
Phage-inducible chromosomal islands promote genetic variability by blocking phage reproduction

Rodrigo Ibarra-Chavez^{*2,1}, Aisling Brady^{3,2}, John Chen⁴, José Penadés^{3,2}, and Andreas Haag^{5,2}

²Institute of Infection, Immunity Inflammation - Biomedical Research Center – Royaume-Uni

¹University of Copenhagen – Danemark

³MRC Centre for Molecular Microbiology and Infection [Imperial College, London] – Royaume-Uni

⁴National University of Singapore – Singapour

⁵School of Medicine [University of st Andrews] – Royaume-Uni

Résumé

Phage-inducible chromosomal islands (PICIs) are a widespread family of highly mobile genetic elements that disseminate virulence and toxin genes among bacterial populations. Since their life cycle involves induction by helper phages, they are important players in phage evolution and ecology. PICIs can interfere with the lifecycle of their helper phages at different stages resulting frequently in reduced phage production after infection of a PICI-containing strain. Since phage defense systems have been recently shown to be beneficial for the acquisition of exogenous DNA via horizontal gene transfer, we hypothesized that PICIs could provide a similar benefit to their hosts and tested the impact of PICIs in recipient strains on host cell viability, phage propagation and transfer of genetic material. Here we report an important role for PICIs in bacterial evolution by promoting the survival of phage-mediated transductants of chromosomal or plasmid DNA. The presence of PICIs generates favorable conditions for population diversification and the inheritance of genetic material being transferred, such as antibiotic resistance and virulence genes. Our results show that by interfering with phage reproduction, PICIs can protect the bacterial population from phage attack, increasing the overall survival of the bacterial population as well as the transduced cells. Moreover, our results also demonstrate that PICIs reduce the frequency of lysogenization after temperate phage infection, creating a more genetically diverse bacterial population with increased bet-hedging opportunities to adapt to new niches. In summary, our results identify a new role for the PICIs and highlight them as important drivers of bacterial evolution.

Mots-Clés: Bacteriophages, Phage satellites, Genetic interference, Bacterial evolution

*Intervenant