



बिरसा मुंडा ट्रायबल युनिवर्सिटी Birsā Munda Tribal University

राजपिपला, जि० नर्मदा Rajpipla, Dist. Narmda

Established by Tribal Development Department, Govt. of Gujarat

School of Science

M.Sc. (Zoology) Programme

Subject Code& Name: MS02CZOO02 – Developmental Biology

Teaching and Evaluation Scheme:

Teaching Scheme				Examination Scheme			
Credits				Component Weightage			
				Internal		External	
L	T	P	Total	TH	PWE	TH	PWE
4	--	--	4	50%	--	50%	--

Programme Name	M.Sc. Zoology
Semester	II
Course Code	MS02CZOO02
Course Title	Developmental Biology
Course Content Type (Th./Pr.)	Theory
Course Credit	4
Sessions Per Week	4
Total Teaching/Lab. Hours	60 Hours

Learning Objectives

- Understand the principles and processes of animal development from gametogenesis to organogenesis.
- Explain the genetic and molecular mechanisms regulating embryonic development.
- Analyze cell communication, pattern formation and developmental signaling pathways.
- Evaluate the role of stem cells, reproductive technologies and developmental disorders in modern biology.

Prerequisites (if any)

- Student should have the basic knowledge of Basic Cell Biology, Genetics, Animal Diversity and Evolution and Fundamentals of Embryology.

Learning Outcomes

After completion of the course, students will be able to:

- Explain developmental processes from fertilization to organogenesis.
- Interpret the genetic and molecular basis of embryonic pattern formation.
- Analyze developmental signaling pathways and cell interactions.
- Evaluate stem cell technologies, reproductive biology, and developmental disorders.
- Apply developmental biology concepts in research, biotechnology and health sciences.





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Detailed Contents		
UNIT	TOPIC/SUB-TOPIC	TEACHING HOURS
I	Foundations of Developmental Biology - History, scope and significance of developmental biology Gametogenesis: - Spermatogenesis and Oogenesis - Structure and functional significance of sperm and ovum - Types of eggs and egg organization Fertilization: - Mechanisms, types and biological significance Early development - Cleavage patterns and developmental significance - Morula and blastula formation - Fate maps and cell lineage - Gastrulation and germ layer formation - Neurulation and notochord formation - Organogenesis and development of major organ systems - Stem cells: types, properties and applications	15
II	Developmental Genetics and Pattern Formation - Early development of Drosophila - Maternal effect genes and body axis specification - Anterior-posterior and dorsal-ventral patterning - Segmentation genes: Gap genes, Pair-rule genes and Segment polarity genes - Homeotic (Hox) genes and body patterning - Cell adhesion and cell migration - Cell signaling in development: FGF signaling, Hedgehog signaling, Wnt signaling, TGF-β/SMAD signaling, JAK-STAT pathway and Notch signaling. - Extracellular matrix in development - Evo-Devo concepts and developmental evolution	15



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Text Book(s)

1. Developmental Biology, by Scott F. Gilbert and Michael J. F. Barresi, Sinauer Associates/Oxford University Press.
2. Principles of Development, by Lewis Wolpert, Cheryll Tickle and Alfonso Martinez Arias, Oxford University Press.
3. Developmental Biology, by T. Subramoniam, Narosa Publishing House.
4. An Introduction to Embryology, by B. I. Balinsky, Saunders College Publishing.
5. Chordate Embryology, by P. S. Verma and V. K. Agarwal, S. Chand & Company Ltd.
6. Developmental Biology, by R. M. Twyman, Garland Science.
7. Embryology, by N. Arumugam, Saras Publication.

Reference Books

1. Developmental Biology, by Scott F. Gilbert, Sinauer Associates.
2. Essential Developmental Biology, by Jonathan M. W. Slack, Wiley-Blackwell.
3. Molecular Biology of the Cell, by Bruce Alberts, Garland Science.
4. From Egg to Embryo, by John Gerhart and Marc Kirschner, Blackwell Scientific Publications.
5. Life Unfolding: How the Human Body Creates Itself, by Jamie A. Davies, Oxford University Press.
6. Principles of Gene Manipulation and Genomics, by Sandy B. Primrose and Richard Twyman, Wiley-Blackwell.
7. Evolutionary Developmental Biology, by Brian K. Hall, Springer.
8. Stem Cells: Scientific Facts and Fiction, by Christine Mummery et al., Academic Press.

Web Resources

1. FlyBase – <https://flybase.org>
2. The Interactive Fly – <https://www.sdbonline.org/sites/fly>
3. Developmental Biology Interactive Resource – <https://devbio.com>
4. HHMI BioInteractive – <https://www.biointeractive.org>
5. Learn Genetics – <https://learn.genetics.utah.edu>
6. NCBI Bookshelf – <https://www.ncbi.nlm.nih.gov/books>
7. e-PG Pathshala – <https://epgp.inflibnet.ac.in>
8. NPTEL – <https://nptel.ac.in>
9. OpenStax Biology – <https://openstax.org/details/books/biology-2e>
10. Stem Cell Information (NIH) – <https://stemcells.nih.gov>

Required Software(s) (if any)

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Practical(s) (if any)

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L:: Lecture, **T::** Tutorial , **P::**Practical

PWE::Practical Work Examination

(PWE includes Laboratory practical work, project work, viva simulation exercise work etc.)

