

**SARDAR PATEL UNIVERSITY
VALLABH VIDYANAGAR**



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

**ZOOLOGY
SEMESTER- IV**

PS04CZOO21: Animal Biotechnology

Unit I:

Introduction to animal tissue culture (Historical background, Advantages of tissue culture, limitations, major differences in vitro, types of tissue culture)

Biology of cultured cells (Brief description on cell adhesion, cell proliferation, energy metabolism and origin of cultured cells)

General out-line of cell types (epithelial tissue, connective tissue, muscular tissue and nervous tissue)

Equipments and materials for animal cell culture technology (Inverted microscope, Laminar flow-hood, humid CO₂ incubator, centrifuges, refrigerators and other miscellaneous equipments) **Aseptic Techniques** (Objectives of aseptic techniques, elements of aseptic environment, sterile handling)

Sterilization (Different types - dry heat (hot air oven), wet heat (autoclaving), various chemical agents used in sterilization, irradiation techniques (UV and Gamma Ray))

Unit II

Defined media and supplements(Physicochemical properties, Balanced salt solutions, serum, selection of medium and serum)

Serum – Free Media (Disadvantages of serum, advantages of Serum -free media, Preparation of serum free media, Animal protein free media)

Primary culture (Initiation of primary cell culture, isolation of tissue, types of primary culture, , mechanical and enzymatic disaggregation)

Sub culture and cell lines (Subculture and propagation, routine maintenance, subculture of monolayer and suspension cultures)

Monitoring for contamination – Visible microbial contamination, Mycoplasma, Viral contamination, Eradication of contamination.

Unit III

Cell cloning and selection (Feeder layer, suspension cloning, separation of clones)

Cell separation (Centrifugation, Antibody based techniques, FACS)

Cell differentiation (Stem cell plasticity, markers of differentiation, induction of differentiation, differentiation and malignancy)

Transformation and immortalization (Immortalization with viral genes, Immortalization)

of human fibroblasts, telomerase induced immortalization, Aberrant growth control, Tumorigenicity)

Characterization (Need for characterization, characterization based on cell morphology, DNA and RNA content, enzyme activity and antigenic markers)

Unit IV

Culture of specialized cells(Mammary epithelium, liver, epidermal keratinocytes, adipose tissue, muscle, glial cells, human astrocytes, lymphocytes, testis and ovary)

Stem cells, germ cells and aminocytes(Culture of embryonic stem cells, culture of aminocytes, applications of stem cells)

Embryo technology (Embryo sexing, embryo splitting)

Assisted reproductive techniques (IVF, ISCI, ZIFT, GIFT)

Scale-up and automation (Scale – up in suspension and monolayer culture)

Three-Dimensional Cultures (Histotypic and organotypic cultures, tissue equivalents)

Basic Text and Reference Books:

1. Freshney, R. I. (2015). *Culture of animal cells: a manual of basic technique and specialized applications*(6thEdn) John Wiley & Sons.
2. Masters, J. R. (2000). *Animal cell culture: a practical approach* (3rdEdn) Oxford University Press
3. Butler, M., 2004. *Animal cell culture and technology*. Taylor & Francis.
4. Clynes, M. (Ed.). (2012). *Animal cell culture techniques*. Springer Science & Business Media.
5. Davis, J. M. (Ed.). (2011). *Animal cell culture: essential methods*. John Wiley & Sons.

PS04CZOO22: Molecular and Applied Endocrinology

Unit 1:

Introduction: A brief history of discovery of hormones

An overview of vertebrate endocrine system. Structural features and hormones of endocrine glands- hypothalamus, pituitary, pineal, thyroid, para-thyroids, GI tract, pancreatic islets, adrenals and gonads.

Endocrine methodologies: Ablation and replacement, bioassays, immunoassays, Immunocytochemistry, autoradiography, electrophysiological and pharmacological methods, hormone-receptor interactions, cloning techniques.

Unit 2:

General classes of hormones: Peptide, Thyroid, Steroid, Neuro-transmitters, Neuropeptides, Chalone, Peptide-growth stimulating factors, Eicosanoids and pheromones

Hormones and endocrine glands: Synthesis and control of synthesis, Storage, Metabolism and functions.

Endocrinology of pregnancy, Parturition and Lactation.

Unit 3:

Mechanisms of hormone action: Receptors and types- Membrane receptors, Nuclear receptors; Receptor regulation and signal transduction, Second messengers, Permissive actions of hormones and termination of hormone action.

Unit 4:

Pathophysiology of hypothalamic, pituitary, pineal, thyroid, parathyroid, GI tract, pancreatic islets, adrenal and gonadal hormones. Imaging and nuclear medicine in endocrine disease and hormone-replacement therapies.

Reference Books:

- Molecular Endocrinology: Franklyn F. Bolander. Elsevier- Academic Press.
- Molecular Cell Biology: J. Darnell, H. Lodish and D. Baltimore Scientific American Book, Inc. USA
- Vertebrate Endocrinology: Norris, D. O. Academic Press, New York
- Endocrinology, Vol. I, II, III: D Groot. L. J. (ed.), W. B. Saunder Philadelphia
- Biochemical Actions of Hormones: Litwack, G. Academic Press.Principles of Anatomy and Physiology: Tortora, G. J. John Wiley & Sons,Inc.
- Essential Endocrinology: Brook, C.G.D. and Marshall, N.J. Blackwell Publishing.

PS04CZOO23: Laboratory I (Practicals based on PS04CZOO21 and PS04CZOO22)

PS04ECZOO21: Laboratory II (Practicals based on PS04EZOO2X and PS04EZOO2X)

PS04ECZOO22: Dissertation

PS04EZOO23: Nutritional and Clinical Biochemistry**Unit I**

Basic concept- composition of human body: Energy content of food. Measurements of energy expenditure. Energy requirements of man, woman and factor affecting energy requirements, Basal metabolic rate, factor affecting BMR.

Carbohydrates- Dietary requirements and sources of available and unavailable carbohydrates and action of dietary fibers.

Disorders of carbohydrate metabolism: Diabetes mellitus; Metabolic syndrome, Glucose tolerance test; Glycogen storage diseases

Unit II

Proteins: protein reserves of body. Nitrogen balance studies and factor affecting it. Protein quality and essential amino acids. Cereal proteins requirement at different stages of development

Disorder of AA metabolism-phenylalaninemia, homocystinuria and tyrosinemia.

Disorders of purine and pyrimidine metabolism.

Protein energy malnutrition (PEM)-Marasmus and Kwashiorkor disease.

Starvation –protein metabolism in prolonged fasting, high proteins, low caloric weight reducing diets.

Unit III

Lipids-major classes of dietary lipids. Properties and composition of plasma lipo-proteins.

Essential fatty acid and their physiological function.

Clinical inter-relationship of lipids, lipoproteins and apolipoproteins.

Tests for apolipoproteins, HDL, LDL, cholesterol and Triglyceride disorder.

Obesity-factor leading to obesity –environmental and genetic. Role of leptin in regulation of body mass.

Unit IV

Electrolytes and water balance

Food processing and loss of nutrients during processing and cooking.

Anti-nutrients-naturally occurring food born toxicants, Protease inhibitors, hepatotoxins allergens, toxins from mushroom, animal and sea foods

Reference Books:

Harper's Illustrated Biochemistry by Murray, Granner and Rodwell 27th edition McGraw Hill

Food and nutrition by Swaminathan

Nutritional biochemistry and metabolism by Linton .

Biochemistry with clinical correlation: Devlin.

PS04EZOO24: Microtechniques

Unit I

Light microscopy

Properties of lenses, Optical corrections, Properties and types of objectives, Oculars and Illumination.

Light microscopes: Bright field, dark field, fluorescence, phase contrast, polarizing, differential interference contrast.

Micrometry and photomicrography

Unit II

Basic components of electron microscopes. Thermionic and field emission guns. Types of electron microscopes: TEM, SEM, STEM, ESEM and HVEM

Unit III

Maceration, squash and clearing techniques. Sample preparation for light microscopy.

Classification of fixatives, formulas', (Plant and animal samples).

Sample preparation for light microscopy: Fixation, dehydration and infiltration procedures.

Embedding media for light microscopy. Stains and staining procedures- negative and positive staining procedures. Microtomes: Rotary, sliding, cryostat. Histochemical localization of metabolites for light microscopy: Starch, proteins, lipids, total carbohydrates, lignins,

polyphenols, nucleic acid, histones, cutin, suberin and waxes. Localization of enzymes: Peroxidase, acid phosphatase and succinic dehydrogenase.

Unit IV

Freeze etching and freeze fracturing.

Sample preparation for Electron microscope: Fixatives, double fixation, dehydration and infiltration procedures, embedding media for electron microscopy. Fixation and embedding of particulate samples like bacteria, virus etc. ultra-microtome and freezing ultramicrotome semithin sectioning, ultrathin sectioning, grids, formavar coating, Staining for electron microscopy.

Ultrastructural cytochemistry: Tannin, protein, cell wall polysaccharide, lignin and membrane.

Enzymes: Peroxidase and phosphatase.

Immunocytochemistry.

References:

- Microscopy and Microtechnique: R Marimuthu MJP Publisher, Chennai
- The study of plant structure: Principles and selected methods- T. P. O' Brien and M E McCully.
- Plant Microtechnique- Johansen, DA, McGraw Hill Book Co., New York.
- Botanical Microtechnique and Cytochemistry; Graeme P. Berlyn and Jerome P Micksche.