

Course number: **BSEXXX**

(The course will be open elective for PG students)

Course name: **Model Organisms in Biology**

Prerequisite: **None**

Per Week Lectures and credits (L-T-P-C :Lecture-Tutorial-Practical-Credits): **[3-0-0-9]**

Proposing Department/IDP: **Biological Sciences and Bioengineering**

Proposing Instructor(s): **Robert Sonowal**

Course Objective:

Model organisms have played a pivotal role in understanding the basic principles of biology. Due to evolutionary conservation of biological processes, the discoveries made in these organisms are often extended to different species, including humans. They have laid the foundation for many biological principles and translational research. The course will primarily discuss the original research articles related to landmark discoveries in different areas of biology. The significance of using different model organisms, including but not limited to *Drosophila melanogaster* (fly), yeast, bacteria, *Caenorhabditis elegans* (worms), zebrafish, mice etc will be discussed. The present day implications of these discoveries in both basic science and translational advancement will be highlighted.

Learning outcome: The course content is intended to teach students the foundational stories of different areas of biology. It will highlight how basic biology puzzles were solved using model systems. As the course discussions will primarily consist of research articles, it is expected that it will enable students to i) select an exciting biological problem for their research, ii) select the right model organisms, tools, and techniques to carry out the research and iii) communicate the significance of their discovery to both scientific and non-scientific community.

Contents:

Broad topic	Specific topics	# Lectures
Introduction	History of model organisms; different types of model organisms; advantages and limitations of using model organisms.	2
Genetics and Genetic engineering	Deciphering the chromosomal theory of inheritance and genetic linkage in <i>Drosophila</i> ; Discovery of the link between genes and biochemical processes in fungus; discovery of gene cloning and CRISPR in bacteria and their applications; history of the development of transgenic mouse models and their implications.	7
Molecular biology	Discovery of messenger RNA; transposable elements in maize; split genes; identification of gene expression regulation by RNAs, RNAi in <i>C. elegans</i> ; Discovery and applications of restriction enzymes, reverse transcriptase.	8

Cell biology	Discovery of cell cycle and its regulators, checkpoints; telomeres; Discovery of programmed cell death in <i>C. elegans</i> , autophagy in yeast.	6
Development and Aging	Discovery of the genetic control of embryonic development in <i>Drosophila</i> , homeotic genes, morphogens; discovery of cellular reprogramming in <i>Xenopus laevis</i> to Yamanaka's iPSC; sex determination; Understanding the genetic control of Aging.	9
Microbiology and Immunology	Discovery of the key cells related to adaptive immunity; specificity of the cell mediated immune defence; discoveries related to the activation of innate immunity in flies and mice; Microbiota in health and diseases;	8
Evolution	Darwin's Theory of Evolution; Spontaneous mutation discovery in microbes; Model organisms as laboratory evolution tools.	2

Books & References: (References will be provided for specific topics during the class)

Dated: 21/08/2025

Proposer: Robert Sonowal

DPGC Convener: Dr. Suresh Kumar

The course is approved / not approved.

Chairman, SUGC/SPGC

Dated: _____