Objective: To enlighten the origin, evolution, adaptive radiation and phylogenetic relationships of invertebrates and chordates.

UNIT I: EVOLUTION OF INVERTEBRATES AND CHORDATES


UNIT II: COMPARATIVE STUDY

Comparative anatomy of digestive, respiratory, exoskeletal, skeletal, circulatory, nervous and urinogenital systems of invertebrates and chordates-Locomotory organs and movements in invertebrates-Flight adaptations of birds-Placentation in mammals.

UNIT III: ADAPTIVE RADIATION


UNIT IV: PARASITES AND VECTORS

Parasitic adaptations and pathogenicity of Entamoeba, Plasmodium, Fasciola, Taenia solium, Trypanosoma, Echinococcus and Ascaris.

UNIT V: AFFINITIES AND SYSTEMATIC POSITION OF MINOR PHYLA

Nemertinea, Rotifera, Bryozoa, Brachiopoda, Chaetognatha and Pogonophora.

SUGGESTED READING

Objective: To realize the biodiversity potential of our country and to understand the principle and methods of nomenclature and systematics.

UNIT I: ECOSYSTEM DIVERSITY
Concepts on Biodiversity, Ecosystem of India, Species and genetic diversity, Biodiversity hotspots, Conservation plans and treaties, Wild Life Protection Act, 1972, Zoos, Sanctuaries, National Parks, Biosphere reserves and protected areas in India. Extinct, critical, endangered and vulnerable fauna of India, Biotechnological tools for conservation of biodiversity.

UNIT II: DIVERSITY OF TERRESTRIAL AND FRESH WATER ECOSYSTEMS
Wetlands, reserve forests, rain forests and desert plains in India and their faunal resources, animals of lotic and lentic ecosystems, Threats to wetlands and conservation. Rivers of India and their faunal diversity.

UNIT III: DIVERSITY OF MARINE AND MANGROVE ECOSYSTEMS

UNIT IV: INTRODUCTION TO ANIMAL TAXONOMY

UNIT V: NOMENCLATURE AND TAXONOMIC TOOLS

SUGGESTED READINGS

Objective: To explore the process and product of evolution since nothing in biology makes sense except in the light of evolution.

UNIT I: EVOLUTIONARY THOUGHT AND CAUSAL FACTORS
A historical overview - Neo-Lamarckism - Neo-Darwinism; Sexual selection; Modern concepts of Recapitulation theory. Mutation theory-Evolutionary significance of mutation.

UNIT II: COSMIC EVOLUTION AND ORIGIN OF LIFE

UNIT III: PALAEOLOGY
Geological time scale- Fossil records (nature; conditions and dating)- Mosaic evolution-Man in the fossil records- Phyletic gradualism and punctuated equilibrium- mass extinction.

UNIT IV: SELECTION IN ACTION
Natural Selection (Normalising; Diversifying; Disruptive) and Genetic Polymorphism- Gene Pool and Hardy- Weinberg equilibrium- Random genetic drift- Animal colouration and mimicry- Micro and Macro evolution- Pre-adaptation and Post-adaptation.

UNIT V: ADAPTATION AND SPECIATION
Adaptive radiation in reptiles and mammals- Convergence- Parallelism -Co-evolution- evolutionary constancy- speciation and Isolating mechanisms- Sibling and semi species- Hybridization as an evolutionary catalyst- Evolutionary genomics.

UNIT VI: MAN AND NATURAL SELECTION
Eugenics, Euphenics and euthenics- Human races- Sociobiology (Scope, selfish gene, altruism, kin selection) -Man and Natural selection- Evolutionary future of mankind.

SUGGESTED READING
Objectives: To enhance an in-depth knowledge on animal and human embryonic development.

Unit I: BASIC CONCEPTS OF DEVELOPMENT

Unit II: GENES IN DEVELOPMENT

Unit III: EXTRA EMBRYONIC MEMBRANES AND PLACENTATION

Unit IV: HUMAN EMBRYONIC DEVELOPMENT

Unit V: APPLICATION OF MODERN TECHNIQUES IN DEVELOPMENTAL BIOLOGY

SUGGESTED READINGS
Objectives: To provide knowledge on cell and tissue architecture in normal and abnormal states, and application of diagnostic tool.

UNIT I: CLASSIFICATION AND HISTOCHEMICAL TECHNIQUE FOR PROTEINS, CARBOHYDRATES AND LIPIDS

Proteins–Ninhydrin Schiff method (Amino groups), Sakaguchi method (Arginine). Carbohydrates –PAS reaction, Bauer-feulgen method (Glycogen); Lipids – Oil Red O method, Sudan black B method.

UNIT II: HISTOCHEMICAL TECHNIQUE FOR NUCLEIC ACIDS

DNA & RNA detection by Methyl Green-Pyronin method and Extraction by Brachet method.

UNIT III: MICROSCOPY, AUTORADIOGRAPHY AND ITS APPLICATIONS


UNIT IV: COLLECTION AND PREPARATION OF MATERIAL

Collection of soil micro arthropods - Whole mount - Dry mount of insects-Kill bottle-preparation of material-pinning, spreading and labelling.

UNIT V: TYPES OF MICROTOMES, IMPORTANCE OF MICROTECHNIQUE AND PREPARATION OF TISSUE

Paraffin Microtome, Cryostat, Ultra Microtome-Steps involved in tissue processing and Microphotography.

UNIT VI: A VISIT OF HISTOPATHOLOGICAL INSTITUTES AND MAINTENANCE OF RECORD

SUGGESTED READINGS


ZO 1824-INVERTEBRATA, CHORDATA AND DEVELOPMENTAL BIOLOGY LAB COURSE
SEMESTER : I  CREDIT : 02
CATEGORY : MC (P)  NO. OF HOURS / WEEK : 06

UNIT I: MAJOR DISSECTION

Crab--- nervous system , sepia--- nervous system , shark--- arterial and nervous system , frog--- arterial system , venous system and cranial nerves.

UNIT II: MINOR DISSECTION

Vaginulus—digestive system , reproductive sysyem and nervous system , Prawn—nervous system , Frog--- spinal and sympathetic nervous system

UNIT III: MOUNTING

Mouth parts of honeybee , cockroach , millipede , housefly and mosquito
Placoid scales of shark
Brain of frog

UNIT IV: SPOTTERS

Systematic position :Centipede , holothuria , scorpion , amphioxus , narcine , ostracion , Anguilla , and synghanthus.

Mode of life :Porpita , nautilus , halioitis , mytilus , spirula , neries .poison apparatus of russels viper , uromastix , exocoetus , synapta , myxine , rhacophorus , and enhyrina.

Structural Modifications :Hippocampus , ambystoma , phrynosoma.

Ecological adaptations :Brain coral , brittle star , starfish , echinus , octopus , murex , chameleon , cobra , turtle , varanus , bat , draco.

Evolutionary importance : Balanoglossus , peripatus , limulus , chiton , axolotl larva

Parasitic adaptation : Ascaris , fasciola , taenia , cymathoa , sacculina.

Osteology: Frog—skull,pectoral and pelvic girdles ans typical vertebra, Bird--- skull , palates in birds and synsacrum, Rat---skull, Calotes--- skull

Embryology: Chick embryo--24h, 48h, 72h , 98h, 11th day , 16th day and 21st day: Placenta of shark , sheep , goat and pig; Huma embryo

UNIT V: FIELD STUDY AND RECORD

SUGGESTED READINGS


ZO 2817 MOLECULAR CELL BIOLOGY
Objectives: To understanding the cellular and molecular basis of life processes.

UNIT I: MOLECULAR TECHNIQUES
Microscopy (Conventional and confocal), Cytological techniques, Ultracentrifugation, X-ray diffraction, Chromatography, Autoradiography, Electrophoresis, Blotting techniques, fluorescent activated cells, Cell Sorter, microplate high through put readers, Fluorescent in situ Hybridization (FISH) and Animal Cell / tissue culture-cell imaging.

UNIT II: CELLULAR ORGANIZATION
Membrane structure and function: Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, ion pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

Structural organization and function of intracellular organelles: Cell wall, nucleus, mitochondria, Golgi bodies, lysosomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure & function of cytoskeleton and its role in motility.

Organization of genes and chromosomes: Operon, interrupted genes, gene families, structure of chromatin and chromosomes, unique and repetitive DNA, heterochromatin, euchromatin, transposons.

Cell division and cell cycle: Mitosis and meiosis, their regulation, steps in cell cycle, and control of cell cycle.

UNIT III: FUNDAMENTAL PROCESSES
DNA replication, repair and recombination: Unit of replication, enzymes involved, replication origin and replication fork, extrachromosomal replicons, DNA damage and repair mechanisms.

RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, transcription activators and repressors, RNA polymerases, capping, elongation and termination, RNA processing, RNA editing, splicing, polyadenylation, structure and function of different types of RNA, RNA transport.

Protein synthesis and processing: Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, genetic code, translational proof-reading, translational inhibitors, post-translational modification of proteins.

Control of gene expression at transcription and translation level: Regulation of phages, viruses, prokaryotic and eukaryotic gene expression, role of chromatin in regulating gene expression and gene silencing.

UNIT IV: CELL COMMUNICATION AND CELL SIGNALING
Host parasite interaction: Recognition and entry processes of different pathogens like bacteria, viruses into animal and plant host cells, alteration of host cell behavior by pathogens, virus-induced cell transformation, pathogen-induced diseases in animals, cell-cell fusion in both normal and abnormal cells.

Cellular communication: General principles of cell communication, cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, neurotransmission and its regulation.
Cancer: Genetic rearrangements in progenitor cells, oncogenes, tumor suppressor genes, cancer and the cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, therapeutic interventions of uncontrolled cell growth.

UNIT V: GENETIC ANALYSIS
Inherited genetic disorders in man, pedigree analysis, gene transfer for desired human behaviour, genetics of aging, human genome project, DNA finger printing, DNA from museum specimen, modern genetics and bioethics.

SUGGESTED READINGS
Objectives: This core paper has been designed to understand the biology of insects, insect pest management, Integrated Pest Management and biological control.

UNIT I: AGRICULTURAL ENTOMOLOGY
Causes for insects assuming pest status, Biology, nature, extent of damage and control measures of insect pests of some important crops – paddy, sugarcane, cotton, groundnut, coconut, mango and tea - Locust and their control and insect pests of stored grains and their control measures.

UNIT II: VETERINARY ENTOMOLOGY
Cattle (horse fly, stable fly, cattle fly), Fowl (shaft louse and chicken flea), Sheep and Goat (head maggot and sheep ked).

UNIT III: MEDICAL ENTOMOLOGY
Mosquitoes, housefly, eye fly, sand fly, black fly, bed bug, assassin bug, flea, human body louse and head louse. Insects associated with household materials.

UNIT IV: PRODUCTIVE INSECTS
Apiculture - apiary, types of honey bees, selection of bees and location of apiary- sericulture - silkworm races, moriculture, rearing of silkworms and postcocoon processing.

UNIT V: PEST CONTROL
Classification of insecticides on the basis of their chemical nature, mode of entry and mode of action ; biological control of Insect pests, Integrated Pest Management and biopesticides – plant protection appliances - Field trips to Agricultural Institutes in and around Chennai.

SUGGESTED READINGS

ZO 2819 – IMMUNOLOGY

<table>
<thead>
<tr>
<th>SEMESTER</th>
<th>04</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATEGORY</td>
<td>MC</td>
</tr>
<tr>
<td>NO. OF HOURS / WEEK</td>
<td>05</td>
</tr>
</tbody>
</table>
**Objectives:** This core paper has been designed to understand the nature and components of defense mechanism of human body.

**UNIT I: BASICS OF IMMUNOLOGY**

Introduction-historical perspective. Innate immunity (Non-specific), Adaptive immunity (Specific)- Humoral immunity, Cell mediated immunity.

**UNIT II: CELL AND ORGANS OF IMMUNE SYSTEM**

Cells of immune system- haemopoiesis, stem cells, lymphoid cells, mononuclear cells, granulocytes, mast cells, Dendritic cells. Organs of Immune system- primary lymphoid organs and secondary lymphoid organs.

**UNIT III: ANTIGENS**

Antigens immunogenicity vs. antigenicity, heptens. Factors influencing immunogenicity. Epitopes- B cells epitope and T cell epitope, immunity against protozoan, Fungi and bacteria.

**UNIT IV: ANTIBODIES**


**UNIT V: MEDIATORS OF IMMUNE SYSTEM AND VACCINES**

T cell receptors, cytokine, adhesion molecules, complement, hypersensitive reaction, Transplantation immunology. Vaccines schedule- principles and types of vaccines – DNA recombinant vaccines, serum therapy.

**UNIT VI: IMMUNITY IN HEALTH AND DISEASE**

Introduction to infectious disease, innate and adaptive immunity to infection, evasion of the immune response by pathogens; inherited immunodeficiency diseases, acquired immune deficiency syndrome; allergy and hypersensitivity- IgE and allergic reactions, hypersensitivity diseases; autoimmunity- responses to self antigens, transplant rejection- responses to alloantigens; manipulation of immune responses, vaccines; evolution of immune system- evolution of innate and adaptive immune system.

**SUGGESTED READINGS**

1. Immunology, David, Brostoff and Roitt, (7th Ed., 2006), Mosby & Elsevier Publishing, Canada, USA.
**Objective:** To provide hands-on training on techniques to explore cell and macromolecules of biological importance.

**UNIT I:** Measurement of nucleocytoplasmic index, culturing suspension and monolayer cells, trypsination procedure, cellular measurement using micrometers, cell culture.


**UNIT III:** Metaphase chromosome preparation form mouse bone marrow cells/ fish gill cells and Karyotyping – Squash preparation of cockroach/ grasshopper testis/ mouse and observation of meiotic stages using plant/animal serum.

**UNIT IV:** Study of Mendelian traits in man and testing probability and chi square, using coin tossing and beads.


**SUGGESTED READINGS**
Objective: To provide hands-on training on techniques to explore the immune system of biological importance.

Immunology

Unit I
Dissection of primary and secondary immune organs from mice: Preparation of single cell suspension from bone marrow and spleen (spleenocytes) of mice - Cell counting and viability testing of the spleenocytes prepared.

Unit II
Preparation and study of phagocytosis by spleenic/peritoneal macrophages.

Raising polyclonal antibody in mice, serum collection and estimating antibody titre in serum by following methods: Ouchterlony (double diffusion) assay for Antigen-antibody specificity and titre -ELISA

Unit III
Antibody purification from the serum collected from immunized mice: affinity purification/ chromatography-Immunoelectrophoresis,

Demonstration of Western blotting: a. Protein estimation by Lowry’s method /Bradford’s method - SDS-PAGE-Immunoblot analysis.

Precipitation an immunodiffusion (Ouchterlony).

Biophysics

UNIT IV SEPARATION TECHNIQUES

Separation of amino acids using radiant and ascending chromatography -polymerisation of gel from using PAGE Fractionation of serum proteins using SDS

UNIT V MEASUREMENTS

Measurement of viscosity of different liquids using drop weight method
Measurement of surface tension on different liquids using burette method

SUGGESTED READINGS

ZO 2957-CHRONOBIOLOGY AND ANIMAL BEHAVIOUR

SEMESTER : II CREDITS : 03
UNIT I: INTRODUCTION TO CHRONOBIOLOGY

Chronobiology in 21st century; Evolution of biological timing system; Clocks, genes and evolution; Adaptive functional significance of biological clocks. Studying biological clocks; Perception of natural zeitgeber signals; Geophysical environment - Seasons; proximate and ultimate factors.

UNIT II: DIVERSITY AND COMPLEXITY OF THE CLOCK SYSTEM

Organization of circadian system in multicellular animals; Concept of central and peripheral clock system; Circadian pacemaker system in invertebrates with particular reference to Drosophila; Molecular Biology of the circadian pacemaker system, Photoreception and photo-transduction; The physiological clock and measurement of day length; Molecular bases of seasonality; The relevance of biological clocks for human welfare - Clock function (dysfunction); Human health and diseases - Chronopharmacology, chronomedicine, chronotherapy.

UNIT III: EVOLUTION OF BEHAVIOUR

Genetics and behavior - Natural selection, Mendel's laws, genetic variation, heritability of behavior, environmental influences upon behavior, juvenile and innate behavior, survival value and fitness, evolutionary strategies, sexual selection, altruism, social organization.

UNIT IV: MECHANISM OF BEHAVIOUR


UNIT V: UNDERSTANDING COMPLEX BEHAVIOUR

Instincts and learning, displacement activities, ritualization and communication, decision making in animals - complex behavior of honey bees, evolutionary optimality, mechanisms of decision making, languages and mental representation, intelligence, tool use and culture, animal awareness and emotion.

SUGGESTED READINGS

ZO 2958 – BIOPHYSICS AND RADIATION BIOLOGY

SEMESTER : II  CREDIT : 03
CATEGORY : ES  NO. OF HOURS / WEEK : 04
Objective: To impart knowledge on the basic principles of biophysics and radiation biology.

UNIT I: PHYSICAL LAWS IN LIVING SYSTEMS

Diffusion- fick’s law-Diffusion constant- Plasmolysis- Haemolysis and Cyclosis Laws of osmosis- surface tension-viscocity.

UNIT II: RADIACITY AND PHOTO ELECTRIC EFFECT


UNIT III: SEPARATION TECHNIQUES

Chromatography -TLC and HPLC- Principles of Electrophoresis PAGE and Immunoelectrophoresis-Thermography and scanning.

UNIT IV: TYPES AND BIOLOGICAL EFFECTS OF RADIATION

Different types of radiation- Direct and Indirect Effects of Radiation -Measurement of radiation levels and limits-Possible implications in Radiotherapy.

UNIT V: HERITABLE EFFECTS AND CARCINOGENESIS

Chromosomal and Chromatid Aberrations - Point Mutations-Chromosomal and Multifractional diseases-Genetic risk assessment-Doubling Dose -Muataion component-Initiation, promotion, progression and dose response for Radiation Induced Cancers.

SUGGESTED READINGS

1. Das, D, 1996. Biophysics and Biophysical Chemistry for Medical and Biology students by, Presidency College, Calcutta.
5. Prasad, K.N., CRC Handbook of Radiobiology, CRC Press, Florida
6. Eric J Hall, Amato J Giaccia Radiobiology for the Radiologist Lippincott
7. Williams & Wilkins (Sixth Edition)
8. A.H.W. Nias An Introduction to Radiobiology John Wiley and sons
9. Alison P Casarette Radiation Biology Prentice Hall Inc