

**SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR**



**Programme: MSC (CBCS)
Syllabus with effective from: JUNE-2017**

**ZOOLOGY
Semester: II**

PS02CZOO21: Developmental Biology

Unit 1:

Introduction to animal development.

Fertilization: Structure of gametes, Egg-Sperm recognition, Fertilization in sea urchins, Differential gene expression and cell-cell communication in development: Differential gene transcription, RNA processing, Control of gene expression at translation, Cell adhesion and cell signalling

Unit 2:

Early development in invertebrates and vertebrates: Cleavage and pattern of embryonic cleavage; Comparative account of gastrulation; Early development in Sea urchin, *C. elegans*; *Drosophila*; Amphibia; Birds; Mammals.

Later embryonic development: Development of ectoderm, Neurulation and Central nervous system, Neural crest cell; Development of mesoderm: Paraxial mesoderm, Intermediate mesoderm, Lateral plate mesoderm. Development of endoderm

Unit 3:

Body Axes: Establishment of body axes in *C. elegans*,. Birds and Mammals, Tetrapod limb development: Tetrapod limb development: Proximo-distal, Anterior-posterior, Dorsal-ventral; Cell death pathway

Drosophila axis specification: Dorso-Ventral pattern, Segmentation and Anterior-Posterior body plan, Maternal gradient, Segmentation genes

Unit 4:

Hormones as mediators of development: Amphibian metamorphosis: Morphological and biochemical changes, Hormonal control.

Insect metamorphosis: Imaginal discs- Determination of axes in wing/leg imaginal discs. Hormonal control, and Molecular mechanism of action of ecdysone.

Birth defects, Endocrine disruptors and cancer.

Environmental as a normal agent in producing phenotype: Polyphenisms and Plasticity, Temperature and sex, Environmental induction of behavioural phenotypes and Learning,

Reference Books:

- S.F. Gilbert, Developmental Biology, Sinauer Associates Inc. Massachusetts
- Ethan Bier, 'The Cold Spring' Cold Spring Harbor Laboratory Press New York
- Karp G, and Berrill N.J., Development

- B.I. Balinsky, An introduction to Embryology, Saunders College Publishing
- Lewis Wolpert, Principles of Development, Current Biology Ltd., London, New York.

PS02CZOO22: Toxicology

Unit-1

Definition and scope of toxicology: Eco-toxicology and its environmental significance.

Toxic effects : Basic for general classification & nature. Dose-Response relationship: Synergism and Antagonism, Determination of ED50 & LD50. Acute and Chronic exposures. Factors influencing Toxicity. Pharmacodynamics & Chemodynamics, dose conversion between animals and human

Diagnosis of toxic changes in liver and kidneys : Metabolism of drugs: paracetamol and aspirin with their toxic effects on tissues.

Unit-2

Xenobiotics Metabolism: Absorption & distribution. Phase I reactions. Oxidation, Reduction, Hydrolysis and Hydration. Phase II reaction/Conjugation : Methylation, Glutathione and amino acid conjugation. Detoxification.

Biochemical basis of toxicity : Metabolism of Toxicity : Disturbances of Excitable membrane function. Altered calcium Homeostasis. Covalent binding of cellular macromolecules & Genotoxicity. Tissue specificity of Toxicity.

Toxicity testing : Test protocol, Genetic toxicity testing & Mutagenesis assays : In vitro Test systems – Bacterial Mutation Test, Ames Test, Fluctuation Tests, *In vivo* Mammalian Mutation tests –DNA repair assays, Chromosome damage test, Evaluation of Apoptosis and necrosis

Unit-3

Pesticide toxicity : Insecticides : Organochlorines, Anti cholinesterases – Organophosphates and Carbamates, Fungicides. Herbicides, Environmental consequences of pesticide toxicity. Biopesticides.

Food Toxicity : Role of diet in cardio-vascular disease and cancer. Toxicology of food additives.

Unit-4

Metal Toxicity : Toxicology of Arsenic, mercury, lead and cadmium. Environmental factors, affecting metal toxicity effect of light, temperature & pH.

Air pollution : Common air Pollutant & their sources. Air pollution & ozone. Air pollution due to chlorofluorocarbons (CFCS) and asbestos.

References Books:

1. Klaassen, C. D (8th Eds.). (2013). *Casarett and Doull's toxicology: the basic science of poisons* . New York: McGraw-Hill.
2. John A. Timbrell (4th Edn) (2008) Principles of biochemical toxicology. Taylor & Francis Ltd, London,.
3. Smart, R. C., & Hodgson, E. (4th Eds.). (2013). Molecular and biochemical toxicology. John Wiley & Sons.
4. Relevant review articles / research papers / handouts of latest development in the subject.

PS02CZOO23: Fundamentals of Immunology

Unit I

Introduction to immune system: mechanisms of barrier to entry of microbes / pathogens;

Cells and organs of the immune system involved in innate and adaptive immunity: cells of the immune system, primary and secondary lymphoid organs, Hematopoiesis and its regulation

Innate immunity: receptors of the innate immunity (TLR and sensing of PAMPs, CLR, RLR and CLR); Inflammatory responses

Antigens: antigenicity, and immunogenicity. B and T cell epitopes

Unit II

Antibody: Structure of immunoglobulin; classes of immunoglobulins, Signal transduction pathways emanating from the BCR,

The Organization and Expression of Lymphocyte Receptor Genes: Hozumi and Tonegawa's Experiment, Multigene organization of Ig Gene, Mechanism of VDJ recombination, B cell receptor expression, allelic exclusion, B cell isotype switching and somatic hypermutation; expression of membrane bound and soluble immunoglobulin; T cell receptor genes and expression

Complement system: Overview of classical, alternative and lectin complement pathways, functions of complement, regulation of complement, complement deficiencies, microbial complement evasion strategies

Unit III

The Major Histocompatibility Complex and Antigen Presentation: The structure and function of MHC molecules, general organization and inheritance of MHC, self – MHC restriction, endogenous and exogenous pathway of antigen processing and presentation; cross presentation of exogenous antigen, presentation of non peptide antigens

Cytokines: properties, receptors, associated diseases, therapeutic applications, cytokine signaling pathways: JAK-STAT and FAS-FASL signaling pathways

Unit IV

Basics of Antigen-antibody interactions: Agglutination, precipitation, RIA and ELISA

Cell and antibody mediated effector response: Antibody mediated effector response (Neutralization, opsonization/ phagocytosis, complement fixation, ADCC); Cell mediated effector response (Generation of effector CTL's, Granzyme and Perforin Mediated Cytolysis, Fas-FasL Mediated Cytolysis, NK cell mediated cytolysis)

Immunity to infection: Immunity to viruses, Immunity to bacteria and fungi, Immunity to parasites (protozoa and worms).

References Books:

1. Owen, J. A., Punt, J., & Stranford, S. A. (2013). *Kuby immunology* (7th Edn). New York: WH Freeman.
2. Murphy, K., & Weaver, C. (2016). *Janeway's immunobiology* (9th Edn) Garland Science.
3. Male, D., Brostoff, J., Roth, D., & Roitt, I. (2012). *Immunology* (8th Edn) *With STUDENT CONSULT Online Access*. Elsevier Health Sciences.

4. Abbas, A. K., Lichtman, A. H., & Pillai, S. (2014). *Cellular and molecular immunology* (6th Edn) Elsevier Health Sciences.
5. Relevant review articles / research papers / handouts of latest development in the subject.

PS02CZOO24: Lab I Practicals based on PS02CZOO21 and PS02CZOO22

PS02CZOO25: Lab II Practicals based on PS02CZOO23 and PS02EZOO2X

PS02CZOO26: viva

PS02EZOO21: Biological Chemistry

Unit 1:

Matter and energy, Atomic structure, ions, electrolytes, free radicals, solutions, colloids, suspensions, chemical reactions, acids, bases, pH. Principles of Bioenergetics: Bioenergetics and Thermodynamics, ATP, Biological oxidation-reduction reactions. Enzymes: Nature, function, classification and nomenclature. Enzyme kinetics, mechanism of action, active sites, substrate binding, Regulation of enzyme activity. Chemistry and functions of Co-enzymes

Unit 2:

Protein Metabolism: Proteins- structure, classification, properties, functions and degradation. Types and properties of amino acids. Nitrogen incorporation and excretion (Urea Cycle). Vitamins: Water and Fat-soluble vitamins, chemistry, occurrence and physiological role.

Unit 3:

Carbohydrate Metabolism: Glycolysis pathway and regulation. Cori cycle Gluconeogenesis, glycogenolysis and glycogenesis. Pentose phosphate pathway, C Synthesis of complex polysaccharides- glycoproteins and proteoglycans.

Unit 4:

Lipid Metabolism: Chemical nature of fatty acids, synthesis of fatty acids. Storage of fatty acids and utilization. Regulation of lipid metabolism. Biochemistry of phospholipids, cholesterol, sphingolipids, prostaglandins, thromboxanes and oxy eicosatetraenoic acids.

Reference Books:

- Principles of Biochemistry- Lehninger, A.L., Nelson D.L. and Cox, M.M. LBS Publishers & distributors, New Delhi.
- Fundamentals of biochemistry- Voet, D., Voet, J. G. and Pratt, C. W. John Wiley & Sons. Inc. New York.
- Biochemistry. Vol.1-3 - Zubey, G. W C Brown Publishers, Oxford.