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DEPARTMENT OF ZOOLOGY SEMESTER – II

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1	Bachelor of Sciences in Life Sciences (Zoology) DISCIPLINE SPECIFIC CORE (DSC) (1) Cell and Developmental Biology of Animals	02-04

DISCIPLINE SPECIFIC CORE COURSE -6 (Zoo-LS-DSC-06):– Cell and Developmental Biology of Animals

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lecture	Tutorial	Practical/ Practice		
Cell and Developmental Biology of Animals Zoo-LS-DSC-06	04	02	Nil	02	Class XII pass	NIL

Learning Objectives

The learning objectives of this course are as follows:

- The course will help the students to learn and develop an understanding of a cell as a basic unit of life.
- The course will enable them to understand the functions of cellular organelles and how a cell carries out and regulates cellular functions.
- The course will provide the students a complete comprehension about the essential vertebrate developmental biology
- The course will help the students to understand the conundrum of **the different levels of biological complexity** by tracing them back to events at the level of genes and genomes.

Learning Outcomes

By studying this course, students will be able to

- Explain the structure and functions of cell organelles involved in diverse cellular processes.
- Know the evolution of different concepts in developmental biology.
- Be able to understand the process of gamete formation from stem cell population to mature ova and sperm. The students will know the differences between Spermatogenesis and Oogenesis.
- Be able to comprehend the sequence of steps leading to the fusion of gametes and learn the contribution of sperm and ova to zygote formation
- Be able to understand how polyspermy is avoided in animal kingdom.
- Learn the mechanisms underpinning cellular diversity and specificity in animals.
- Learn the methods and tools related to developmental biology help to understand different processes of embryogenesis.

SYLLABUS OF Zoo-LS-DSC-06

UNIT - I Cell Division and Differentiation

(3 Weeks)

Types of animal cells and tissues, Mitosis, meiosis, Cell cycle regulation, Cell-cell communication, Stem cells, Differential gene expression.

UNIT- II: Scope and History of Developmental Biology

(1.5 weeks)

Historical perspective including contributions by eminent scientists and landmark experiments in the field of Developmental Biology, Concepts of Epigenesis, Preformation, Von Baer laws.

UNIT- III: Early Embryonic Development

(7.5 weeks)

Gametogenesis: Spermatogenesis and Oogenesis in mammals; Types of Eggs and Egg membranes Fertilization: External (amphibians) and Internal (mammals), Fast and slow blocks to Polyspermy; Types and Patterns of cleavage; Types of morphogenetic movements; Early development of frog and chick up to gastrulation. Fate maps

UNIT- IV: Late Embryonic Development

(2 Weeks)

Fate of Germ Layers; Formation of neural tube, Extra-embryonic membranes in birds

UNIT- IV: Post Embryonic Development

(1 Week)

Metamorphic events and its hormonal regulation in amphibians. Prokaryotic and Eukaryotic cells; Various models of plasma membrane structures, Transport across membranes: active and passive transport, facilitated transport; Cell-cell junctions, structures, and functions: Tight junctions, adherens junctions, gap junctions.

Practical Component –

1. Study of the various stages of meiosis through permanent slides.
2. Frog - Study of developmental stages - whole mounts and sections through permanent slides- cleavage stages, blastula, gastrula, neurula, tail bud stage, tadpole external and internal gill stages.
3. Chick – Study of Whole Mounts of developmental stages of Chick through permanent slides (HH stages)- 13 hrs, 18hrs, 24hrs, 28hrs, 33hrs, 36hrs, 48hrs, 72hrs and 96hrs.
4. Study of the different types of placenta along with its function- through permanent slides / photomicrograph.
5. Study of various developmental stages in the life Cycle of Drosophila using stock culture/ permanent slides/ photomicrograph.
6. Visit to IVF centre/ Poultry Farm.
7. Project report on IVF Centre/ Poultry farm/ Drosophila culture/ Zebra fish culture.

Essential/recommended readings

1. Cooper, G.M., Hausman, R.E. (2019) The Cell: A Molecular Approach. VIII Edition, ASM Press and Sinauer Associates.
2. Becker, Kleinsmith, and Hardin (2018) The World of the Cell, IX Edition, Benjamin Cummings Publishing, San Francisco.
3. Gilbert, SF (2014) Developmental Biology (10th edition). Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA. ISBN : 9780878939787
4. Balinsky, B.I. (2008). An introduction to Embryology, International Thomson Computer Press.
5. Freeman and Bracegirdle (1975, 2nd Edition) "An Atlas of Embryology", Published by Heinmann.

Suggestive readings

1. De Robertis, E.D.P. and De Robertis, E.M.F. (2009) The Cell and Molecular Biology, Lippincott Williams & Wilkins, Philadelphia.
2. Karp, G. (2015). Cell and Molecular Biology: Concepts and Experiments, VIII Edition, John Wiley & Sons Inc
3. Kalthoff Klaus (2001) Analysis of Biological Development, 2nd ed. Boston, MA: McGraw-Hill, ISBN : 0071180788
4. Wolpert, L & Tickle, C (2011) Principles of Developmental Biology (4th edition). Oxford University Press, ISBN: 9780198792918
5. Carlson, Bruce M (1996). Patten's Foundations of Embryology, McGraw Hill, Inc. ISBN : 9780070634275