

Morphogenesis of the Head of Bacteriophage T4

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The biochemical studies of the phage and bacterium showed that gene acted not only for transmitting genetic information from parent to child, but also for keeping of the life of individual. Structures of living things are made according to the genetic information. Although the structure is determined by the protein itself, the protein is determined by its gene. Only one base change of gene causes large effect to organisms. The studies of the T4 phage morphogenesis used these mutations. Cells infected with a conditional lethal mutant of phage produce its abnormal structures. The studies of morphogenesis of phage structures were developed by the genetic and molecular biological analysis of these mutants.

These studies Clarified that the morphogenesis of T4 phage proceeded to binding head to tail then tail to tailfibers, after formation of head, tail and tailfibers, independently each other. The head formation started from formation of prohead that is a precursor of the head, then DNA is packed into the prohead (DNA packaging). Before or during this process, conformational change of the prohead occurred. The mutation of producing isometric head also produced isometric prohead. This fact means that the length of head has already been determined the stage of the prohead. As the length of DNA is determined by the capacity of the prohead, the mor-

phogenesis of the prohead is an important problem. Connector that is a proximal vertex of the head and a binding site for the tail acts a key function of the formation of the prohead.

It is useful to elucidate a role of the purified protein by the experiment of *in vitro* reassembling prohead. We succeeded in purification of active connector (gp 20-complex) and making an *in vitro* reassembling prohead. From the results of the experiments of prohead reassembly, I made a model of the prohead morphogenesis, and explained the length and form determination of prohead.

The formation of head completes to package DNA into the prohead. DNA packaging is performed by the general mechanism among the phages having a linear double stranded DNA. It needs two proteins and ATP besides prohead and DNA. One protein acts for binding prohead to DNA that is a concatemer and another acts for moving DNA into prohead. An entrance of the prohead is the connector. During DNA packaging, ATP is hydrolyzed to use energy for moving DNA.