Module 2B – Viruses

- Viruses are not complete living organisms. They are smaller and simpler in structure than even the simplest prokaryotic cells.
- However, because they have some characteristics of life, they are important subjects of research for biologists.

1

Objective # 9

Explain the similarities and differences between viruses and living organisms.

2

Objective 9

- Like living organisms, viruses contain genetic instructions. However, they lack the machinery needed to carry out these instructions.
- On their own, they are inert chemicals and cannot perform any life functions.
- However, if they enter a living host cell, they can use the cell's machinery to replicate.

3

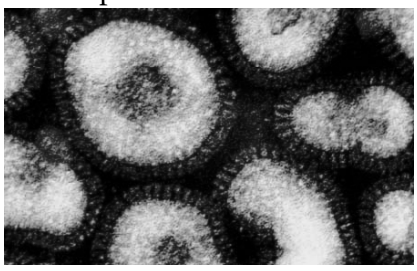
Objective # 10

Describe the structure of a typical virus. Be sure to discuss the following: nucleic acid core, protein coat or capsid, envelope, viral-specific enzymes.

4

Objective 10

- A virus consists of a nucleic acid core surrounded by a protective coat. Here is a photo of the Influenza virus:



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Objective 10

All viruses contain at least 2 parts:

1) Nucleic acid core or Genome
   - May be DNA or RNA but not both
   - Usually only 1 or 2 molecules
   - DNA or RNA may be linear or circular, and either single-stranded or double-stranded
   - Functions as the genetic material

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Objective 10

2) Protein coat or Capsid

- Surrounds and protects the nucleic acid core
- Composed of one or a few proteins repeated many times
- Shape is usually helical or icosahedral. An icosahedron may look spherical on lower power, but is actually composed of 20 equilateral triangular facets:

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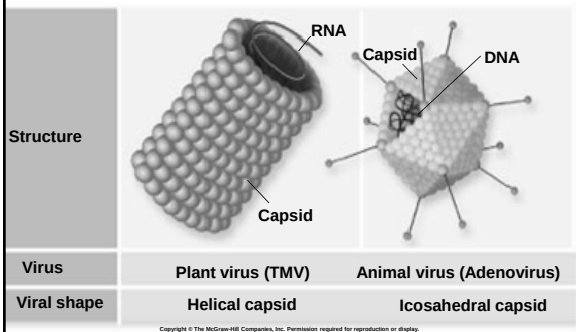
Objective 10

Viruses with helical and icosahedral capsids:



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Objective 10

- Some viruses have a complex capsid with binal (two-fold) symmetry that is neither purely icosahedral nor helical
- For example, the capsid of T-even bacteriophages consists of a head that is an elongated icosahedron attached to a tail that is helical. Tail fibers and a base plate are also present:

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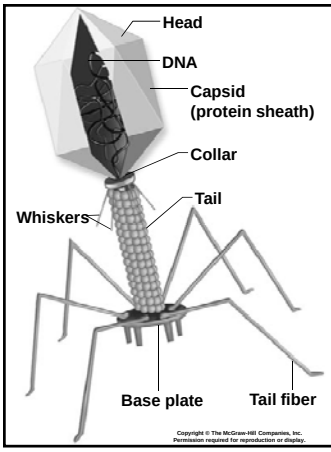

Complex capsid of a T-even phage consists of an icosahedral head attached to a helical tail with tail fibers and base plate

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Objective 10

In addition to a genome and capsid, some viruses also have:

3) Envelope

- Surrounds the capsid
- Rich in lipids, proteins, and glycolipids
- Derived from the host's cell membrane, but also contains proteins coded by viral genes

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Objective 10

4) Viral-specific enzymes

- Enzymes the virus needs, but that are not supplied by the host cell
- Coded by the viral genome
- Stored inside the capsid

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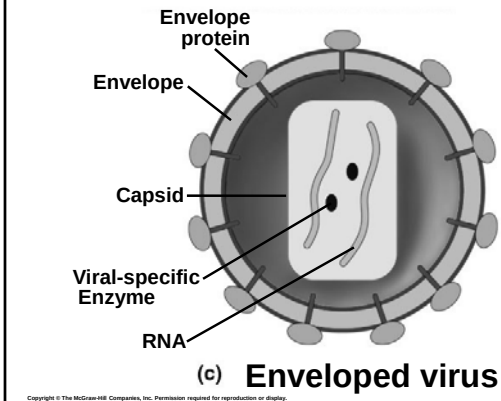

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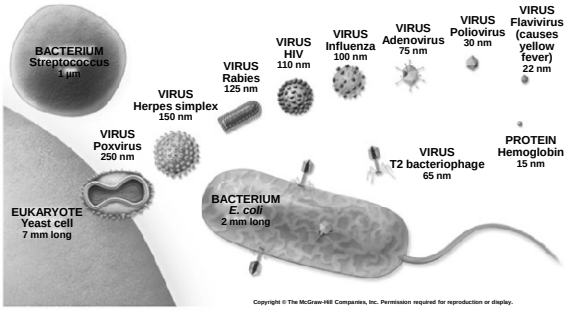
Viral Diversity



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Objective # 11

Explain what a bacteriophage is, and be able to name and describe the 2 types of reproductive cycles found in bacteriophages.

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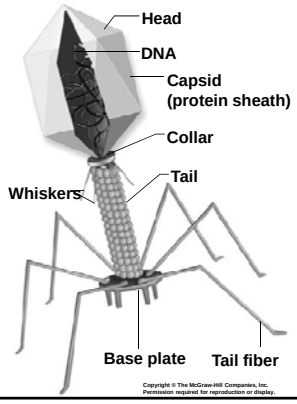
Objective 11

- Bacteriophages, called phages for short, are viruses that infect bacteria.



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Objective 11

Two types of reproductive cycles are found in bacteriophages:

1) Lytic cycle:
   - Phage exists free in the host cell's cytoplasm.
   - Phage replicates and the new phages are released by lysis (bursting) of the host cell.

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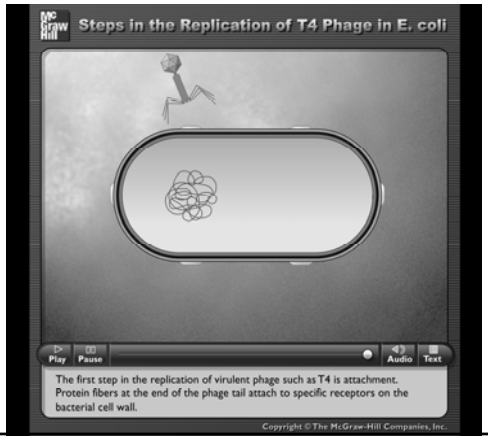

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Objective 11

2) Lysogenic cycle:

- Phage DNA is integrated into the host cell's DNA.
- Phage DNA can remain inactive and be replicated along with the host DNA for many generations.
- Under certain conditions, phage will enter lytic cycle and lyse the host cell.

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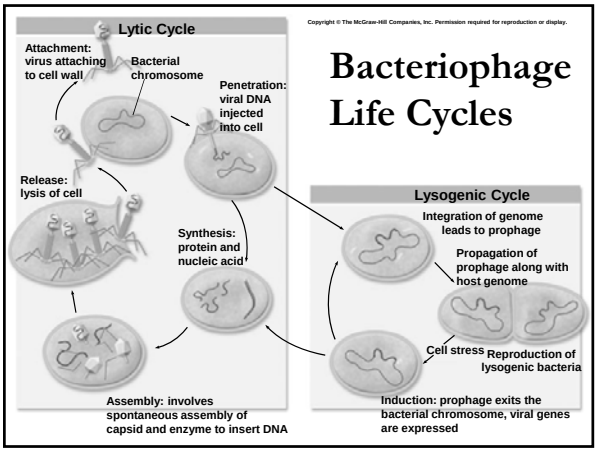

Bacteriophage Life Cycles

Objective # 12

- Describe the life cycle of a representative animal virus, such as HIV.

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Objective 12

- One group of animal viruses are the retroviruses.
- Retroviruses are enveloped viruses that have an RNA genome. Once inside a host cell, they use the enzyme reverse transcriptase to make a DNA copy of their RNA genome.
- HIV is an example of a retrovirus.

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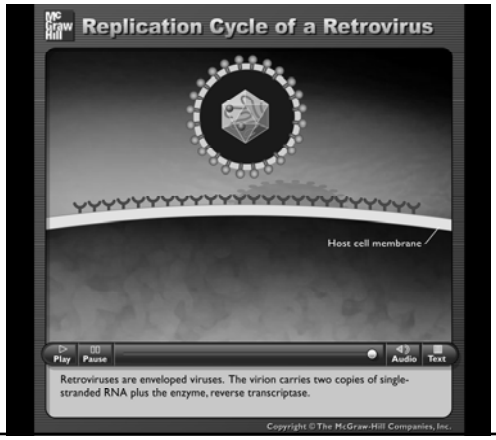

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Mechanism for Releasing Enveloped Virions
Cell exterior
Cell interior
Play
Pause
Audio
Text
Enveloped viruses are usually released from the host cell by a budding mechanism.
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How the HIV Infection Cycle Works
Play
Pause
Audio
Text
When HIV first enters the human bloodstream the virus circulates throughout the body. The protective surface of HIV is studded with particular proteins called gp120, and inside is a capsid that contains the viral RNA and viral enzymes.
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Treatment of HIV
HIV RNA
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Text
At present, treatment for HIV infection involves using a combination of drugs. One type of drug inhibits nucleic acid replication.
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