DNA ejection mechanism in bacteriophages

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Bacterial viruses or bacteriophages have generally a tail which mediates host recognition and attachment, host membrane perforation and DNA transfer from the capsid to the host cytoplasm. Siphoviridae bacteriophages have a long flexible non contracting tail which is assembled by the polymerisation of the tail tube proteins (TTP) along and around the Tape Measure Protein (TMP). Myoviridae have a long contractile tail also formed of a TMP-TTP tube, with an additional outer tail sheath. For Myoviridae, the contraction of the sheath protein has been proposed to be the trigger for the DNA release from the capsid. For Siphoviridae, the mechanism of DNA ejection is more elusive. We solved the structure of the Myoviridae ΦRSL1 phage tail before and after contraction by cryo-electron microscopy to ~4Å resolution. The TTP of ΦRSL1 is remarkably similar to other phage TTPs and tube proteins of bacterial puncturing devices (like R-pyocin and Type VI secretion system). The sheath protein has a nearly identical fold before and after contraction at the exception of the N- and C-terminal arms, which adapt during the large rigid body movement occuring in each sheath subunit during contraction. We solved as well the structure of the Siphoviridae T5 tail before and after interaction with its cell receptor, at 6Å resolution by cryo EM. We observed no difference in the TTP structure, showing that the receptor binding information is not transmitted by the tube protein. We rather suggest that the ejection of the TMP would transmit the signal. Our results thus point to a more central role of the TMP in signal transduction during DNA ejection of Siphoviridae.