

# Crossing the barrier: Understanding the life cycle of membrane containing phages at molecular resolution

*Somavally Dalvi*<sup>1</sup>, *Chani Rakov*<sup>2</sup>, *Matthew Johnson*<sup>1</sup>, *Qinyu Xia*<sup>1</sup>, *Sigal Ben Yehuda*<sup>2</sup>, *Debnath Ghosal*<sup>1</sup>

<sup>1</sup>*Bio21, Department of Biochemistry and Pharmacology, University of Melbourne, Melbourne, Australia,*

<sup>2</sup>*Department of Microbiology and Molecular genetics, IMRIC, The Hebrew University-Hadassah Medical school, The Hebrew university of Jerusalem, Jerusalem, Israel.*

Email: somavallyd@student.unimelb.edu.au

## Abstract:

Bacteriophages are the most abundant biological entities and found in every biosphere. Based on nucleic acid composition, capsid symmetry and presence or absence of a membrane bacteriophages can be classified into eleven families<sup>1</sup>. Unlike mammalian viruses, relatively very few bacteriophages have an internal or exterior membrane<sup>2</sup>. The infection cycle of these membrane containing phages (EnvB) remains elusive despite the discovery of these phage 50 years ago. In this study, we unravelled the structural intricacies of EnvB at unprecedented resolution by cryo-electron tomography (cryo-ET). We captured phages undergoing striking morphological changes during their attachment to the host. We were able to obtain low resolution structure of nucleocapsid and spike protein using Sub-tomogram averaging. Additionally, we have shown the role of EnvB phage proteins in facilitating the lytic cycle within the host. Our current work provides comprehensive insights into the molecular and mechanistic nitty-gritties of lifecycle of membrane containing phages.

## References

1. Dion, M. B., Oechslin, F. & Moineau, S. Phage diversity, genomics and phylogeny. *Nature Reviews Microbiology* vol. 18 125–138 Preprint at <https://doi.org/10.1038/s41579-019-0311-5> (2020).
2. Mäntynen, S., Sundberg, L. R., Oksanen, H. M. & Poranen, M. M. Half a century of research on membrane-containing bacteriophages: Bringing new concepts to modern virology. *Viruses* vol. 11 Preprint at <https://doi.org/10.3390/v11010076> (2019).