

Al- Mustaqbal University
College of Science
Medical Physics Department
First Stage



General biology

Lecture : 9

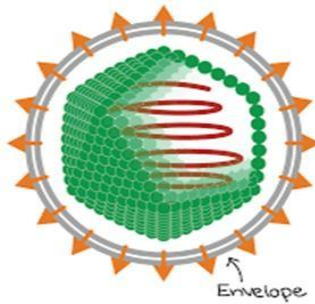
Viruses

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2024 – 2025

Viruses

Viruses are generally smaller than 200 nm in diameter and therefore are comparable in size to a large protein macromolecule.

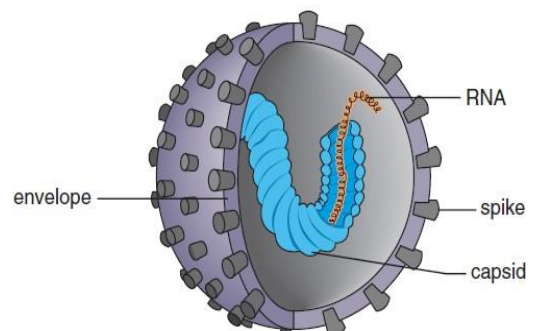
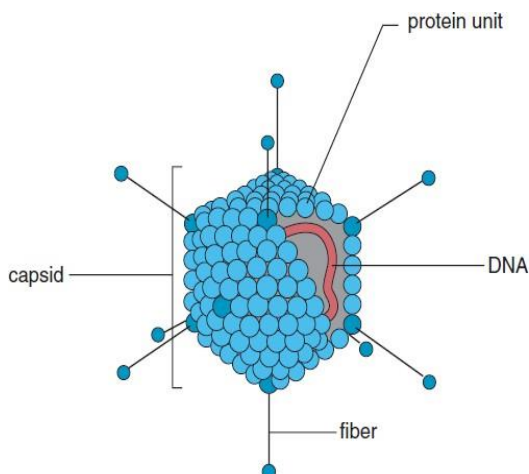
Viruses are not included in the classification of organisms because they are noncellular and should not be classified with organisms which are always cellular.



Structure of Viruses

A virus always has at least two parts:

- 1- an outer capsid composed of protein units
- 2- an inner core of nucleic acid either DNA or RNA
- 3- A virus may also contain various enzymes for nucleic acid replication.
- 4- The capsid is often surrounded by an outer membranous envelope, which is actually partially composed of their host's plasma membrane.

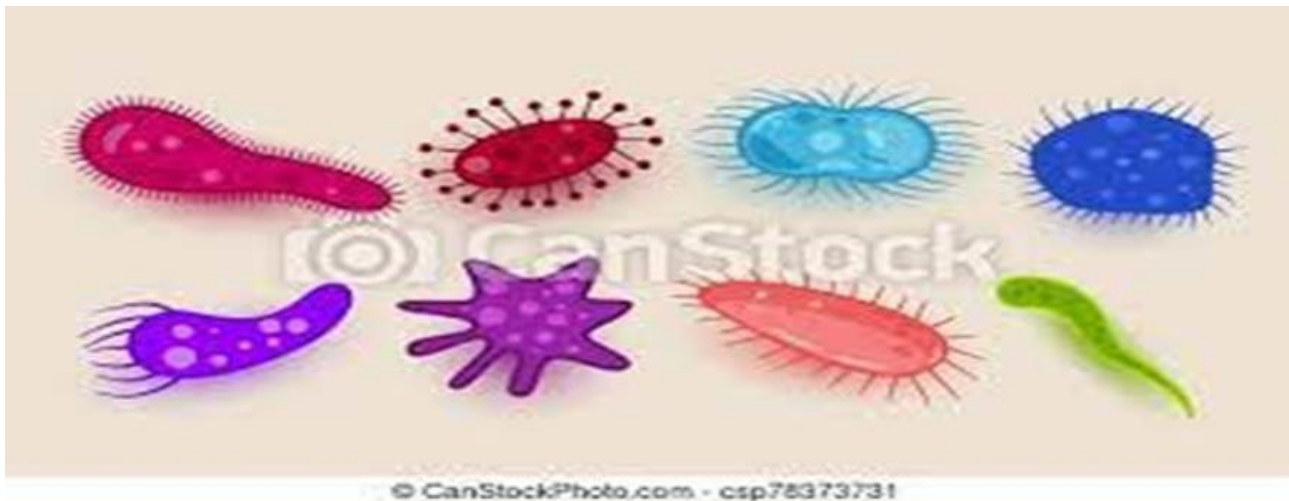


The classification of viruses is based on:

- (1) type of nucleic acid, including whether it is single stranded or double stranded
- (2) viral size and shape.
- (3) the presence or absence of an outer envelope.

Parasitic Nature

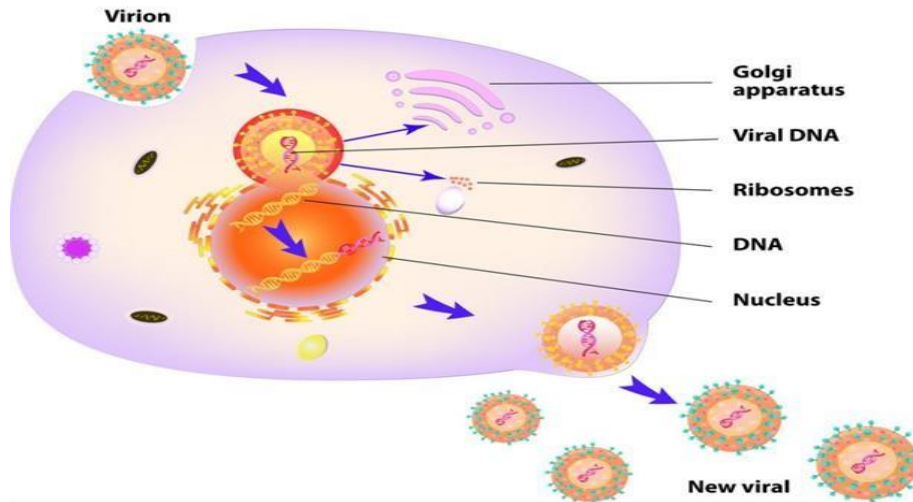
- 1- Viruses are obligate intracellular parasites.
- 2- Viruses infect all sorts of cells—from bacterial cells to human cells—but each type is very specific. For example, bacteriophages infect only bacteria
- 3- Human immunodeficiency viruses (HIV) enter specific types of blood cells, the polio virus reproduces in spinal nerve cells, and the hepatitis viruses infect only liver cells.
- 4- parasite–host-cell relationship exemplified by hypothesis that the nucleic acids of viruses are derived from host-cell genomes! If so, viruses must have evolved after cells came into existence and new viruses may be evolving even now.



Replication of Viruses

Viruses are specific to a particular host cell because portions of the capsid (or the spikes of the envelope) bind in a lock-and-key manner with a receptor on the host cell. After viral nucleic acid enters the cell, it takes over the host-cell plasma membrane. After viral nucleic acid enters the cell, it takes over the metabolic machinery of the host cell so that more viruses are produced.

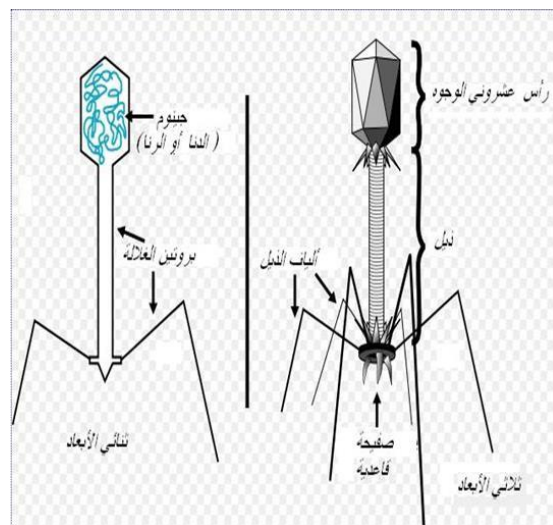
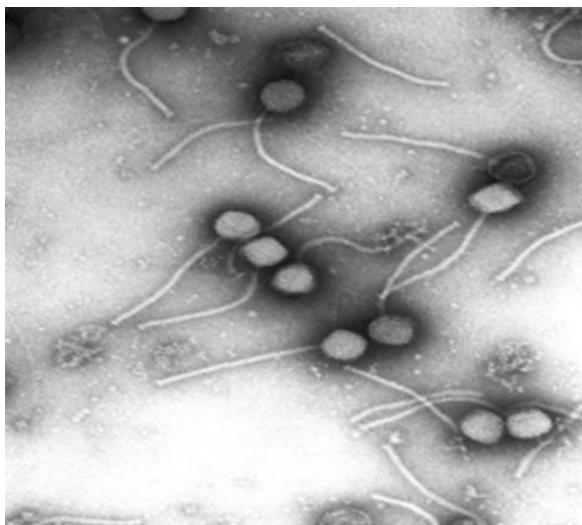
Virus Replication



Replication of Bacteriophages

Bacteriophages, or simply phages, are viruses that parasitize bacteria *Escherichia coli*, which lives in our intestines. The bacteriophage, termed lambda, is capable of carrying out two cycles.

- 1- lytic cycle
- 2- lysogenic cycles.



- **lytic cycle**

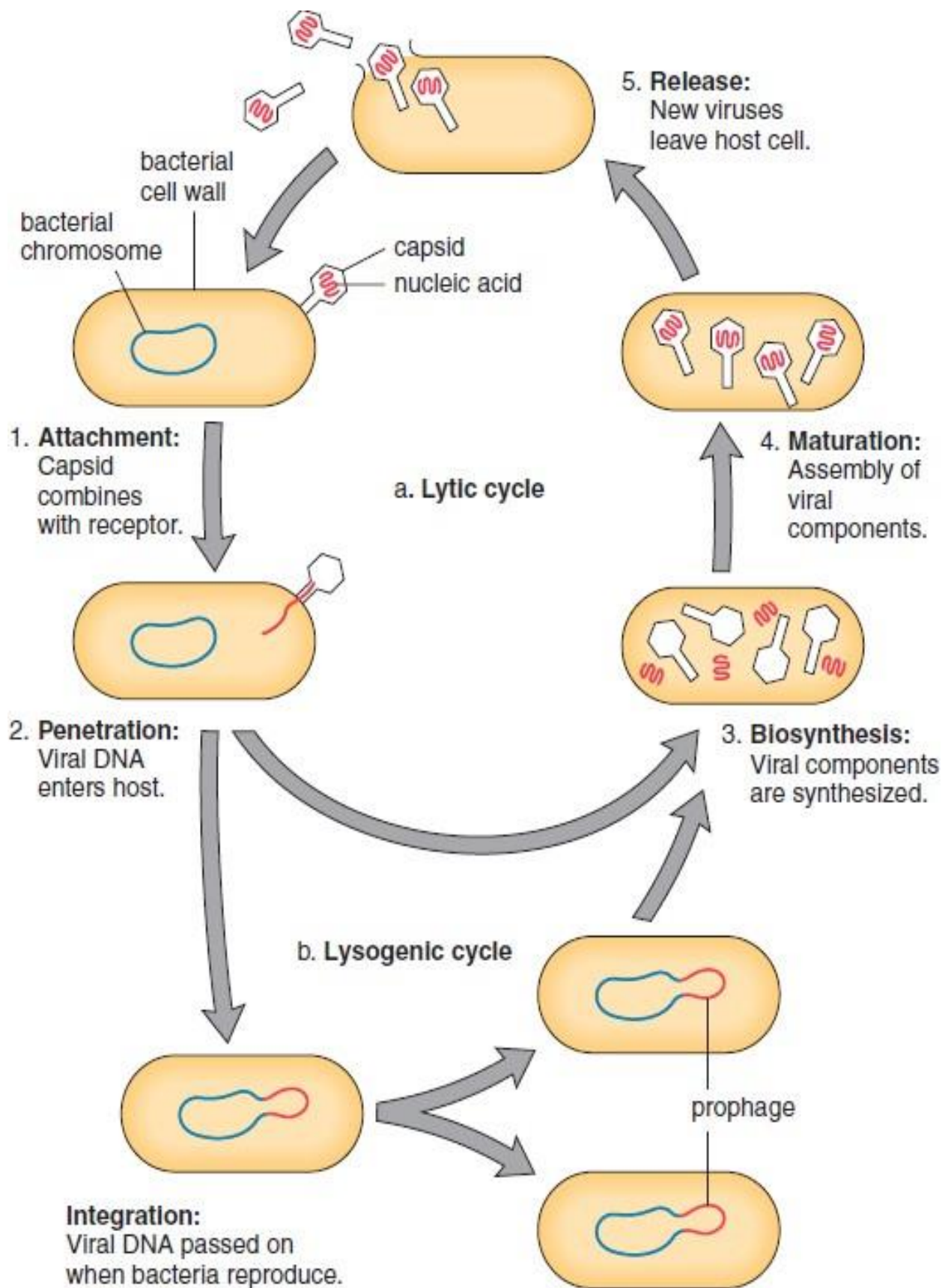
lytic cycle may be divided into five stages:

- 1- During attachment, portions of the capsid combine with a receptor on the rigid bacterial cell wall in a lock-and-key manner.
- 2- penetration, a viral enzyme digests away part of the cell wall, and viral DNA is injected into the bacterial cell.
- 3- Biosynthesis of viral components begins after the virus brings about inactivation of host genes not necessary to viral replication. The virus takes over the machinery of the cell in order to carry out viral DNA replication and production of multiple copies of the capsid protein subunits.
- 4- During maturation, viral DNA and capsids are assembled to produce several hundred viral particles.
- 5- release, Lysozyme, an enzyme coded for by a viral gene, is produced; this disrupts the cell wall, and new viruses are released.

- **Lysogenic Cycle**

In the lysogenic cycle, the infected bacterium does not immediately produce viruses but may do so sometime in the future.

- 1- the phage is latent—not actively replicating.
- 2- Following attachment and penetration, viral DNA becomes integrated into bacterial DNA with no destruction of host DNA.
- 3- While latent, the viral DNA is called a prophage. The prophage is replicated along with the host DNA, and all subsequent cells, called lysogenic cells, carry a copy of the prophage.
- 4- Certain environmental factors, such as ultraviolet radiation, can induce the prophage to enter the lytic stage of biosynthesis, followed by maturation and release.



Replication of human viruses

- 1- If the virus has an envelope, its glycoprotein spikes allow the virus to adhere to plasma membrane receptors.
- 2- Then the capsid and viral genome penetrate a host cell.
- 3- Once inside, the virus is uncoated as the capsid is removed.
- 4- The viral genome, either DNA or RNA, is now free of its coverings, and biosynthesis proceeds.
- 5- Another difference among enveloped viruses is that viral release occurs by budding.

