How Bacteriophage Genomes Get Inside Cells

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Modern molecular biology was founded in part on the basis of experiments done in the context of bacterial viruses. There has been a resurgence of interest in these viruses as a result of the fact that they serve as powerful model systems for the attempt to build detailed quantitative models of a biological system and to test those models with systematic, quantitative experimentation. One of the central unanswered questions in the study of these viruses is the precise mechanism whereby the genomic DNA enters its host. To that end, we have carried out both in vitro and in vivo single-molecule experiments aimed at measuring the DNA translocation process in real time. In this talk, I will report on a series of single-molecule experiments which explore the mechanism and rate of ejection in vitro and how it depends upon factors such as dye concentration, salt, surface preparations, etc. These experiments suggest ejection mechanisms that are at odds with the standard picture of DNA translocation by bacterial viruses. The second set of experiments amount to a single-molecule version of the Hershey-Chase experiment which permits the observation of individual viruses infecting individual bacteria.