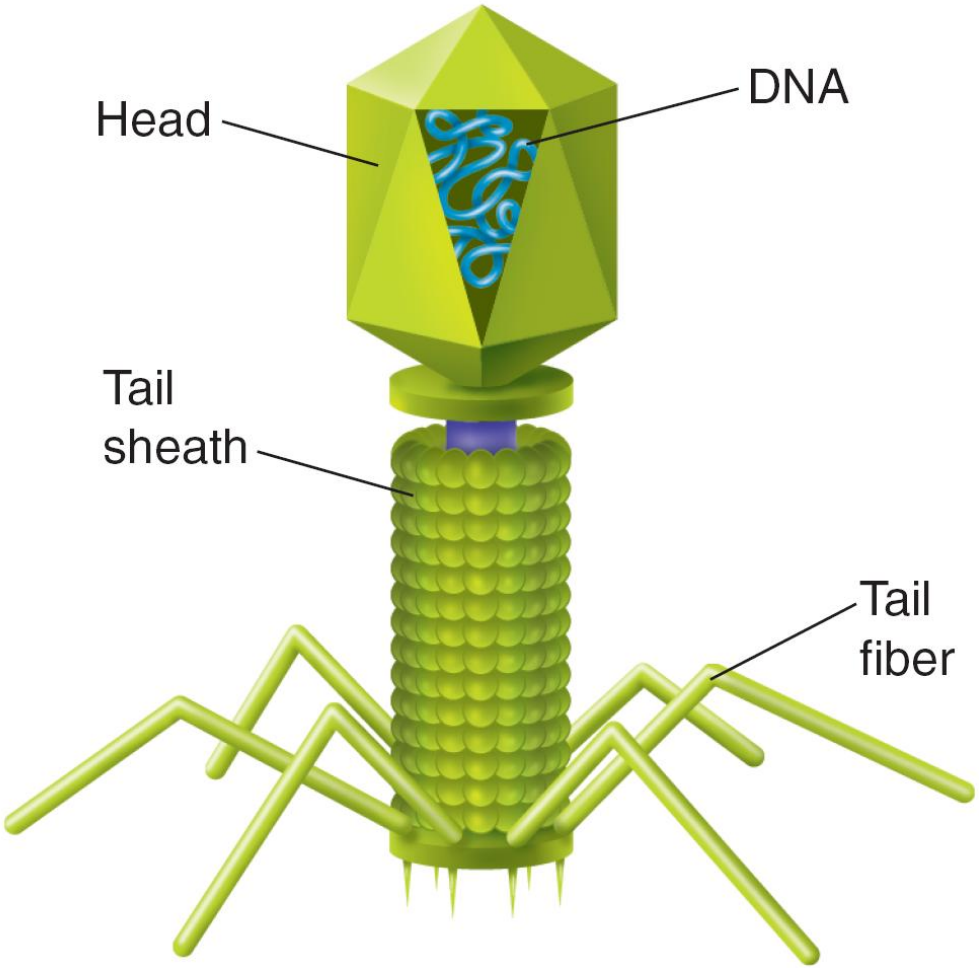
19–2 Viruses

T4 Bacteriophage



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What Is a Virus?

Viruses are particles of nucleic acid, protein, and in some cases, lipids.

Viruses can reproduce only by infecting living cells.

Viruses differ widely in terms of size and structure.

All viruses enter living cells and use the infected cell to produce more viruses.

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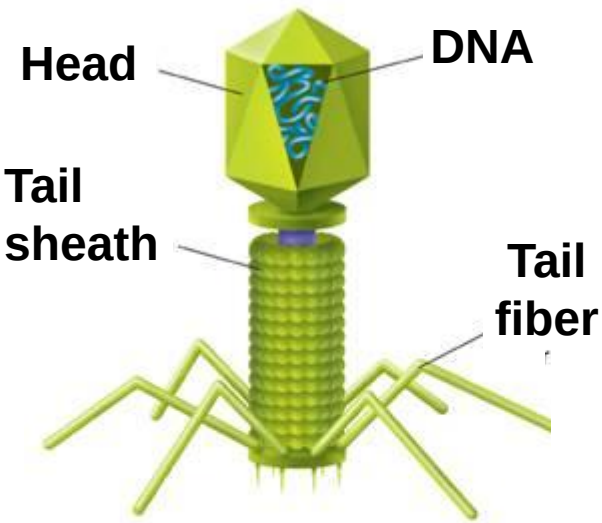
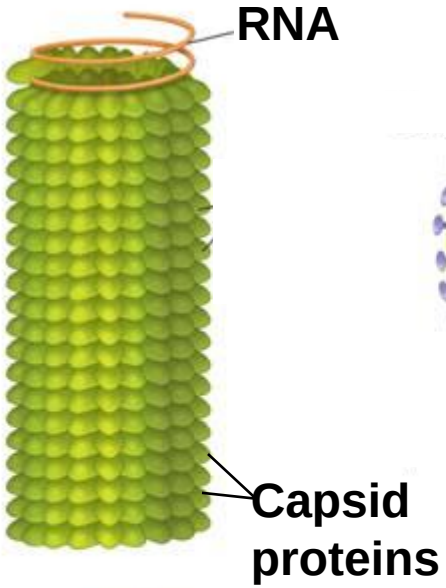
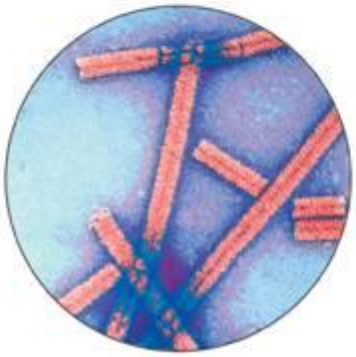
T4 Bacteriophage

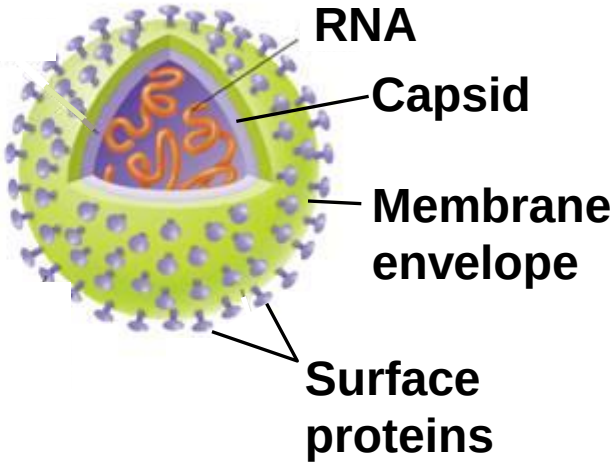


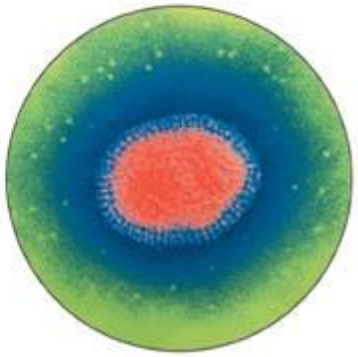
Tobacco Mosaic Virus





Influenza Virus





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A typical virus is composed of a core of DNA or RNA surrounded by a protein coat.

A **capsid** is the virus's protein coat.

Capsid proteins bind to receptors on the cell surface and "trick" the cell into allowing it inside.

Once inside, viral genes are expressed and the cell transcribes and translates them into viral capsid proteins.

The host cell may makes copies of the virus, and be destroyed.

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Most viruses are highly specific to the cells they infect.

Viruses that infect bacteria are called **bacteriophages.**

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Viral Infection

Once the virus is inside the host cell, two different processes may occur.

- Some viruses replicate immediately, killing the host cell.
- Others replicate, but do not kill the host cell immediately.

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19-2 Viruses ➡ Viral Infection

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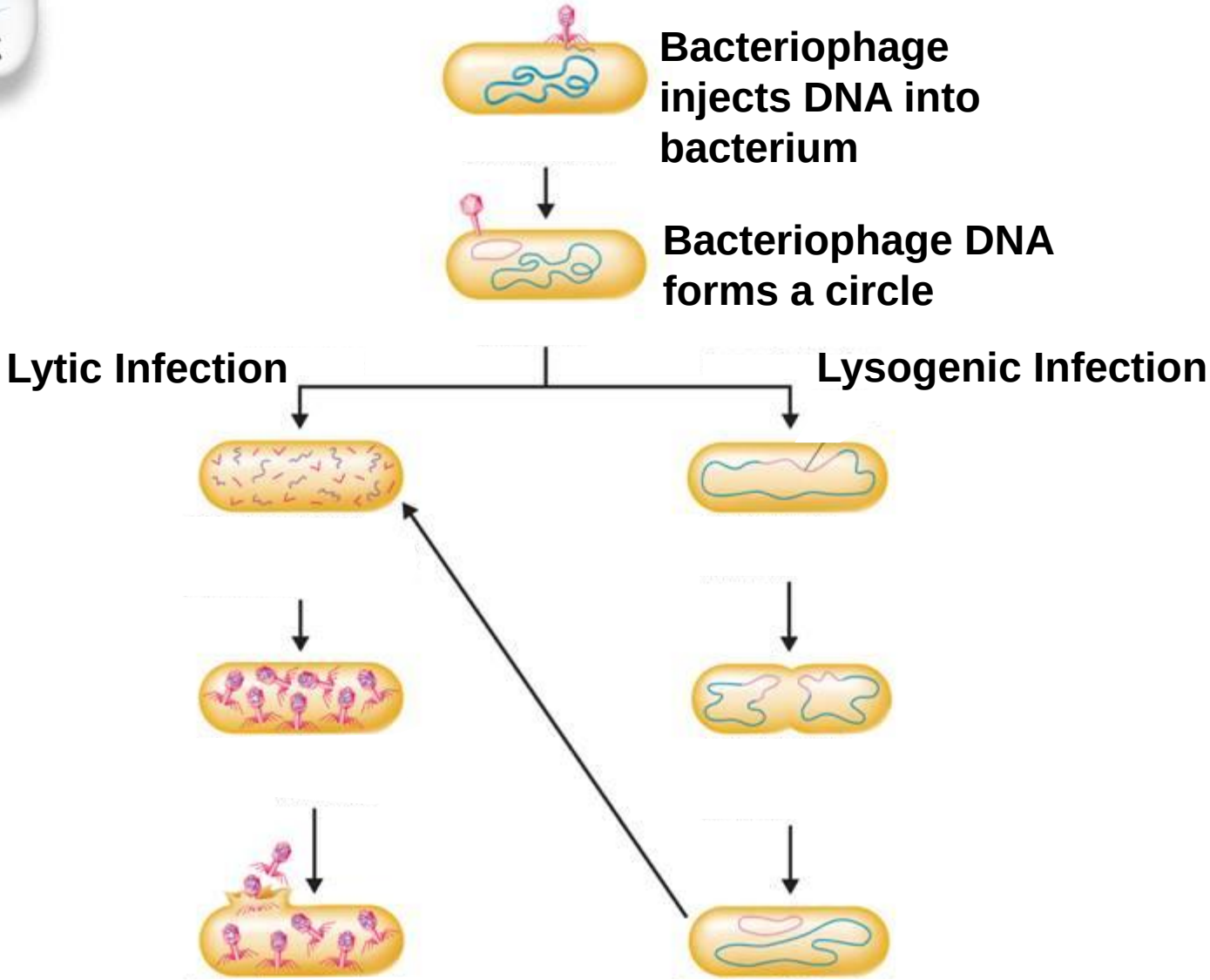

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Lytic Infection

In a lytic infection, a virus enters a cell, makes copies of itself, and causes the cell to burst.

First, the bacteriophage injects DNA into a bacterium.

The bacteriophage DNA forms a circle.

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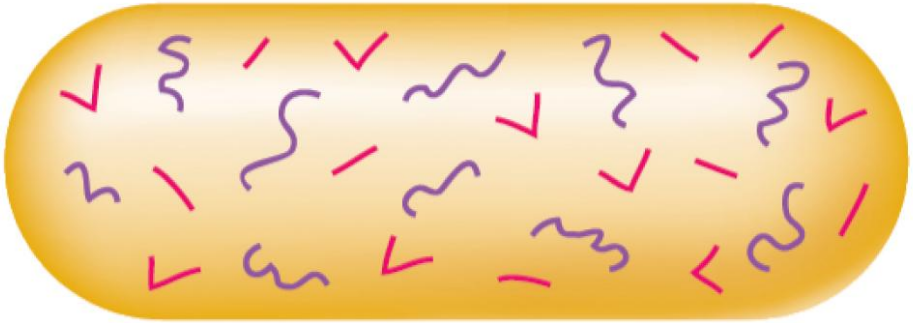
Lytic Infection



Bacteriophage takes over bacterium's metabolism, causing synthesis of new bacteriophage proteins and nucleic acids.

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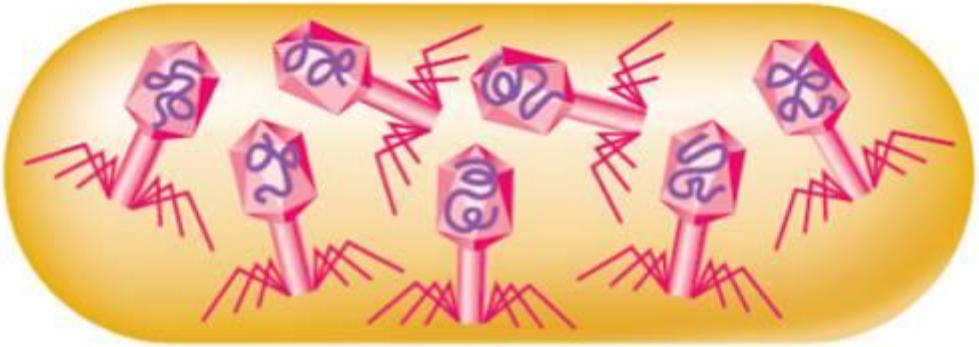
Lytic Infection



Bacteriophage proteins and nucleic acids assemble into complete bacteriophage particles.

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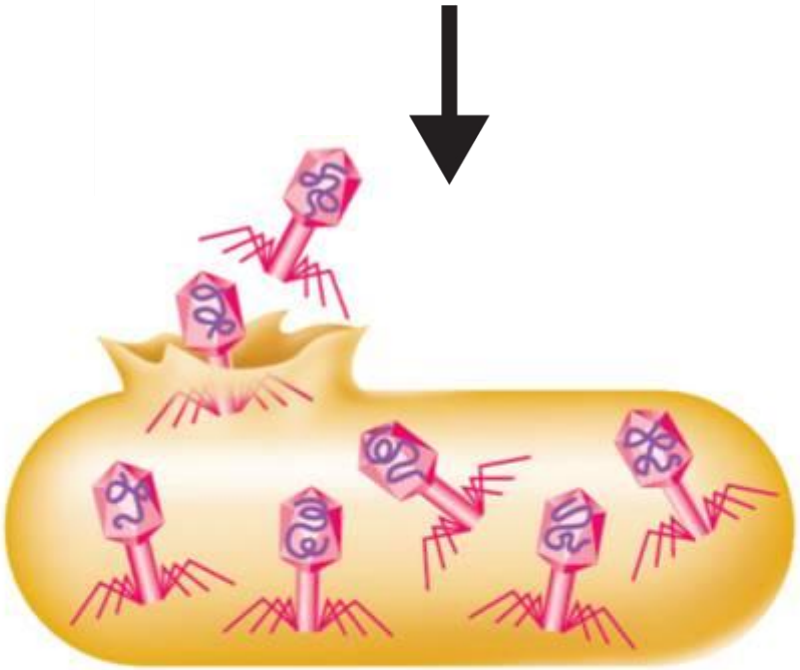
Lytic Infection



Bacteriophage enzyme lyses the bacterium's cell wall, releasing new bacteriophage particles that can attack other cells.

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Lysogenic Infection

Other viruses cause **lysogenic infections** in which a host cell makes copies of the virus indefinitely.

In a lysogenic infection, a virus integrates its DNA into the DNA of the host cell, and the viral genetic information replicates along with the host cell's DNA.

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A lysogenic infection begins the same way as a lytic infection.

The bacteriophage injects DNA into a bacterium.

The bacteriophage DNA forms a circle.

The viral DNA embedded in the host's DNA is called a **prophage**.

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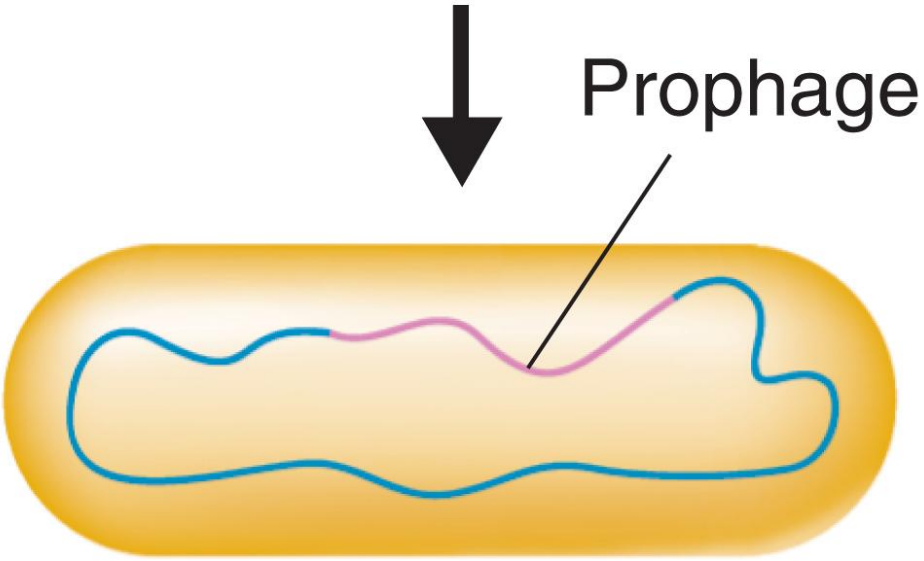
Lysogenic Infection



Bacteriophage DNA inserts itself into bacterial chromosome.

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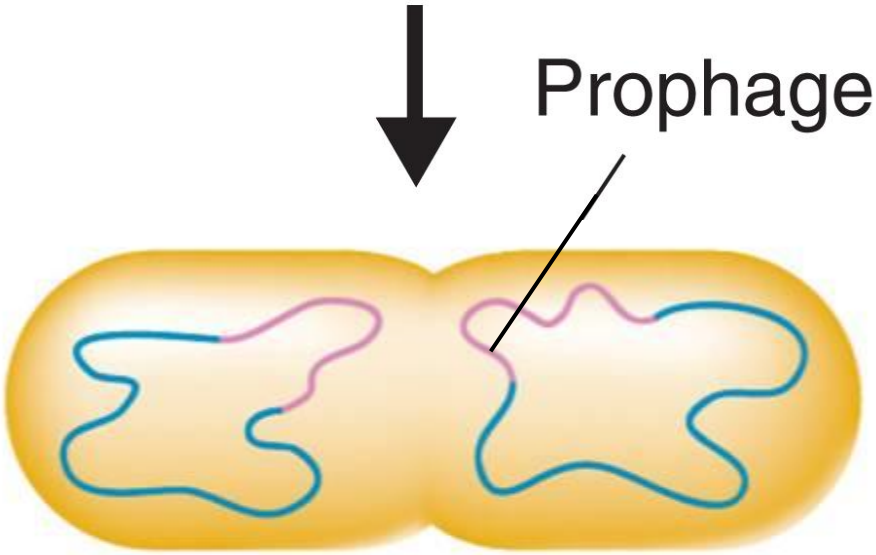
Lysogenic Infection



Bacteriophage DNA (prophage) may replicate with bacterium for many generations.

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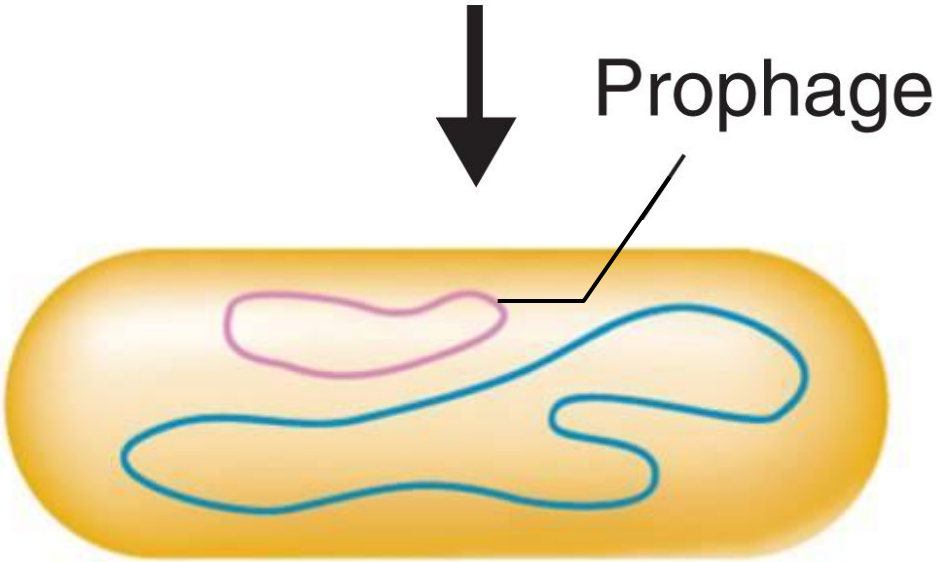
Lysogenic Infection



Bacteriophage DNA (prophage) can exit the bacterial chromosome. Bacteriophage enters lytic cycle.

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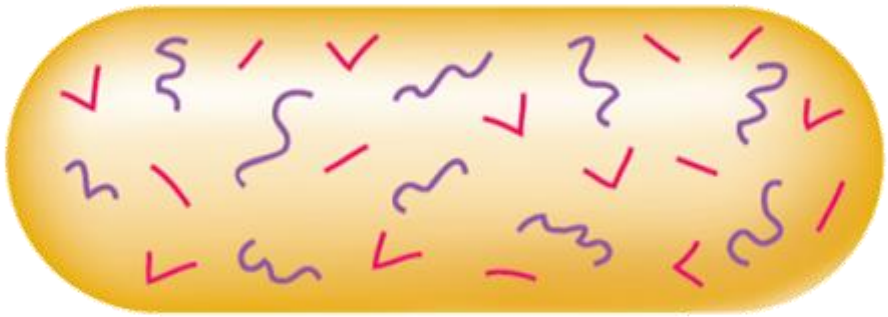
Lytic Infection



Bacteriophage takes over bacterium's metabolism, causing synthesis of new bacteriophage proteins and nucleic acids.

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Retroviruses

Retroviruses contain RNA as their genetic information.

When retroviruses infect cells, they make a DNA copy of their RNA.

This DNA is inserted into the DNA of the host cell.

A retrovirus' genetic information is copied backward—from RNA to DNA.

The virus that causes AIDS is a retrovirus.

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Viruses and Living Cells

Viruses must infect a living cell in order to grow and reproduce.

They take advantage of the host's respiration, nutrition, and all other functions of living things. Viruses have many of the characteristics of living things.

After infecting living cells, viruses can reproduce, regulate gene expression, and even evolve.

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Because viruses are dependent on living things, it seems likely that viruses developed after living cells.

The first viruses may have evolved from genetic material of living cells.

Viruses have continued to evolve over billions of years.

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19–2 Section QUIZ

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1 Viruses that contain RNA as their genetic information are known as

a. prions.

b. oncoviruses.

c. retroviruses.

d. bacteriophage.

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2 The first type of virus to be studied was the

a. bacteriophage.

b. tobacco mosaic virus.

c. influenza virus.

d. AIDS virus.

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3 Which of the following statements about viruses is true?

a. Viruses appear similar to bacteria when studied with a light microscope.

b. Viruses display the essential characteristics of living things.

c. Viruses can reproduce independently if they contain DNA.

d. Viruses cannot reproduce unless they infect a living cell.

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4 A virus integrates its DNA into the DNA of the host cell but remains inactive for a while in

a. a lytic infection.

b. a lysogenic infection.

c. neither a lytic nor a lysogenic infection.

d. retroviral infection.

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5 Retroviruses are considered unique because

a. their capsids are made of RNA in and not DNA.

b. they have DNA in their capsid and not RNA.

c. after infection of a host cell, their RNA makes DNA.

d. after infection of a host cell, their DNA makes RNA.

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