

Model Systems for Medical Research (MMD-998)

Credit Hours 3 (3-0)

Course Description

This course aims to teach the concepts of pre-clinical and clinical common models. There are many types of models used in *biomedical research*, e.g., *in vitro* assay, computer simulation, mathematical models, and *animal models*.

Educational Objective

- Upon completion of this course, learners will be able to select the suitable model for their biomedical research and evaluate data model designs.

Course Contents

1. Introduction to Model Systems/Experimental Models
 - Significance in Scientific Research
 - Classification of Model Systems
 - Selection of Suitable Mode for Biomedical Research
2. Dictyostelium discoideum as a Model System
3. Microbes of Medical Significance
 - Communal Behavior of Bacteria
 - Conceptual Overview of Quorum Sensing
 - Quorum Signals and Circuits
 - Crosstalk or Interkingdom Signaling Via Quorum Signals
 - How Quorum Signals Modulate the Immune Response
 - Influence of Mammalian Hormones on Bacterial Virulence
 - Exploiting QS to Treat Disease
 - Biofilms as a Cause of Chronic Infection
 - Biofilm Development
 - Mechanisms of Biofilm-Related Antibiotic Tolerance and Interventions
4. Synthetic Biology in Biomedical Research
5. Caenorhabditis elegans as a Model System
 - Development and Maintenance of C. elegans
 - Reverse Genetics and Gene Inactivation
 - Neurobiology of C. elegans
 - Mutagenesis and Mutant Screening
6. Drosophila as a Model Organism
 - Introduction (Origin and Studies)

- *Drosophila* as a Cancer Model
 - *Drosophila* Models to Investigate Insulin Action and Mechanisms Underlying Human Diabetes Mellitus
7. Marine Organisms as Model Systems
 - Beach to Bench to Bedside: Marine Invertebrate Biochemical Adaptations and Their Applications in Biotechnology and Biomedicine
 - The Use of Zebra fish in Medical Genomics
 - Zebrafish models of olfactory and neuromuscular dysfunction of degeneration
 - The Crown-of-Thorns Starfish: From Coral Reef Plague to Model System
 8. Large Animal Models
 - Model Organisms
 - Animal models of Cardiac Disease
 - Animal Models of Diabetes
 - Animal models of IBD
 - Models of Chronic Kidney Disease
 9. Genetically modified animal models
 10. The Ethical Basis for Animal Use in Research

Recommended Books

1. Muñoz-Braceras, S., Mesquita, A., & Escalante, R. (2013). Dictyostelids. Evolution, Genomics and Cell Biology.
2. Tang, Y. W. (2014). *Molecular medical microbiology*. Academic press.
3. Singh, S. (Ed.). (2018). *Synthetic Biology: Omics Tools and Their Applications*. Springer.
4. Michaelson, L. (2000). *C. elegans: a practical approach*. *Heredity*, 85(1), 99-99.
5. Yamaguchi, M. (Ed.). (2018). *Drosophila Models for Human Diseases* (Vol. 1076). Springer.
6. Kloc, M., & Kubiak, J. Z. (Eds.). (2018). *Marine Organisms as Model Systems in Biology and Medicine* (Vol. 65). Springer.
7. Conn, P. M. (Ed.). (2017). *Animal models for the study of human disease*. Academic Press.
8. Conn, P. M. Models for Biomedical research.