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The Phage Nucleus shapes the Virulence Spectrum in Chimalliviridae

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Chimalliviridae reorganise infected bacterial cells by assembling a phage nucleus for replication of their genomes. However, the role of the phage nucleus in host takeover and unique infection dynamics is poorly understood (1,2,3). Here, we investigate how these phages reshape the organisation of protein complexes in infected cells and how this helps sustain phage replication under stress. Using gradient fractionation coupled with proteomic analysis, we identified multiple phage protein complexes during infection. Additionally, we observed that host protein complexes associated with stress response, translation, and central metabolism were remodelled, suggesting the suppression of stress for prolonged phage replication. After nucleus-forming phages appeared enriched in bacterial isolates (1), we examined infection dynamics using electron microscopy and fluorescence imaging. Strikingly, we observed phage replication in dividing cells. These observations reveal an infection state in which nucleus-forming phages can replicate permanently rather than following a strictly virulent replication style that suggests an extended virulence spectrum. Together, our findings link the phage nucleus to extensive remodelling of the host cell and identify permanent replication as a distinct infection mode of nucleus-forming phages.

Reference #1

Dougherty, P. E., Bernard, C., Carstens, A. B., Bumunang, E., Gerovac, M., Müsken, M., Stanford, K., McAl

Reference #2

Gerovac, M., Buhlmann, L., Zhu, Y., Đurica-Mitić, S., Rech, V., Carien, S., Gräfenhan, T., Popella, L., \t

Reference #3

Gerovac, M., Chihara, K., Wicke, L., Böttcher, B., Lavigne, R., \textbackslash{}\& Vogel, J. (2024). Phage

Author: GEROVAC, Milan (Helmholtz Centre for Infection Research)

Presenter: GEROVAC, Milan (Helmholtz Centre for Infection Research)

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