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Poster #63: Differences in regulatory genes drive divergent evolutionary outcomes under phage challenge

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Temperate phages use a bistable genetic switch to balance two different modes of transmission: lytic replication leads to horizontal transmission whereas lysogenic persistence allows vertical transmission. Dynamics of this switch are increasingly recognized as an evolvable trait shaped by the architecture of the underlying regulatory network, but the extent to which differences in its genetic architecture influence evolutionary outcomes remains unclear. Here we compare two closely related temperate phages, lambda and HK629, which share conserved structural genes, integration site, and host receptor usage but show significantly different infection outcomes in clonal bacterial populations. While infection with lambda resulted in a high level of lysogen formation, infection with HK629 led to rapid emergence of phage-resistant non-lysogens and low levels of lysogen formation. Whole-genome sequencing further revealed substantial amplification of the HK629 prophage locus, consistent with a 100-fold higher level of spontaneous prophage induction of HK629 lysogens compared to lambda lysogens. This suggests that closely related temperate phages can encode fundamentally different regulatory strategies that alter the stability and ultimately the fitness consequences of lysogeny.

Reference #1

Reference #2

Reference #3

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