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

Course Outline

Programme	BS Zoology	**Course Code**	**ZOOL-403**	**Credit Hours**	1
Course Title	**Lab. Analysis of Development**				

Course Introduction

Developmental analysis introduces the organogenetic and histological analysis of development. The final part combines classical and modern types of analysis towards the investigation of long-standing problems in development. Key experiments are described throughout to reinforce the relationship between scientific models and experimental data. Practical course will demonstrate the theoretical learnings in experimental models. It will be comprised of the permanent whole mounts of chick embryos to study various phases of development. In each laboratory exercise, students examine developing embryos of vertebrates, and also perform several experiments to probe the developmental process and experimental manipulation of embryos, best illustrated by the particular vertebrate models (Amphibian, Avian, Mammalian).

Learning Outcomes

On the completion of the course, the students will:

1. Familiarize with processes like histogenesis and organogenesis.
2. Be able to identify the various stages of development in different models *in vivo*.
3. Acquire the ability to know the morphological defects or normal vs abnormal embryo.
4. Get knowledge about experimental manipulation of embryos for biomedical applications.
5. Be well prepared for histological sectioning and staining.

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 prepared permanent slides of 24h chick embryo Continue…	
	• 36hrs and 56hrs	
Week 3	• 72hrs. and 96 hrs.	
Week 4	**Preparation and study of permanent whole mounts of chick embryos** • Procedural demonstration • Materials preparation	
Week 5	• Extraction of chick embryos from incubated eggs and fixation. Continue….	
Week 6	• Processing of fixed embryo and mounting to make a permanent slide.	
Week 7	**Cryopreservation of gametes & embryos** • Procedural instructions, continue….	

Week 8	• Performance • Preservation of mice sperms • Preservation of embryos (avian or mammalian)	
Week 9	Experimental manipulation of chick model (CAM assay) in developmental therapies. • Procedural instructions, • Prerequisite (Instruments & materials) continue….	
Week 10	• Experimental manipulation • Results compilation	
Week 11	Histology of male and female reproductive organs (Testis, ovaries…) • Procedural instructions, • Chemical preparations	
Week 12	• Organ/Tissue processing	
Week 13	• Block making • Sections cutting and slide making	
Week 14	Staining of prepared slides	
Week 15	Hospital survey / Field, to report Congenital disorders / Birth defects / Life Cycles in humans and animals respectively. Continue…..	
Week 16	Hospital survey / Field, to report Congenital disorders / Birth defects / Life Cycles, in humans and animals respectively	

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.
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.