

# Viruses

# TEKS

- Compare the structures of viruses to cells, describe viral reproduction, and describe the role of viruses in causing disease such as Human Immunodeficiency Virus (HIV) and influenza

# VOCABULARY

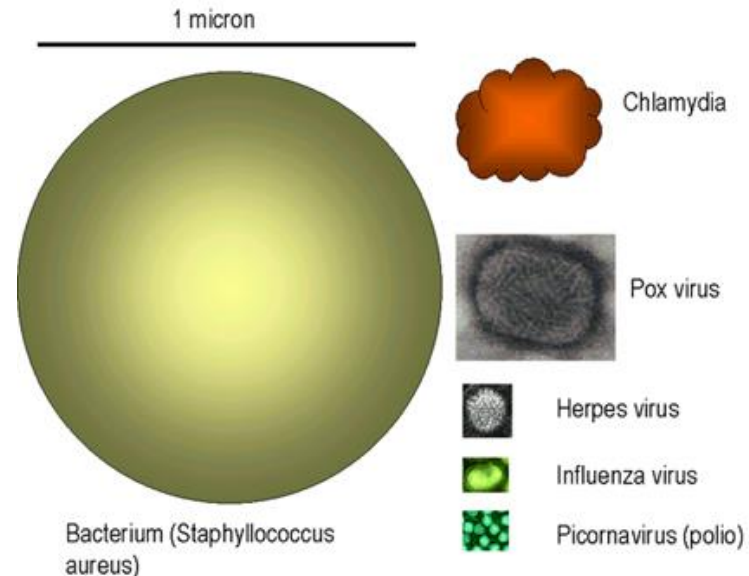
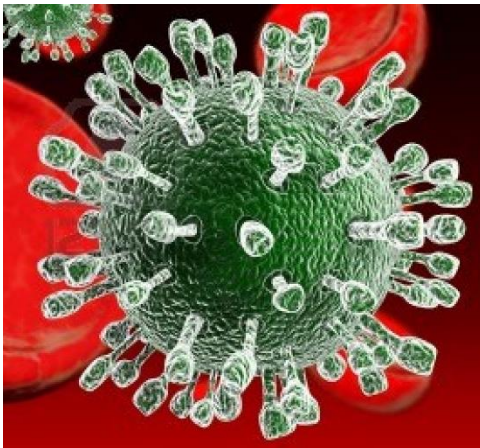
- Virus
- Capsid
- Envelope
- Human Immunodeficiency Virus (HIV)
- Influenza
- Lytic Cycle
- Lysogenic Cycle
- Lysis
- Retrovirus

# Prerequisite questions

- What are the eight characteristics which all living things have in common?
- What are the 4 organelles/molecular structures that all living things must contain?

# What is a virus?

- Are **Non-living** particles
- Composed of **nucleic acid** in a protein coat
- Smaller than any **bacteria**
- Named for **disease they cause, or for the organ or tissue they infect**



# Viruses...are they alive?

They are considered **NON LIVING** because they:

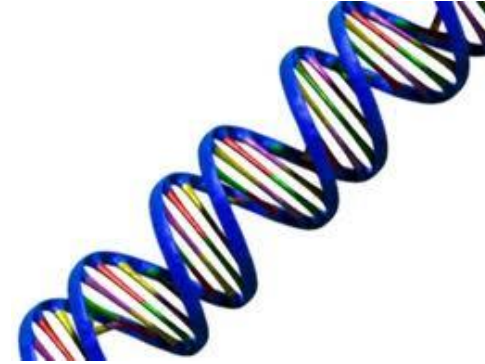
1. don't **grow**
2. don't **develop**
3. don't **reproduce**
4. don't **carry out respiration**



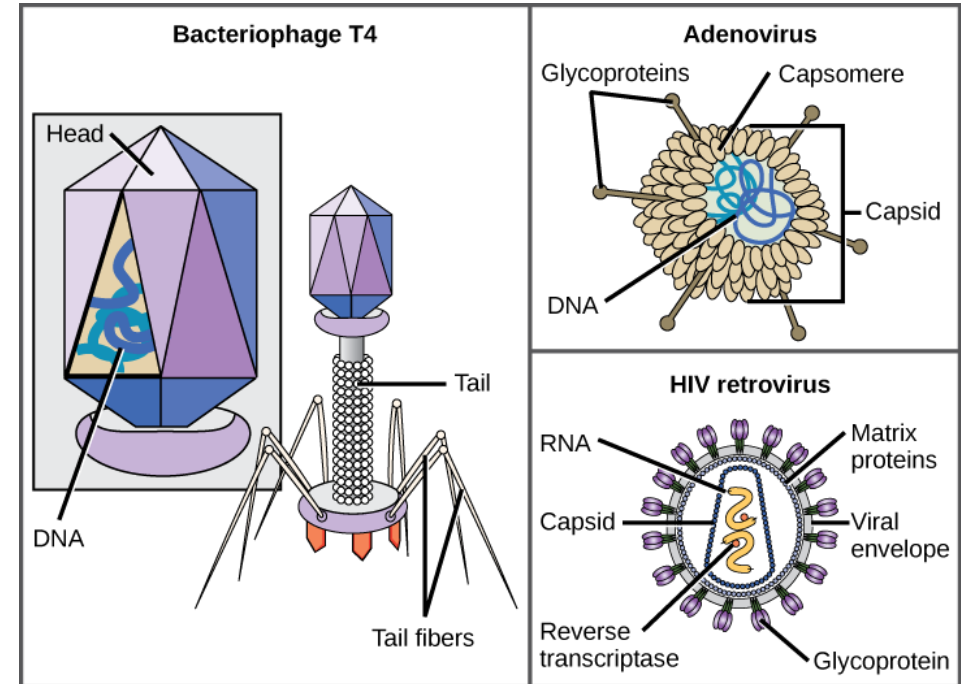
\*Viruses DO NOT divide on their own, they are **REPLICATED** in a host cell

# Structures found in all viruses

## 1. Nucleic acids (either DNA or RNA)

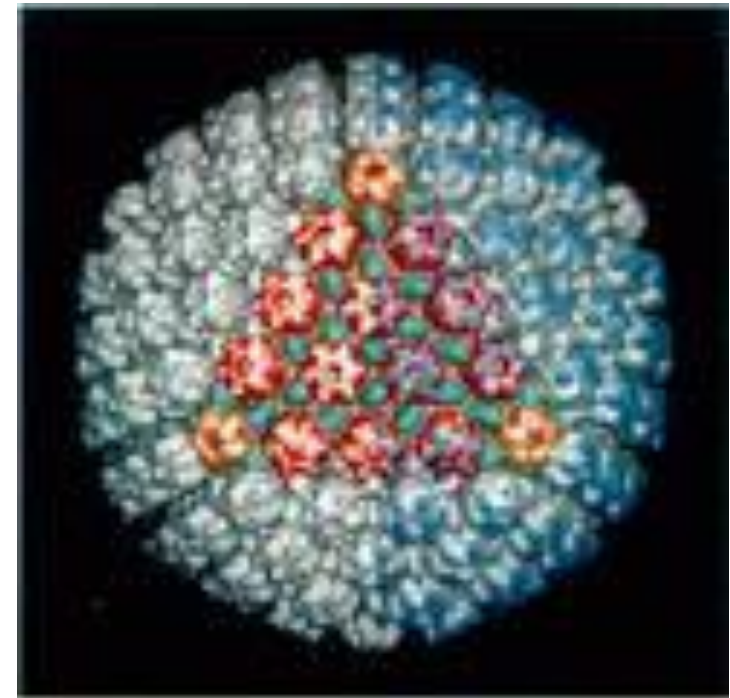


## 2. Capsid - protein coat that surrounds the nucleic acid



# What is that sticking off the capsid?

- Projections on some capsids determines what cell can be infected and how the virus infects the cell
- Think of them like keys to get through the cell membrane

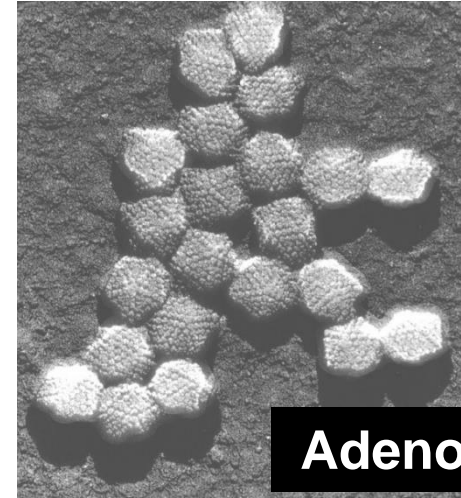
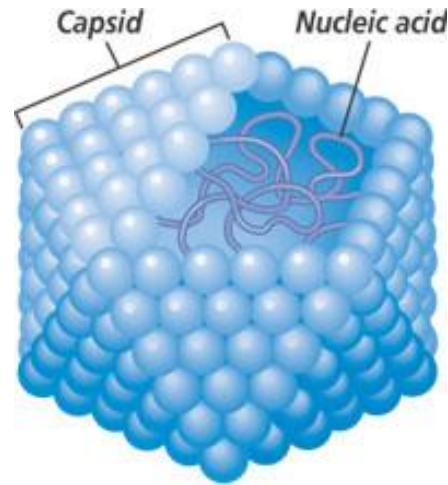




# 4 Most Common Viral Shapes:

## 1. Polyhedral

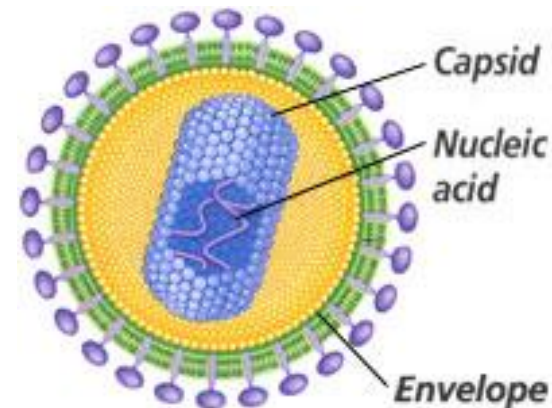
- Papilloma virus
  - causes warts



**Adenovirus**

## 2. Envelope studded with projections

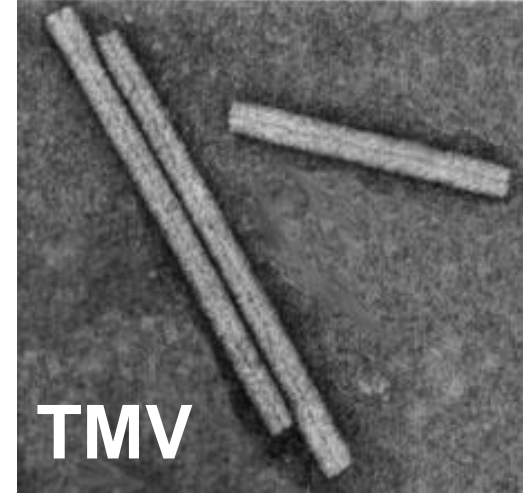
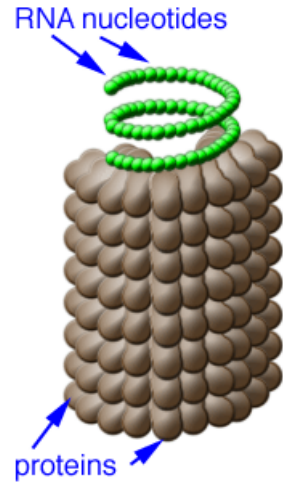
- Influenza (flu)
- HIV



# Viral Shapes

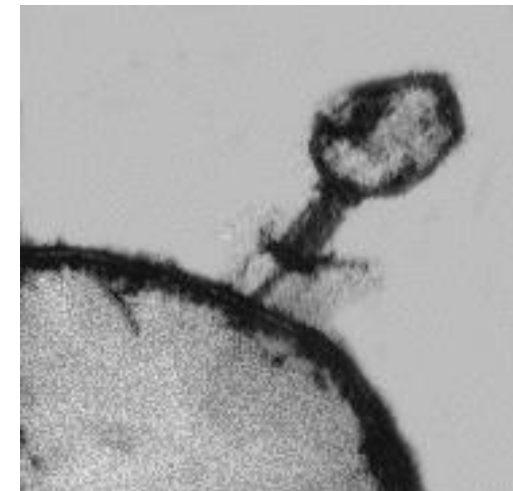
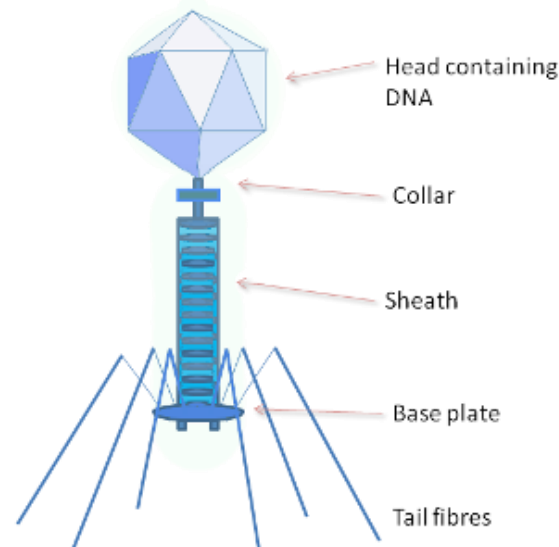
## 3. Helical

- tobacco mosaic virus
  - Plant virus

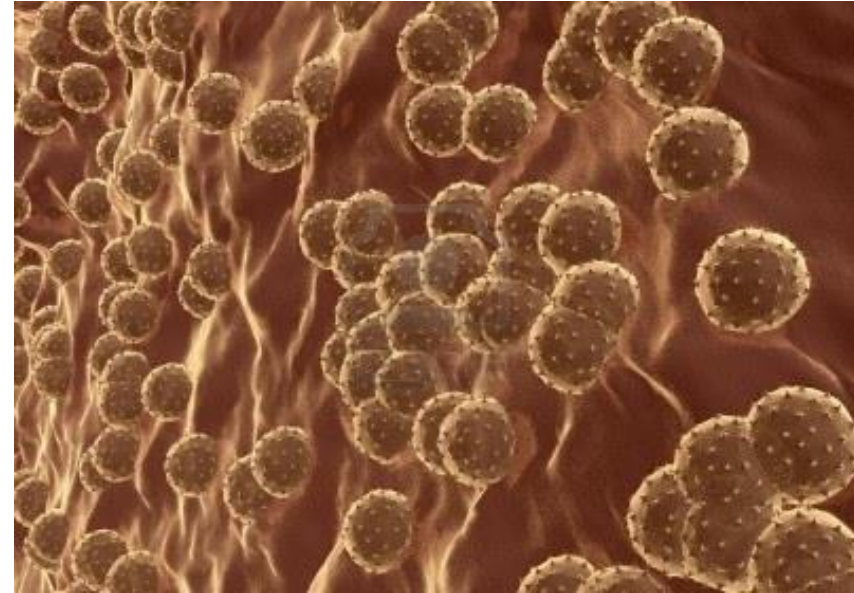
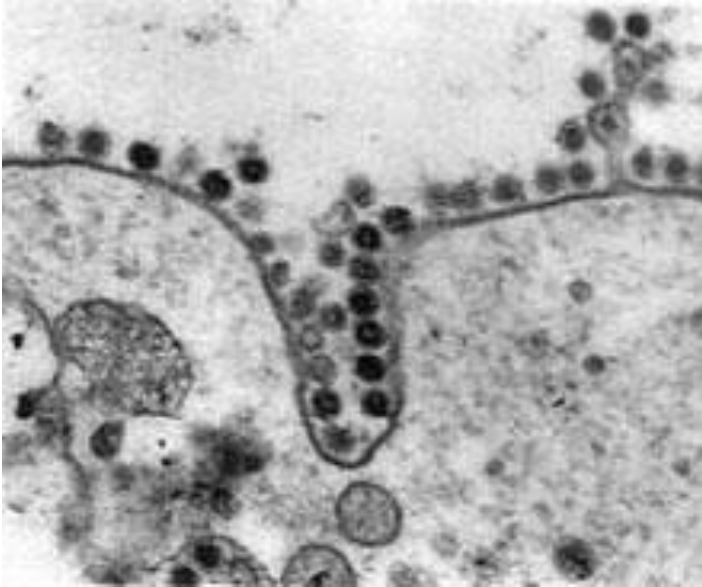


## 4. Bacteriophage

- polyhedral-shaped head
- cylindrical tail
- leglike fibers
- Only infects **BACTERIA**

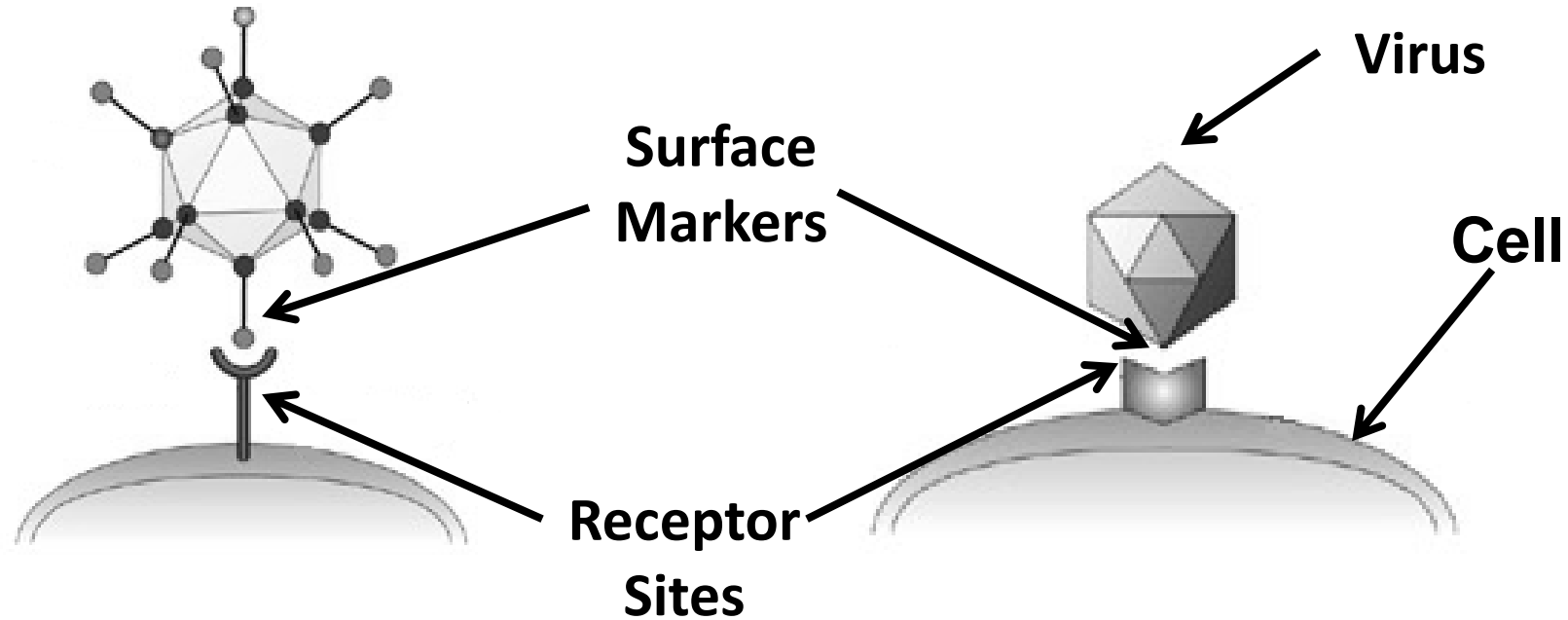


# Viral Replication



- Remember viruses do NOT reproduce
- Viruses require a **HOST CELL** to replicate (they are built)

A virus recognizes cells it can infect by matching its surface marker with a receptor site on a cell.

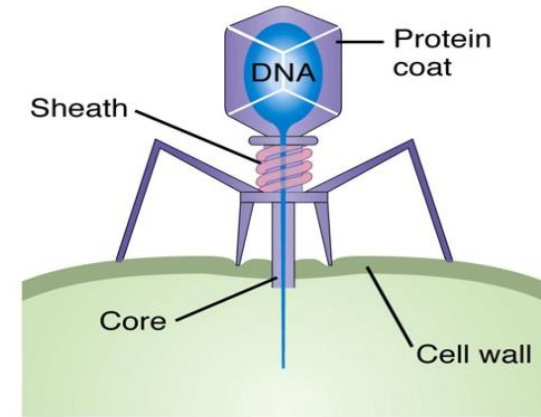


This process of protein reception is very similar to the enzyme/substrate complex specificity.

# Two ways viruses get into cells

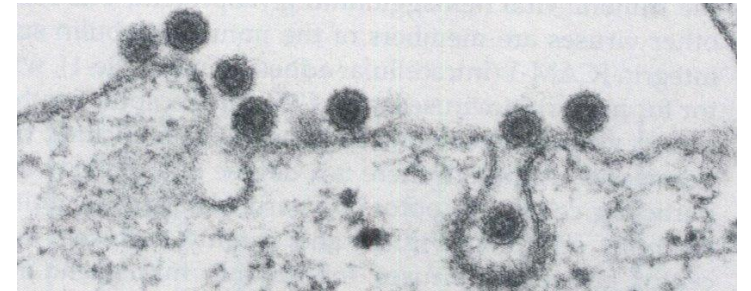
## 1. Virus injects only nucleic acid into host

- capsid stays outside host cell



## 2. Whole virus enters cell (**Endocytosis**)

- plasma membrane surrounds virus
- creates virus-filled vacuole inside cytoplasm
- vacuole bursts releasing nucleic acid into cell

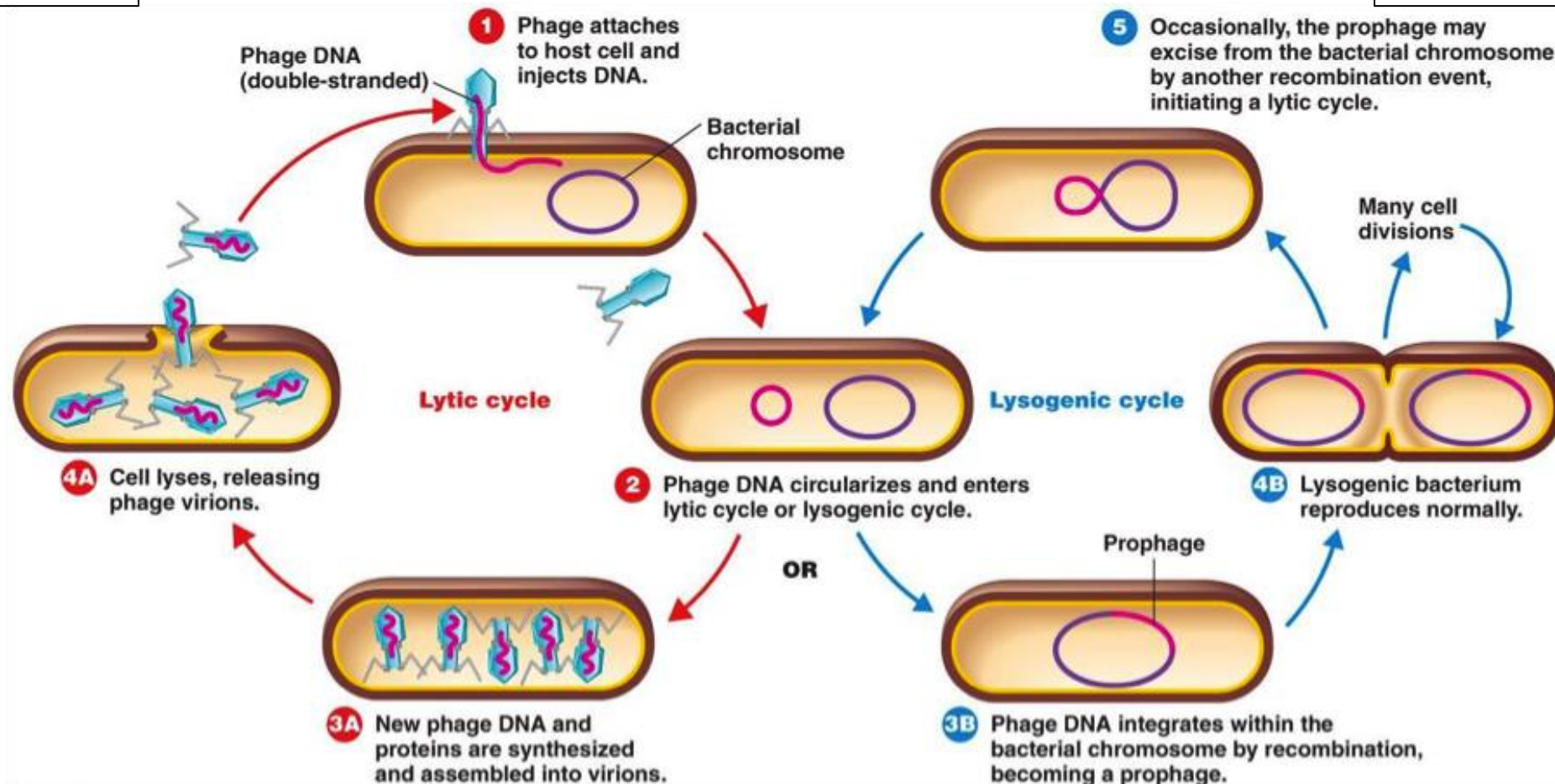




# Once a virus is inside cell, it can go through either one or both cycles:

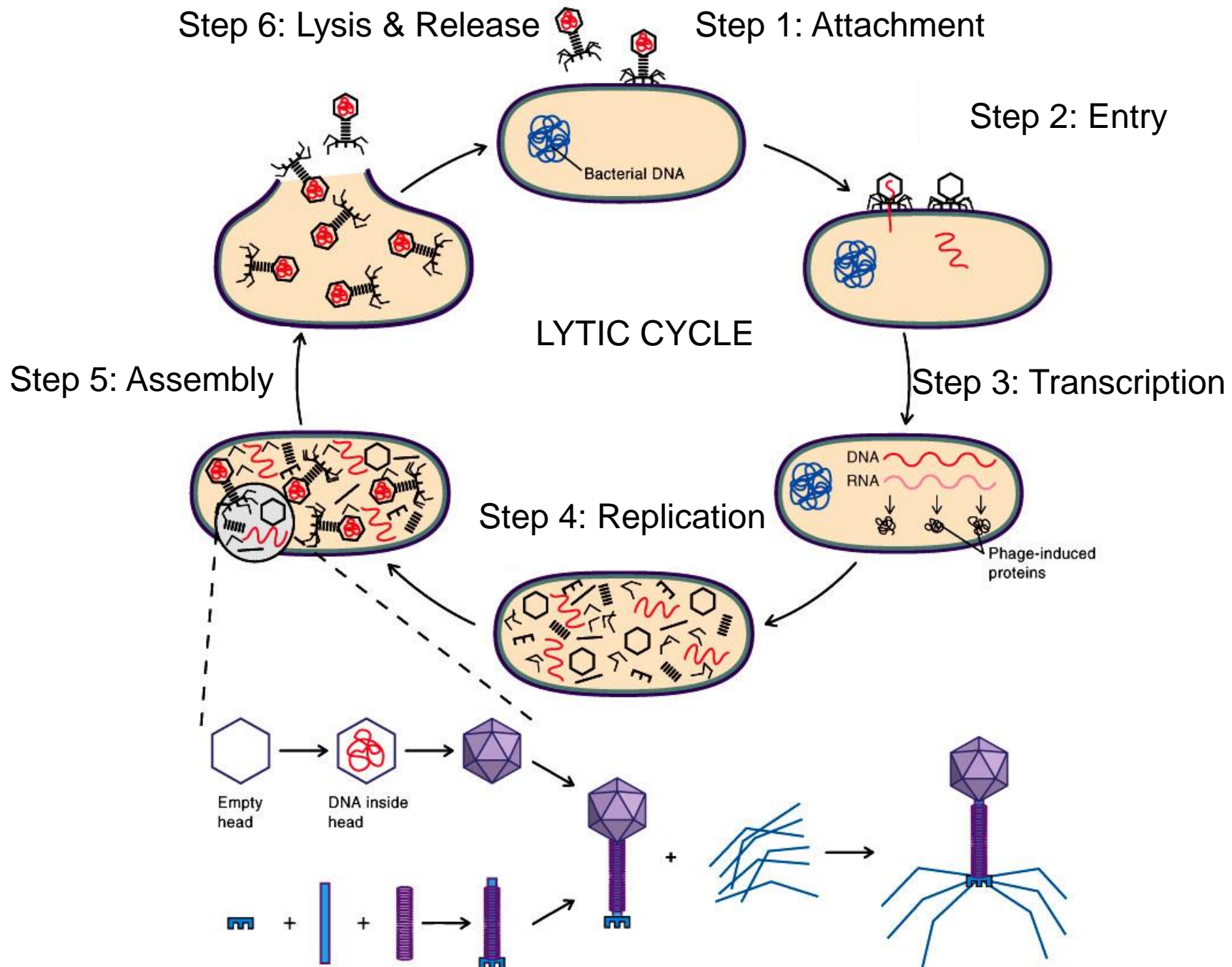
## LYTIC CYCLE

## LYSOGENIC CYCLE



# What is the lytic cycle?

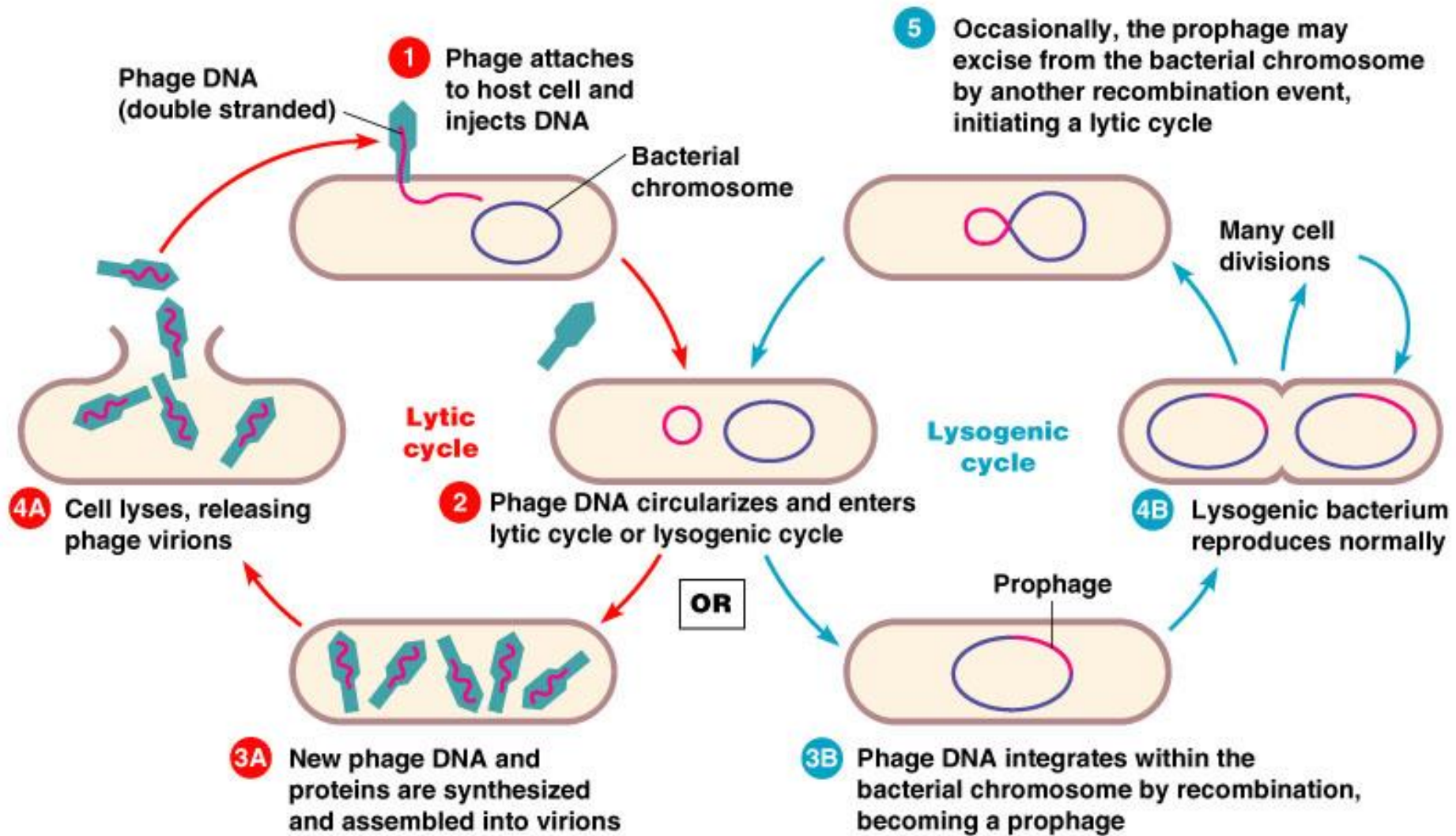
- Once inside host, virus's genes are expressed
  - take over host cell's genetic material
  - cell enzymes and energy used to make new viruses
- New viruses burst from host
- Host cell **lyses and dies (DESTROYED)**
- New viruses can infect and kill other host cells





# What happens during a lysogenic cycle?

- Virus attaches
  - Nucleic acid enters cell
  - Host cell is **NOT DESTROYED by virus**
  - **Viral DNA** included in host cell's chromosome  
(viral DNA now called **provirus**)
  - Cell carries out own metabolic activity
  - Every time host cell reproduces, **provirus replicates**
- Can remain dormant (hidden) for many years
  - At any time provirus can be activated to enter lytic cycle

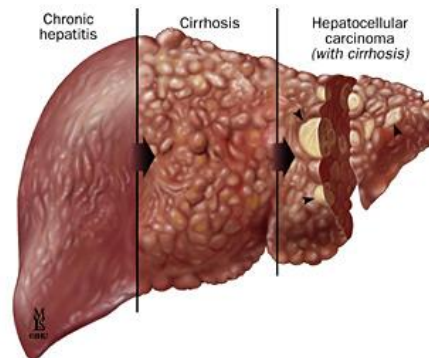


# What are some of the diseases caused by proviruses?

- Cold sores – **herpes simplex I**
  - causes of activation
    - physical stress (sunburn)
    - emotional stress (anxiety)

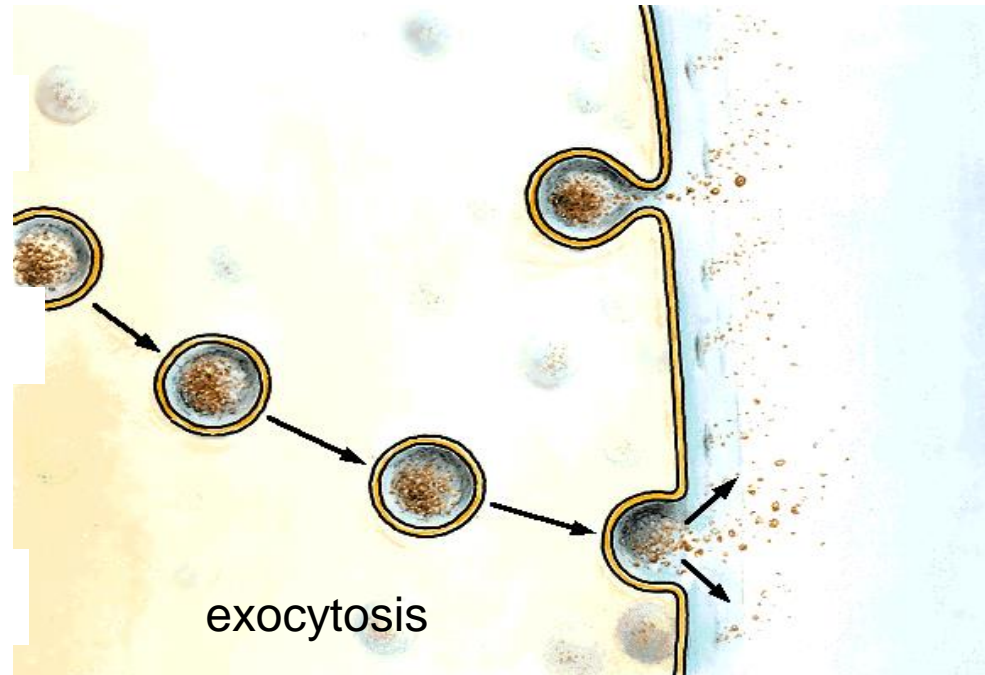
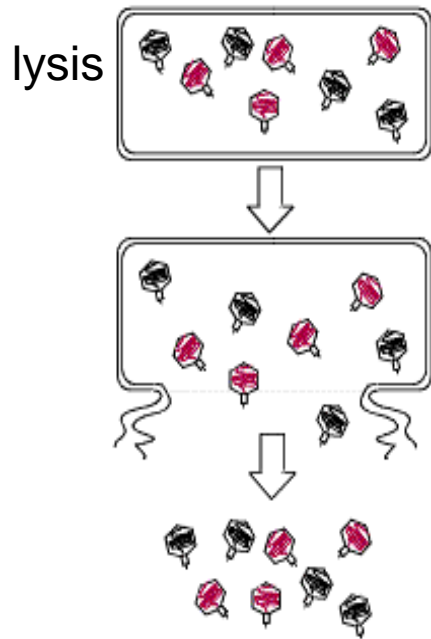


- Examples of lysogenic viruses
  - hepatitis B and chicken pox



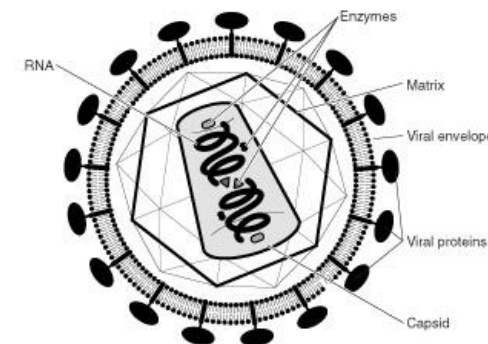
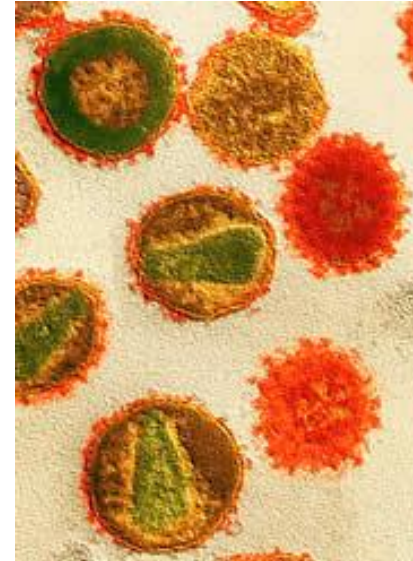
# How are viruses released?

- **lysis** – bursting of a cell
- **exocytosis** – active transport process by which materials are expelled from a cell



# What is a retrovirus?

- Virus has genetic material that is **RNA**
- Example: **HIV**  
(human immunodeficiency virus)
- Most complex replication cycle
- Have enzyme (**reverse transcriptase**)  
that changes RNA to DNA

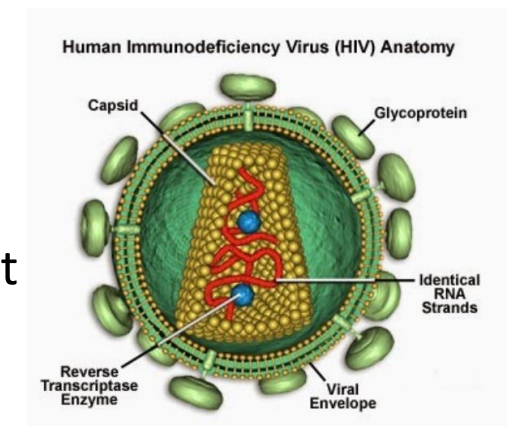
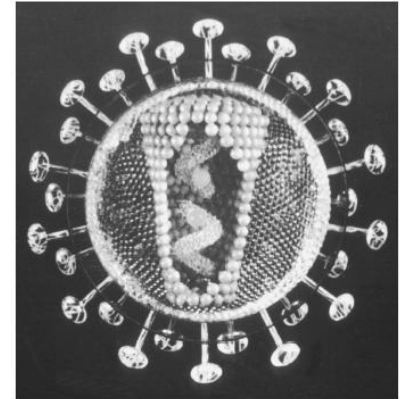
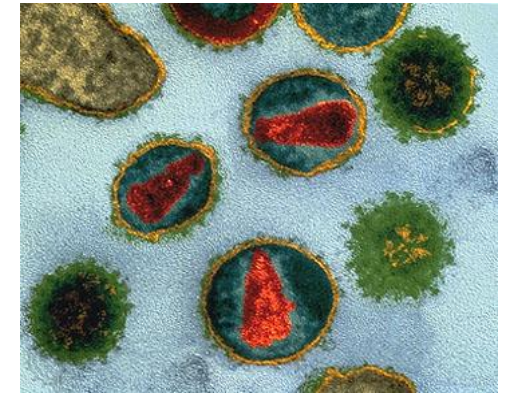


Structure of Human Immunodeficiency Virus (HIV)



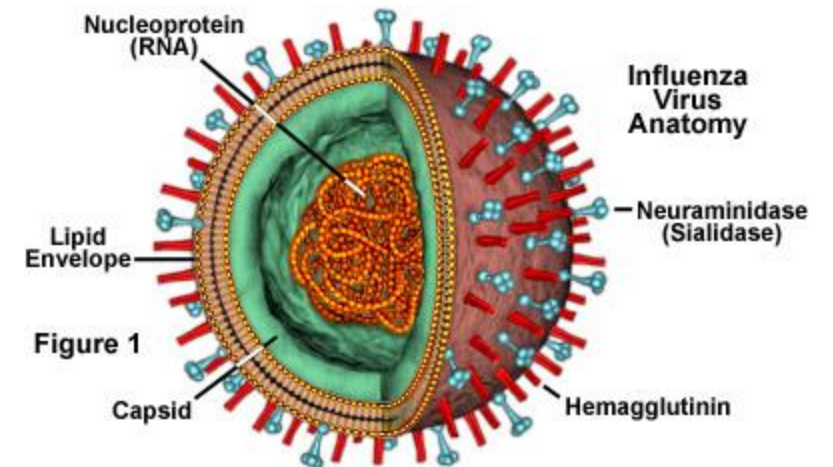
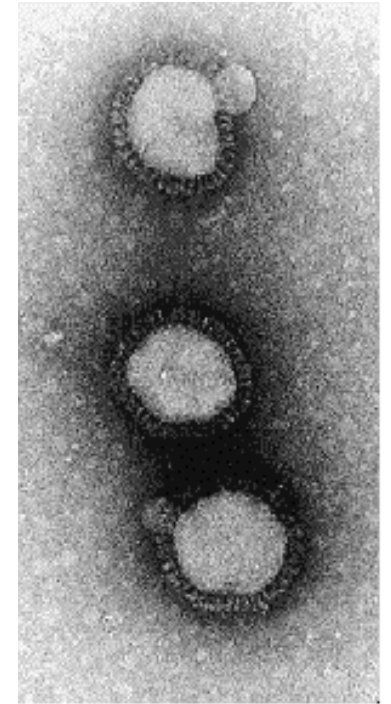
# What is HIV?

- Lysogenic virus
- HIV infects **Helper T cells** (white blood cells)
- Viral genetic material is a provirus
- HIV-infected person
  - might not experience AIDS symptoms for long time
  - infected host cells function until provirus enters lytic cycle and kills host



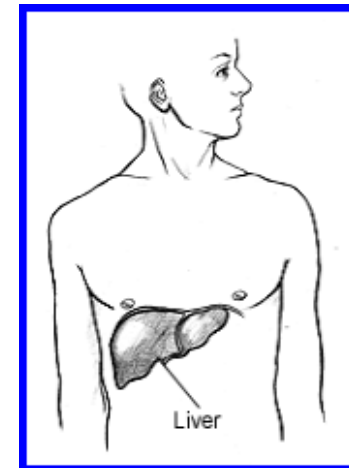
# Influenza (Flu Virus)

- RNA virus
- Infectious to birds and mammals
- Generally spread through airborne means



# Cancer and Viruses

- Some viruses are linked to cancer in humans and animals
- Disrupt normal cell growth and division in host
- Can create tumors
- Examples: hepatitis B virus and liver cancer
- HPV and cervical cancer





# Vaccine

- A vaccine is preventative medicine.
- It provides a weakened viral form for the immune system to create “Wanted Poster”
- Immune system will attack the actual virus faster after a vaccine

# Vaccine vs Antibiotic

- Antibiotics **only** work on prokaryotes (Bacteria) because of their chemical make up
- Vaccines can work on either, but most vaccines focus on preparing the immune system for viruses