Institute of Zoology
Faculty of Life Sciences
University of the Punjab, Lahore

Course Outline

Programme	BS Zoology	**Course Code**	**ZOOL-315**	**Credit Hours**	1
Course Title	**Lab. Developmental Biology**				

Course Introduction

Developmental biology practically encompasses experimental examination of the development of multicellular organisms' growth, differentiation and remodeling to give rise to the adult form, using molecular, cellular, tissue, organ and whole organism methodology. Practical course will demonstrate the theoretical learnings in experimental models. It will be comprised of the gamete's anatomy to various stages of ontogenetic development. In each laboratory exercise, students examine gametes and developing embryos of vertebrates, and also perform several experiments to probe the developmental process best illustrated by the particular vertebrate models (Amphibian, Avian, Mammalian).

Learning Outcomes

On the completion of the course, the students will:

1. Familiarize with the transmission of traits from the parents in their gametes, the formation of zygote and its development
2. Be able to identify the various types of germ cells formed during gametogenesis before the formation of Ovum and Sperm.
3. Acquire the ability to know the morphology of normal vs abnormal sperm along with live and dead sperm.
4. Get knowledge about induced spawning and fertilization under laboratory conditions.
5. Know about the developmental stages that lead to the establishment of the body plan of the vertebrates at the cellular and genetic level.

Course Content		**Assignments/Readings**
Week 1	*Introduction Laboratory manuals of Developmental Biology*	
	Practical Exercise and Laboratory SOPs • Following instructors • Handling chemicals & apparatus • Having due regard for safely • Making accurate observations • Recording results in an appropriate form	
Week 2	Study of the structure of gametes in some representative cases (Mammals, birds, fishes)	
	Study of permanent slides of Mammalian testis cross section	
Week 3	Study of permanent slides of Mammalian ovary cross section	
Week 4	Microscopic studies of prepared slides of adult fish testis at various magnifications	
Week 5	Microscopic studies of prepared slides of adult fish ovaries at various magnifications	
Week 6	Semen analysis: Motility and Sperm count (demonstration)	

Week 7	Mouse cauda epididymal fluid for sperm count and morphology by Improved Neubauer Hemocytometer	
Week 8	Results calculations, photomicrography	
Week 9	Sperm vitality study using suitable stains continue….	
Week 10	Sperm vitality study using suitable stains	
Week 11	Study of Egg Structure (Avian Egg) before incubation	
Week 12	Study of Egg Structure (Avian Egg) after incubation	
Week 13	Visual analysis of extraembryonic structures of developing chick after cracking the incubated egg	
Week 14	Study of fertilization, early development of frog/fish through induced spawning under laboratory conditions.	
Week 15	Study of cleavage and subsequent development from prepared slides and/or models in various animals i.e., frog, mammals and chick etc.	
Week 16	Microscopic analysis of prepared slides of T.S. Blastula, T.S. Gastrula	

Textbooks and Reading Material

1. Keller, L.R. and Evans, J.H. and Keller, T.C.S. (1999). Experimental Developmental Biology: A Laboratory Manual. Academic Press, ISBN 9780124039704, ICCN 99165035. https://books.google.com.pk/books?id=XIpR4QTUMVEC
2. Gilbert, S. F. 2013. Developmental Biology, Sinauer Associates, Sunderland, MA.
3. Klaus, K. 2001. Biological Development. 2nd Ed., McGraw-Hill.
4. Scott F. Gilbert and Michael J. F. Barres. 2016. Developmental Biology. Sinauer Associates, Sunderland, MA.
5. Jamie. A. Davies. 2014. Life Unfolding: How the Human Body Creates Itself. Oxford University Press, USA
6. Balinsky, B. I. 1985. An Introduction to Embryology, Saunders.

Teaching Learning Strategies

Laboratory tours, Lab. Demonstrations, group work, Short videos/films for handling scientific equipment

Assignments: Types and Number with Calendar

Material preparations, class quizzes, presentation, class participation/attendance

Assessment

Sr. No.	Elements	Weightage	Details
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.