ACADEMIC ORGANISER 2015-16

M.Sc SEMESTER I

Biochemistry: PAPER I: Chemistry and Metabolism of proteins, lipids and porphyrins

Name of the lecturer: Dr.S.Padma

MONTH/No of teaching days	Unit	TOPICS COVERED
AUGUST 9	**I: Chemistry of Amino Acids, & Proteins**	Classification and structure of 20 aa, essential, non–essential, unusual and non-protein. General properties of aa, acid – base titrations, pKa Peptide bond – stability and formation, Primary structure, GN Ramachandran plots Secondary structure and motifs, α helix, β sheet, 3-10 helix Leucine zipper, Zinc finger, Trans-membrane regions, βLHL Tertiary & Quaternary structure (myoglobin, hemoglobin)
SEPTEMBER 15	I **Unit – II: Metabolism of Amino acids, & Proteins**	Protein-protein interactions (actin, tubulin) Small peptides (glutathione, peptide hormones), Cyclic peptides (Gramicidin) Classification of proteins-globular, fibrous, membrane, metallo-proteins, SCOP, CATH Denaturation (pH, temperature, chaotropic agents), refolding Metabolic fate of dietary proteins and amino acids Degradations to glucose and ketone bodies Amino acids degraded to Pyruvate, Oxaloacetate Amino acids degraded to Acetyl-CoA, Succinyl-CoA Metabolism of branched chain amino acids Role of glutamate cycle information & circulation of ammonia Glucose alanine cycle, urea cycle Linking of citric acid and urea cycles, regulation of urea cycle Nitrogen cycle - Biological nitrogen fixation dehydrogenase-& glutamine synthetase. Nitrate & ammonia utilization, Biogenesis of organic nitrogen
OCTOBER 14	**Unit – III: Chemistry of Lipids &Porphyrins** **I/IVMetabolism of Lipids & Porphyrins**	Classification & biological significance of lipids & fatty acids. Steroids, Sterols, relation to vitamin D and steroid hormones Bile acids and salts, Phospholipids, Oils, waxes, isoprene units, Lipoproteins Glycolipids, Sphingolipids Structure & function of porphyrins (e.g. Heme, chlorophyll) Cerebrosides, gangliosides Prostaglandins, Prostacyclins Thromboxanes, Leukotrienes Fate of dietary lipids and Apo-lipoproteins Beta oxidation, breakdown of odd chain fatty acids, energy Fatty acid biosynthesis yields, Desaturation of fatty acids

A. Lai Padma
20/7/15

NOVEMBER 20	**I/IVMetabolism of Lipids & Porphyrins**	Regulation of β – oxidation, ώ – oxidation & α – oxidation Metabolism of phospholipids &Sphingolipids Regulation and Biosynthesis of cholesterol and other steroids Fate of acetyl CoA, formation of ketone bodies and ketosis Biosynthesis of prostaglandins, Prostacyclins, Thromboxanes, Leukotrienes
DECEMBER 8	**I/IVMetabolism of Lipids & Porphyrins**	Role of HDL, LDL, and Very-low-density lipoprotein (VLDL)and cholesterol levels in body, Metabolism of Porphyrins and associated porphyrias

A. Lal
27/7/17

Academic Organizer (2015-16)
M.Sc Biochemistry
Semester-I
Paper –II, BI 102T: Chemistry and Metabolism of Carbohydrates, Vitamins and Nucleic Acids
Lecturer: Dr. A.Sai padma

Month/ No of Teaching Days	Unit	Name of the topic
August 8	**Unit – I: Chemistry of Carbohydrates**	Classification, monosaccharides (aldoses & ketoses) Configuration and conformation of monosaccharides (pyranose & furanose, chair & boat), Reducing and optical properties of sugars, Stability of glycosidic bond disaccharides, oligosaccharides,
September 14	, **Unit – II: Metabolism of Carbohydrates**	Structural polysaccharides-cellulose, hemicellulose, pectin, lignin, chitin, chitosan, Storage polysaccharides; starch, glycogen, inulin, Steric factors in polysaccharides folding, sugar code and lectin, Glycosaminoglycans, mucopolysaccharides, hyaluronic acid, Chondriotin sulfate, keratan sulfate, dermatan sulfate, Bacterial cell wall , – proteoglycans and peptidoglycans. Reactions and energy balance in Glycolysis, Reactions and energy balance in , Gluconeogenesis, Reactions and energy balance in TCA cycle, Pentose phosphate, Pasteur and Crabtree effect, Anapleurotic reactions, Glyoxylate cycle, Glucuronic acid cycle, Glycogen metabolism, Photosynthesis reactions for biosynthesis of glucose, C3 and C4 cycle in plants.
October 14	**Unit – III: Chemistry and Metabolism of Nucleic Acids:**	Purines, pyrimidines, nucleosides, nucleotides, unusual bases. Structure of DNA – Watson Crick Model, A- and Z- forms Supercoiling of DNA – negative and positive, linking number, , structure of RNA, tRNA, rRNA, siRNA / miRNA, Properties of NA – denaturation and renaturation, Tm (factors affecting Tm) and Cot curves, Heteroduplex mapping – D loops and R , loops.

A. Sai Padma
20/7/15

November 15 +1	**Unit – IV: Chemistry and Metabolism of Vitamins**	Biosynthesis of purines and pyrimidines, Degradation of purines and pyrimidines, Regulation: *de novo*, salvation, nucleotide analogs. : Discovery of vitamins, classification, RDA, Vitamin A – source, biological role, deficiency, Vitamin B1 – Thiamine – source, biological role, deficiency. Vitamin B1 – Thiamine – source, biological role, deficiency, Vitamin B2 – Riboflavin –, Vitamin B3 – Niacin – and B5 – Pantothenic acid , Vitamin B6 Pyridoxamine – and B7 – Biotin
December 8		Vitamin B9 – Folic acid – and B12 – Cobalamine , Vitamin C – Ascorbic acid, Vitamin D – Calciferol, Vitamin E, Vitamin K – source, biological role, deficiency

A. Lai Dadi
29/7/15

Academic organiser
2015 – 2016
M.Sc Biochemistry, Semester-I
Paper-III
Bioanalytical Techniques

Lecturer: M.K.S. Sukumaran

Month & No of teaching Days	Unit	Name of the topic
August 15	Unit I	**Spectroscopy** Beer Lambert's Law, Molar extinction coefficient, Absorption maximum UV-Vis: Spectroscopy, Colorimetry – principle, instrumentation, application Fluorescence Spectroscopy – principle, instrumentation, application Atomic Absorption Spectrometry – principle, instrumentation, application NMR – principle, instrumentation application ESR – principle, instrumentation application CD – principle, instrumentation, application ORD – principle, instrumentation, application Mass spectroscopy – principle, instrumentation, application X-ray crystallography.
1	Unit II	**Chromatography** Partitioning and counter current distribution
September 14	Unit II	PC – principle, instrumentation, application. TLC – principle, instrumentation, application GC – principle, instrumentation, application 5 Ion–exchange – principle, instrumentation, application Gel filtration (Gel exclusion chromatography) – principle, application Affinity chromatography – principle instrumentation, application; immunoprecipitation HPLC and RP-HPLC – principle, instrumentation, application FPLC, LC – principle, instrumentation, application Peptide mapping and N-terminal sequencing of proteins
October 15	Unit III	**Centrifugation and Electrophoresis** Centrifugation, RCF and types of rotors Ultracentrifugation – principle, instrumentation, application CsCl density gradient and sucrose gradient centrifugation – principle, application 4Electrophoresis – moving boundary and zonal electrophoresis Native and SDS PAGE, IEF and 2D PAGE Agarose Gels, PFGE Zymography, PAGE for DNA sequencing DNase-I hypersensitivity mapping DNA-Foot-printing and Chromatin IP methods Denaturing gels for RNA, Southern and Northern Blots.
5	Unit IV	**Tracer Techniques** Stable and radioactive isotopes, Radioactivity theory, half life and emission spectra of half life of biologically useful isotopes - 2H, 3H, 14C, 18O, 32P, 35S, 125I 2 Isotopes used for labeling proteins (3H 14C, 35S, 125I) and nucleic acids (3H, 32P) 3 Detection of radioactivity by Scintillation counting Autoradiography.
November 10	Unit IV	Fluorography, Phosphor-imaging, applications 5 GM counter, gamma counter 6 Radiation hazards and safe disposal of radioactivity waste; luxometry and chemiluminescence as alternative to radioactivity 7 Isotope dilution method – pulse chase 8 Historic examples- 14C and 18O to study photosynthesis 9 Historic examples- 31P and 32S to study viral replication (Hershey-Chase experiment) 10 Historic examples- 14N and 15N in DNA replication (Meselson and Stahl experiment).

A-Lai Jade
27/7/15

Academic organiser
2015 – 2016
M.Sc Biochemistry, Semester-I
Paper-IV
Bioenergetics and Cell Biology check

Lecturer: M.K.S. Sukumaran

Month & No of teaching Days	Unit	Name of the topic
September 15 3	Unit I	**Bioenergetics** Elements of importance in biochemistry (H, C, N, O, P, S), types and energy of bonds and interactions (ionic, covalent, coordinate, H-bonds, van der Waals, hydrophobic interactions) Laws of thermodynamics, Gibbs free energy, relevance of entropy and enthalpy in biological systems and reactions; first and second-order reactions Log and ln scales in biological processes (exponential growth curves, radioactive decay) Biological oxidation, high energy compounds High energy bonds, redox and phosphate potential Structure of membrane, forces stabilizing membranes Formation of ion gradients across a membrane (proton gradients in organelles), role of transporters and channels ETC in mitochondria and chloroplasts, un-couplers and inhibitors of energy transfer Polarization of cell, resting potential, action potential, propagation of impulse Biological fluorescence (GFP and derivatives), Bioluminescence.
October 12	Unit IV	**Methods of Cell Study** Simple and compound microscope. Phase contrast, dark field and polarization microscopy. Electron microscopy, SEM, TEM; freeze fracture. Fluorescence and Confocal microscopy; imaging live cells. FRET and FRAP. Atomic force microscopy. Flow-Cytometry and cell sorting (FACS). Plant tissue culture. Animal and insect tissue culture. Methods of cell disruption and fractionation, isolation of organelles.
November 15	Unit II Unit III	**Structure of Prokaryotic cells:** Classification of prokaryotes (systems of classification) Ultra-structure of eubacteria, cyanobacteria, mycoplasma Motility of bacteria, bacterial films, isolation of bacteria from natural sources Sterilization of materials (autoclaving, dry heat, filtration, chemical disinfection, irradiation) and commonly-used media (minimal, enriched, selective) for bacterial growth Staining methods for bacteria; maintenance, and preservation of bacterial cultures Growth curve, Doubling time, Factors effecting growth – pH, temperature, oxygen, agitation Batch and continuous growth of bacteria, chemostat, synchronized cultures Industrial (large-scale) growth of bacteria, fermenter design Bacteria of industrial importance, development of commercially valuable strains Discovery of antibiotics, mode of action of various classes of antibiotics, antibiotic resistance. **Structure of Eukaryotic cells**: Ultra-structure of animal cells Ultra-structure of plant cells Composition of cytoskeleton-microfilaments, microtubules, intermediate filaments Nuclear skeleton-lamina, scaffold Vesicle trafficking (endocytosis, exocytosis), role of Rabs and Rab GTPases Structure of chromatin and chromosomes (centromere, telomere, kinetochore)
December 9		Mitosis, meiosis, and interaction of chromatin with cytoskeleton (attachment of spindle fibers). Formation and structure of special chromosomes (polytene, lampbrush) Cell cycle Apoptosis.

A. Lalitha
29/7/15

Academic Organizer (2015-16)
Semester-III
M.Sc II Year, Biochemistry

Paper-I: BI 301T: Gene Regulation and Genetic Engineering
Lecturer: Dr. A.Sai padma

Month/ No of Teaching Days	Unit	Name of the topic
August 16	**Unit – I: Gene Regulation in Prokaryotes and Viruses**	Operon concept for gene regulation, Positive (+ve)&Negative (-ve) control – Lac operon, Attenuation – Trp operon, Dual promoters – gal operon: Dual function of repressor – ara operon, Phase variation in *Salmonella* flagellar protein synthesis, Sporulation gene expression in *Bacillus,* Riboswitch, Anti – termination in lambda phage, Lytic / lysogenic switch in lambda phage, Control of plasmid copy number.Chromatin structure in active and inactive regions – DNA methylation.
September 15	**Unit – II: Gene Regulation in Eukaryotes:**	Eu-chromatin, histone acetylation, H2AX foci, histone code, Transcriptional control – cell specific expression – promoters, enhancers, Transcription factors, Post- transcriptional control – alternative splicing RNA editing, RNA transport and stability, Translational feedback, Gene silencing – inactivation of mammalian X chromosome, Regulation by siRNA. Gal operon of yeast.MAT locus and mating type switch in yeast, Antigenic variation in *Trypanosoma*
October **12**	**Unit – III: Recombinant DNA Technology**	Enzymes in rDNA technology: Restriction endonucleases (discovery, properties), Enzymes in rDNA technology: DNA and RNA polymerases, Enzymes in rDNA technology: Nucleases, Kinases. Phosphatases, and Ligases, Prokaryotic and Eukaryotic vectors (plasmids, cosmids, phage, phagemid, BAC, YAC), Shuttle vectors, Targeting vectors, Expression vectors (insect, plant, mammalian cells), Construction of cDNA and genomic DNA libraries, Screening a library (+ve)&(-ve) selection strategies, Preparation of probes. Creating KO cells, Cre – Lox systems, Sequencing DNA by Maxam-Gilbert and Sangar method.

A. Sai Padma
22/7/15

November 15	**Unit – IV: Genetic Engineering:**	Sequencing DNA by Pyrosequencing, Solexa, SoLiD, Helicos, SMaRT, Ion Torrent Yeast 2 hybrid, Phage display, Reporter genes – GFP, b – gal, luciferase, Expression in heterologous systems – bacteria, Expression in heterologous system – yeast cells, Expression in heterologous system – insect cells, Expression in heterologous system – mammalian cells. Molecular markers – RFLP, AFLP, Random amplification of polymorphic DNA (RAPD),
December 3		Short tandem repeat, single-nucleotide polymorphism (SNP),Ribotyping, Silencing using siRNA.

A. Lal Pad
22/9/14

Academic organizer (2015 – 2016)
M.Sc Biochemistry
Semester-III, Paper-II
Immunology and Immunotechnology

Lecturer: Dr. M.K.S. Sukumaran

Month & No of teaching Days	Unit	Name of the topic
July 4	Unit I	**Components of the Immune System**: 1 History of immunology 2 Natural & acquired immunity, Specific & non-specific immune response. 1 4 4 Cells of immune system.
August 16	Unit I Unit II	Organs of immune system Antigenic determinants, Epitopes, Haptens, Properties of strong antigens Adjuvants – types, mode of action, and applications. 6 Classification, structure, and biological properties of immunoglobulins Isotypes, allotype, idiotypes. Theories of antibody formation, Generation of antibody diversity Genomic rearrangements of light and heavy – chain loci in B-cells Genomic rearrangements in T-cell receptor, structure of CD3, CD4, CD8. **Events in Immune Response:** Humoral& cell-mediated immune response activation of T cells & B cells 3 Kinetics and regulation of primary and secondary immune response.
September 16	Unit II Unit III	MHC proteins structure & functions Antigen processing & presentation, Transplantation immunology; Graft Versus Host Disease Complement fixation: pathways and biological consequences. Discovery and action of Interferons, Cytokines; Inflammation; Role in obesity, cancer Tumor immunology. **Immune Disorders:** Hypersensitivity; Coombs classification Type I-V hypersensitivity Tests for diagnosis of hypersensitivity (Coombs), Tuberculin test.
October 14	Unit III Unit IV	Auto immune diseases; classification Study of selected auto – immune disorders of types I – V Immuno- deficiency disorders – primary and secondary deficiencies Gene therapy for ADA deficiency Immunology of AIDS Immunosuppressive drugs/agents & their mechanism of action Immune evasion by bacteria and viruses. **Immunotechnology**: Production of polyclonal antibodies; Animals models for production of antibodies.Methods of antibody purification: Salt precipitation, Affinity chromatography Antigen-antibody binding (Equilibrium dialysis, Surface Plasmon Resonance); Affinity, Avidity.
November 10	Unit IV	Immunoprecipitation methods - gel diffusion (Ouchterlony; Mancini); Immune-electrophoresis (Rocket, counter-, 2-D) Agglutination tests (Direct and indirect), Inhibition of Agglutination, Complement fixation test, Inhibition of complement fixation ELISA, RIA Western Blots; use of antibody staining for FACS Hybridoma technology – production of monoclonal antibodies; applications in research and immunotherapy; antibody engineering History and types of Vaccines; Conventional vaccines - killed, attenuated, and subunit vaccines Modern vaccines; peptide, DNA, recombinant / vector, and anti-idiotypic vaccines Schedules of common vaccination, Benefits and adverse consequences of vaccination.

A - Sai Vadi
27/7/15.

Academic Organizer, 2015-16
M.Sc Biochemistry
Semester III, paper-III
Virology, Nutrition & Clinical Biochemistry

Lecturer: D.Rajani

Month and No of teaching days	Unit	Name of the topic
July 2	Unit IV	Specimen collection. Specimen collection and types of biological specimens.
August 13	Unit IV	Specimen collection. Automation and QA in clinical laboratories. Examination of CSF. DM type I,II, endocrine regulation of CHO metabolism, growth,Ca, P, neuroendocrine regulation of hormones, Acid-base balance,. Physiological Interrelationship between cardiovascular, respiratory and renal system. Jaundice and hepatitis.
September 14 + 1 extra	Unit III	**Nutrition** Balanced diet, Macro & Micro Nutrients, Caloric values (carbohydrates, proteins, lipids, alcohol). Nutritional assessment by clinical testing,Anthropometric and Biochemical testing. BMR and RDA for infants, children, adults, expectant and nursing mothers, anorexia and bulimia.
October 16	Unit III Unit I Unit II	Food fortification probiotics., Diet and longevity, ageing, role of leptin. **Prokaryotic Viruses** Discovery of bacteriophages, Structure and composition of bacteriophages, Classification system of Baltimore& ICTV. Applications of phages - therapy; Concern over phage contamination in industry (dairy Phage biodiversity, Genome diversity and host- specific interactions. Isolation and purification by filtration, ultracentrifugation and affinity chromatography. Plaque assay and other assay methods One step growth, single burst and eclipse experiments. Life cycle of model bacteriophages infecting *E coli* – λ (lytic lysogenic). Life cycle of model bacteriophages: ϕ X 174, M13, Life cycle of model bacteriophages: T4, T7, Qβ, Mu. **Eukaryotic Viruses** introduction.
November 14	Unit II	Discovery and classification of plant and animal viruses, structure of viruses, viroids, virusoids. Host – viruses interactions, permissive and non – permissive hosts; Cytopathic effects. Isolation and purification of viruses, Cultivation and propagation. Assay methods – pock assay, hemagglutination assay, transformation assay. Model plant virus: TMV. Model plant virus: CaMV. Modell animal viruses: SV 40, Poliovirus, Adenovirus, Influenza virus, HBV, HPV

A. Lai Dads
27/7/15

ACADEMIC ORGANISER 2015-16

SEMESTER III

Paper-IV: BI 304T: Cell-Cell Communication and Signal Transduction.

Name of the lecturer: Dr.S.Padma

MONTH/No of teaching days	Unit	NAME OF THE TOPIC
JULY/3	**I: Extra Cellular Matrix (ECM) and Cell Surface**	Molecules in the ECM in plant and animals
AUGUST/16	I **II: Cell Signaling**	Cell communication and types of signaling molecules.Types of receptors and their structure. Monomeric and trimeric G-proteins and their role. Cell division, differentiation, Growth factors
SEPTEMBER/ 15+11 extra	II III: **Signal Transduction and Cancer**	EGF, PDGF, VEGF, IGF. Second messengers – cAMP, cGMP, Ca^{+2}, calmodulin, inositol, NO Receptors tyrosine kinases (Insulin signaling) MAPK pathway, role in signaling. Signal cascades, Inhibitors of signal cascades Discovery of oncogenes, proto-oncogenes Modes of action of oncogenes – G proteins – Ras Growth factors – Erb, Sis and transcription factors – Fos, Jun, AP1, V-erbA Discovery of tumor suppressor genes.
OCTOBER/6	III IV:**Signal Transduction in Bacteria and Plants**	RB and retinoblastoma, APC and colon cancer. Modes of action of TS genes – p110, p16, p21, Phosphatase and tensin homolog (pTEN) p53 and cancer risk Selected examples – c-Myc and leukemia, BRCA and breast cancer Introduction of signaling components in bacteria Chemotaxis

Hod. Lai Padh
27/7/15

NOVEMBER/9	IV	Protein kinases in bacteria His-kinases: structure and role Plant signaling system an over view Stress signaling in plants (biotic) Stress signaling in plants (abiotic) Plants hormones and their mechanism of action Signaling in yeast STAT pathway in yeast

A. Lai Dadi
27/7/15

Academic Organizer (2015-16)
Semester-II
M.Sc II Year, Biochemistry

Paper-I: BI 201T: Enzymology
Lecturer: Dr. A.Sai padma

Month/ No of Teaching Days	Unit	Name of the topic
February 25	**Unit – I: Enzymes, Coenzymes, and catalysis**	Thermodynamics of catalysis, Energy of activation, Relation of ΔG and Keq, Coupled reactions (endergonic and exergonic) in biochemical pathways, Methods to isolate and purify enzymes, Assays, Activity Units, Specific activity, Nomenclature and classification of enzymes: EC, SCOP, CATH, Metal, co-factor, and co-enzyme requirements, Vitamin cofactors: TPP, FMN/FAD, NAD/NADP, Pantothenic acid, Vitamin cofactors: PLP, Biotin, Folate, Cobalamine, Phylloquinone, Factors affecting catalysis (pH, temperature, pressure, enzyme and substrate concentration), Chemicals to identify active site residues: Arg, Cys, Lys, His, Site-directed mutagenesis to identify active site residues: Triose Phosphate Isomerase.
	Unit – III: Catalytic Mechanisms::	Types of catalysis: acid-base, transition state, covalent intermediates, Reversible and irreversible activation of enzymes (pro-enzymes, phosphorylation), Enzymes activation by ligand binding and dimerization (protein tyrosine kinase receptors),
March 20	**Unit –II: Enzyme Kinetics**	Catalytic mechanism of RNase, Catalytic mechanism of Chymotrypsin, Trypsin, Lysozyme. Catalytic mechanism of Carboxypeptidase, Subtilisin),. MM equation transformation, Bi substrate reaction: Ordered, random, sequential, ping-pong. Inhibitors-competitive, noncompetitive, suicide, effects on kinetics, Enzyme inhibitors as drugs: RT & protease inhibitors as anti HIV drugs.

A. Sai Padma
4/1/16.

April 15	**Unit–IV: Enzymes in Physiology and Biotechnology**	Convergent and divergent evolution of enzymes, Reporter enzymes for gene expression (β-gal, β-glucuronidases, CAT); Restriction enzymes and ligases in recombinant DNA technology. Enzymes in dairy (Rennin, lipases, lactases), brewing (amylases, proteases, glucanases), Food processing technology (invertase, pectinases, papain), Enzymes in detergent (lipases, cellulases, proteases), paper (cellulases), and tanning Enzymes in bioremediation, biofuel industry (cellulases) Enzyme engineering: Catalytic RNA and antibodies; Designing High-Throughput enzyme assays

A Lal
4/1/16

Academic Organizer (2015-16)

M.Sc Biochemistry, I Year Semester II

Paper II – 202T Molecular Biology., Name of the Lecturers: Dr.A.Sai Padma

	UNIT	TOPIC
January 25	**Unit-I** **Replication** **Unit-III** **Transcription**	Models of replication, Prokaryotic and eukaryotic DNA polymerases, helicases, ligases, topoisomerases, Initiation – primosome, ori-sequences, accessory proteins, Elongation – replisome, leading and lagging strands, Okazaki fragments, Termination, Inhibitors of replication, Replication of circular chromosomes by theta model-φX174, E. coli Replication of circular chromosomes by rolling circle (lambda phage) andStrand displacement models (mt-DNA), Replication of linear chromosomes, telomeres, telomerase, Amplification – Polytene and double minute chromosomes, *In vitro* replication – PCR Principles of transcription. and prokaryotic RNA polymerase., Bacterial transcription-Initiation – promoter sequences.Basal, Constitutive and regulatory expression.Elongation and termination of transcription– rho dependent and independent., Eukaryotic DNA dependent RNA polymerase-I (ribosomal repeats).Polymerase –II, Promoters and enhancers.
February 2		Polymerase-III, 5s and tRNA. Post-transcriptional modifications - capping Poly A addition Splicing, RNA editing. Inhibitors of transcription.
March 15 + 3	**Unit-III** **Translation**	Nature of genetic code, Wobble hypothesis. Structure of ribosome. Components and mechanism of translation. Initiation , elongation and termination of translation in Prokaryotes .Initiation , elongation and termination of translation in Eukaryotes.Translational controls.Non-ribosomal protein synthesis-peptide antibiotic hypothesis. *In vitro* translational systems-Wheat germ, rabbit reticulocyte lysate and Xenopus Oocyte,Inhibitors of protein synthesis,Post translational modifications of proteins, role in targeting (isoprenylation)

A. Sai Padma
4/1/16.

April 15	**Unit-II DNA Repair**	Types of damage – oxidation, deamination, alkylation, adducts, breaks, Direct repair – MGMT, photo-reactivation, AlkB, Base Excision Repair (Short and Long Patch), Nucleotide Excision Repair, Mismatch Repair, Repair of DSBs by NHEJ and Homologous recombination, Holliday junctions and repair of collapsed forks, SOS and bypass repair, Diseases due to defects in DNA repair, Roles of ATM, BRCA in DNA repair

A Lal Patel
4/1/16.

Academic organizer (2015 – 2016)
M.Sc Biochemistry
Semester-II, Paper-III
Biochemical Genetics and Model Organisms

Lecturer: M.K.S. Sukumaran

Month & No of teaching Days	Unit	Name of the topic
January 13	Unit I	**Mendelian Genetics**: Mendel's Laws, Importance of meiosis in heredity Non-Mendelian Inheritance – Maternal effect, Maternal influence, Cytoplasmic inheritance Gene interactions - Epistasis, Expressivity, Penetrance Sex linked, sex limited, and sex influenced genes; Polygenic inheritance and polyploidy Mutations (spontaneous / induced, somatic / germinal, forward / reverse, transition / transversions) Mutations (Silent, missense, nonsense, and frame shift mutations, conditional, leaky) Detection, selection & isolation of microbial mutants, Estimation of mutation rates Reversion and suppression of mutations
February 17	Unit I Unit II	Mutagens – physical, chemical , Transposon mutagenesis, site-directed mutagenesis **Linkage and Mapping** Discovery of linkage, Morgan's experiments Cytological proof of crossing over 3 2- and 3- point crosses Recombination, Interference Tetrad analysis Mapping human genes by pedigree analysis; Fundamentals of population genetics (HW Law) Pedigrees of AR, AD, XR, and XD inherited traits Mobile genetic elements – Zea Ac, Ds and Spm elements Drosophila copia, Yeast Ty elements 1 Using recombination to make knockout cells / organisms.
March 17	Unit III Unit IV	**Bacterial Genetics** Discovery of conjugation Mapping bacterial genes by conjugation Discovery of transformation Mapping bacterial genes by transformation Discovery of transduction Mapping bacterial genes by transduction Discovery of transposition Structure of transposons, replicative and conservative transposition, use as mutagens Mapping phage genes – Fine structure of rII locus: Complementation analysis , Deletion mapping. **Model Organisms** Dictyostelium to study cell – cell communication and differentiation. Saccharomyces to study homologous recombination in mating type switch. site of formation of buds.
April 10 + 3 extra	Unit IV	Neurospora to study one gene – one enzyme hypothesis Drosophila to study embryonic development (homeotic mutations) C. elegans to study development and nervous system Danio to study vertebrate development, GLO fish Xenopus to study embryogenesis Mus inbred and knockout strains, NOD and nude mice Zea to demonstrate cytological proof of crossing over Arabidopsis to study flower development.

A. Lai Das
4/11/16.

ACADEMIC ORGANISER 2015-16
SEMESTER II
Paper-IV: Computational and cell study methods.
Name of the lecturer: Dr.S.Padma

MONTH	Unit	TOPICS COVERED
JANUARY/16	I Biostatistics-I	Biostatistics fundamentals (sample, population, variable); Types of variables, Measurement and measurement scales Measures of central tendency (mean, median, mode) Measurement of dispersion (range, variance, standard distribution)Study of bivariate data: correlation and regression; Regression to calculate concentration of DNA/protein,molecular weight of DNA/protein Graphical methods to depict data (histograms, bar-plots, pie charts, line graphs)Probability in biology, Laws of Probability Bayesian probability Normal distribution. Binominal distribution.Poisson distribution and its use to calculate mutation frequency: burst size of phages
FEBRUARY/16	II Biostatistics-II	Design of experiments: factorial experiments Student's t – test F – test Chi – square test; Contingency test CRD: Completely Randomized Design; 1-way ANOVA RCBD: Randomized Complete Block Design; 2-way ANOVA Non parametric tests: sign test Wilcoxon signed rank test, Mann-Whitney test
MARCH/17	Unit – III: Quantitative Biology and Computers	Elementary calculus: differentiation Use of differentiation to calculate rate of enzymatic reactions. Elementary calculus: integration and its use to calculate AUC Determination of Km, Vmax, Kcat for enzymatic reactions Determination of Ki for various inhibitors Analysis of growth curves for bacteria: calculate doubling time Analysis of growth curve for phage: calculate latent and eclipse period Basic structure and function of computers Evolution of computers and Computer languages Computer networks Simple and compound microscope. Phase contrast, dark field and polarization microscopy
APRIL/12	IV	Electron microscopy, SEM, TEM; freeze fracture. Fluorescence and Confocal microscopy; imaging live cells. FRET and FRAP Atomic force microscopy. Flow-Cytometry and cell sorting (FACS). Plant tissue culture. Animal and insect tissue culture. Methods of cell disruption and fractionation, isolation of organelles.

A. Lai Padh
4/7/16.

Academic organizer (2015 – 2016)
M.Sc Biochemistry
Semester-IV, Paper-I
Endocrinology and Metabolic Disorders

Lecturer: Dr. M.K.S. Sukumaran

Month & No of teaching Days	Unit	Name of the topic
January 13	Unit I	**Hormones and Endocrine glands**: History of endocrinology Organization and classification of hormones and endocrine systems Basic mechanism of action of peptide hormones and receptors Basic mechanism of action of steroid hormones and receptors Chemistry, physiology, and disorders related to Hypothalamus-Pituitary axis Chemistry, physiology, and disorders related to thyroid and parathyroid glands Glycoprotein hormones (LSH, FSH, TH, hCG, POMC) Growth hormone family (GH, hCS, Prolactin) Adrenal hormones.
Febrauary 16	Unit I Unit II	Gonadal hormones **Endocrine regulation** Regulatory pathways (positive, negative, feedback loops), Regulation of biosynthesis of steroid hormones by peptide hormones (LH, FSH, ACTH) Endocrine regulation of growth Endocrine regulation of stress Endocrinology of Ca homeostasis Endocrinology of blood sugar, hunger, digestion, and obesity Endocrine regulation of renal function Endocrine regulation of cardiovascular system (angiotensin, BNP, ET1) Endocrinology of fertility (changes in menstruation, pregnancy, and menopause) Medical uses of steroid hormones (contraception, HRT, hydrocortisone, anabolic steroids) Erythropoietin,
March 17	Unit II Unit III Unit IV	Adipo-cytokines, Orexins Unit – III: Disorders of Amino Acid and Carbohydrate Metabolism Hyperphenylalaninemia Disorders of proline and hydroxyproline metabolism Alcaptonuria Disorders of lysine metabolism Disorders of tyrosine metabolism Hemoglobinopathies; Thalassemia Disorders of glycogen storage 8 Disorders of fructose metabolism Disorders of Galactose metabolism Pentosuria, Diabetes **Disorders of Lipids and Nucleic Acids Metabolism** Disorders of acid Lipase deficiency
April 11 + 3 extra	Unit IV	Farber's disease Neiman-Picks disease Goucher's disease Krabbe's disease Sulphatide-lipidosis disease Fabry disease Downs and Turner's syndrome Hyperuricemia and Gout, hereditary xanthine Urea and Lesch-Nyhan syndrome.

A. Lai Das
4/1/16.

ACADEMIC ORGANISER FOR 2015-16
SEMESTER IV
Paper-II: BIOINFORMATICS
Name of the lecturer: Dr.S.Padma

MONTH/no of teaching days	Unit	Name of the topic
JANUARY 15	I **Genomics**	Genomics and branches of genomics (Why study a genome?) HGP and Strategies for sequencing genomes (shotgun and hierarchical sequencing), 1st generation sequencing methods (Maxam and Gilbert Method; Sanger's method), 2nd and 3rd Generation DNA sequencing methods (Next Generation Sequencing), Genetic and Physical maps of the genome, EST, STS, DNA sequence databases, Use of databases; data mining, Comparing DNA sequences, pairwise local and global alignment, BLAST, FASTA, PAM and BLOSUM matrices, Multiple sequence alignments (Phylogenetic trees, Clustal-W, COBALT),
FEBRUARY 15	II **Transcriptomics**	Epigenomics and metagenomics: Relation of transcriptome to genome and proteome (Why study a transcriptome?) Tools of transcriptomics: Northern blots, RNase protection assays, RT-PCR and Q-PCR, HT tools of transcriptomics: Microarrays for expression profiling, alternate sequencing, HT RNA sequencing: SAGE, MPSS, RNA-Seq, GIGA, Identifying expressed sequences by ChIP-seq, DNase-seq, ENCODE Project (Encyclopedia of DNA Elements), Design and analysis of siRNA / RNAi for expression analysis; siRNA libraries, Anti–sense oligos for regulating transcriptome, Regulation by miRNA, Extent and role of ncRNA, GWAS association with phenotypes, Transcriptome databases (ESTs, Transcriptome Shotgun Assembly, ArrayExpress)
MARCH 15+2 EXTRA	III: **Proteomics**	Relation of proteome to genome and transcriptome (Why study a proteome?) HUPO goals and accomplishments, Methods for sequencing proteins: Edman degradation 2D gels and peptide maps MS – MALDI. LC-MS, Tandem MS (MS-MS) Micro-arrays for proteins, Proteins motifs, sequences, and structure databases; Peptide sequence and MS profiles databases, Comparing protein sequences, alignment, Predicting secondary structure-*ab initio*,

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		Homology folding, threading, Post-translational modification (kinome, glycosylation)
APRIL 13	IV: **Synthetic Biology**	Comparative genomics, evolution of human karyotype, Sequencing genomes of individuals; ethical concerns SNPs and human disease Genomics for rational drug design and drug discovery,Pharmacogenomics Nutrigenomics Metabolomics, PCR techniques to create synthetic genes and genomes Minimal genome concept, Building an artificial phage; Building an artificial bacterium, Metagenomics for study of ecological samples

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Academic Organizer
(2015-16)
M.SC II YEAR

Semester IV: Paper III - Biotechnology
Name of the lecturer: S.Vanitha

Month & no of teaching days	Unit	Name of the topic
January 13	Unit IV Protein engineering	Methods of immobilization of enzymes and cells, large scale production, site directed mutagenesis, high throughput screening tools, rational protein design and directed enzyme evolution, top 7 (Kuhlman *et.al*), tags for protein purification, natural and recombinant fusion protein, altering kinetics, pH, specific activity, increasing stability, pegylated interferon, macro modifications.
February 14 (2 extra)	Unit IV Protein engineering Unit III Animal biotechnology	Methods of drug design & delivery. Development, maintenance and establishment of animal cell culture, cloning in mammalian and non- mammalian cells, production of viral vaccines, IFN, tPA, high value therapeutics, urokinase, monoclonal antibodies, chimeric antibodies, immunotoxins as therapeutics.
March 14 (2 extra)	Unit III Animal biotechnology Unit II Plant biotechnology	Gene knockout , transgenic animals and application, human gene therapy, humanized animals as organ farm. Plant cell culture, callus, protoplast fusion, differentiation to plantlets, plant vectors- Ti plasmid, GM food and crops, terminator technology, anti- sense RNA, plantibodies, case studies of Bt cotton, Bt corn, Zeneca tomato paste, flavr savr tomato, virus resistant plants, roundup ready, golden rice.
April 13 (2 extra)	Unit I Microbial biotechnology	Large scale cultivation of microbes, fermenter design, down stream processing, production of biomass, SCP, low molecular weight compounds, insecticides, enzymes for research, production of HFCS, cheese, polysaccharides (xanthan gum, gellan, pullulan etc), microbial mining, production of human insulin, interferon, human growth hormone, tPA, Superbug, microbial degradation of oil - bioremediation of oil spills.

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4/1/16.

ACADEMIC ORGANISER FOR 2015-16
SEMESTER IV
PAPER IV: PHYSIOLOGY AND XENOBIOTICS
Lecturer:Dr.S.Padma

MONTH	Unit	TOPICS COVERED
January 14	I **Neurophysiology**	Types of neuronal cells – Neuroglia, microglia, astrocytes, oligodendrocytes, Schwann, satellite and epididymal cells Nerves: regeneration of nerve fibers, generation of nerve impulse, all or none principle. Mechanism of synaptic transmission, transmission of nerve impulse. Types of neurotransmitters and their receptors, mode of signaling, Electrical synapse and giant neurons, Division of vertebrate nervous system: CNS, PNS, ANS, regions of the brain, Sensory organs – eye, ear, skin, tongue Vision: visual system, rhodopsin and classical GPCR mechanism, termination of visual signal, Cone cells, specialization in color vision, physiology of colour blindness, Similarity between vision, olfaction and gustation
February 13 II	II: **Structure and Physiology of Muscle**	Structure of various types of muscle: striated, cardiac, smooth, fast twitch, slow twitch, Mechanism of muscle contraction, regulation of contraction, Role of actin and myosin in non-muscle cells., Cytochalasins and cytokinesis.Muscle gene expression, regulation at transcriptional and posttranscriptional level.Role of muscle proteins in cell locomotion, Neuro-muscular transmission, Electromyography, Sherrington starling Kymograph (recording drum), Disorders of muscle (dystrophy, myopathy, monocytisis, myotonia, paralysis, Myasthenia gravis), Detection and treatment of muscle disorders Disorders of muscle (dystrophy, myopathy, monocytisis, myotonia, paralysis, Myasthenia gravis), Detection and treatment of muscle disorders
March 20	III: **Human Reproductive Biology**	Female reproductive system: anatomy and endocrinology, Causes of female infertility (acquired and genetic), treatments, Male reproductive system: anatomy and endocrinology, Causes of male infertility (environmental and genetic), treatments, Puberty, reproductive aging (menopause and andropause), Gametogenesis and fertilization (natural and assisted (*in vitro*)), implantation and placenta, Milestones in first trimester of pregnancy (http://www.ehd.org/virtual-human-embryo/), Milestones in second trimester of pregnancy. Milestones in third trimester of pregnancy, child birth, Placenta as source of stem cells, cord banking

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APRIL 15	**IV: Liver and Xenobiotics**	Liver functions, pharmacopeia drug deposition and mechanisms of drug detoxification, Cytochrome P450 enzymes, molecular biology, catalytic cycle, isozymes, inhibitors. Dose response relationship, drug-receptors interactions, Pharmacodynamics; pharmacokinetics, Phase I reactions – modifications, Phase II reactions - conjugation Phase III reactions - modifications and elimination, Environmental factors influencing drug metabolism Effects and metabolism of model toxins: aflatoxins, bacterial exotoxins (types I, II, and III), Nutrient drug interactions – I and II

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4/1/16.