

*Telangana Mahila Viswavidyalayam*  
*Women's University Koti, Hyderabad 500 095.*  
*Formerly University college for women, O.U.*  
*Accredited by NAAC with 'A' Grade*

## **DEPARTMENT OF ZOOLOGY**

**M.Sc. SYLLABUS – CBCS**

**SEMESTER – II**

**Paper – I, II, III & IV**  
**With effect from 2022 – 2023**

**DEPARTMENT OF ZOOLOGY**  
**Telangana Mahila Viswavidyalayam, KOTI, HYDERABAD**  
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Keeping in view the CBCS system, of Osmania University, M.Sc. Zoology I Year Semester – I Syllabus was discussed with the members of BOS and it is resolved to follow the same syllabus of Department of Zoology, Osmania University, for Paper – I, II, III & IV.

Approval of the Panel of Examiners were discussed for Semester – I ; Paper – I, II, III & IV for both Theory and Practical for 2022-23.

**Semester – I Proposed Credit Distribution Pattern**

<b>Semester – I</b>	<b>Paper Title and Code</b>	<b>Credits</b>
Core Paper – I	Evolution & Vertebrate Biology (EVB) Zoo-201T	3T + 2P = 5
Core Paper – II	Immunology (IMM) Zoo-202T	3T + 2P = 5
Core Paper – III	Animal Physiology (AP) Zoo-203T	3T + 2P = 5
Core Paper – IV	Genetics & Developmental Biology (GDB) Zoo-204T	3T + 2P = 5
	<b>Total Credits :</b>	<b>20</b>

## MINUTES OF THE MEETING

Board of Studies meeting was convened in the Department of Zoology, Telangana Mahila Viswavidyalayam (Women's University), Koti, Hyderabad, on 09-11-2022 at 1:30 PM under the Chairmanship of Dr. Y. Sunila Kumari, Head Department of Zoology, TMV, Koti, Hyderabad, to discuss the following agenda.

**Agenda 1 : Review of M.Sc. I Year curriculum as per O.U. CBCS Syllabus.**

**Agenda 2 : Approval of panel of Examiner for the academic year 2022-23.**

**Agenda 3 : Any other Matter with the permission of the chair.**

### **MEMBER OF BOS COMMITTEE:**

<b>Sl. No.</b>	<b>Member of BOS and Address</b>	<b>Designation</b>	<b>Signature</b>
1	Dr. Y. Sunila Kumari, Assistant Professor, Head & Chairperson of Board of Studies Dept. of Zoology, TMV, Koti, Hyd.	Head & CBOS, TMV	
2	Prof. M. Madhavi, Chairperson Board of Studies, Department of Zoology, UCS, OU.	Subject Expert CBOS (O.U)	
3	Prof. B. Neeraja, Dept. of Zoology, TMV, Koti, Hyd.	Senior Faculty Member	
4	Dr. G. Shamita, Associate Professor, Department of Zoology, Kakitaya University	Subject Expert	
5	Dr. M. Radha Krishna, Assistant Professor, Department of Zoology, Nizam College	Subject Expert	
6	Dr. K. Ashok Reddy, Managing Director, Synteney Life Science PVT, LTD. Nallakunta Hyderabad.	Industry Expert	
7	Dr. D. Priya Kumari, Assit. Prof. [C] Department of Zoology, TMV, Koti, Hyderabad	Faculty Member	
8	Dr. G. Shailaja, Assistant Professor, [C] Department of Zoology, TMV, Koti, Hyderabad	Faculty Member	
9	Dr. C. Sanat Kumar, Assit. Prof. [C] Department of Zoology, TMV, Koti, Hyderabad	Faculty Member	
10	Ms. Mazia Jabeen, Lecturer, Gautam Junior & Degree College, Nalgonda	Alumini Member	
11	Ms. Roselin, Student UCW, Koti	Student Member	

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CodeZoo\_201

Semester-II  
CORE PAPER

Paper: I Evolution and Vertebrate Biology {EVB}

UNIT I-Evolution of Vertebrates

15Hrs

- 1.1 Evolution of Agnathans-a) Extinct Agnathans (Conodonts, Ostracoderms & Pteraspidomorphi) and b) Living Agnathans (Myxinoidea & Petromyzontiformes).
- 1.2 Evolution of Gnathostomes a) Placodermi and b) Chondrichthyes (including Elasmobranchii & Holocephali).
- 1.3 Evolution of Teleostomi-a) Acanthodii and b) Osteichthyes (Actinopterygii & Sarcopterygii).
- 1.4 Evolution Tetrapods- a) Labryinthodonts b) Lepospondyls, and c) Lissamphibia (Urodela, Anura & Apoda).
- 1.5 Evolution of Amniotes-a) Reptilia (Mesozoic and living reptiles), b) Aves (Palaeognathae & Neognathae), and c) Mammalia {Prototheria & Theriiformes}.

UNIT II-Functional Anatomy of Vertebrate-I

15Hrs

- 2.1 Integumentary system- Integument and its derivatives.
- 2.2 Cranial skeletal system-a) Basic plan of skull; b) Temporal fossae -its function; c) Jaw suspension and its types.
- 2.3 Post-cranial skeletal system a) Axial skeleton; b) Appendicular skeleton; and c) Joints (both axial & appendicular and their types).
- 2.4 Digestive system in Aves and Mammals-Components and function; Dentition in mammals.
- 2.5 Respiratory system in vertebrates (Fishes to Mammals)-Gills, lungs, and other respiratory structures.

UNIT III-Functional Anatomy Vertebrates-II

15Hrs

- 3.1 Excretory system in vertebrates (Fishes to Mammals)-Kidney and its structure; Modes of excretion.
- 3.2 Nervous system in vertebrates (Fishes to Mammals)-Brain, spinal cord, and peripheral nerves.
- 3.3 Eye in vertebrates (Aves and Mammals)-Structure and function in different classes.
- 3.4 Amniotic egg-its structure and evolutionary significance.
- 3.5 Evolutionary significance of internal fertilization; Placenta-its types and functions

## PRACTICALS

1. Specimen study: Unique representatives of
  - 1) Elasmobranchii - Shark, Ray fish
  - 2) Actinopterygii - *Labeo*, *Exocoetus*
  - 3) Dipnoi - *Protopterus*, *Neoceratodus* and *Lepidosiren*
  - 4) Amphibia – one representative of each Anura, Apoda, Urodela.
2. Specimen study of
  - 1) Reptilia: Marsh Crocodile, Star tortoise, Gecko, Russell's Viper, and Rat Snake.
3. Specimen study of
  - 1) Aves: Ostrich, Kiwi, Penguin, Vulture, and Duck;
  - 2) Mammalian: Echidna, *Platypus*, *Mocropus*, Tiger, Spotted Deer.
4. Collection and preparation of slides of scales of fishes.
5. Comparative study of alimentary canals of vertebrates.
6. Comparative study of Reproductive system of vertebrates.
7. Comparative studies of (Axial skeleton) – Skull of vertebrates.
8. Comparative studies of (Axial skeleton)-Vertebrae of vertebrates.
9. Comparative studies of (Apendicular skeleton) Girdles-pelvic and pectoral.
10. Comparative studies of (Apendicular skeleton) Limb bone–Fore limbs and hind limbs.
11. Study of skin and derivatives of Integument-Nail, claw, horn, and hoof.
12. Study of different types of feathers, hairs, and scales
13. a. Dissection(Demonstration/virtual) of Weberian ossicles of *Labeo*  
b. Dissection(Demonstration/virtual) of Respiratory trees of *Clorius*
14. Dissection (Demonstration/virtual) of Cranial nerves of *Labeo* (V, VII, IX & X cranial nerves)
15. Visit to National Park in Hyderabad.

Submission of assignment on: Diagrammatic representation with labeling of 1) Theories of evolution; 2) Types of speciation; 3) Evolution of primates; 4) Evolution of human; 5) Adaptive radiation in amphibians, reptiles, birds, and mammals; 6) Integument and its derivatives; 7) Types of axial and appendicular joints; 8) Senses organs–a) Eye invertebrates; b) Ear in tetrapods; 9) Structure of brain, nervous system, respiratory system, digestive, and excretory system in fishes to mammals; 10) Different types of skulls basing on temporal fossae; 11) Structure of Amniotic egg; 12) Placenta and different types of the placenta.

[To be submitted at the time of Practical Examination–5 Marks]

### Assignments:

1. Theory Assignment will be three detailed essays on any *one* topic each from Units I, II & III.  
The theory assignment shall be submitted before the II Internal Assessment.
2. Practical Assignment shall be submitted at the Semester end Practical Examination Suggested Books
  1. Evolution of Vertebrates by E.H.Colbert
  2. Evolutionary Biology by Mitkoff
  3. Organic Evolution by Veer Bala Rastogi
  4. Vertebrates-Comparative Anatomy, Function & Evolution(8<sup>th</sup>Ed. ) by K.V.Kardong
  5. Life of Vertebrates by J.Z.Young
  6. A Textbook of Zoology Vol.II by Parker and Haswell (revised by Marshall)
  7. Vertebrate Body by A.S.Romer
  8. Chordates by Alexander
  9. Comparative Vertebrate Anatomy by Hyman
  10. Vertebrate Structure and Function by Waterman
  11. Comparative Anatomy by Kent
  12. Vertebrates by R.L.Kotpal
  13. Chordate Zoology by E.L.Jordan & P.S.Verma
  14. Vertebrate Zoology & Evolution by Yadav B.N.&D Kumar

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Zoo\_202

Semester–II

COREPAPER

Paper II: Immunology [IMM]

**UNIT I-Introduction to Immunology**

15Hrs

- 1.1 Introduction and evolution of immune system in invertebrates and vertebrates; Immunity types-Innate and adaptive immunity.
- 1.2 Physiology of immune system–Physical and chemical barriers; Primary and secondary lymphoid organs; Lymphatic tissues and lymphatic traffic.
- 1.3 Immuno reactive cells-Structure and function of Macrophages, Granulocytes, Natural Killer Cells, T cells, B cells, Dendritic cells, and Mast cells.
- 1.4 Immune response –Humoral and Cell mediated immune response; Role of cytokines, lymphokines, interleukins, and interferons in immune system.
- 1.5 **Hypersensitivity reactions- Type – I, Type –II, Type-III & Type –IV.**

**UNIT II-Immunoglobulins and Complement system**

15Hrs

- 2.1 Antigens- Nature and Types; Epitope, Haptens, Antigenicity, and Adjuvants.
- 2.2 Immunoglobulins – Structure, function, and classification of antibodies; Antigen and Antibody reactions.
- 2.3 Monoclonal and polyclonal antibodies; Production of monoclonal antibodies and their application
- 2.4 Complement system –Components of the complement system; Pathways –Classical and Alternative; Biological consequences of complement activation and complement significance.
- 2.5 Major Histocompatibility Complex (MHC); Human Leukocyte Antigens (HLA) system: Structure and function; Immune phagocytosis; Inflammation and Anaphylaxis.

**UNIT III- Transplantation, Tumor Immunology and immune disorders**

15Hr

- 3.1 Toxicity of chemicals on immune system functions; Immunomodulators and immunostimulators; Immune compromised states.
- 3.2 Transplantation–Concept and challenges in Transplantation; Solid organ transplantation; Barriers to transplantation, graft rejection, and Graft-versus-host disease (GvHD).
- 3.3 Immunity against diseases and evasion of immune response by bacteria, virus, fungi, and parasites.
- 3.4 Tumour immunology – Immunity to tumour; TSA (tumour-specific antigens); Immune surveillance; Immune suppression; Oncogene and cancer induction, and anti-tumor drug resistance.
- 3.5 Immunodeficiencies, Mechanisms of autoimmunity; Organ-specific autoimmune diseases.

## PRACTICALS

1. Blood grouping- Forward and Reverse, RH typing.
2. HIV test (Tridot method).
3. ROT Kit for Malaria/Dengue (Source for kit-NVBDCP).
4. RPR Test for Syphilis.
5. Widal test for diagnosis of enteric fever.
6. Identification of various immune cells (Lymphocytes) by morphology—Leishman stain/Geimsa stain.
7. Identification of histological slides of lymphoid tissues: Spleen, Thymus, Lymph Node and Bone marrow.
8. Total count/Differential count of leucocytes
9. Agglutination reaction-Latex agglutination reaction – Rheumatoid factor
10. Haemagglutination
11. Serum electrophoresis/ PAGE of serum proteins
12. Precipitation reaction- Single Radial immune diffusion, double diffusion, Rocket electrophoresis counter current immune electrophoresis.
13. Preparation of lymphocytes from peripheral blood by density gradient centrifugation/ficoll method.
14. Separation of IgG by chromatography using DEAE cellulose or sephadex.
15. Demonstration of Western blotting technique

Submission of assignment on: structure of immune cells, antibodies, antigen-antibody reactions, Immunological techniques (ELISA, RIA, Immunoprecipitation-FISH and GISH) Monoclonal antibodies, MHC, Autoimmunity Hypersensitivity types, transplantation and tumour immunology primary and secondary diseases.

[TobesubmittedatthetimeofExamination–5Marks]

### Assignments

1. Theory Assignment will be three detailed essays on any one topic each from Units I, II & III. The theory assignment shall be submitted before the II Internal Assessment.
2. Practical Assignment shall be submitted at the Semester end Practical Examination.

### Suggested Books

1. Immunology, Kuby, W.F. Freeman, U.S.A .
2. Fundamentals of Immunology, W.Paul.
3. Essentials of Immunology, I.M. Roitt.
4. Immunology A Foundation Text by Basiro Davey.
5. An introduction to immunology, by Ian RTizard.
6. The Experimental Foundations of Modern Immunology by W.Clark John Wiley and Sons, New- York.
7. Cellular and Molecular Immunology by Abbas, Lichtman and Pober, W .B.Saunders Company , Philadelphia.

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Semester-II

CORE PAPER

Paper III: Animal Physiology [AP]

**UNIT I – Digestion, Respiration & Circulation**

15Hrs

- 1.1 Cellulose digestion – Ruminant and non ruminant digestion; absorption in mammals; Events of absorptive and post-absorptive states and their regulation (endocrine and neural).
- 1.2 Respiration–Cascade of oxygen transport to tissues at high altitude; Adaptation to diving.
- 1.3 Responses to CO<sub>2</sub> and O<sub>2</sub> rich environment; Oxygen toxicity; Hypercapnea, regulation of respiration.
- 1.4 Buffering mechanisms by body fluids.
- 1.5 Circulation– Principles of hemodynamics ;Blood pressure and its regulation; Blood coagulation; Cardiac cycle and Electrocardiograph

**UNIT II- Osmoregulation, Excretion & Thermoregulation**

15Hrs

- 2.1 Osmoregulation in aquatic organisms (brackish water, fresh water, and marine water organisms)  
and in terrestrial animals; Hormonal control of osmoregulation.
- 2.2 Excretion–Urine formation, counter –current mechanism; Juxtaglomerular apparatus; Hormonal regulation: Renin - Angiotensin System (RAS), Anti Diurtic Hormone (ADH),and aldosterone.
- 2.3 Detoxification of nitrogen products; purine cycle and miscellaneous detoxification pathways.
- 2.4 Thermal physiology - Temperature regulation in poikilotherms, homeotherms and heterotherms, and their mechanisms of survival; Central control of homeothermy.
- 2.5 Cold death, cold resistance, and heat death; Torpor ,hibernation, and aestivation.

**UNIT III – Muscle Physiology, Neurophysiology and Hormones**

15Hrs

- 3.1 Comparative molecular structure and function of skeletal, smooth, and cardiac muscles; Energy metabolism in skeletal muscle; Muscle fatigue.
- 3.2 Basis and significance of membrane potentials; Action potential–Sodium potassium currents, and neurotransmitters; Types of neuron and glial cells; Types of synapses, synaptic transmission, and synaptic inhibition.
- 3.3 Receptors–Receptor mechanisms, sensory coding; Mechanoreceptors, photochemical aspects of vision, and phonoreception in mammals.
- 3.4 Mechanism of hormone action —Peptide and steroid hormones; Hormones of vertebrates: Hormones of hypothalamus, pituitary, thyroid, and parathyroid.
- 3.5 Hormones of adrenalglands, pancreas, testis, and ovaries; Biological clocks.



## PRACTICALS

1. Preparation of Buffer of known pH- Buffering capacity.
2. Isolation of casein protein from milk and estimating iso electric pH of casein
3. Estimation of blood chlorides under hetero osmotic media.
4. Cold and heat stress on metabolic rate in tilapia fish/crab.
5. Effect of heat stress on glycogen levels in tilapia fish/crab.
6. Estimation of Acetylcholinesterase activity.
7. Estimation of Phosphorylase activity.
8. Adrenalin induced changes in blood glucose level in rat/mice.
9. In sulin induced changes in blood glucose levels in rat/mice
10. Kymographic recordings of twitch, tetanus and fatigue.
11. Estimation of Hb, ESR and blood clotting time.
12. Demonstration of cell fragility.
13. Estimation of serum creatinine by Jaffe's et al method.
14. Effect of drugs and hormone on contraction of smooth muscles.
15. Preparation of models of amino acid, peptides, DNA, and RNA.

Submission of assignment on: Ruminant and non-ruminant digestion. Absorption and post absorptive states and their regulation in mammals. Respiration–Cascade of oxygen transport to tissues at high altitude. Hemodynamics. Osmoregulatory problems in aquatic and terrestrial animals. Renin-angiotensin system and hormonal regulation–ADH and aldosterone, purine cycle, torpor hibernation and aestivation. Types of neurons and glial cells. Synaptic transmission and Neurotransmitters. Receptor mechanism, photo reception and phonoreception in mammals. Endocrine glands of invertebrates. Biochemistry & significance of luminescence. Stress–hormones and the sympathetic nervous system in stress. Social communication and social dominance **[To be submitted at the time of Examination –5Marks)**

## Assignments

1. Theory Assignment will be three detailed essays on any one topic each from Units I, II & III.  
The theory assignment shall be submitted before the II Internal Assessment.
2. Practical Assignment shall be submitted at the Semester end Practical Examination..

## Suggested Books

1. Principles of Animal Physiology by D.W. Wood.
2. Principles of Animal Physiology by Gordon.
3. Animal Physiology-Adaptations and Environment by K.Schnlidt-Nielson.
4. Principles of Animal Physiology by Wilson.
5. Text Book of Medical Physiology by Guyton.
6. General & Comparative Animal Physiology by William Hoar.
7. Comparative Animal Physiology by Florey.
8. Comparative Animal Physiology by L.C. Prosser.
9. Human Physiology by Vander.
10. Principles of Animal Physiology by Eckert and Randall

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CodeZoo\_204

Semester - II

COREPAPER

Paper IV: Genetics and Developmental Biology [GDB)

UNIT I-Genetics

(15Hrs)

- 1.1 Extension of Mendelian inheritance; Gene interaction Pleiotropy Expressivity, Penetrance, Genomic Imprinting.
- 1.2 Molecular anatomy of eukaryotic chromosomes–Heterochromatin, Euchromatic, Polytene, and Lamp brush chromosomes.
- 1.3 Mutations–Types: Lethal, Conditional, Biochemical; Loss of functions and Gain of functions; Germinal and somatic mutants; Dosage compensation in *C.elegans*, *Drosophilo*, and Human.
- 1.4 Molecular markers in genome analysis: RFLP, RAPD, AFLP analysis; Molecular markers linked to disease resistance genes.
- 1.5 Nature of gene and its functions; Fine structure of gene (rllocus); Methods of gene mapping: 3-point test cross in *Drosophila*; Gene mapping in humans by linkage analysis in pedigree.

UNIT II- Gametogenesis, Fertilization and Early Development

(15Hrs )

- 2.1 Origin, migration, and fate of primordial germ cell; Gametogenesis–Factors controlling spermatogenesis and oogenesis.
- 2.2 Fertilization–Egg-sperm interactions; Post fertilization cortical reactions and prevention of polyspermy; Cleavage–Mechanism and influence of yolk; Chemical changes during cleavage.
- 2.3 Gastrulation and formation of primary organ rudiments in *Amphioxus*; General metabolism during gastrulation; Concept of primary organizer (concept of Hans Spemann & Hilde Mangold).
- 2.4 Induction–Mesoderm development, Growth factors; Embryonic induction and competence; Neural tube induction.
- 2.5 Cell differentiation–Equivalence of nuclei and genome constancy; Chemical basis of differentiation; Hormones and differentiation.

UNIT III – Stem cells & Organogenesis

(15h)

- 3.1 Stem cells–Embryonic stem cells and adult stem cells, and their medical applications; Embryo Transfer (ET) and In Vitro Fertilization (IVF) in Humans and Livestock; Superovulation and embryo culture.
- 3.2 Genetics of axis formation–Determination of dorso-ventral and anterior-posterior axis and axis specification in *Drosophila*; Role of maternal genes, segmentation genes, and homeotic genes.
- 3.3 Organogenesis–Limb, central nervous system, and heart; Role of HOX genes and other pattern forming genes in vertebrate limb development.
- 3.4 Determination of polarity
- 3.5 Teratogenesis–Genetic and environmental causes; Teratological effects of xenobiotics; Developmental mechanisms of teratogenesis.

## PRACTICAL

1. Isolation and estimation of DNA in chick embryo–24hrs/48hrs/72hrs/96hrs
2. Isolation and estimation of RNA in chick embryo–24hrs/48hrs/72hrs/96hrs.
3. Estimation of structural proteins in chick embryo-24hrs/48hrs/72hrs/96hrs.
4. Estimation of soluble proteins in chick embryo-24hrs/48hrs/72hrs/96hrs.
5. Estimation of SDH & LOH activity in chick embryo-24hrs/48hrs/72hrs/96hrs.
6. Estimation of calcium in egg shell by EDTA method–24hrs/48hrs/72hrs/96hrs.
7. Identification of chick embryo developmental stages-24hrs/48hrs/72hrs/96hrs.8.
8. Study of cleavage patterns in *Lymnaea* .
9. Observational study of development of eye in *Lymnaea* .
10. Observational study of foot development in *Lymnaea* .
11. Observation of early development of frog–2-,4-,8-,and16-celled stage, blastula, gastrula and yolk plug stage (Virtual Demonstration).
12. Vital staining experiments on chick embryos employing window method and tracing the development of stained parts (Virtual Demonstration).
13. Handling of *Drosophila* and study of its life cycle
14. Examination of wild type (males and females) and mutants of *Drosophila*.
15. Study Life cycle and development of *Caenorhabditis elegans* (Virtual Demonstration).

Submission of assignment on: Linkage; Crossing over; Multiple alleles; Blood group antigens; Bacterial transformation, transduction, conjugation (only diagrams); Hybridization techniques–Southern blot, Northern blot, and Western blot; Features of vectors–cosmids, plasmids and shuttle vector; DNA finger printing and its application; Gametogenesis (spermatogenesis & oogenesis ); Fertilization and its significance; Parthenogenesis and its significance; Cleavage types; Presumptive areas and fate maps; Concept of organizers and Inducers; Role of hormones in the metamorphosis of frog; Regeneration in Amphibia (limb and tail regeneration).

(To be submitted at the time of Examination -5Marks)

### Assignments

1. Theory Assignment will be three detailed essays on any one topic each from Units I, II & III.  
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2. Practical Assignment shall be submitted at the Semester end Practical Examination. Suggested Books
  1. Balinsky, B.I. (1981). An introduction to Embryology 5th Ed. Holt Saunders Publ., Philadelphia.
  2. Browder, L.W., Erickson, C.A. and Jeffery, R.W. (1991). Developmental Biology 3rd Ed. Saunders College Publ., Philadelphia.
  3. Jenkin, P.M. (1970). Control of growth and metamorphosis, 1st Ed. Pergamon Press, Oxford.
  4. Melissa A Gibbs (2003). A Practical guide to Developmental Biology Oxford University Press 118 pages, B/willus, figs
  5. Lodish et al.; Molecular cell Biology, Latest edition, W. H. Freeman & Company, 2000.
  6. Developmental Biology by Berry I
  7. Cell and Molecular Biology–Concept and Experiments by Gerald Karp. John Wiley and Sons Inc. Latest edition.
  8. Watson et al. Molecular Biology of the gene, Latest Edition, Pearson Prentice Hall, USA.
  9. Alberts et al: Molecular Biology of the Cell (4<sup>th</sup> Ed 2002, Garland)
  10. Gilbert: Developmental Biology (8<sup>th</sup> Ed 2006, Sinauers)
  11. Kalthoff: Analysis of Biological development (1996, McGraw)
  12. Watson et al.: Molecular Biology of gene by Watson et al. Vol I & II
  13. Cell and molecular biology by De Robertis and De Robertis, 8th ed.
  14. Developmental Biology-Patterns, problems and principles by W. Saunders Jr.