DISCIPLINE SPECIFIC CORE COURSE -19

Animal Models and Experimentation

Zoo-DSC-19

CREDIT DISTRIBUTION, ELIGIBILITY AND PRE-REQUISITES OF THE COURSE

Course title & Code	Credits	Credit distribution of the course			Eligibility criteria	Pre-requisite of the course (if any)
		Lectures	Tutorial	Practical /Practice		
Animal Models and Experimentation **Zoo-DSC-19**	04	02	Nil	02	Should have appeared in Semester VI	-

Learning Objectives

The learning objectives of this course are as follows:

- To acquire an in-depth knowledge of the importance and applications of animal models in scientific research.
- To understand theoretical concepts, ethical principles and legal frameworks governing animal experimentation to assist in comprehending the quick response to pandemics in the form of vaccines.
- To gain theoretical and practical knowledge of experimental techniques using animal models.
- To develop skills to design experiments involving animal models for studies related to diseases, drug testing, and toxicity assessments/ Biomedical research.
- To explore alternatives to animal experimentation and their role in modern research.

Learning Outcomes

By studying this course, students will be able to:

- Have a better understanding of the concepts of the selection criteria, types, and applications of animal models in research.
- Demonstrate competence in handling, restraining, and administering treatments to animals in a humane and ethical manner.
- Analyze and interpret data generated from animal experiments.
- Critically evaluate the ethical considerations in using animals for research and propose alternatives when feasible.

- Design small-scale experiments using appropriate animal models to investigate scientific hypotheses.

SYLLABUS OF DSC-19

THEORY **(30 hrs)**

UNIT 1: Introduction to Animal Models 6 hrs

Definition and Importance, Historical perspective and significance in biomedical research. Types of Animal Models: Inbred, outbred, transgenic, and knockout models. Criteria for Selecting an Animal Model: Relevance to human biology. Ethical considerations.

UNIT 2: Experimental Design and Techniques 10 hrs

Design of Experiments (DoE): Importance of hypothesis-driven research. Sample size estimation and randomization. Tissue collection and processing. Gene Editing in Animal Models: CRISPR-Cas9 and its applications. Creating knockout and knock-in models.

UNIT 3: Application of Animal Models 8 hrs

Disease Models: Oncology - Induced tumour models. Neurological disorders: Alzheimer's and Parkinson's models. Metabolic disorders: Diabetes and obesity models. Infectious diseases: Models for tuberculosis, malaria, and viral infections. Drug Discovery and Toxicology: Role of animal models in preclinical trials. Acute and chronic toxicity studies. Use of animals in stem cell research.

UNIT 4: Ethical and Regulatory Aspects of Animal Experimentation 6 hrs

Ethics in Animal Experimentation: Importance of humane treatment of animals. Principles of the 3Rs: Replacement, Reduction, and Refinement. Regulatory Frameworks: CPCSEA (India) and International Guidelines. Role of Institutional Animal Ethics Committees (IAECs). Good Laboratory Practices (GLP) for animal studies. Alternatives to Animal Testing: *In-vitro* models, organoids, and computational models. Advantages and limitations of alternatives.

PRACTICALS **(60 hrs)**

(Laboratory periods: 15 classes of 4 hours each)

1. Selection and Handling of Animal Models: Basic handling and restraint techniques. for mice, rats, and zebrafish. Observation of behavior and physiological parameters.
2. Techniques in Experimental Research: Induction of disease models, Behavioral testing: Maze and anxiety tests. Sample collection: Blood and tissue collection techniques.
3. Histology and Imaging: Preparation of tissues for histological studies. Basic imaging techniques (e.g., fluorescent microscopy).
4. Ethical Simulations: Case studies on ethical dilemmas. Mock IAEC proposal writing and review.
5. Presentation of Findings - Preparation of Scientific Posters - Oral Presentation Skills for sharing Research Outcomes

6. Project on any topic/ Project report on visit to any research institute/laboratory to for understanding some ongoing research studies using any animal model.

Essential/Recommended readings

1. Guide for the Care and Use of Laboratory Animals – National Research Council 8th Edition, 2011 9 Publisher: National Academies Press; ISBN: 978-0-309-15400-0.
2. Laboratory Animal Medicine 2nd Edition, 2002 Publisher: Academic Press; ISBN: 978-0-12-263951-7– James G. Fox, Bennett J. Cohen, Franklin M. Loew.
3. Principles of Laboratory Animal Science, Revised Edition, 2001, Publisher: Elsevier ISBN: 978-0-444-50612-2– L.F.M. van Zutphen, V. Baumans, A.C. Beynen.
4. Handbook of Laboratory Animal Management and Welfare, 4th Edition, 2013, Publisher: Wiley-Blackwell; ISBN: 978-0-470-65567-1– Sarah Wolfensohn, Maggie Lloyd.
5. Ethics of Animal Research: Exploring the Controversy, 2012, Publisher: MIT Press; ISBN: 978-0-262-01734-6– Jeremy R. Garrett.

Suggested Readings

1. Experimental Design and Data Analysis for Biologists 2002, Publisher: Cambridge University Press; ISBN: 978-0-521-00976-8– Gerry P. Quinn, Michael J. Keough.
2. Animal Models in Biomedical Research, 2010, Publisher: Humana Press; ISBN: 978-1-60761-670-2 – Timothy G. Geary, Aaron Maule (Editors).
3. Alternatives to Animal Testing: New Ways in the Biomedical Sciences, 2008, Publisher: Wiley-VCH; ISBN: 978-3-527-32090-2 – Christoph A. Reinhardt. Laboratory Manual for Animal Research, 1997, Publisher: Oxford University Press; ISBN: 978-0-19-511908-4– Tom L. Beauchamp *(A practical resource for students learning techniques in animal research and experimentation).*
4. CPCSEA Guidelines for Laboratory Animal Facility, 2003 – Committee for the Purpose of Control and Supervision of Experiments on Animals (India).
5. Zebrafish: Methods and Protocols. 2012, Publisher: Humana Press; ISBN: 978-1-61779-597-8 – Allan V. Kalueff, Adam C. Gould.
6. Behavioral Research and Animal Welfare, 2019 Publisher: Springer; ISBN: 978-3-030-13966-1 – Edward Narayan.

NOTE: Examination scheme and mode shall be as prescribed by the Examination Branch, University of Delhi, from time to time.