ZOO 301: COMPARATIVE ANATOMY OF VERTEBRATES

UNIT I

1. Origin of Chordata: Concept of Protochordata
2. Origin and classification of vertebrates
3. Vertebrate morphology: Definition, scope and importance
4. Development, structure and functions of vertebrate integument and its derivatives (glands, scales, feathers and hairs)

UNIT II

5. Respiratory system: Characters of respiratory tissue, external and internal respiration, comparative account of respiratory organs
6. Evolution of heart
7. Evolution of aortic arches and portal systems
8. Blood circulation in various vertebrate groups

UNIT III

9. Form, function, body size and skeletal elements of the body
10. Comparative account of jaw suspensorium and vertebral column
11. Comparative account of limbs and girdles
12. Evolution of urinogenital system in vertebrates

UNIT IV

13. Comparative account of organs of olfaction and taste
14. Comparative anatomy of brain and spinal cord (CNS)
15. Comparative account of peripheral and autonomic nervous system
16. Comparative account of lateral line system

UNIT V

17. Comparative account of electrorception
18. Comparative account of simple receptors
19. Flight adaptations in vertebrates
20. Aquatic adaptations in birds and mammals

Suggested Readings:

Kent, C.J. Comparative Anatomy of Vertebrates.
UNIT I
1. Basis concepts of Development: Cell division and the cell cycle, Chromosomal puffs and gene activation, Cell commitment and differentiation (Specification, determination, induction competence, differentiation), Morphogen gradients, cell fate, cell potancy and morphogenesis

2. Gametogenesis: Origin and migration of primordial germ cells, 2.2 Production of male gametes (Spermatogenesis), 2.3 Gene expression during spermatogenesis and sperm maturation, Production of female gametes (oogenesis) (Previtellogenesis, vitellogenesis and maturation phase in development of amphibian egg), Gene expression during amphibian oogenesis, Ovulation and ovum transport in mammals

UNIT II
3. Fertilization and early development: Pre fertilization events (sperm penetration of egg and acrosomal reaction, binding of sperm to the egg, Blocks to polyspermy), Biochemistry of fertilization (metabolic activation of egg, penetration of spermatozoa into the egg, union of gametes), Post – fertilization events
4. Establishment of polarity in amphibians and birds
5. Gastrulation and formation of germ layers in animals
6. Multiple ovulation and embryo transfer technology: In vitro oocyte maturation and super ovulation

UNIT III
7. Hormonal regulation of ovulation, pregnancy and parturition
8. Hormonal regulation of development of mammary glands and lactation
9. Endocrinology and physiology of placenta
10. Collection and cryo preservation of gametes and embryos

UNIT IV
11. Teratological effects of xenobiotics on gametes
12. Wolian lens regeneration
13. Melanogenesis
14. Differentiation and development of gonads

UNIT V
15. Cell diversification in early embryos, xenopus blastomeres, totipotency & pluripotency
16. Embryonic stem cells, chord-blood cells & their significance
17. Hemopoetic stem cells, formation of blood cells
18. Connective tissue cell family

Suggested Readings:
3. ENTOMOLOGY

Zool. 303 (D): General Entomology & Insect Morphology

Unit I
1. Introduction, history and scope of Entomology
2. Fossil insects and origin and evolution of insects
3. Insect diversity and their outline classification
4. Coloration and mimicry in insects
5. Light production in insects

Unit II
6. Insect collection: Significance and insect nets and traps
7. General organization of a typical insect body
8. Structure of insect head, structure and functions of antennae
9. Head segmentation and its theories
10. Different types of mouth parts and relationship with feeding habits of insects

Unit III
11. Structure of typical wing bearing thoracic segment
12. Structure of insect legs, their modifications and functions
13. Structure of insect wings, their modifications and wing coupling apparatus
14. Hypothetical wing venation

Unit IV
15. Wing venation in grasshopper, housefly and honeybee
16. Structure of flight muscles and flight-mechanisms in insects
17. General structure of insect abdomen and its appendages
18. Male and female genitalia in grasshopper

Unit V
19. Sound production in insects
20. Sound reception in insects
21. Phase theory of locusts
22. Polymorphism in aphids
23. Methods of insect communication
Zool. 304 (A): Insect Anatomy and Physiology

Unit I
1. Structure and functions of insect integument
2. Mechanism of moulting and sclerotization of cuticle
3. Structure and types of spiracles
4. Tracheal system in a generalized insect and mechanism of respiration
5. Respiration in aquatic and parasitic insects

Unit II
6. Structure of Malphigian tubules including cryptonephridia
7. Physiology of excretion and significance of cryptonephridia
8. Structure of brain and ganglia
9. Variation in central nervous system in different insect orders

Unit III
10. Structure and functions of mechanoreceptors
11. Structure and functions of chemoreceptors
12. Photoreceptor organs: Simple and compound eyes, formation of image
13. Structure and functions of fat body

Unit IV
14. Composition and functions of haemolymph
15. Insect circulatory system
16. Digestive system: Structure and modifications of alimentary canal and associated glands
17. Histology of alimentary canal, salivary glands and peritrophic membrane
18. Physiology and regulation of digestion

Unit V
19. Neuroendocrine system and its variations in different insects
20. Chemistry and functions of hormones
21. Structure of male and female reproductive systems
22. Types of insect reproduction
23. Insect pheromones
C. ENDOCRINOLOGY:

ZOOL. 303 (C): COMPARATIVE ENDOCRINOLOGY

UNIT I
1. History and scope of endocrinology
2. Endocrine methodologies
3. Mechanism of hormone action
4. Hormones and environment

UNIT II
5. General and comparative structure of anterior pituitary gland
6. General and comparative structure of neurohypophysis
7. General and comparative structure of thyroid
8. General and comparative structure of parathyroid

UNIT III
9. General and comparative structure of pancreas
10. Structure of mammalian pineal body
11. General and comparative structure of adrenal medulla and chromaffin tissue
12. General and comparative structure of adrenal cortex and inter-renal tissue

UNIT IV
13. Neurosecretion and neuroendocrine mechanisms in non-arthropod invertebrates
14. Neuroendocrine system in Crustacea
15. Neuroendocrine system in Insects
16. Neuroendocrine system in Mollusca

UNIT V
17. Caudal neurosecretory system in fish
18. General structure of thymus
19. Endocrine integration: migration of birds and fishes, bird plumage
20. Hormone like substances: Ectohormones, phytohormones, root growth hormones,
UNIT I
1. Role of hypothalamus and neuroendocrine integration in mammals
2. Hormones of anterior pituitary and their functional significance
3. Hormones of neurohypophysis and their functional significance in mammals
4. Hormones of pars-intermedia and control of pigmentary function in vertebrates

UNIT II
5. Functional significance of pineal hormones
6. Biosynthesis and functions of thyroid hormones
7. Regulation of thyroxine secretion
8. Thyroxine and its influence on development and metamorphosis

UNIT III
9. Parathyroid hormone and its physiological significance
10. Calcitonin, thyrocalcitonin and their functional significance
11. Catecholamines (epinephrine and nor-epinephrine) their biosynthesis and physiological influence on metabolism
12. Physiological significance of mineralocorticoids and glucocorticoids

UNIT IV
13. Gastrointestinal hormones and their physiological significance
14. Insulin and insulin-like peptides and their role in early mammalian development
15. Renin and angiotensins and their functional significance
16. Physiological significance of insulin in carbohydrate metabolism

UNIT V
17. Physiological significance of glucagon in carbohydrate metabolism
18. Biochemistry and functional significance of sex steroids
19. Role of hormones in insect physiology
20. Role of hormones in crustacean physiology
B. CELL BIOLOGY

ZOO1 503 (B): METHODS IN CELL & MOLECULAR BIOLOGY

UNIT I

1. Principle and applications of spectrophotometry
2. Cell sorting: Principle and applications of flow cytometer
3. Working principle and applications of fluorimeter
4. Working principle and applications of Confocal microscope

UNIT II

5. Cell fractionation: Differential velocity and density gradient centrifugation
6. Basic idea of NMR and ESR
7. Atomic force microscopy
8. Gel Electrophoresis: 2D-PAGE and Isoelectric focusing

UNIT III

9. Immunotechniques: Precipitation, Immunofluorescence, ELISA and RIA
10. Methods in protein purification
11. DNA-protein Interactions: Electrophoretic mobility shift assay (gel shift assay), DNA footprinting
12. DNA micro-array and DNA chips

UNIT IV

13. Stem cells: Types, culture and applications
15. Methods in gene analysis-II: General idea of site directed mutagenesis, Linker scanning mutations analysis and Reporter assay
16. DNA modifying enzymes, properties, action and uses in recombinant DNA technology

UNIT V

17. General idea of Yeast two-hybrid system, Subtractive hybridization, Chromosome walking, Chromosome jumping and positional cloning
18. RNA analysis: General idea of RNAase protection assay, Primer extension, S1 nuclease protection assay and RT PCR
19. Genome analysis: DNA finger printing, RAPD and RFLP
ZOOI. 304 (B): CELLULAR STRUCTURE MOLECULAR ORGANIZATION

UNIT I

1. General organization and characteristics of viruses (examples: SV40 & HIV)
2. Yeast: Structure, reproduction and chromosome organization; Basic idea of its applications as vectors for gene cloning
3. Molecular organization of respiratory chain assemblies, ATP/ADP Translocase and F0F1, ATPase

UNIT II

4. Cell cycle: Cell cycle control in mammalian cells
5. Cell cycle regulation in Xenopus
6. Cytochemistry of Golgi complex and its role in cell secretion
7. Peroxisomes: Synthesis and targeting of peroxisomal proteins

UNIT III

8. Nucleolus; Structure and biogenesis of ribosomes
9. Intracellular digestion: Ultrastructure and functions of lysosomes
10. Synthesis and targeting of mitochondrial proteins

UNIT IV

11. Secretary pathways and translocation of secretory proteins across the EPR membrane
12. Genome complexity: C-value paradox and cot value
13. DNA sequences of different complexity
14. Receptor-ligand interaction, signal transduction and cross-talk among various signaling pathways

UNIT V

15. Differences between normal cells and cancer cells: Biochemical, cytoskeletal and cell surface changes
16. Genetic basis of human cancer and chromosomal abnormalities
17. General idea of oncogenes and cancer; transforming agents, proto-oncogenes and tumor suppressor genes

Suggested Readings:
De Robertis and De Robertis, Cell and Molecular Biology, Lea and Febiger.
P. K. Gupta, Molecular Cell Biology, Rastogi Publications.
Watson, Gilman, Witkowski, Zoller, Recombinant DNA, Scientific American Books
Gerald Karp, Cell Biology.
Levin B. Genes VII.
King, Cell Biology.
Daniel L. Hartl, Elizabeth W. Jones, Genetics-Principles and Analysis, Jones and Bartlett Publishers.
Kuby, Immunology, W. H. Freeman and Company.
Roll. Male, Snustad, Immunology.
COURSES FOR SPECIAL (ELECTIVE) GROUPS:

A. AQUATIC BIOLOGY AND AQUACULTURE

ZOOOL. 303 (A) AQUATIC ECOLOGY & RESOURCES

UNIT I

1. Aquatic ecology: Science and its development
2. Origin and classification of wetlands including lakes
3. Morphology of lakes, reservoirs and ponds
4. Physical chemical and biological characteristics of marine environment

UNIT II

5. Estuaries and other brackish water environments in India and their faunal importance
6. Physical and chemical characteristics of lakes, ponds and rivers
7. Freshwater biota: Plankton, benthos and macrophytes
8. Food chain, food web, trophic levels and energy flow

UNIT III

9. Primary productivity in Inland water and methods of its determination
10. Degradation of wetland in India and control measures
11. Aquatic resources: Invertebrates and vertebrates
12. Importance and management of aquatic resources in India

UNIT IV

13. Migration pattern of aquatic animals including aquatic birds
14. Threatened wetlands and endangered aquatic species
15. Aquatic wild life: Habitat and its importance, composition and conservation strategies
16. Aquatic pollution, its causes and control measures

UNIT V

17. Major sources of pollution in rivers and remedies
18. Biological indicators of water pollution
19. Eutrophication, its impact on water bodies and control measures
20. Aquatic toxicology: Aquatic toxicity, long-term toxicity and chronic toxicity
UNIT I

1. Structure and functions of skin and scales, significance of scales in taxonomy
2. Chromatophores: Classification, ultrastructure and functional significance
3. Origin of paired fins and modification of caudal fin
4. Respiratory organs including accessory respiratory organs and respiration in fish

UNIT II

5. Swim bladder and its functional significance
6. Food, feeding habits and nutrition in fish
7. Digestive system and physiology of digestion in fish
8. Osmoregulatory organs and osmoregulatory mechanisms in fish

UNIT III

9. Brain of fishes and its functional organization in relation to ecological conditions
10. Lateral line system: Structure, modifications and functional significance
11. Electric organs and their significance
12. Bioluminescence in fish and its significance
13. Chemical communication in fish

UNIT IV

14. Neuro-endocrine integration and hypothalano-hypophysial system in fish
15. Anatomy and physiology of pituitary gland
16. Anatomy and physiology of thyroid gland
17. Pineal organ, inter-renal gland and caudal neurosecretory system

UNIT V

18. Seasonal cycles of gonads in Indian fish
19. Hormonal and endocrine control of reproduction in fish
20. Development of teleost fish
21. Parental care in fish

Suggested Readings:

E. FISH BIOLOGY AND FISHERIES:

ZOOI. 303 (E): FISH STRUCTURE AND FUNCTION

UNIT I

1. Structure and function of skin
2. Structure and function of scales, determination of growth and age
3. Origin and evolution of paired fins
4. Different types of fins and their specific modifications
5. Skeleton of teleost fish

UNIT II

6. Locomotion in fish
7. Structure and function of swim bladder
8. Accessory respiratory organs with special reference to Indian fishes
9. Different types of feeding and feeding habits of fish

UNIT III

10. Structure, function and homologues of Weberian ossicles
11. Hill stream adaptation in fish
12. Deep sea fishes
13. Migration in fish
14. Chemical communication in fish

UNIT IV

15. Structure and functions of electric organs and electrorceptors
16. Structure and function of luminous organs
17. Structure and function of sound producing organs and sound reception
18. Poisonous and venomous fish.

UNIT V

19. Structure, working and functions of eye
20. Structure, working and functions of ear
21. Mendelian and non-Mendelian genetics in fish
22. Hybridization in fish
23. Sex determination in fish
UNIT I

1. Chromatophores: Classification, ultrastructure, and functional significance
2. Color changes: Types, neural and endocrine control mechanisms
3. Respiratory organs: Kinds and physiology of aqueous breathing
4. Digestive system: Anatomy and physiology of alimentary canal

UNIT II

5. Nervous system: Brain its functional organization with ecological bearing
6. Nervous system: Nerves and their supply
7. Lateral line system: structure, modifications and significance
8. Circulatory system in fish, heart, venous and arterial system

UNIT III

9. Excretory system: kidney and physiology of excretion in teleost fish
10. Osmo-regulatory organs and mechanisms in fish
11. Neuroendocrine integration in fish
12. Hypothalmo hypophysial neurosecretory system in fish

UNIT IV

13. Anatomy and physiology of the pituitary gland
14. Anatomy and physiology of the thyroid gland
15. Pineal organ, interrenal tissue and caudal neurosecretory system
16. Seasonal cycles of male and female gonads

UNIT V

17. Hormonal control of reproduction
18. Environmental control of reproduction
19. Early development of a teleost
20. Parental care in fish

Suggested Readings:

Leo.S.Berg: Classification of fishes (fossilized & Recent).
Francis day Vol I & II Fishes of India.
C.B.I.Shrivastava: Fish Biology.
K.S.Mishra: An aid to classification of Fishes.
B.Qurashi: Identification of fishes.
W.D.Russell: Aquatic Productivity.
K.F.Lagler: Ichthyology.
J.F.Norman: An History of fishes.
R.L.Rath: Fresh water Aquaculture.