

on line - 05/05/2021.

Q2. Describe the <sup>Types</sup> Structure and Multiplication of Bacteriophages.

Ans.

Viruses that attack Bacteria form a group called bacteriophages. It is a Coliphage which infects cotton bacillus bacterium - E. coli. They are ultramicroscopic and obligate parasite. Primarily they were discovered independently by F. Twort (1915) and d'Herelle (1917) and were named as - Bacteriophagum intestinale.

All bacteriophages are basically made up of N. acid and Protein. The N. acid may be either DNA or RNA, but never both. The genome size varies. The simplest phage code for 3-5 average size gene product on the other hand, complex genome may code for over 100 gene products. Protein protect the N. acid from nucleases present in the surrounding environment.

\* Structure of Bacteriophage:-

Bacteriophages are made up of two <sup>distinct</sup> parts -

(i) Head - It varies in size and shape i.e. icosahedral to filamentous, it is also known as capsid which is made up of several copies of one or more different proteins. It houses the N. acid and provide protection.

(ii) Tail:- It is a hollow tube through which the N. acid passes during infection. Head.



②

remains attached with tail by a proteinaceous 'collar'. Tail also varies in size and in complex form, it remains surrounded by a contractile sheath. The tails remain attached with a hexagonal <sup>base</sup> plate to which 6 long tail fibres remain attached. These fibres help during attachment of coliphage with bacteria. In this way tail has 4 components —

- a. a central core/tube
- b. a proteinaceous sheath surrounding the tube
- c. a hexagonal basal plate provided with pin at every corner. and
- d. the 6 long tail fibres.

### \* Types of phages:-

There are four groups of phages such as -

#### (1) T-series of DNA Bacteriophages —

They are made up of a characteristic hexagonal head and a tail. Genome is made up of a single linear molecule of ds DNA. These phages replicate exclusively by lytic cycle. There are in all seven T-series phages, which are divided into 'T-even' and 'T-odd' types (Bradly, 1967).

#### # T-odd phages —

- T<sub>1</sub> phage - smaller in size, genome size is nearly 40 k
- T<sub>3</sub> phage - they have smaller tail
- T<sub>5</sub> phage - smaller in size, genome, 21,752 bpl, in l
- T<sub>7</sub> phage - have small tail, T<sub>7</sub> genome is linear, 39937

# T-even phages -

- T<sub>2</sub> phage
  - T<sub>4</sub> phage
  - T<sub>6</sub> phage
- } They have head 80 m. micron in dia. and tail about 100 m. micron long and 25 m. micron. wide.

- Tail<sub>tube</sub> of T<sub>2</sub>, T<sub>4</sub> & T<sub>6</sub> phages remain surrounded by a contractile sheath.

- T<sub>2</sub>, T<sub>4</sub> & T<sub>6</sub> contain large genome. T<sub>4</sub> genome is 168,895 bp in length.

- T<sub>2</sub> phage - 210 nm long; Head - 95 nm long, tail 115 nm long and 17 nm in dia. capsid - made up of 200 sub-units of protein. Nucleoid - dsDNA of 50,000 nm long (single). M.O. wt - 2.5 million. cytosine in phage DNA is hydroxymethylated.

(2) Temperate bacteriophage -

They show both lytic & lysogenic life cycle. Under lysogenic cycle the phage remains in the cell as a prophage. Example - Lambda phage. It infects E. coli and has 48,502 bp long linear dsDNA.

(3) Small DNA bacteriophages -

These are small phages with ssDNA genomes they encode for 10-12 proteins and are differentiated into 2 groups -

i) Spherical phage -  $\phi$ X174,  $\phi$ 4,  $\phi$ 13. The genome is circular ssDNA molecule.  $\phi$ X174 genome is 5,386 bp long.

ii) Filamentous phage - common example is M13. Such phages have filamentous enveloped capsid with a ~~linear~~ circular ssDNA mol. which codes for 10 genes. The modified cloning vector of M13 is 7249 bp long.

4)

#### 4) RNA bacteriophages -

They are the simplest viruses with small ssRNA genome that are 3,600 - 4,200 bp long (MS2 is 3,569 bp long) and encode for 4 proteins.

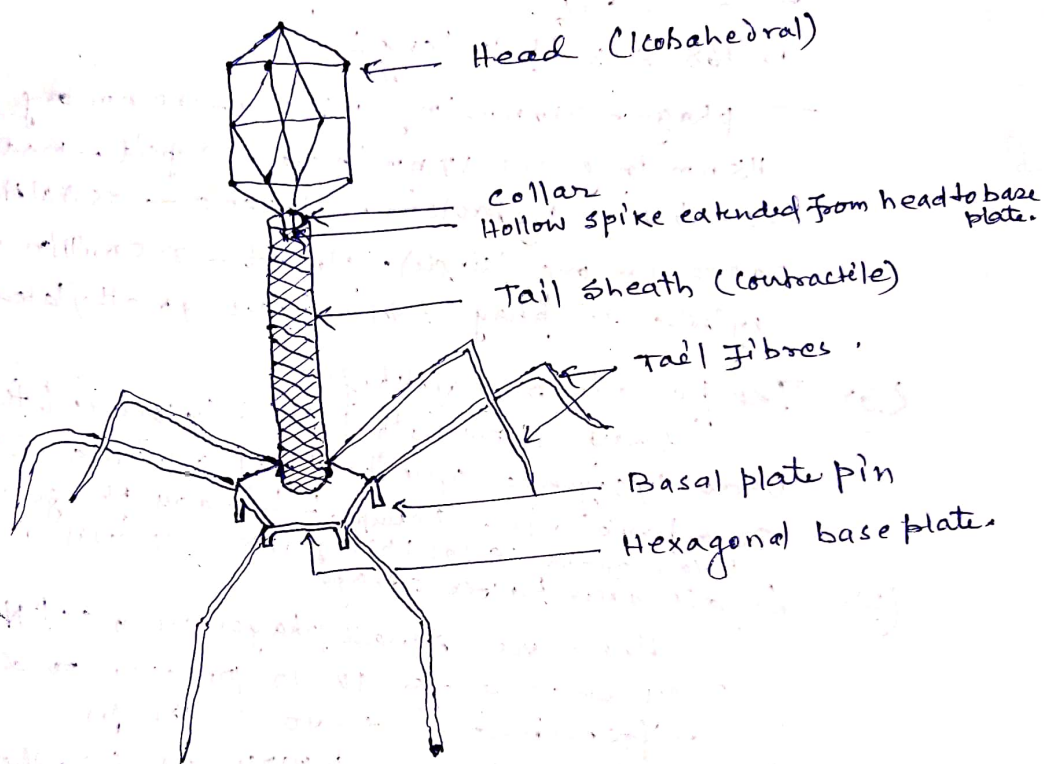


Fig. - Structure of a bacteriophage

#### \* Importance/Significance of Bacteriophages (Phage Virus Secundus) :

- Bacteriophages provide a source of cloning vectors.
- Specific viral strains are cultured and used as vaccines.
- Cyanophages LPP-1 and SM-1 are used to control water blooms.
- Ganga water is free from Bacteria due to Bacteriophages.