SKILL ENHANCEMENT ELECTIVE (SEC) COURSES

Drosophila and Zebrafish model organism in Biological Studies

(CREDITS: PRACTICAL-2)

Course Title & Code	**Credits**	**Credit distribution of the course**			**Eligibility criteria**	**Pre-requisite of the course (if any)**
		Lecture	**Tutorial**	**Practical / Practice**		
Drosophila and Zebrafish model organism in Biological studies	**2**			**2**	12th pass with Biology	NIL

LEARNING OBJECTIVES:

The course will help students to understand the skills required to work with model organisms. To learn the use of model organisms such as Drosophila and Zebrafish in understanding the Biological concepts and processes and its applications in biomedical and Pharma research and industry. The specific objectives of the course are:

- To learn basic requirements for setting up Drosophila and Zebrafish lab.
- To learn to handle, breed and maintain Drosophila and Zebrafish model organism.
- To learn more about biological processes, genetics, drug discovery, toxicology and human diseases using these model organisms.
- To learn to design experiments using these model organisms.

COURSE OUTCOMES

Upon completion of this course students will be skill trained in Drosophila and Zebrafish model system and its applications in Bioscience education, research and Pharmacology and Biotechnology industry.

- Will be able to set up Drosophila and zebrafish lab.
- Will be skilled trained in maintenance of Drosophila stocks and propagation and zebrafish husbandary.

- Have knowledge of designing experiments in genetics, toxicology, behavioural and human disease modelling using these model systems.
- Analyze and interpret the data collected in the laboratory experiments.

Practical (2 credits) **Total 15 weeks**

Total hours: 60

Unit I: Introduction to Drosophila model system (4 weeks)

- Introduction to different model organisms, advantage and disadvantage of using various model organisms, animal ethics.
- Study of life cycle and developmental stages of Drosophila melanogaster
- Male female differentiation
- Study of various mutants
- TLC of eye pigments
- Study of polytene chromosome in Drosophila

Unit II: Mendelian and non Mendelian Genetics (3 weeks)

Drosophila as a model organism to study different principles of genetics

- Collection of virgin fly
- Setting up of crosses in Drosophila
- Scoring of F1 and F2 population, chi-square test

Unit III: Introduction to Zebrafish model system (3 weeks)

Advantages of zebrafish model organism. Basic requirement to set up zebrafish lab. Zebrafish husbandry. Study development stages and developmental phenotypic end points.

- Handling zebrafish, identify male and female zebrafish, and breeding setup.
- To prepare Zebrafish feed and culture Pramecium and Artemia.
- Egg collection and study of developmental stages starting from the zygote - cleavage - blastula - gastrula - segmentation, pharyngula, hatching and early larval development.

Unit IV: Zebrafish as a research and education model (5 weeks)

Importance of zebrafish as a versatile research and education model. Genetic and morphological homology with humans.

- Query based experimental design using zebrafish model system.
- Perform Toxicological assays.
- Perform Behavioral assays.
- Create Human disease models in zebrafish
- Use of transgenic reporter lines.

Essential Reading

- Lakhotia S. C. and Ranganath H. A. (2021) Experiments with Drosophila for Biology Courses, Indian Academy of Sciences, Bengaluru, India, ISBN: 978-81-950664-2-1
- Sunita Joshi, S. and Dhamija, N. (2016) Rediscovering Genetics, IK International, 1st edition, ISBN: 9789384588984
- Westerfield, M. (2000). The Zebrafish book. A guide for laboratory use of Zebrafish (Danio rerio). 4th ed., Univ. of Oregon Press, Eugene. USA
- Mudgal, P., Bhasin, C., Joshi A., Gupta, R. (2021) Zebrafish, a versatile learning tool. Resonance: Journal of science education, 26(11), 1499-1521

Suggested Readings

- Kimmel, C.B., Ballard, W.W., Kimmel, S.R., Ullmann, B. and Schilling, T.F. (1995), Stages of embryonic development of the zebrafish. Dev. Dyn., 203: 253-310. https://doi.org/10.1002/aja.1002030302
- zfin.org