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Functional dissection of the Bacillus subtilis SPβ prophage lysogeny-lysis system

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SPβ-like phages possess a unique lysogeny control system [1]. Our recent work identified the master repressor of SPβ and an essential activator of the lytic cycle [2]; however, the regulatory network governing the lysis-lysogeny decision requires further elucidation [1]. Furthermore, fundamental mechanisms such as virion assembly or the adsorption of SPβ to its bacterial hosts remain poorly understood [3].

We are using time-resolved quantitative proteomics to gain a better understanding of the regulatory dynamics of SPβ. This involves studying (1) MrpR-dependent induction and (2) infection. Analyses of a non-inducible lysogen and an inducible lysogen revealed different dynamics of phage protein accumulation following induction. Time-resolved proteomics suggests that the absence of *yosL* affects the temporal organization and/or progression of the lytic phage program. Moreover, the study is investigating which temporal changes in the bacterial proteome are associated with successful lytic induction. During phage infection a rapid and sequential accumulation of phage proteins occurs. Most phage proteins were first detected during the early phase of infection, whilst other proteins accumulated at a later stage. This suggests a staggered expression program during infection.

In addition, we investigated the mechanisms underlying phage–host recognition. Isolation and whole-genome sequencing of *B. subtilis* strains resistant to SPβ infection confirmed the involvement of the minor teichoic acid biosynthesis genes ggaA and ggaB in phage resistance [4]. To identify a potential secondary receptor involved in SPβ adsorption or entry, transposon mutagenesis is currently being employed.

Reference #1

[1] Kohm K, v. Clanner A, Hertel R, Commichau FM (2025) Closely related and yet special – how SP phages c

Reference #2

[2] Kohm K, Jalomo-Kharyova E, Krüger A, Basu S, Steinchen W, Bange G, Frunzke J, Hertel R, Commichau FM,

Reference #3

[3] Kohm K Hertel R (2021) The life cycle of SP and related phages. Arch Virol 166: 2119–2130.

[4] Estrela AI, De Lencastre H, Archer LJ (1986) Resistance of a Bacillus subtilis mutant to a group of temperate bacteriophages. Microbiology 132:411–415.

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