

Viruses

By

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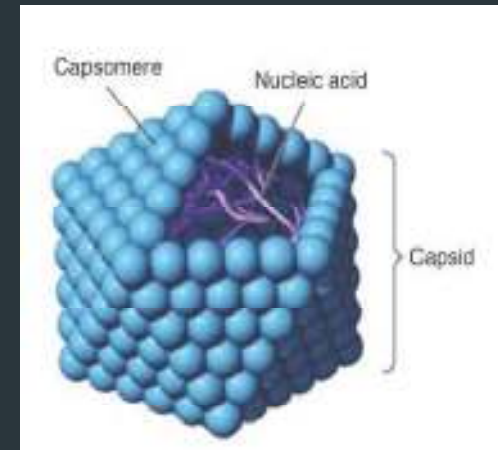
Introduction

- ▶ A virus is a small infectious agent that replicates only inside the living cells of other organisms.
- ▶ Viruses can infect all types of life forms, from animals and plants to bacteria.
- ▶ Since Dmitri Ivanovsky's 1892 article describing a non-bacterial pathogen infecting tobacco plants, and the discovery of the tobacco mosaic virus by Martinus Beijerinck in 1898.

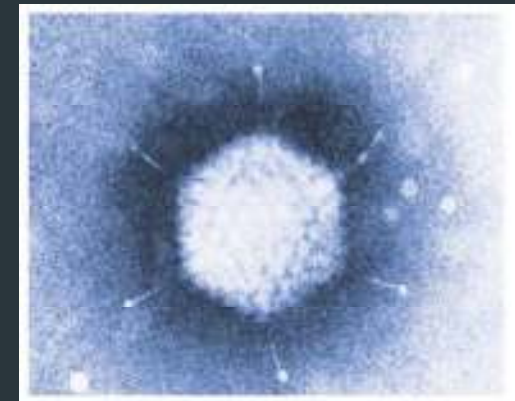


Basic structure and Feature

- ▶ **Nucleic acid**
- ▶ a virus can have either DNA or RNA- but never both.
- ▶ nucleic acid of a virus can be single-stranded or double-stranded.



- ▶ **Capsid and Envelope**
- ▶ The nucleic acid of a virus is protected by a protein coat called the capsid
- ▶ Each capsid is composed of protein subunits called capsomeres.

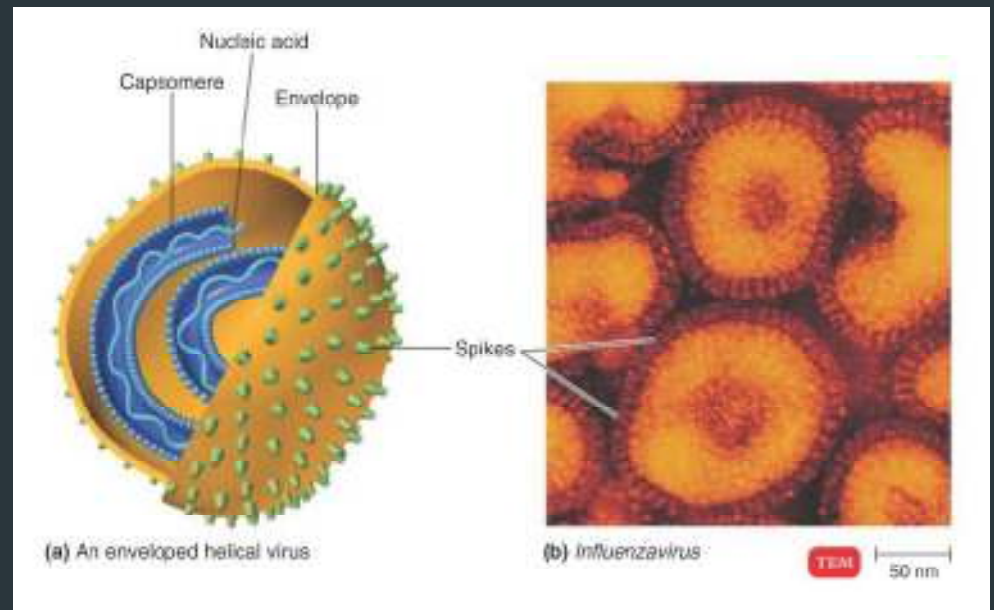


▶ Envelop

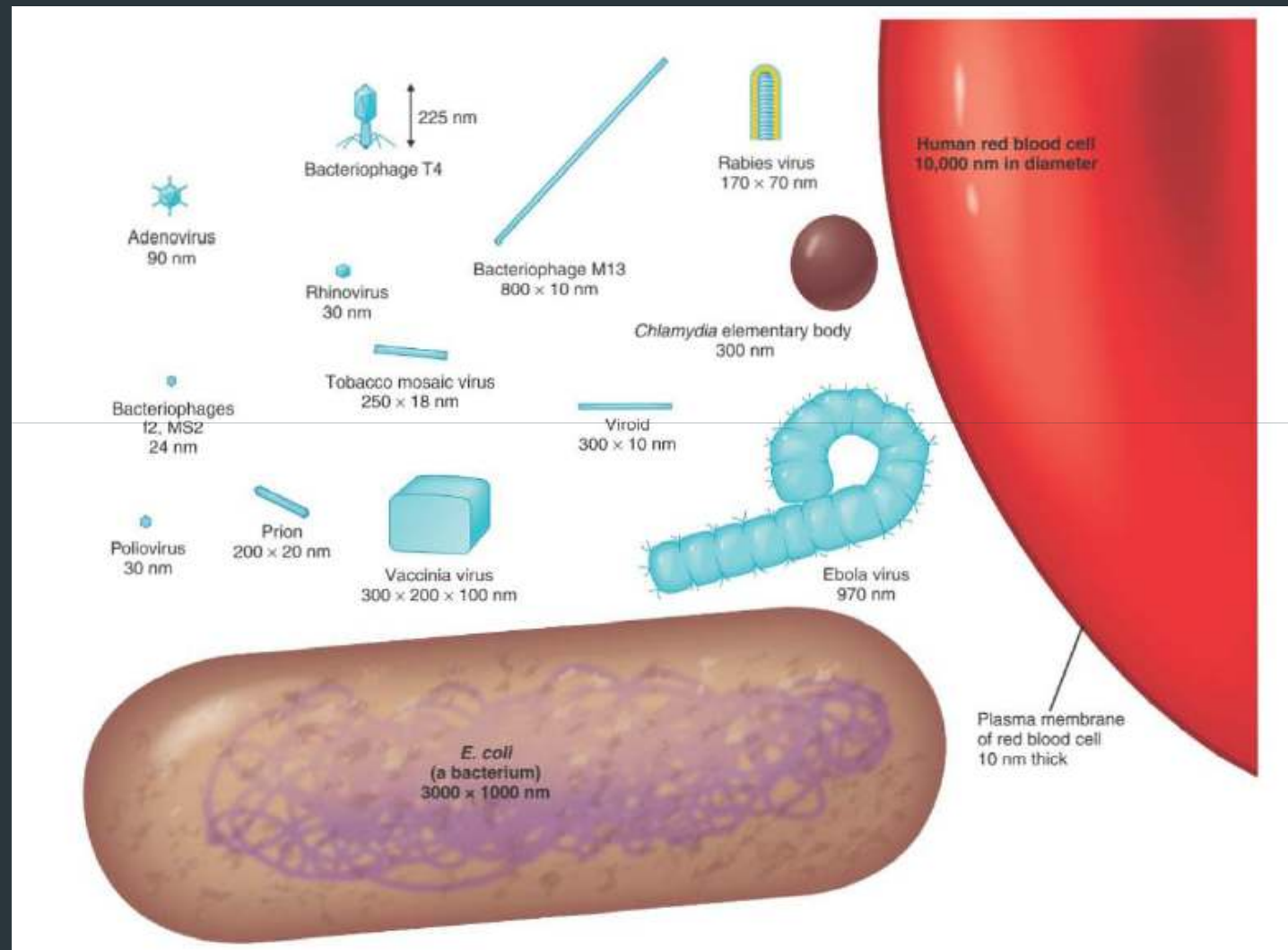
- ▶ In some viruses, the capsid is covered by an envelope which usually consists of some combination of lipids, proteins, and carbohydrates.

▶ Spikes

- ▶ Depending on the virus, envelopes may or may not be covered by spikes, which are carbohydrate-protein complexes that project from the surface of the envelope. Some viruses attach to host cells by means of spikes.



Viruses range
from
20 to 1000
nm in length



Baltimore classification

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- ▶ Baltimore classification (first defined in 1971) is a classification system that places viruses into one of seven groups depending on a combination of their nucleic acid (DNA or RNA), strandedness (single-stranded or double-stranded), Sense, and method of replication.
 - ▶ I: dsDNA viruses (e.g. Adenoviruses, Herpesviruses, Poxviruses)
 - ▶ II: ssDNA viruses (+ strand or "sense") DNA (e.g. Parvoviruses)
 - ▶ III: dsRNA viruses (e.g. Reoviruses)
 - ▶ IV: (+)ssRNA viruses (+ strand or sense) RNA (e.g. Picornaviruses, Togaviruses)
 - ▶ V: (−)ssRNA viruses (− strand or antisense) RNA (e.g. Orthomyxoviruses, Rhabdoviruses)
 - ▶ VI: ssRNA-RT viruses (+ strand or sense) RNA with DNA intermediate in life-cycle (e.g. Retroviruses)
 - ▶ VII: dsDNA-RT viruses (e.g. Hepadnaviruses)
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Bacteriophage

- ▶ Virus that infect bacteria – Bacteriophage
- ▶ Discovered independently by –
 - ▶ Frederic W. Twort in England – 1915
 - ▶ Felix d'Herelle in Paris – 1917
 - ▶ Coined the term “Bacteriophage” in 1917 means “bacteria eater”



Classification of Bacteriophage

- ▶ DS DNA (Non -enveloped)

- ▶ T₂

- ▶ T₇

- ▶ DS DNA (Enveloped)

- ▶ MV-L₂

- ▶ SS DNA

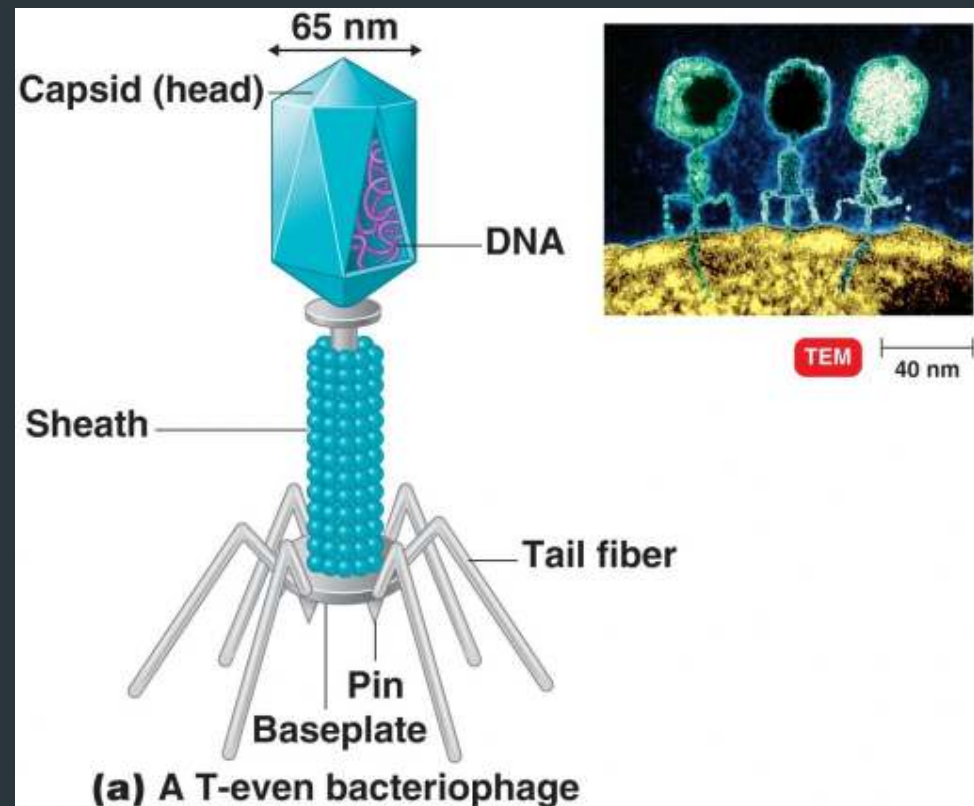
- ▶ ØX174

- ▶ SS RNA

- ▶ MS2

- ▶ DS RNA

- ▶ Ø6



Viral Multiplication/Replication

Multiplication cycle of bacteriophages: lytic vs lysogenic cycle

Two modes of multiplication cycle in bacteriophages namely lytic cycle and lysogenic cycle.

Lytic cycle or lytic phages called as virulent phages multiplies inside the host bacterium and new viral particles comes out by lysing or by rupturing the host bacterial cell wall. Eg: T phages, T2, T4, T6 etc.

Lysogenic cycle or lysogenic phages called as temperate phages does not undergo multiplication or induce lysis, here the viral DNA gets integrated into the bacterial DNA without causing lysis. Eg Lambda phages.



Viral Replication : Lytic Cycle

Lytic cycle in detail:

Step I :

Adsorption: attachment of adsorption of tail fibres of the phage on to a specific receptor site on the bacterial cell wall.

Step II:

Injection: injection of viral genome into the host through the hollow tubes of the tail

Step III:

Protein synthesis: Inside the host, the viral genome directs the synthesis of viral proteins using the machinery of the host. Viral genome generally encodes for some enzymes and coat proteins.

Step IV:

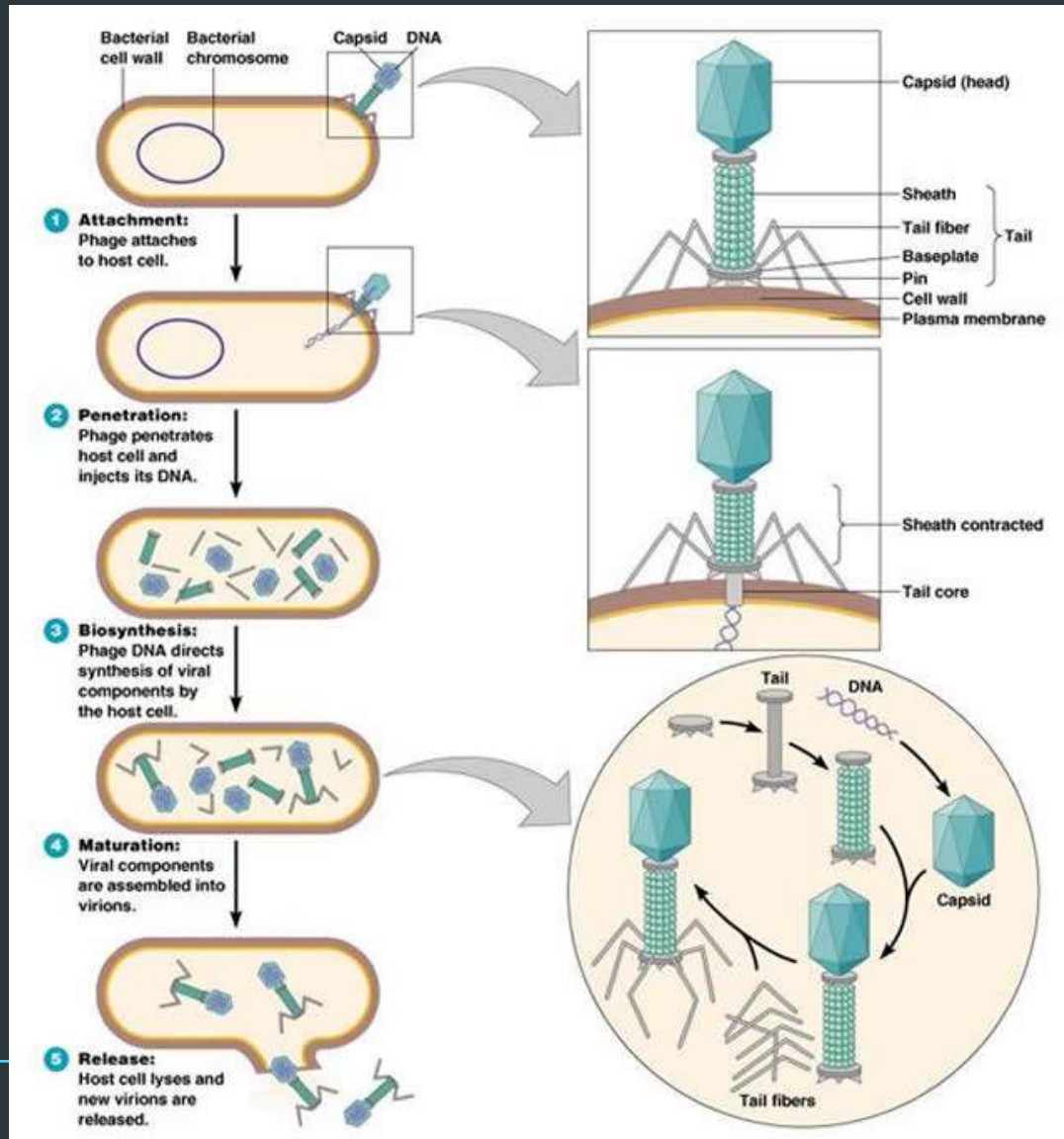
Viral genome synthesis: Viral genome replicates inside the host making several copies.

Step V:

Packaging and release: The viral genome gets packaged inside the protein coat.



Viral Replication : Lytic Cycle



Step I:

Adsorption: attachment of adsorption of tail fibres of the phage on to a specific receptor site on the bacterial cell wall.

Step II:

Injection: injection of viral genome into the host through the hollow tubes of the tail.

Step III:

Integration of viral genome to the host genome: After the entry of viral genome, it gets integrated into the bacterial genome of the host. *The viral genome integrated to the bacterial genome is termed prophage.*

Step IV:

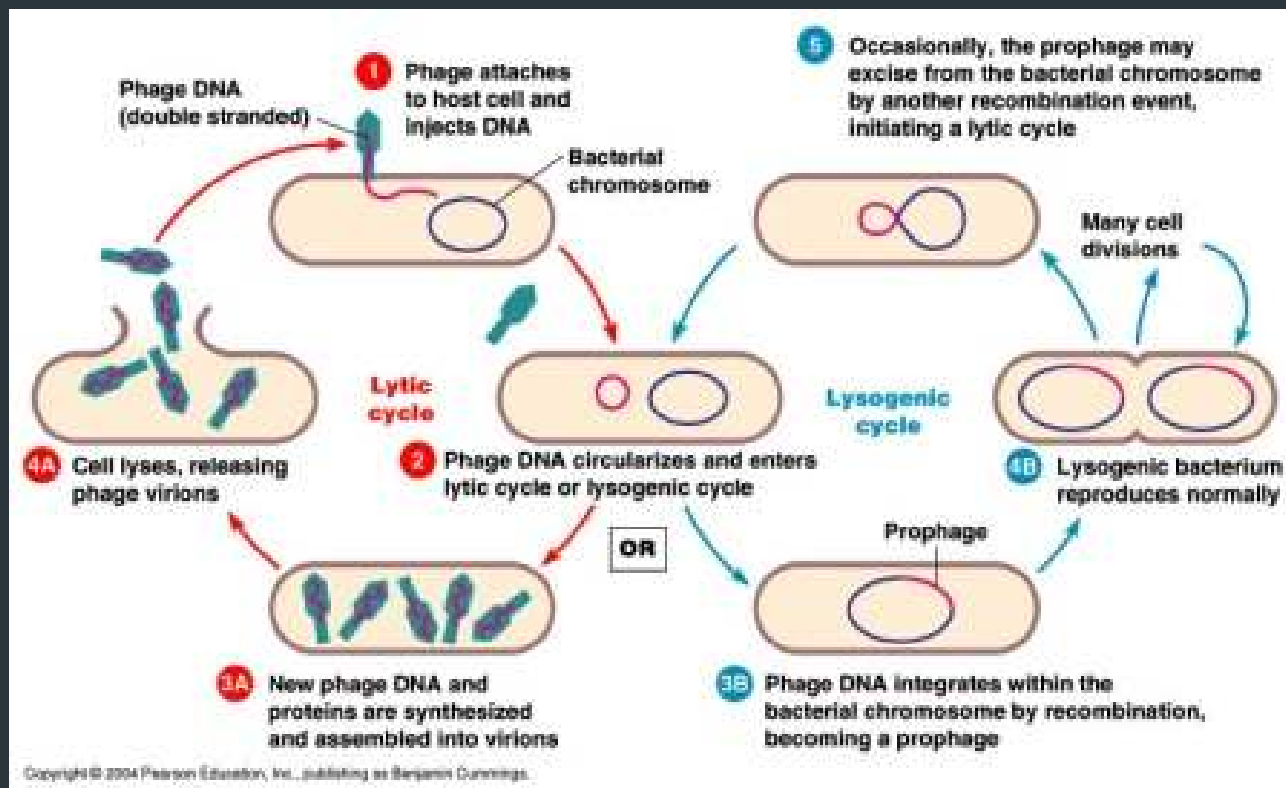
Viral genome synthesis: Viral genome replicates along with the bacterial genome replication and pass on to the daughter cells.

Step V:

Induction of lytic cycle: Occasionally, integrated viral genome detaches and released into the bacterial cytoplasm. This dissociation is called **induction** and lytic cycle is followed releasing mature lysogenic phages. Induction can be induced artificially using ultraviolet rays or heat treatment.

And that is the viral story of destroying bacterium, the microbial super powers.







Thankyou

