

Degree projects on acquired structure-functions of viruses (Master degree project, 30hp, 45hp, and 60hp)

“Viruses impact on our health and ecosystem worldwide. I am looking for motivated students of studying structure-functions of viruses.”

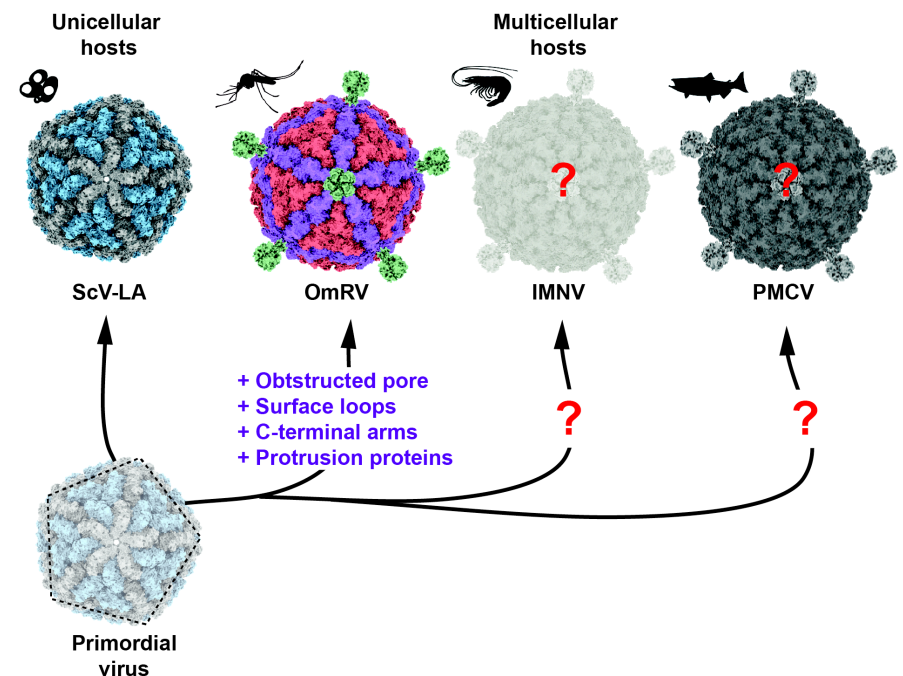
In the degree project, the students will learn following multidisciplinary techniques according to their expectations and interests. **Molecular and Cellular biology:** Cloning and mutagenesis, Fluorescent imaging, qPCR, protein purification, and cell culture. **Structural biology:** Cryo-electron microscopy and the single particle analysis. Atomic modeling and the refinement of virus proteins. Structural analysis and rendering. **Biophysics:** DSF (Differential Scanning Fluorimetry), nanoDSF, MST (MicroScale Thermophoresis) **Virology:** Virus detection and titration, Virus purification. Infectious cloning. In situ viral RNA hybridization. Endocytosis assays.

Acquired Structure-Functions in Metazoan Totivirus-like Viruses

Over their long evolutionary history, viruses have acquired structural features to adapt to diverse hosts, which can be observed as acquired structural remnants in contemporary viruses. Our intensive structural comparison between the so-called primordial viruses and the phylogenetically closely related viruses in the same evolutionary lineages can reveal acquired functional structures in pathogenic viruses that infect higher eukaryotes, such as humans, animals and crops (Okamoto et al., 2016; 2020, Munke et al., 2020; 2021). The gain and loss of such structural segments is significant for transmission, immune response, host tropism, and virulence of these viruses. One of our working hypotheses is that protozoan viruses are transmitted intracellularly in unicellular hosts, but intracellular transmission is not efficient in multicellular hosts (metazoa). Gaining the capability to infect multicellular organisms requires the acquisition of structural segments, which are essential for extracellular cell-to-cell transmission systems, such as cell attachment and cell entry.

In the advertised degree project, we offer the studies on the structural acquisitions in metazoan dsRNA totivirus-like viruses. Unlike *Totiviridae* viruses such as *S. cerevisiae* virus L-A (ScV-LA) infecting unicellular hosts, metazoan totivirus-like viruses have acquired four structural segments in their particles: obstructed pores, surface loops, C-terminal arms and protrusion proteins. To attest our hypothesis, we have generated the first infectious DNA clone of the totivirus-like virus has been generated (Wang et al., 2021) and produced the variants by mutating critical amino acid residues for the acquired structural segments (Filipe et al., 2022 unpublished). Following experiments are planned.

- Generating new function-deficient variants using reverse genetic system
- Cellular assays for testing in situ nascent single-stranded RNA transcription
- Cellular and molecular assays for testing virus transmission
- In vitro biophysical assays for testing particle stability and protein-protein interactions
- Structural studies on the virus transmission/replication in the atomic levels



For further information, please contact Han Wang and Kenta Okamoto

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