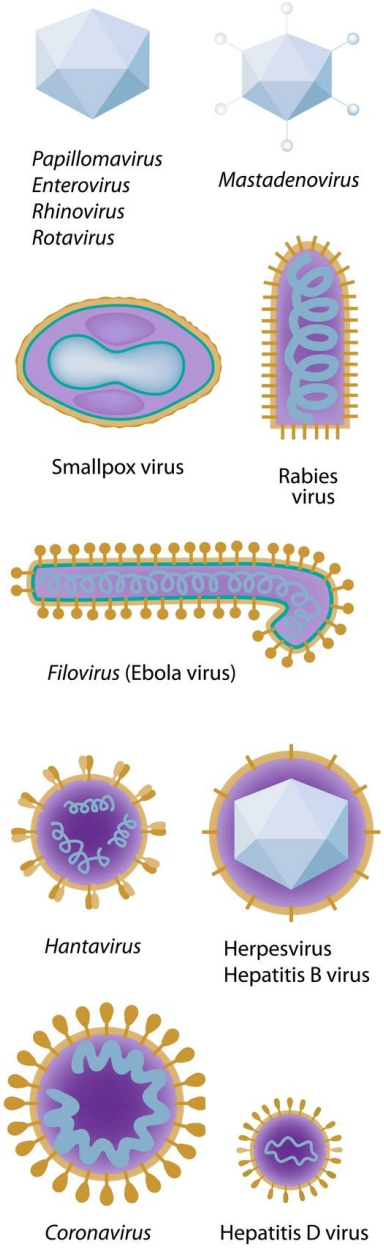
The student is expected to:

TEKS

4C Compare the structures of viruses to cells, describe viral reproduction, and describe the role of viruses in causing diseases such as human immunodeficiency virus (HIV) and influenza

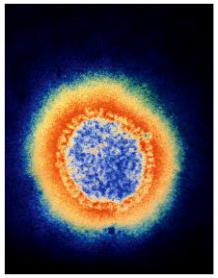
KEY CONCEPT

Viruses exist in a variety of shapes and sizes.

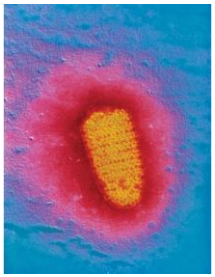


Viruses differ in shape and in ways of entering host cells.

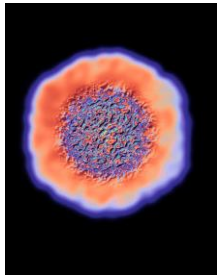
- Viruses have a simple structure.
  - genetic material
  - capsid, a protein shell
  - sometimes a lipid envelope, a protective outer coat



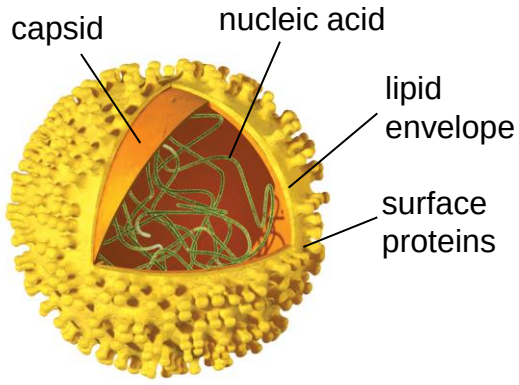
enveloped (influenza)

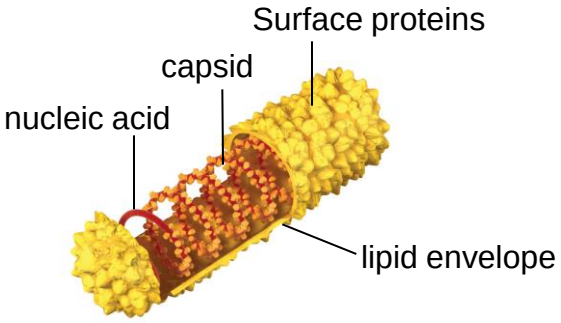


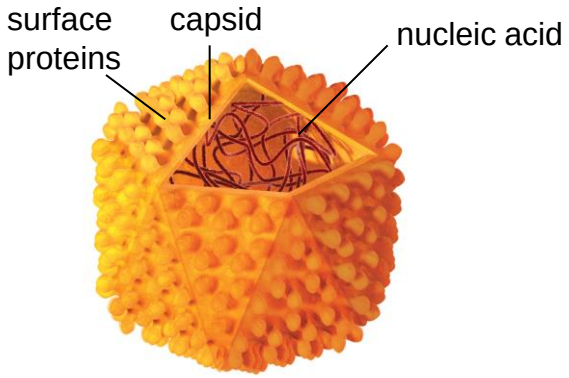
helical (rabies)



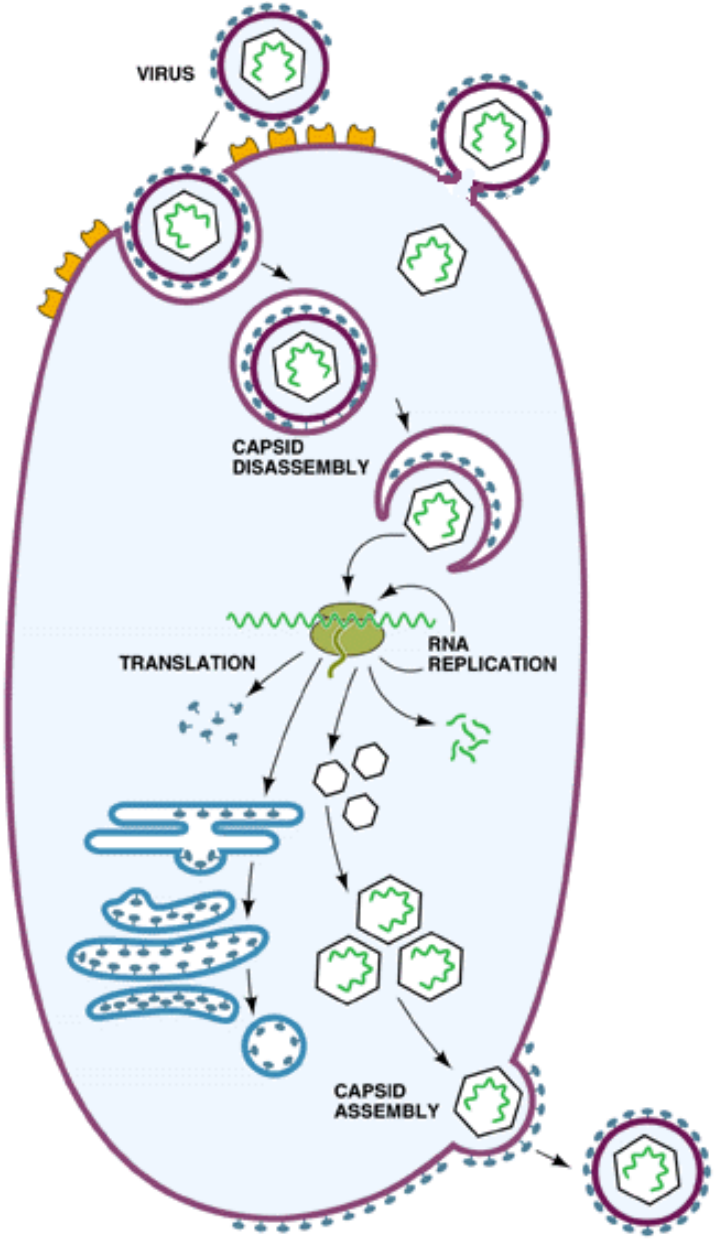
polyhedral (foot-and-mouth disease)







- Viruses enter cells in various ways.
  - viruses of eukaryotes can enter by endocytosis
  - newly assembled viruses then exit via exocytosis, gaining their lipid envelope from the membrane of the host cell

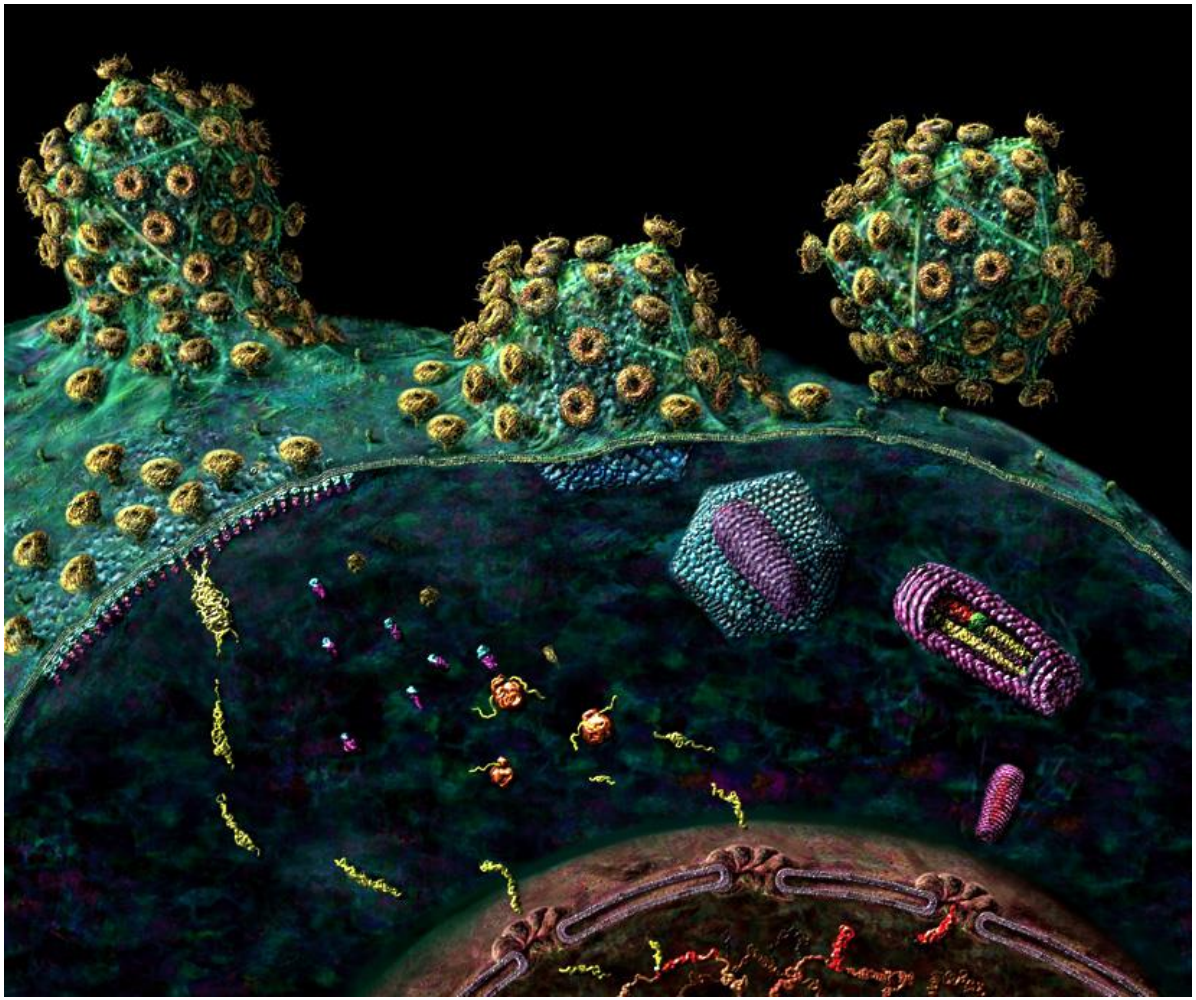


- Viruses enter cells in various ways.

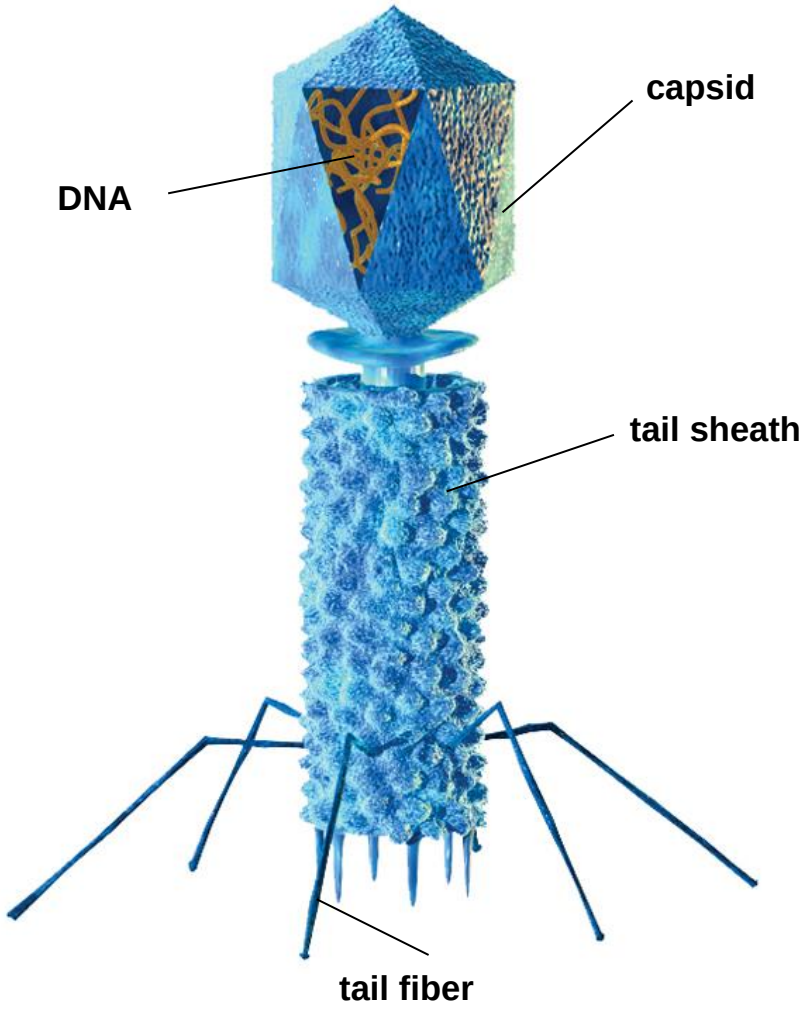
– viruses of eukaryotes can also fuse with the cell membrane

– DNA (or RNA) are released into the cytoplasm of the host, while the viral envelope remains as part of the cellular membrane

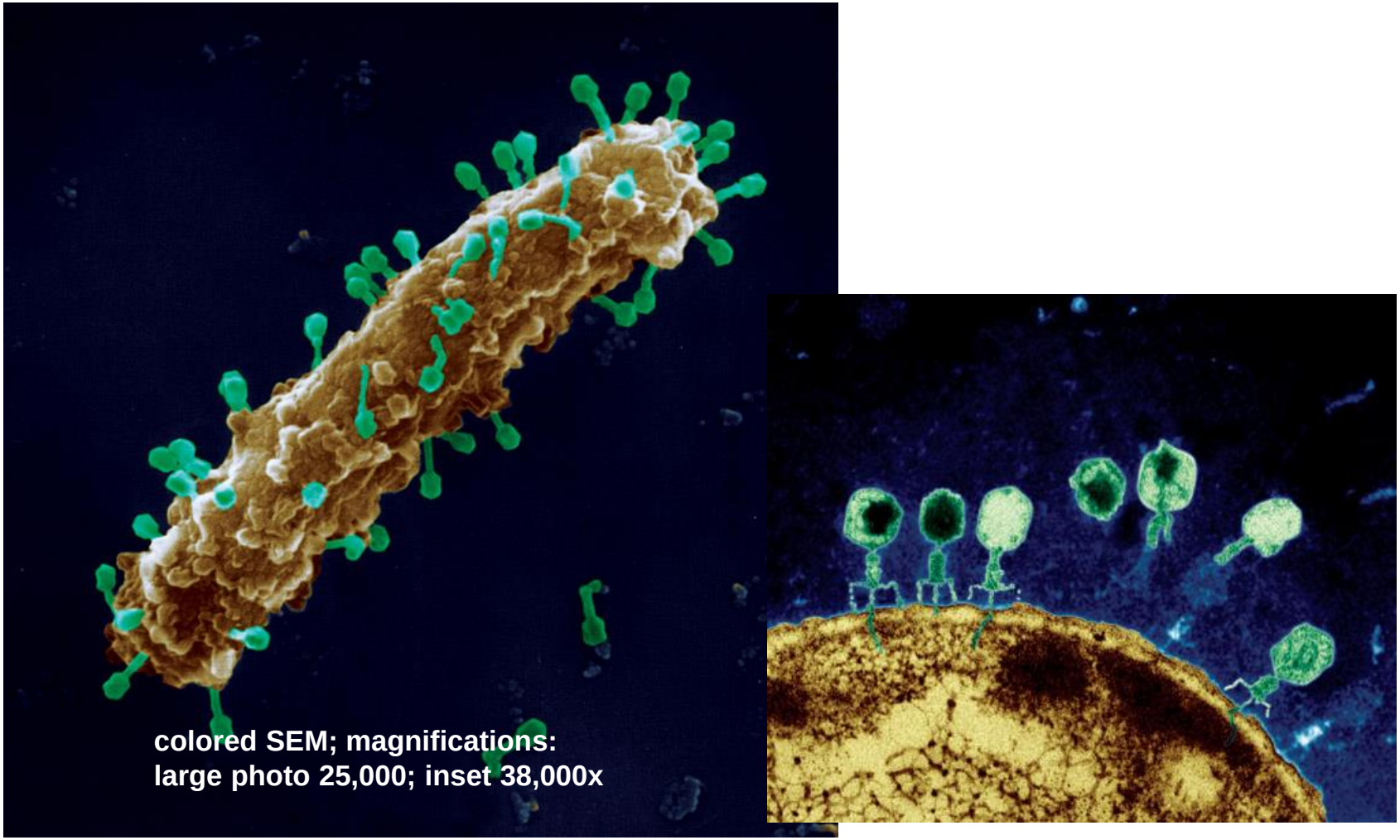
– newly assembled viruses then fuse with sections of viral membrane in the host membrane to exit, or bud out



- Bacteriophages are viruses that infect bacteria.



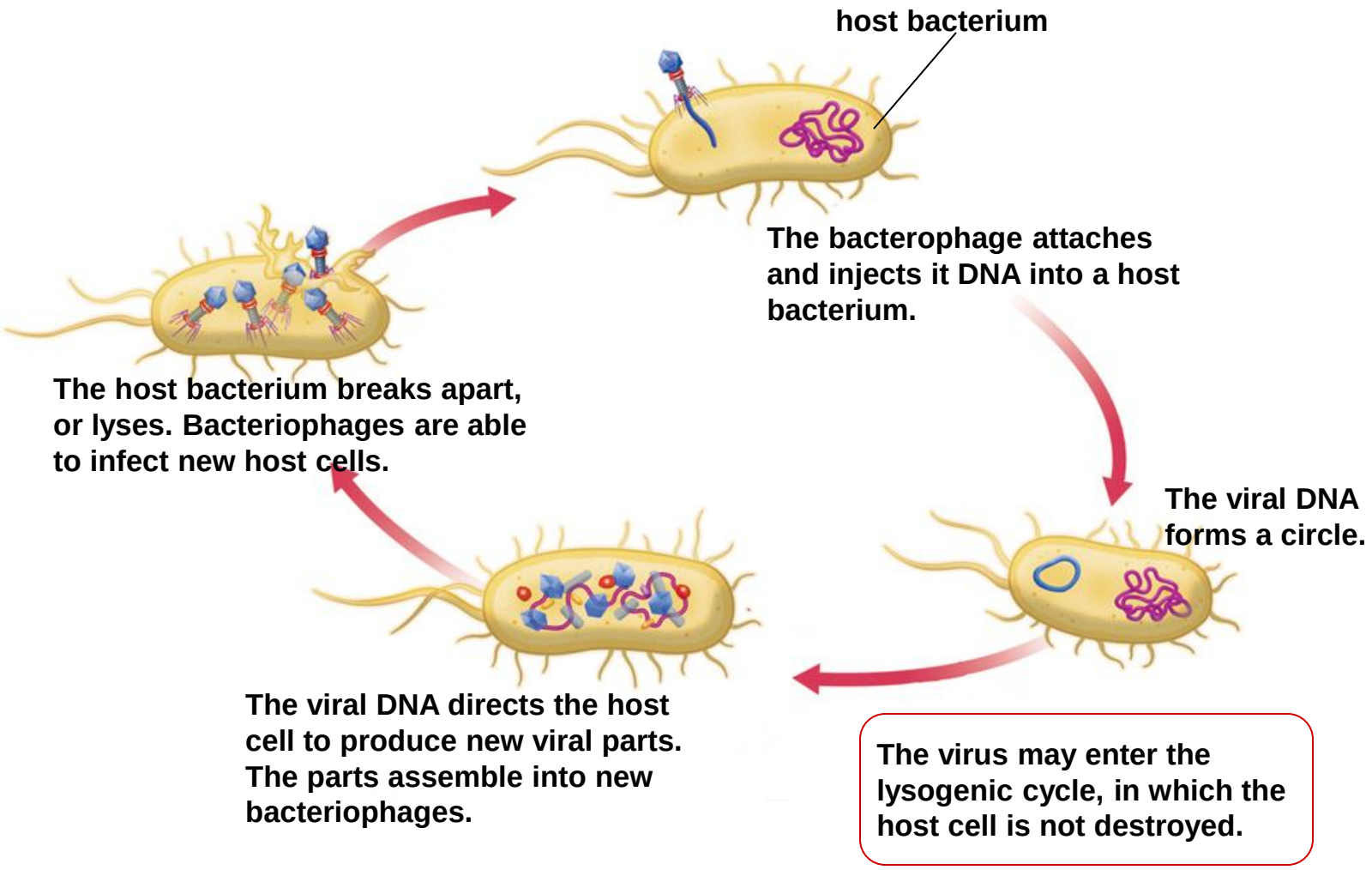
- Viruses enter cells in various ways.
  - bacteriophages pierce host cells to inject their genetic material



colored SEM; magnifications:
large photo 25,000; inset 38,000x

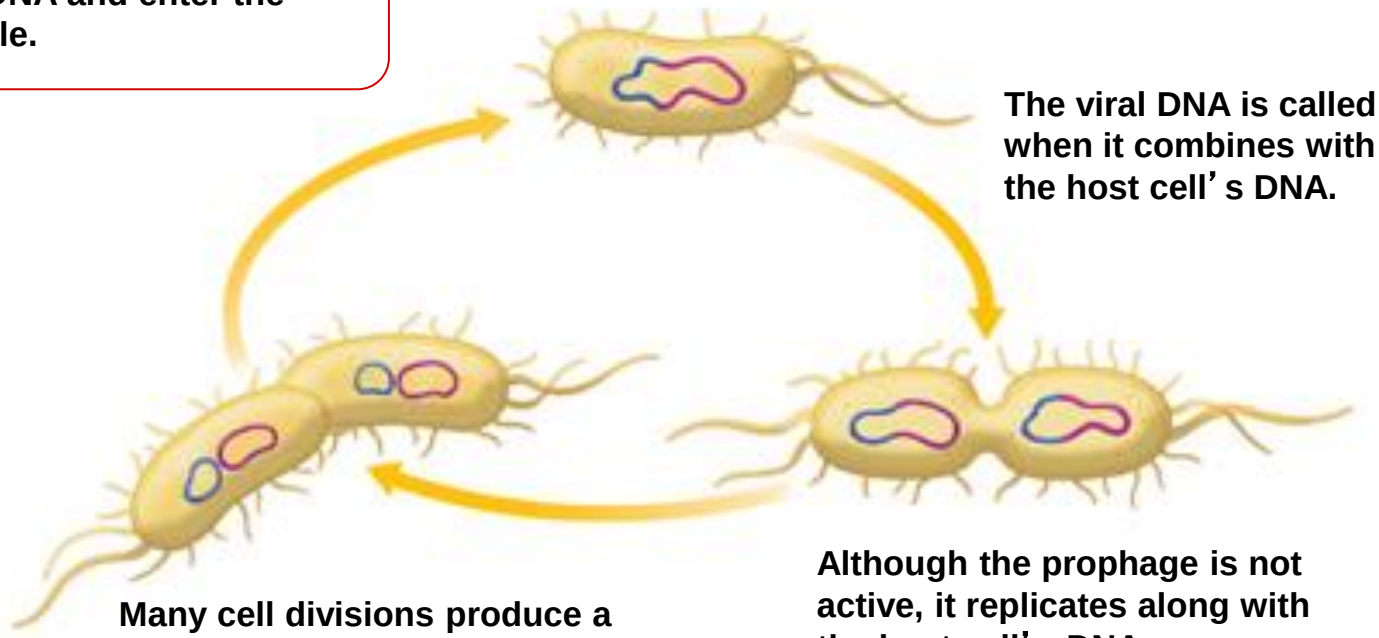
Viruses cause two types of infections.

- A lytic infection causes the host cell to burst.



- A lysogenic infection does no immediate harm.

The prophage may leave the host's DNA and enter the lytic cycle.



The viral DNA is called a prophage when it combines with the host cell's DNA.

Although the prophage is not active, it replicates along with the host cell's DNA.

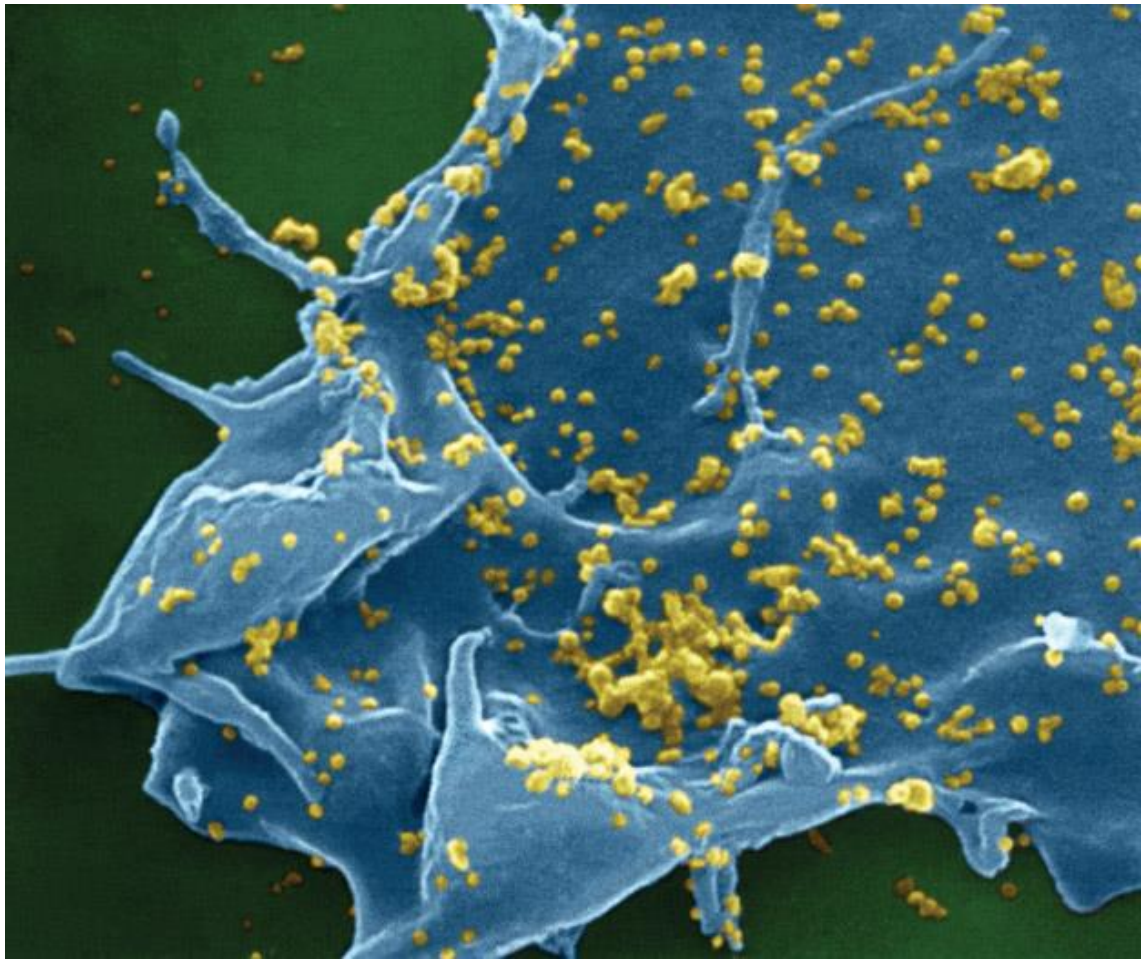
Many cell divisions produce a colony of bacteria infected with prophage.

KEY CONCEPT

Some viral diseases can be prevented with vaccines.

Viruses cause many infectious diseases

- There are many examples of viral infections.
  - common cold



Viruses cause many infectious diseases

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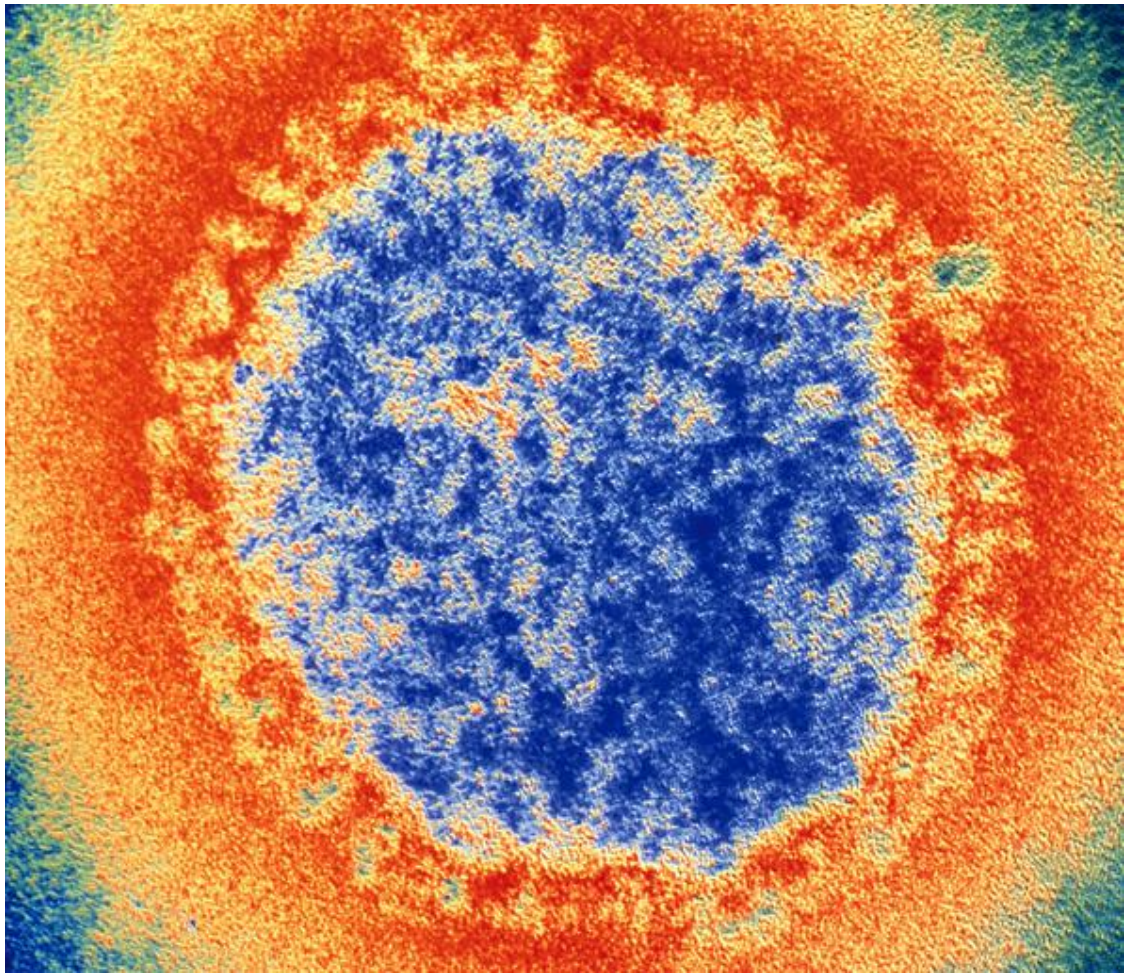
  - common cold
  - influenza



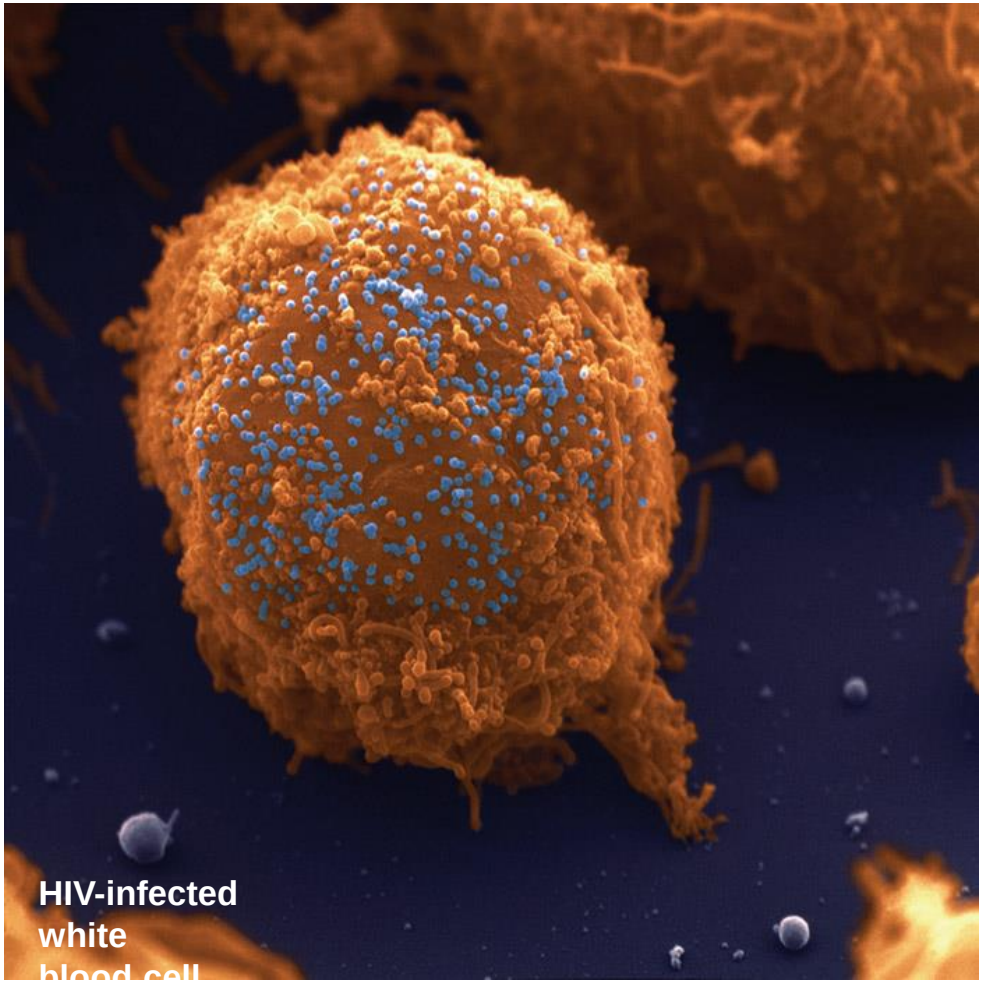
Viruses cause many infectious diseases

- There are many examples of viral infections.
  - common cold
  - influenza
  - SARS

Viruses cause many infectious diseases

- There are many examples of viral infections.
  - common cold
  - influenza
  - SARS
  - HIV

- The body has natural defenses against many viruses.



Vaccines are made from weakened pathogens.

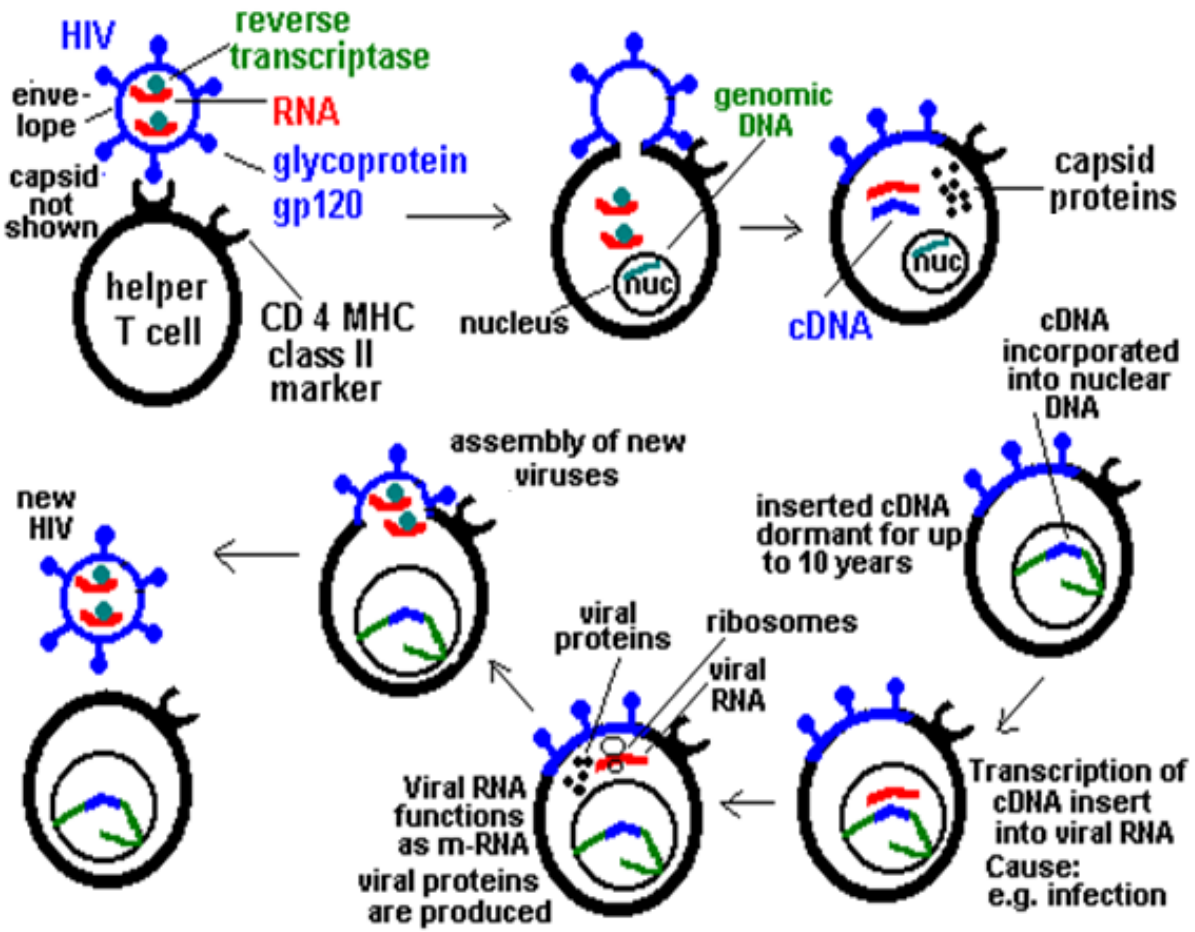
- A vaccine stimulates the body's own immune response.
- Vaccines prepare the immune system for a future attack.

VIRAL INFECTION	SYMPTOMS OF DISEASE	TRANSMISSION OF DISEASE	U.S. VACCINE RECOMMENDATION
Chickenpox	rash, itchy skin, fever, fatigue	contact with rash, droplet inhalation	for children between 12 and 18 months
Hepatitis A	yellow skin, fatigue, abdominal pain	contact with contaminated feces	for people traveling to infected locations and protection during outbreaks
Mumps	painful swelling in salivary glands, fever	droplet inhalation	for children between 12 and 15 months and again at 4 to 6 years
Rabies	anxiety, paralysis, fear of water	bite from infected animal	for veterinarians and biologists in contact with wildlife
West Nile	fever, headache, body ache	bite from infected mosquito	no available vaccine

- Vaccines are currently the only way to control the spread of viral disease.

HIV Infection

- HIV has RNA as its genetic material
- Glycoproteins on the envelope cause humar cells to allow it to enter
- The HIV virus also has a copy of an enzyme called reverse transcriptase which is used to make a complementary DNA copy of the virus RNA



- The complementary DNA is inserted into the cells genomic DNA, where it can lie dormant, sometimes for years
- When activated, the viral DNA serves as a template for production of viral RNA, which is then used as a template for viral proteins

Influenza Infection

- the flu virus has eight RNA segments in a capsid, surrounded by an envelope studded with two types of glycoproteins, Hemaglutinin (H) and Neuraminidase (N)
- the virus has a specific RNA polymerase which transcribes m-RNAs from each of the viral RNA's
- the H glycoproteins on the virus surface attaches to receptors on the host cell, allowing the virus to enter the host cell
- N glycoproteins are thought to deform the membrane from inside allowing newly assembled viruses to leave the cell during virion budding
- antibodies against flu are mainly directed against H and N, but these are different in different strains of flu, making vaccines hard to make