Title of the Course: AQUATIC VIROLOGY [T]

Course Code: MIC-605
Number of Credits: 2
Contact hours: 30
Effective from Academic Year: 2022-2023

Prerequisites	Students should have an understanding of basic concepts in microbiology and molecular biology.	
Objective:	Develops the concept of viruses as key determinants of aquatic ecology. It introduces the traditional, modern and emerging techniques used in the study of aquatic viruses.	
Content:		
1.	**Aquatic viruses and their significance**	**15**
	Introduction to viruses, their structure and classification	2
	Abundance and distribution of virioplankton in various aquatic environments	2
	Diversity of aquatic viruses in terms of morphology, life cycle and host range; giant viruses and virophages	3
	Viruses as agents of microbial mortality; effects of viral infection on microbial community composition; viruses as an active component of aquatic microbial communities	2
	The role of viruses in biogeochemical cycles and the aquatic food web; Aquatic viruses and climate change	2
	Horizontal gene transfer and evolutionary contributions of viruses.	2
	Aquatic viruses pathogenic to humans and animals of economic importance	2
2.	**Cultivation, enumeration and molecular studies of aquatic viruses**	**15**
	Methods for isolation of aquatic viruses – concentration and purification of viruses from water, cultivation and assay of microbial viruses in liquid and solid media	**4**
	Methods for enumeration and ultrastructural observation of viruses – epifluorescence microscopy, transmission electron microscopy, flow cytometry	**3**
	Molecular techniques for detection of aquatic viruses – PCR-amplification of marker genes such as *g20, psbA, polB*; whole genome sequencing of cultured isolates; metagenomics of viral communities from diverse aquatic ecosystems	**4**
	Significance of culture-based and culture-independent methods for studying aquatic viruses	**1**
	Novel approaches in aquatic virus research and detection: single virus genomics, viral cross-linking and solid-phase purification, optical trapping, integrated approaches	**3**
Pedagogy:	Lectures/tutorials/assignments	

References/ Readings	Abedon, S. (Ed.), *Bacteriophage Ecology: Population Growth, Evolution, and Impact of Bacterial Viruses* - Advances in Molecular and Cellular Microbiology, Cambridge: Cambridge University Press (2010). Adriaenssens, E. M., & Cowan, D. A. Using signature genes as tools to assess environmental viral ecology and diversity. *Applied and Environmental Microbiology*, 80(15), 4470-4480 (2014). Clokie, M.R.J., and Andrew M.K. *Bateriophages Methods and Protocols, Volume 1: Isolation, Characterization, and Interactions*. Springer International Publishing (2009). Hyman, P. & Abedon, S.T., *Viruses of Microorganisms*. Caister Academic Press (2018). Malmstrom, C., *Environmental Virology and Virus Ecology*. Elsevier Academic Press (2018). Moon, K., & Cho, J. C. Metaviromics coupled with phage-host identification to open the viral 'black box'. *Journal of Microbiology*, 59(3), 311-323 (2021). Weitz, J. S., & Wilhelm, S. W. Ocean viruses and their effects on microbial communities and biogeochemical cycles. *F1000 Biology Reports*, 4:17 (2012). Wilhelm, S.W., Weinbauer, M.G., & Suttle, C.A., *Manual of Aquatic Viral Ecology*. American Society of Limnology and Oceanography, USA (2010). Wommack, K. E., & Colwell, R. R. Virioplankton: viruses in aquatic ecosystems. *Microbiology and Molecular Biology Reviews*, 64(1), 69-114 (2000). Zhang, Q. Y., Ke, F., Gui, L., & Zhao, Z. Recent insights into aquatic viruses: Emerging and reemerging pathogens, molecular features, biological effects, and novel investigative approaches. *Water Biology and Security*, 100062 (2022). Zhang, R., Weinbauer, M. G., & Peduzzi, P. Aquatic viruses and climate change. *Current Issues in Molecular Biology*, 41(1), 357-380 (2021).	
Course outcome	● Summarize the roles of viruses in aquatic ecosystems. ● Apply the traditional and modern techniques to isolate and characterize aquatic viruses ● Integrate the knowledge of viruses into an existing framework of aquatic microbiology ● Frame relevant research objectives in the field of aquatic virology.	