NOTES

Structure of a Transducing Mycobacteriophage

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Received for publication 16 December 1971

Electron micrographs of the transducing phage I3 for *Mycobacterium smegmatis* strain SN2 revealed a phage with a contractile tail and a head with isometric symmetry and visible capsomeres.

Recently, Sundar Raj and Ramakrishnan (12) isolated a phage strain from soil which gave turbid plaques for *Mycobacterium smegmatis* strain SN2. This phage, called I3, was characterized as a transducing agent for a number of genetic markers (12). I3 has now been prepared, purified by the method of Sundar Raj (Ph.D. Thesis, Indian Institute of Science, Bangalore, 1971), and examined in an RCA EMU-4 fitted with a re-entry-type grid cap. The phosphotungstic acid-negative staining method was used. The results were recorded on Dupont COS-4 film at a magnification of about $\times 15,000$ and were then photographically enlarged.

The structure of I3 is shown in Fig. 1 and 2. The phage head has regular isometric symmetry and measures of 80 ± 10 nm in length by 80 ± 10 nm in width. The equal dimensions of the head length and width and the large triangular faces on the phage ghosts (Fig. 2) reveal the cubic symmetry but do not distinguish between octahedral and icosahedral symmetry. Head capsomeres can be seen on the edges of the triangular faces. A partially disrupted head (insert in Fig. 2) also reveals hollow capsomeric structures. It should be noted that observations of capsomeres on phage head structures are quite rare (4).

The tail of I3 is 80 ± 10 nm in length and can contract to 60% of the total tail length. A typical hollow tail tube running the length of the tail (Fig. 1) is apparent after contraction. Other components of the tail are a double collar at the neck of the virus particle and a plate-like structure at the bottom of the tail.

Only limited studies of both the chemistry and morphology of various mycobacteriophages have been reported (1, 3, 5-11, 13). I3 probably contains double-stranded deoxyribonucleic acid since it has the ability to transduce and, therefore,

belongs in Bradley's class A of bacteriophages (2) which includes all phages having double-stranded deoxyribonucleic acid and contractile tails. Electron micrographs of 11 different mycobacteriophages (1, 3, 5-11, 13) for a variety of mycobacteria were found in a recent survey of the literature. In contrast to I3, these phages all have non-contractile tails and cannot be put in Bradley's class A.

This investigation was supported by Public Health Service grant AI 06336 from the National Institute of Allergy and Infectious Diseases and by grants from the Indian Institute of Science, University Grants Commission, India.

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FIG. 1. Electron micrograph of mycobacteriophage I3. The arrows show (i) a double collar, (ii) a platelike structure near the tail tip, and (iii) a hollow tail tube. The magnification bar represents 100 nm.

FIG. 2. Electron micrographs of I3 showing what appears to be an orderly arrangement of subunits in the head coat of the whole virus, the ghosted virus, and the single coat layer of a ruptured ghost (insert). The magnification bar represents 100 nm.

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