
Membrane-less compartmentalization in time and space of bacteriophage SPP1 replication and assembly in the Gram-positive bacterium *Bacillus subtilis*.

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Résumé

Viral infection affects host cell homeostasis and draws extensive cellular biosynthetic resources. Cell machineries are also hijacked for optimal viruses multiplication. Here, we investigated the impact of these processes in the spatial organization of the bacterial cell. We show that infection by bacteriophage SPP1 leads to the formation of two types of membrane-less compartments in the cytoplasm of the Gram-positive bacterium *Bacillus subtilis*.

Phage DNA localizes in a single DNA compartment in mono-infected cells. More than 300 copies of the SPP1 viral genome are synthesized in the first 25 minutes of infection, doubling the cell DNA content. This process requires fast recruitment of the bacterial replisome proteins orchestrated by the SPP1 helicase gp40 that binds to the DnaG primase and to DnaX, a subunit of DNA polymerase III. Hybrid phage-bacterial replisomes accumulate in discrete genome replication factories within the phage DNA compartment. Collectively, our data reveal that the host replisome machinery is massively redirected and dedicated for optimal SPP1 DNA replication.

Later in infection, procapsids localize at the periphery of the DNA compartment for genome

*Intervenant

packaging whereas DNA-filled capsids fully segregate to spatially distinct warehouse compartments where viral particles accumulate. Warehouses are found mostly side by side from the viral DNA replication *foci*.

The dynamics of the SPP1 replication factory and virions warehouses were visualized during the complete SPP1 infection cycle using microfluidics. The spatial and temporal distribution in the bacterial cytoplasm highlights a sequential program of molecular interactions. It leads to an extensive re-organization of the crowded cytoplasm to achieve assembly of about 150 infective particles within 25 minutes of infection. Structuration of viral factories to confine phage DNA enzymatic reactions appear as a very efficient strategy for SPP1 to exploit the bacterial resources for its own profit.

Mots-Clés: Viral factories, virions warehouses, membrane, less compartments, DNA replication, particles assembly, video, microscopy