



SECOND SEMESTER 2022-2023
COURSE HANDOUT (PART-II)

Date: 09/01/2024

In addition to part I (General Handout for all courses appended to the Time Table) this portion gives further specific details regarding the course.

Course No. : BIO F341
Course Title : Developmental Biology
Instructor-in-charge : VIVEK SHARMA
Other Instructors : Kumar Pranav Narayan, Vivek Sharma

1. Scope and Objective of the Course:

Developmental biology is an academic discipline that emphasizes the process by which organisms develop. This course deals with the principles, processes and research involved in how a single-celled zygote is transformed into an entire multi-cellular organism. Salient features in the development stages of model organisms (e.g. frog, chick, fruit fly, and mouse) would be taken up, to exemplify the general principles of development such as patterning and axis formation; morphogenesis; germ cells and sex; cell differentiation and stem cells; growth, ageing and regeneration. In addition, the course also has integration of advanced Molecular biology, Cell-biology and Genetics.

2. Text Book (TB): *Principles of Development* by Lewis Wolpert, Oxford University Press (4th Ed), 2011.

Reference Books (RB1): *Developmental Biology* by Scott F. Gilbert, Sinauer Associates Inc. Publishers (9th Ed), 2006.

Reference Books (RB2): *Essential Developmental Biology (2nd edition)* by Slack, J.M.W. Malden, MA (USA): Blackwell Publisher, 2006.

Reference Books (RB3): *The Coiled Spring: How Life Begins* by Ethan Bier (2000) Cold Spring Harbor Laboratory Press. ISBN 0-87969-563

3. Course Plan:

Lec . No	Learning Objective	Topics to be covered	Chapter in the Text Book
1-3	History and basic concepts	Origin of developmental biology, scope and problems.	Ch.1 (TB) Ch. 2 (RB2)
4-6	Models of life cycle	Vertebrate and invertebrate life cycle, outlines of development in different organisms (Xenopus, Chick, Mouse and Drosophila).	Ch. 3 and 2 (TB) Ch. 7 and 8 (RB1)
7-9	Fertilization: beginning of a new organism	Germ cells, recognition of opposite gametes, gamete fusion and prevention of polyspermy, fusion of gametes and activation of egg metabolism.	Ch. 9 (TB) and 7 (RB)
10-12	Germ cells, Fertilization and Sex	Germ cells development; events at fertilization; determination of sexual	Ch. 9 (TB), Ch. 4 (RB1)

		phenotype	
13-15	Tools and techniques in Developmental biology	Exploring differential gene expression, RNA localization, whole-mount in situ hybridization, Importance of transgenesis in identifying gene functions and developmental anomalies.	Ch. 4 (RB) Ch. 2 and 3 (TB)
16-20	Illustrative examples of invertebrate development	Development of <i>Drosophila melanogaster</i>	Ch. 2 (TB), Ch. 3 (RB1)
21-23	Patterning the vertebrate body plan : axes and germ layers	Setting up the body axes, origin and specification of germ layers in <i>Xenopus</i> , Chick and <i>Drosophila melanogaster</i> .	Ch. 4, 3 and 2 (TB)
24-26	Patterning Early nervous system and somites	Organizer and neural induction, Neural crest cells, somite formation and A-P patterning, HOX genes	Chapter 5 (TB)
27-29	Morphogenesis: changes in early embryo	Gastrulation in <i>Xenopus</i> and Mouse. Regulation of cell migration	Ch. 8 (TB) Ch. 6 (RB)
30-32	Cell Differentiation and Stem Cells	Cell-cell communication in development, Models of differentiation; plasticity of gene expression; stem cells – types and uses	Ch. 10 (TB), Ch. 13 (RB2)
33-35	Development of nervous system	Specification of cell identity in nervous system, neuronal migration, synapse formation and refinement.	Ch. 12 (TB) and 12 (RB)
36-38	Organogenesis: development of organs	Development of Limbs, heart, kidney, eyes and bones.	Ch. 15 (RB) & 11(TB)
39-40	Growth, ageing, regeneration and applications of developmental biology	Cell proliferation, cell enlargement, Determination of organ size, Aging and senescence, Amphibian limb regeneration	Ch.13 (TB) and Ch.14 and class notes
	Introduction to Plant Development	Plant life cycles, fertilization and embryonic developments.	Ch. -7 (TB) Self-Study

4. Evaluation Scheme:

Components	Duration	Weightage (%)	Date	Nature
Mid Semester	90 min	25	13/03 - 2.00 - 3.30PM	CB
Surprise tests in Tutorials (5 tests)		20		CB
Two Assignments 1 before and 1 after Mid Sem- In-class Assignment given during Tutorials		20		OB
Comprehensive Examination	180 mins	35	11/05 AN	CB

OB- Open Book, CB- Closed Book

Chamber consultation hour:

To be announced in the class.

Notices:

All notices/ announcements regarding this course shall be displayed in Course Management System (CMS).

Grading policy:

Award of grades will be guided in general by the histogram of marks. Decision on border line cases will be taken based on individual's sincerity, student's regularity in attending classes, and instructor's assessment of the student.

Make-up policy:

Make-ups will be granted for mid semester test or comprehensive test only if candidate is sick and hospitalized. No make-up will be granted for quizzes under any circumstances.

Academic Honesty and Integrity Policy:

Academic honesty and integrity are to be maintained by all the students throughout the semester and no type of academic dishonesty is acceptable.

Instructor-in-charge
Vivek Sharma
BIO F341