

KUVEMPU UNIVERSITY
B.Sc. DEGREE – ZOOLOGY Semester scheme (SEP)
V semester syllabus
Title –CELL AND MOLECULAR BIOLOGY (Paper -5)

Program Name	B.Sc	Semester	V
Compulsory Course	CELL AND MOLECULAR BIOLOGY (Paper -5)		
Course Code	–	No. of Credits	03
Contact hours	4 hrs/ week	Duration of SEA/Exam	3hrs
Formative assessment marks	20	Summative assessment marks	80

Objective:

- To study the structural and functional organization of cell with an emphasis on nucleus, plasma membrane.
- To learn about cellular components underlying the mitotic division.
- To study the cell communication and signalling.
- To study the molecular basis of life and to study transcription and translation in cells.
- To understand gene expression and regulation.

Outcome

- Understand the structure, diversity and functions of cell
- Elaborate the process of aging and cancer
- Explain gene expression mechanisms and evaluate characteristic features of genetic code.
- Acquire knowledge about the structure and function of the cell as the fundamentals for functioning of all living organisms.
- Developing critical thinking, skill and research aptitudes in basic and applied biology

Cell Biology- Theory

UNIT - 1

- 1. Introduction to cell biology:** Definition and scope, Cell theory. Cell shape, size and number. Cell types- prokaryotic and eukaryotic cell; similarities and differences
- 2. Cell membrane:** Structure and function: Molecular models of cell membrane - Sandwich model, Unit membrane model, Fluid mosaic

model, *Cell properties* - permeability, Transport (Diffusion, Osmosis, Passive transport, Active transport, bulk transport), Cell receptors.

- 3. Nucleus and Chromosomes:** Structure of nucleus, nuclear membrane and nucleolus. Chromosome number and types. Structure of a metacentric chromosome, Heterochromatin, Euchromatin, Nucleosomes, Giant chromosomes- polytene chromosomes and lamp brush chromosomes.
- 4. Cell Cycle:** Cell Cycle: G₁, S, G₂ and M phases – Check points; G₀ phase.

UNIT - 2

- 5. Cell division:** Amitosis (brief account); Mitosis and its significance, mitotic apparatus and mitotic inhibitors. Meiosis and its significance. Comparison between mitosis and meiosis. Synaptonemal complex- Structure and functions.
- 6. Cell Communication:** Basic principles of cell communications, Cell signalling and its types, *Signalling molecules* (neurotransmitters, hormones, Growth Factors, Cytokines Vitamin A and D derivatives).
- 7. Cancer and Apoptosis:** Characteristics of cancer cells; causes of transformation; protooncogenes and tumor suppressor genes and their role in transformation. Apoptosis, mechanism of apoptosis and its significance. Brief account of Carcinogens, Types and Causes of cancer.
- 8. Cell Senescence:** Definition and concept of cell senescence. Senescence in Ageing.

Molecular Biology - Theory

UNIT - 3

- 1. Introduction to molecular Biology–** Scope and importance of molecular biology. Discovery of DNA as genetic material – Griffith's transformation experiments. Hershey Chase Experiment on Bacteriophage infection.
- 2. Structure of nucleic acids:** Structure of DNA and RNA. Different forms of DNA – A form, B, form, D form and Z form. Types of RNA – rRNA, mRNA, tRNA. Gene concept and genomic organization: cistron, muton, recon, viral genes. General account on the following - Split genes - introns and exons, Pseudogenes, Overlapping genes and transposons
- 3. DNA replication:** Types, Semi conservative method, enzyme involved in replication. Replication in prokaryotes and Eukaryotes.

UNIT - 4

4. **Gene Expressions:** Central Dogma of molecular biology and central dogma reverse, one gene one enzyme hypothesis, One gene-one polypeptide hypothesis Characteristics of genetic code, Wobble hypothesis, Contributions of Hargobind Khorana.
5. **Transcription and Translation:** Mechanism of transcription and translation in prokaryotes and Eukaryotes, Post transcriptional modifications in Eukaryotes
6. **Gene regulations:** Prokaryotic (inducible& repressible systems) Operon concept -Lac operon and Tryptophan operon.

References:

1. Sharma, A. K. & Sharma, A. (1980): Chromosome Techniques; 3rd Edition, ebook ISBN: 9781483100845, Butterworth, 724 pages.
2. Verma, P.S. & Agarwal, V.K. (1999): Cytology. S., Chand & Co., 504 Pages.
3. Powar C.B. (1983) Cell Biology (Himalaya Pub. Company)
4. K.G. Purohit Fundamental concepts of Cell Biology
5. P.C. Vasishta and P.S.Gill Cell Biology and Molecular Biology
6. Rastogi S. C. (1998) Cell Biology. Tata Mc.Graw Hill Publishing Co., New Delhi.
7. M.J.D. White. Animal Cytology and Evolution
8. N Saba and W K Balwan, Cytogenetic Random Publications, New Delhi.
9. P K Gupta. Cell Biology and Genetics
10. De Robertis E.D.P. Cell and Molecular Biology.
11. Bruce Albert, Bray Dennis, Levis Julian, Raff Martin, Roberts Keith and Watson James (2008). Molecular Biology of the Cell, V Edition, Garland publishing Inc., New York and London.
12. De Robertis, E.D.P. and De Robertis, E.M.F. (2006).Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
13. Gupta, P. K (2002) Cell and Molecular Biology, (2ed), Rastogi Publications., Meerut.
14. James Darnell. (1998) Molecular Biology. Scientific American Books Inc
16. Ariel G Loewy Philip Sickevitz, John R. Menninger and Jonathan A.N. Gallants (1991) cell structure and function. Saunder's College Publication
17. James Darnell. (1998) Molecular Biology. Scientific American Books Inc.
18. Karp, G. 2018, Karp's Cell Biology. 8th Edition. John Wiley and Sons. Inc.

19. Koshy Thomas & Joe Prasad Mathew (Editors) (2011) Cell Biology and Molecular Biology.
20. Sarada K & Mathew Joseph (Editors) (1999) Cell Biology, Genetics and Biotechnology, Zoological Society of Kerala, Kottayam.

KUVEMPU UNIVERSITY

B.Sc. DEGREE – ZOOLOGY Semester scheme (SEP)

V semester syllabus

Title – Developmental Biology and Immunology (Paper-6)

Program Name	B.Sc	Semester	V
Compulsory Course	Developmental Biology and Immunology (Paper-6)		
Course Code	–	No. of Credits	03
Contact hours	4 hrs./ week	Duration of SEA/Exam	3hrs
Formative assessment marks	20	Summative assessment marks	80

Objective

- To study ontogenesis, the development of animals including parthenogenesis.
- To study embryonic adaptations, human reproduction and reproductive technology in man.
- To study the process which help to maintain the organism's internal environment, when challenged with foreign substances.
- To understand the advances in Immunology

Outcome: the learner will be able to

- Develop critical understanding how development of an embryo take place through the processes of cell division, cell differentiation and morphogenesis.
- Understand how developmental processes and gene functions within a particular tissue or organism
- Understand how variation in the gene expression and function of gene governs development
- To procure information on state- of- the art experimental procedures in embryology.
- Understand the antigen- antibody reaction.
- Describe the structure and function of immunoglobulins.

Developmental Biology – Theory

UNIT - 1

1. **Introduction to Developmental biology:** Scope and importance of Developmental biology, Historical concept; theories- Preformation, Epigenesis.
2. **Gametogenesis:** Process of spermatogenesis, spermiogenesis and Oogenesis, Structures of mature mammalian spermatozoon and ovum, structure of Graafian follicle, comparison between spermatogenesis and oogenesis, classification of eggs based on different criteria.
3. **Fertilization:** Types, mechanism and its significance, Monospermic and polyspermic fertilization, Parthenogenesis- introduction, natural and artificial parthenogenesis, arrhenotoky and thelytoky, obligatory and facultative, significance of parthenogenesis.
4. **Cleavage:** Types of cleavage - holoblastic and meroblastic; patterns of cleavage – radial, bilateral, and spiral with examples.

UNIT - 2

5. **Early development in frog:** Structure of egg, cleavage blastula fate map and gastrulation, Derivatives of germ layers. Early development in chick- structure of hens egg, blastula, gastrulation and origin of primitive streak development, structure and functions of extra- embryonic membranes.
6. **Regeneration:** Morphallaxis and Epimorphosis, Blastema and its significance, mechanisms of regeneration in Planaria, Earthworm and Limb regeneration in Amphibia.
7. **Early development of mammals:** up to implantation, Types and functions of placenta. Reproductive cycle; oestrous and menstrual cycles and their regulation.

UNIT - 3

8. **Reproductive Health:** Infertility in male and female: causes, diagnosis and management; Assisted Reproductive methodology: sex selection, sperm banks, frozen embryos, in vitro fertilization, AI, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive methods.

IMMUNOLOGY

1. **Introduction to Immunology:** Basic concept of immunology, types of immunity-Inherent (Active and passive) and acquired immunity (Active and passive).
2. **Components of immune system:** Lymphoid organs- Primary (Thymus, Bone marrow) and secondary lymphoid organs (lymph nodes, Peyer's patches, spleen). Cells of the immune system- Lymphocytes: T and B cells, Natural killer cells, memory cells, macrophages.

UNIT - 4

3. **Antigens and Antibodies:** Basic properties of antigens, B and T cell epitopes, haptens and adjuvants. Antibody Structure, types and function of antibodies, monoclonal antibodies, antigen antibody interactions.
4. **Types of Immune Response-** Humoral (Primary & secondary response) and cell mediated immune response Major histocompatibility complex (MHC); definition, structure and functions of class I and class II proteins.
5. **Applied immunology:** Vaccines and vaccination, hypersensitivity reaction. Autoimmunity–Definition and examples (SLE, RA & HT), and Immunodeficiency diseases – Definition and examples (CVID, SCID & HIV).

References

1. Gilbert, S. F. (2010). Developmental Biology, IX Edition, Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
2. Balinsky B. I. and Fabian B. C. (1981). An Introduction to Embryology, V Edition, International Thompson Computer Press.
3. Kalthoff (2008). Analysis of Biological Development, II Edition, McGraw-Hill Publishers.
4. Berril. N.J. and Karp: Developmental Biology. McGraw Hill, New York.
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6. Majumdar, N.N. 1990. Text Book of Vertebrate embryology. Tata McGraw – hill Publishing company Ltd. New Delhi.
7. McEwen, R.S., 1969. Vertebrate Embryology. Oxford and IBH Publishing Co., New Delhi.
8. Jain, P.C 1998, Elements of Developmental Biology. Vishal Publication, New Delhi.
9. Dubey 2006 Text book of Biotechnology S. Chand and Co., New Delhi.
10. Roitt, I. M. 2000 Essential Immunology, Blackwell Scientific Publishers.
11. Paul, W.E.M. 1989, Fundamental Immunology, Raven Press, New York.
12. Kubly. J. 1999, Immunology. W. H. Freeman and Co. New York.
13. Madhavi Latha. P, 2012. Text book of Immunology, S. Chand & Company.
14. M.S. Jayaraj An Introduction to embryology Veer Bala Rastogi Publication.

B.Sc zoology III year Practical syllabus
Semester-V
Discipline specific core course- (Paper-5&6)
CELL AND MOLECULAR BIOLOGY
&
DEVELOPMENAL BIOLOGY AND IMMUNOLOGY

Single practical/week	Duration- 4 hours	Total No. of practical- 15
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Cell Biology

Sl. No	Name of experiment	No. of practical
1	Study of mitosis and meiosis through permanent slides for different stages.	2
2	Squash preparation of onion root tips.	1
3	Calculation of mitotic index and metaphase index in onion root tips.	
4	Squash preparation of grasshopper testes	1
5	Study of salivary gland chromosome and polytene chromosome through photograph.	1
6	Measurement of size of microscopic objects using ocular and stage micrometres.	1
Molecular Biology		
7	Study and interpretation of electron micrographs/ photograph showing (a) DNA model and its types. (b) DNA replication (c) Transcription (d) Split genes (e) Different types of RNA.	1
8	Isolation of DNA from suitable samples.	1
Developmental Biology		
9	Early development of frog: Cleavage stages, blastula, gastrula, and neurula through permanent slides	1
10	Developmental stages of chick: primitive streak, 24, 36, 48, and 72 hours of incubation period embryo through permanent slides.	2
11	Study of development of chick embryo in -vivo by making a Window in the egg shell (window technique method)	1
12	Determination of gonad and Gonado somatic Index (GSI) in fishes.	1
Immunology		
13	Identification of cells of the immune system; basophil's, neutrophil's, eosinophils, monocytes and lymphocytes (through photo copy/chart/demonstration).	1
14	Identification of lymphoid organs - Spleen, Thymus, Lymph node, Bone marrow (through photo copy/chart).	1

****There shall be at least one excursion / field trip to visit biotechnology laboratory/various place of zoological importance.**

