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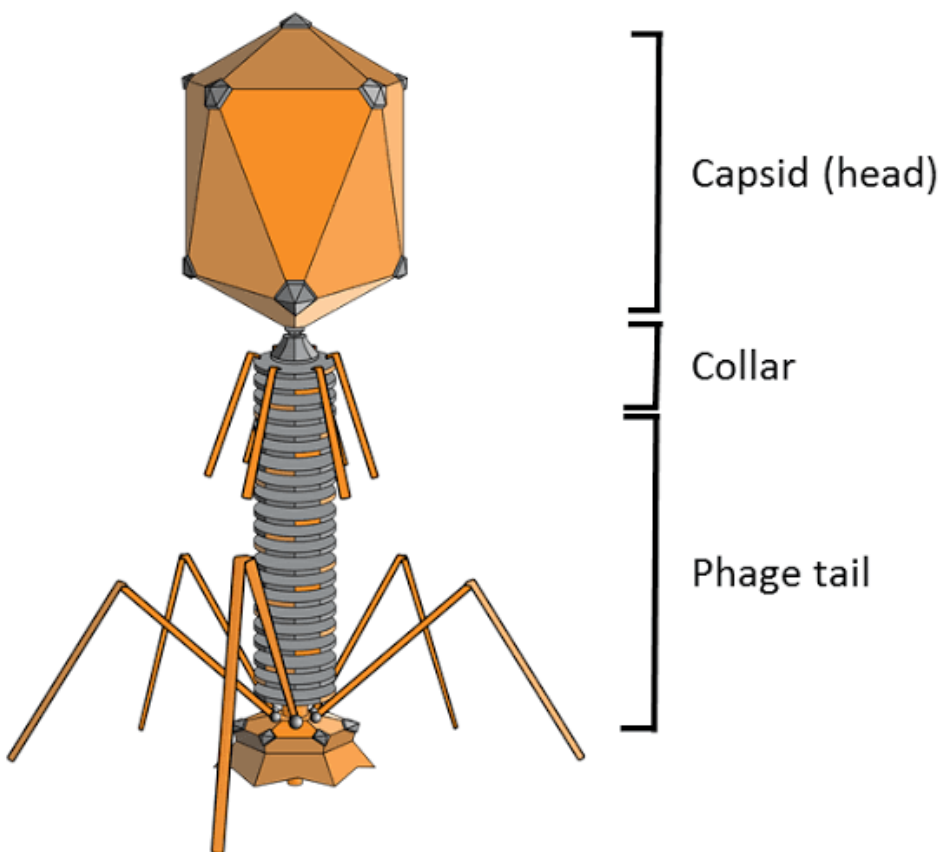
Date: 13th April, 2020

CORE CONCEPT OF
Microbiology

HONS. PART 1

BACTERIOPHAGE

The bacteriophages or bacterial viruses or simply phages are widely distributed in nature. They are ultramicroscopic, but some (vaccinia) are larger than small bacteria. A bacteriophage has a hexagonal to polyhedral head and a rigid tail which are almost same in length. The tail has a central core surrounded by contractile sheath. The tail serves as adsorption organ. The portion of the closer to the head has a projected structure called collar and the tail is terminated by six plates each of which again has contractile fibres. Bacteriophages occur in six morphological types. The bacteriophages infecting colon bacteria (E. Coli) are called

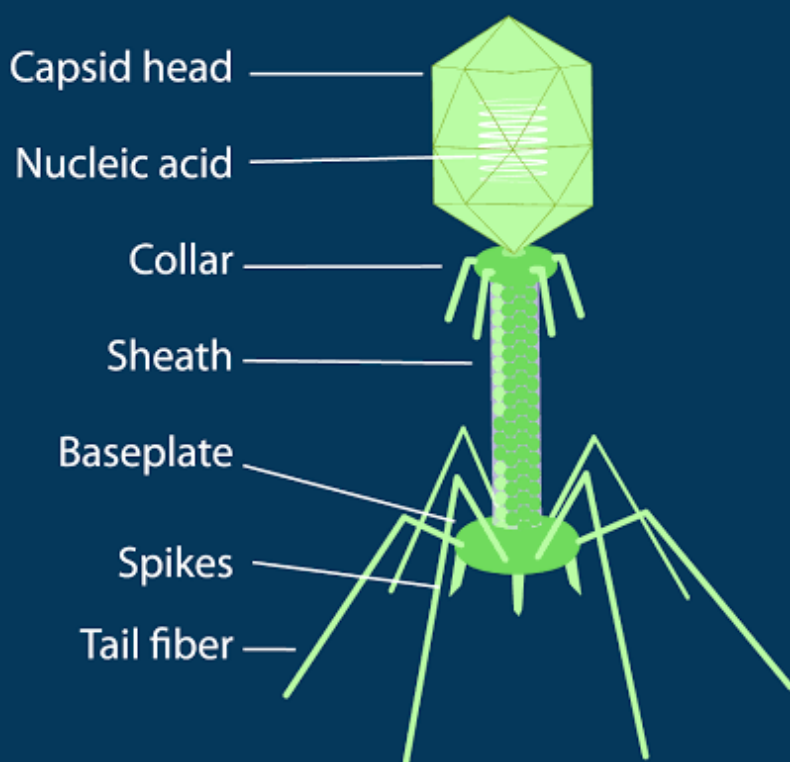


coliphage. The genetic material is confined to the head piece. The head piece contains about 2,000 Capsomeres, while the Tail consisting of a core tube and a sheath contains about 144 subunits of capsomeres. The end of the sheath contains basal plate bearing six small spikes and six long tail fibres. The host enzymes supply energy for phage replication through the breakdown of glucose, synthesize the subunits of protein and nucleic acid of replicating phage, and even participate in the synthesis of phage nucleic acid and phage coat protein. For the active replication of nucleic acid the synthesis of viral proteins viruses require cellular ATP, ribosomes, transfer RNA, enzymes and certain biosynthetic process. During the replication of any virus the viral protein and nucleic acid components develop separately from each



other. During maturation of phage, assembly of phage protein and phage DNA takes place independently. So also the head and tail by stepwise processes. Once the head is formed, it is packed with phage DNA,

after which the tail is attached, a new phage is assembled. During the latter stages of infection period, another phage, induced enzyme, coded for the phage DNA, makes its appearance. This is the phage lysozyme that digests the host cell wall from within, resulting in the host cell lysis and release of the new phages.



LIFE - CYCLE OF BACTERIOPHAGE

Two types of life - cycle are known in viruses -

(I) Some viruses multiply after their entrance into the host cell resulting in lysis (break - down) of the host cell. This type of viruses are called lytic viruses and mode of infection is called virulent, e.g. T - even phages.

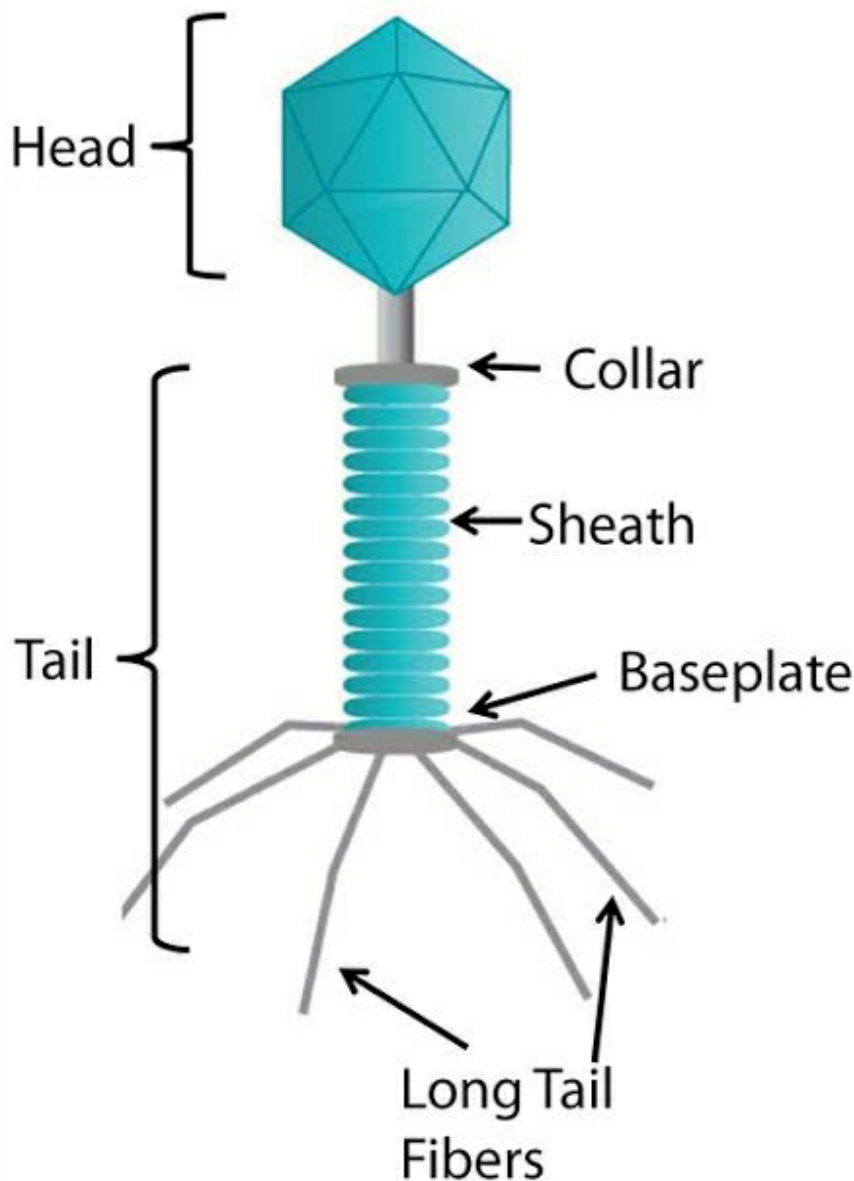
(II) Some viruses do not cause lysis of the host cell, rather viral

nucleic acid becomes integrated with host DNA and is called lysogenic viruses and the mode of infection is called temperate. e.g. Lambda (λ) phage.

LYTIC CYCLE

IT takes place in the following steps -

(I) **Adsorption (attachment)** - Bacteriophage attaches itself on the wall of the E. Coli by means of its tail fibres.



(II) Digestion of the bacterial wall - By lysozyme, which drills a hole in the cell wall.

(III) Injection of DNA - The DNA is injected into the host cell. The entire protein coat (capsid) remains outside.

(IV) Synthesis of early protein - The early proteins include enzymes-DNase, RNase, deoxycytidine triphosphatase, etc. Phage DNA is resistant to the attack of DNase because it contains the base 5-hydroxymethyl cytosine instead of cytosine.

(V) Breakdown of Bacterial DNA and RNA - By DNase and RNase respectively. Bacterial protein machinery is made available for the phage. Bacterial DNA fragments are later used in the synthesis of phage DNA.

(VI) Replication of phage DNA - Replication of DNA begins 7 to 8 minutes after infection.

(VII) Synthesis of late proteins - It includes coat protein and lysozyme.

(VIII) Maturation - The process of assemblage of the phage from its components is called maturation. The head, tail and fibres formed independently and only then they combine.

(IX) Release - The release of viruses takes

place by bursting of the bacterial cell-wall, weakened by the activity of lysozyme. The newly formed viruses are now ready for infection. The whole cycle is completed within about 20 minutes.

LYSOGENIC CYCLE

IN this cycle the DNA of phage after adsorption and injection enters the cell but instead of taking over host protein synthesis machinery, the viral genome gets integrated with the bacterial genome constituting 'prophage', which replicates as such giving rise to daughter genomes.



PLANT DISEASES CAUSED BY VIRUSES

Dwarf disease of rice, Tobacco leaf curl, Tobacco mosaic. Maize streak, Potato leaf curl, sugarcane mosaic, wheat streak mosaic, Stripe disease of rice. Bunchy top of Banana, yellow vein mosaic of bhindi etc.

CANCEROUS DISEASES CAUSED BY VIRUSES

(I) **Carcinoma** - Associated with epithelial tissues.

(II) **Leukemia** - Associated with blood cells.

(III) **Sarcoma** - Associated with connective tissues.

(IV) **Lymphoma** - Associated with lymph cells.

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