutation.

UNIT IV

DNA sequencing, recombinant DNA technology, vectors, isolation of genes, recombinants vector, selection of recombinants, PCR; general features of replication, transcription, site directed mutagenesis and translation in eukaryotes.

Practical

Isolation and purification of DNA and RNA from different sources, check of purity of isolated DNA and RNA, restriction fragmentation and separation of oligos by agarose electrophoresis, RAPD analysis of DNA, cDNA synthesis using PCR, Southern and Northern blotting experiments

Suggested Readings

Adams RLP, Knowler JT & Leader DP. 1992. *The Biochemistry of the Nucleic Acids*. 11th Ed. Chapman & Hall.

Alberts B, Bray D, Lewis J, Raff M, Roberts K & Watson JD 2006. *Molecular Biology of the Cell*. 6th Ed. Garland Publ.

Blackburn GM & Gait MJ. 1996. *Nucleic Acids in Chemistry and Biology*. 2nd Ed. Oxford University Press.

Freifelder D & Malacinski GM. 1996. *Essentials of Molecular Biology*. 3rd Ed. Panima.

Glick BR & Pasternak JJ. 1994. *Molecular Biology: Principles and Applications of Recombinant DNA Technology*. ASM Press.

Lewin B. 2007. *Genes IX*. Oxford University Press.

Lodish H, Berk A, Zipursky SA, Matsudaira P, Baltimore D & Darnell J. 1999. *Molecular Cell Biology*. WH Freeman.

Old RW & Primrose SB. 1989. *Principles of Gene Manipulation: An Introduction to Genetic Engineering*. 4th Ed. Blackwell Scientific Publ.

Sambrook J & Russel DW. 2001. *Molecular Cloning: A Laboratory Manual*. Vols. I-III. Cold Spring Harbor.

BIOCHEM 505

TECHNIQUES IN BIOCHEMISTRY

1+2

Objective

To impart practical knowledge about various techniques used in purification and characterization and estimation of cellular constituents.

Theory

UNIT I

Chromatographic and electrophoretic methods of separation, Principles and applications of Paper, Thin layer & HPTLC, Gas, Gas-liquid, Liquid chromatography, HPLC and FPLC; Paper and gel electrophoresis, Different variants of polyacrylamide gel electrophoresis (PAGE) like native and SDS-PAGE, 2D-PAGE, capillary electrophoresis.

UNIT II

Spectrophotometry: Principles and applications UV-Visible, Fluorescence, IR and FTIR, Raman, NMR and FTNMR, ESR and X-Ray spectroscopy.

UNIT III

Hydrodynamic methods of separation of biomolecules such as viscosity and sedimentation-their principles, variants and applications.

UNIT IV

Tracer techniques in biology: Concept of radioactivity, radioactivity counting methods with principles of different types of counters, concept of α and β emitters, scintillation counters, γ -ray spectrometers, autoradiography, applications of radioactive tracers in biology, principles and applications of phosphor imager.

Practical

Determination of absorption maxima of some important chemicals from their absorption spectra, estimation of biomolecule using spectrophotometer, Separation of carbohydrates and amino acids by paper chromatography, Separation of lipids by thin layer and column chromatography, Separation of proteins by ion exchange and gel filtration chromatography, Electrophoretic techniques to separate proteins and nucleic acids, Centrifugation- Cell fractionation, Application of GLC, HPLC, FPLC in separation of biomolecules, Use of radioisotopes in metabolic studies.

Suggested Readings

Clark JM. 1977. *Experimental Biochemistry*. 2nd Ed. WH Freeman. Sawhney SK & Singh R. 2000. *Introductory Practical Biochemistry*. 2nd Ed. Narosa.

Willard M, Merritt LL & Dean JA. 1981. *Instrumental Methods of Analysis*. 4th Ed. Van Nostrand.

William BL & Wilson K. 1975. *Principles and Techniques of Practical Biochemistry*. Edward Arnold.

Wilson K, Walker J & Walker JM. 2005. *Principles and Techniques of Practical Biochemistry*. Cambridge Univ. Press.

BIOCHEM 506

IMMUNOCHEMISTRY

2+1

Objective

To give an insight into the biochemical basis of immunity.

Theory

UNIT I

History and scope of immunology, antigens, adjuvants, immune system, organs, tissues and cells, immunoglobulins, molecular organization of Immunoglobulin.

UNIT II

Classes of antibodies, Antibody diversity, theories of generation of antibody diversity, Vaccine, Monoclonal antibodies, polyclonal antibodies, Hybridoma, Recombinant antibodies, complement system- classical and alternate.

UNIT III

Cellular interactions in the immune response, major histocompatibility complex, cell mediated immune response, cytokines.

UNIT IV

Immunoregulation, immunological tolerance, hypersensitivity, mechanisms of immunity, innate resistance and specific immunity. Current immunological techniques-ELISA, RIA

Practical

Handling, inoculation and bleeding of laboratory animals, Preparation of antigens and antisera, natural antibodies, Carbon clearance test, lymphoid organs of the mouse, Morphology of the blood leucocytes, separation of lymphocytes from blood, viable lymphocyte count, Antigen-antibody interaction, precipitation, agglutination, direct and indirect haemagglutination, Immunoelectrophoresis, Complement fixation, Quantitation of immunoglobulins by zinc sulphate turbidity and single radial immunodiffusion.

Suggested Readings

Abbas AK & Lichtman AH. 2003. *Cellular and Molecular Immunology*. 5th Ed. WB Saunders.
Goldsby RA, Kindt TJ & Osborne BA. 2003. *Immunology*. 4th Ed. WH Freeman.
Harlow & Lane D. (Eds.) 1988. *Antibodies: A Laboratory Manual*. Cold Spring Harbor Laboratory.
Kuby J. 1996. *Immunology*. 3rd Ed. WH Freeman.
Male D, Brostoff J, Roth DB & Roitt I. 2006. *Immunology*. 7th Ed. Elsevier.

BIOCHEM 507

PLANT BIOCHEMISTRY

3+0

Objective

Detailed information about biochemical and molecular basis of various plant processes and plant growth regulatory substances.

Theory

UNIT I

Scope and importance of biochemistry in Agriculture, Plant cell organelles and their separation, structure and function of cell organelle. Photosynthetic pigments in relation to their functions, photosynthesis, C3, C4 and CAM pathways, photorespiration.

UNIT II

Sucrose-starch interconversion, biosynthesis of structural carbohydrates, storage proteins and lipids. Biochemistry of nitrogen fixation and nitrate assimilation, sulphate reduction and incorporation of sulphur in to amino acids.

UNIT III

Biochemistry of seed germination and development, Biochemistry of fruit ripening, phytohormones and their mode of action, signal transduction.

UNIT IV

Biochemistry and significance of secondary metabolites-cyanogenic glycosides, glucosinolates, phenolic compounds, terpenoids, alkaloids, plant defense system.

Suggested Readings

Buchanan BB, Gruissem W & Jones RL. 2000. *Biochemistry and Molecular Biology of Plants*. 2nd Ed. John Wiley.
Dey PM & Harborne JB. 1997. *Plant Biochemistry*. Academic Press.
Goodwin TW & Mercer EI. 1983. *Introduction to Plant Biochemistry*. Pergamon Press.
Heldt HS. 1997. *Plant Biochemistry and Molecular Biology*. Oxford Univ. Press.
Lea PJ & Leegood RC. 1993. *Plant Biochemistry and Molecular Biology*. 2nd Ed. John Wiley.

Objective

To impart knowledge regarding biochemistry of various physiological processes, specialized tissues and hormone action in animal system.

Theory**UNIT I**

Digestion and absorption of food, Vitamins,, Detoxification, biochemistry of specialized tissues – connective tissue, skin, muscle, nervous tissue and blood and other body fluids.

UNIT II

Water, electrolyte and acid-base balance, biochemistry of respiration, structure, function and mechanism of major trace elements.

UNIT III

Hormones of thyroid, hypothalamus, pituitary, pancreas, adrenals and sex hormones, Membrane receptors of hormones, signal transduction, biochemistry of reproduction.

UNIT IV

Immune systems, immunoglobulins, monoclonal antibodies, formation of antibody, antibody diversity, complement system – classical and alternate, major histocompatibility complexes, cell mediated immune response, mechanisms of immunity.

Suggested Readings

- Devlin TM. 2006. *Text Book of Biochemistry with Clinical Correlations*. 6th Ed. John Wiley.
- Goldsby RA, Kindt TJ, Kuby J & Osborne BA. 2003. *Immunology*. 4th Ed. WH Freeman. & Co.
- Harper H. A. 2000. *Physiological Chemistry*. MacMillan.
- Buchanan BB, Gruissem W & Jones RL. 2000. *Biochemistry and Molecular Biology of Plants*. 2nd Ed. John Wiley.

Objective

To impart knowledge regarding the biochemical aspects of various nutrients and their interactions in foods during processing, storage and deterioration.

Theory**UNIT I**

Fundamentals of human nutrition, concept of balanced diet, biochemical composition, energy and food value of various food grains (including cereals, pulses, oilseeds), fruits and vegetables. Physico-chemical, functional and nutritional characteristics of carbohydrates, proteins and fats and their interactions (emulsions, gelation, browning etc.).

UNIT II

Biochemical and nutritional aspects of vitamins, minerals Nutraceuticals, antinutritional factors, biochemistry of post harvest storage.

UNIT III

Effect of cooking, processing and preservation of different food products on nutrients, biochemical aspects of food spoilage, role of lipase and lipoxygenase, oxidative rancidity and antioxidants.

UNIT IV

Enzymes in food industry, food additives (coloring agents, preservatives etc.), biogenesis of food flavours and aroma, nutritional quality of plant, dairy, poultry and marine products.

Practical

Estimation of starch, lipid/oil, phenols in plant tissue/sample, Estimation of carotenoids, Estimation of Trypsin and chymotrypsin inhibitor activities in seeds, Estimation of Vitamin C in fruits, Reducing & non reducing sugar in fruits, Estimation of protein contents, Estimation of dietary fibre, Determination of limiting amino acids, Estimation of Phytate/Oxalate.

Suggested Readings

Alais C & Lindel G. 1995. *Food Biochemistry*. Amazon Springer.

DeMan JM. 1999. *Principles of Food Chemistry*. 3rd Ed. Springer.

Fennema OR. 1996. *Food Chemistry*. 3rd Ed. CRC Press.

Hulme AC. (Ed.). 1970. *Biochemistry of Fruits and Vegetables and their Products*. Vols. I, II. Academic Press.

Ranganna S. (Ed.). 1986. *Handbook of Analysis and Quality for Fruits and Vegetable Products*. Tata McGraw Hill.

Robinson DS. 1987. *Food Biochemistry and Nutritional Value*. Longman.

BIOCHEM 510

CARBON AND NITROGEN METABOLISM

2+1

Objective

To impart knowledge of general carbon and nitrogen metabolism in plants with special reference to starch and cell wall polysaccharides and biological nitrogen fixation and assimilatory pathways.

Theory

UNIT I

Carbon metabolism: Synthesis of sucrose, Regulation of sucrose phosphate synthesis, Transport of sucrose, phloem loading and unloading, synthesis of starch in leaves and seeds, concept of transitory starch.

UNIT II

Synthesis of fructose, galactomannans raffinose series oligosaccharides and trehalose.

UNIT III

Nitrogen cycle- Biochemistry of nitrate assimilation and its regulation, GS/GOGAT and GDH pathway, ureides and amides as nitrogen transport compounds, chemoautotrophy in denitrifying bacteria.

UNIT IV

Biological nitrogen fixation; structure function and regulation of nitrogenase; nif genes and their regulation; biochemical basis of legume- Rhizobium symbiosis, genes involved in synthesis.

Practical

Estimation of nitrite content, Estimation of protein by Lowry's method, Estimation of starch, Estimation of nitrate content by hydrazine sulphate reduction method, *in vivo* assay of nitrate reductase activity, *in vitro* assay of nitrate reductase activity, *in vitro* assay of nitrite reductase activity, *in vitro* assay of glutamine synthetase activity, *in vitro* assay of glutamate synthase and glutamate dehydrogenase activity, Estimation of ureides and amides, Assay of nitrogenase activity by acetylene reduction method, Estimation of hydrogen evolution by legume nodules.

Suggested Readings

Beevers L. 1979. *Nitrogen Metabolism in Plants*. Gulab Vazirani for Arnold-Heinermann.
Bergersen FJ. (Ed.). 1980. *Methods for Evaluating Biological Nitrogen Fixation*. John Wiley & Sons.
Bray CM. 1983. *Nitrogen Metabolism in Plants*. Longman Buchanan BB, Grissem W & James RL. (Eds.). 2000. *Biochemistry and Molecular Biology of Plants*. American Society of Plant Physiologists.
Mehta SL, Lodha ML & Sane PV. (Eds.). 1993. *Recent Advances in Plant Biochemistry*. ICAR.

BIOCHEM 601

ADVANCED ENZYMOLOGY

2+0

Objective

To provide advanced knowledge about the structure, mechanism, kinetics and regulation of enzymes and their use as biosensors.

Theory

UNIT I

Theory of enzymatic catalysis, specificity, concept of active site and enzyme substrate complex, active site mapping, acid-base and covalent catalysis, factors associated with catalytic efficiency, proximity and orientation, distortion and strain, induced fit hypothesis, Mechanism of enzyme reactions.

UNIT II

Effect of different factors affecting enzyme activity, transition state theory, Arrhenius equation, Determination of energy of activation, kinetics of pH and temperature and determination of pKa and H of active site amino acids.

UNIT III

Kinetics of bisubstrate reactions, mechanism determination by radioisotope exchange, kinetics of mixed inhibitions, substrate and product inhibition.

UNIT IV

Role of enzymes in regulation of metabolism, allosteric enzymes and their kinetics, enzyme engineering, Bifunctional enzymes, enzyme engineering,

Suggested Readings

Dixon M & Web EC. 1979. *Enzymes*. 3rd Ed. Longmans Green.

Seigel IH. 1975. *Enzyme Kinetics*. John Wiley.

Selected reviews and articles from journals.

BIOCHEM 602

ADVANCED MOLECULAR BIOLOGY

3+0

Objective

To impart latest information on the molecular biochemistry of isolation, transfer and expression of genes in plants and biochemical approaches employed in gene therapy.

Theory

UNIT I

Organization of prokaryotic genome, nuclear and organelle genes, concept of genome mapping, molecular evolution, cell development and differentiation.

UNIT II

Prokaryotic and eukaryotic gene regulation, RNA editing, molecular biology of viruses.

UNIT III

Methods of gene isolation and transfer in plants and animals, molecular basis of male sterility, Application of genetic engineering in different fields.

UNIT IV

Site directed mutagenesis, gene targeting and gene therapy, bioethics and biosafety guidelines and IPR in recombinant DNA research.

Suggested Readings

Alberts B, Bray D, Lewis J, Raff M, Roberts K & Watson JD. 2006.

Molecular Biology of the Cell. 6th Ed. Garland Publ.

Lewin B. 2007. *Gene IX*. 9th Ed. Pearson Publ.

Selected articles from journals.

BIOCHEM 603

BIOCHEMISTRY OF BIOTIC AND ABIOTIC STRESSES

3+0

Objective

To impart latest development about biochemistry of biotic and abiotic stresses in plants.

Theory

UNIT I

Plant-pathogen interaction and disease development; molecular mechanisms of fungal and bacterial infection in plants; changes in metabolism, cell wall composition and vascular transport in diseased plants.

UNIT II

Plant defence response, antimicrobial molecules; genes for resistance, hypersensitive response and cell death; systemic and acquired resistance.

UNIT III

Plant viruses, host-virus interactions, disease induction, virus movement, and host range determination; viroids, pathogen-derived resistance.

UNIT IV

Biochemical basis of abiotic stresses namely osmotic (drought, salinity), temperature, heavy metals, air and water pollutants, synthesis and functions of proline and glycine betaine in stress tolerance interaction between biotic and abiotic stresses; stress adaptation.

UNIT V

Reactive oxygen species and biotic and abiotic stress, antioxidants, enzymes defense system. Role of calcium, nitric oxide and salicylic acid in plant development. Molecular strategies for imparting tolerance against biotic and abiotic stress.

Suggested Readings

- Basra AS. 1997. *Stress Induced Gene Expression in Plants*. Harwood Academic Publ.
Chessin M, DeBorde D & Zipf A. 1995. *Antiviral Proteins in Higher Plants*. CRC Press.
Crute IR, Burdon JJ & Holub EB. (Eds.). 1997. *Gene-for-Gene Relationship in Host-Parasite Interactions*. CABI.

BIOCHEM 604

CURRENT TOPICS IN BIOCHEMISTRY

1+0

Objective

To acquaint the students with the advanced developments in the field of biochemistry and to inculcate the habit of searching and reading the topics of current importance.

Theory

UNIT I

Advanced topics related to Nutrition and metabolism.

UNIT II

Advanced topics related to enzymology and industrial biochemistry.

UNIT III

Advanced topics related to molecular biochemistry and immunology.

UNIT IV

Advanced topics related to metabolic engineering and bioprospecting.

Suggested Readings

Selected articles from journals.

Objective

To impart knowledge in the upcoming areas of biochemistry. and to acquaint the students with the recent developments of job opportunities in pharmaceutical and other industries.

Theory**UNIT I**

Protein and nucleic acid sequencing: Various methods of sequencing including automated sequencing and microarrays, whole genome sequence analysis.

UNIT II

Comparative genomics, functional genomics, transcriptomics, gene identification, gene annotation, pairwise and multiple alignments, application of genomics, Quantitative PCR, SAGE, MPSS, microarray.

UNIT III

Proteome technology- 2D-PAGE, MSMS, MALDI-TOF, protein microarray, comparative proteomics and structural proteomics.

UNIT IV

Metabolic pathway engineering, vitamin A engineering in cereals, microarray analysis, role of bioinformatics in functional genomics.

Suggested Readings

Baxevanis AD & Ouellette BFF. 2004. *Bioinformatics - A Practical Guide*

to the Analysis of Genes and Proteins. 3rd Ed. Wiley InterScience.

Dale JW & Schantz MV. 2002. *From Genes to Genomes*. John Wiley.

Lieber DC. 2002. *Introduction to Proteomics - Tools for the New Biology*. Humana Press.

Suhai S. 2002. *Genomics and Proteomics - Functional and Computational Aspects*. Kluwer.

Objective

To teach structure and functions of biomembranes, structure-function relationships, membrane biogenesis.

Theory**UNIT I**

Concept of biomembranes and their classification based on cellular organelles; physico-chemical properties of different biological and artificial membranes, cell surface receptors and antigen.

UNIT II

Membrane biogenesis and differentiation; membrane components-lipids, their distribution and organization; proteins, intrinsic and extrinsic, their arrangement; carbohydrates in membranes and their function.

UNIT III

Various membrane movements; transport across membrane and energy transduction.

UNIT IV

Role of membrane in cellular metabolism, cell recognition and cell –to – cell interaction; signal transduction, recent trends and tools in membrane research.

Suggested Readings

- Lodish H, Berk A, Zipursky SA, Matsudaira P, Baltimore D & Darnel J. 1999. *Molecular Cell Biology*. WH Freeman.
- Nelson DL & Cox MM. 2000. *Lehninger Principles of Biochemistry*. 3rd Ed. Printed in India by Replika Press Pvt. Ltd., New Delhi for Worth Publ., New York.
- Smallwood M, Knox JP & Bowls BJ. 1996. *Membranes: Specialized Functions in Plants*. Bros. Scientific Publ.

BIOCHEM 607

ADVANCED TECHNIQUES IN BIOCHEMISTRY

0+2

Objective

To impart students a hands on training of techniques of biochemistry and molecular biology.

Theory

UNIT I

Isolation and purification of protein from microbial/plant/animal source. Electrophoretic separation of protein. Determination of molecular weight of protein using PAGE/ gel filtration method.

UNIT II

Experiments on DNA: Isolation, agarose gel electrophoresis and restriction analysis of DNA.

UNIT III

Isolation of chloroplast and mitochondria by differential centrifugation and their purification by density gradient centrifugation.

UNIT IV

Isolation and purification of enzymes, isozymic analysis and enzyme immobilization

Suggested Readings

- Kolowick NP & Kaplan NP. *Methods in Enzymology*. Academic Press (Series).
- Plummer DT. 1998. *An Introduction to Practical Biochemistry*. 3rd Ed. Tata McGraw Hill.
- Rickwood D. (Ed.). 1984. *Practical Approaches in Biochemistry*. 2nd Ed. IRL Press, Washington DC.
- Wilson K & Goulding KH. 1992. *A Biologist's Guide to Principles and Techniques of Practical Biochemistry*. 3rd Ed. Cambridge Univ. Press.
- Wilson K & Walker J. 2000. *Principles and Techniques of Practical Biochemistry*. 5th Ed. Cambridge Univ. Press.

List of Journals

Annual Review of Biochemistry

Annual Review of Genetics

Annual Review of Plant Physiology and Plant Molecular Biology

Biochemical and Biophysical Research Communication

Biochemical Journal

Biochim. Biophysic Acta

Cell

Current Science

Federation of European Biochemical Society

Indian Journal of Experimental Biology

Journal of Biological Chemistry

Journal of Immunology

Journal of Molecular Modeling

Journal of Plant Biochemistry and Biotechnology

Nature

Physiologia Plantarum

Plant Physiology

Plant Science

Planta

Proceedings of National Academy of Sciences, USA

Protein Science

RNA

Science

Scientific American

Trends in Biochemical Sciences

Trends in Biotechnology

Trends in Plant Sciences

e-Resources

www.unixl.com/dir/molecular_sciences/biochemistry/biochemistry_jobs/

www.unixl.com/dir/medical_sciences/

<http://www.ncbi.nlm.nih.gov/>

<http://us.expasy.org>

<http://us.expasy.org/spdbv/>

<http://www.brenda.uni-koeln.de/>

<http://www.worthington-biochem.com>

<http://www.cefotaxime.net>

<http://home.123india.com/nbsc/>

<http://www.biochemist.org>

<http://www.gwu.edu/~mpb>

Suggested Broad Topics for Master's and Doctoral Research

Immobilization of industrially important enzymes

Manipulation of metabolic pathways for reserve biosynthesis and utilization.

Biochemistry and molecular biology of biotic and abiotic stresses in plants.

Biochemistry of fruits and vegetables during ripening and post ripening.

Manipulation of metabolic pathways at molecular level to increase shelf life of fruits and to increase contents of alkaloids, flavones and isoflavones, PUFA etc.

Use of molecular markers for identification and improvement of crop plants.

Enzyme engineering and functional genomics/proteomics.

Biochemical and molecular evaluation of varieties for quality improvement.

Use of biomolecules as biosensors.

Study of metabolome and elucidation of metabolic pathway of secondary metabolites.