

Viruses

- ✓ Characteristics of living things
- ✓ What is a virus?
- ✓ Is a virus a living thing?
- ✓ Terminology
- ✓ Structures & Shapes
- ✓ Vaccines

What are characteristics of living things?

- Contain **DNA**
- Made of one or more **cells**
- **Reproduce** and **grow**
- **Metabolize**: produce and consume energy
- **Respire**: gas exchange
- Maintain **homeostasis**: a constant internal environment regardless of external conditions
- **Adapt** to their environment

What is a virus?

- A virus is one type of **pathogen**
 - An agent that causes disease
- Composed of nucleic acids (DNA /RNA) contained in a protein coat (**capsid**)
- Viruses can only reproduce inside a living host
 - **Host:** an organism that shelters and nourishes something else
- Viruses are NOT cells ... why?

Is a virus a living thing?

Living

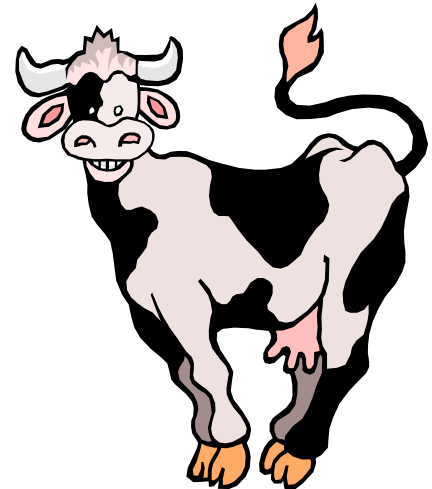
- Contain DNA/RNA
- Made of structural proteins

Non-living

- Are not made of cells
- Reproduce only by invading and destroying a living cell
- Cannot grow
- Cannot metabolize
- Cannot respire
- Cannot maintain homeostasis

Terminology

- Bacteriophage- a virus that attacks a bacteria
- Viroid- a single strand of viral RNA that causes plant diseases (TMV)
- Prion- a viral protein molecule that causes disease in animals (Mad Cow Disease)



How were viruses discovered?

1935: When trying to find the cause of Tobacco Mosaic Disease (disease that stunts the growth of tobacco plants) scientists discovered something **other than bacteria** was causing TMV

Concluded it was **smaller** than a bacterium and named it *virus* after the Latin word meaning "poison"

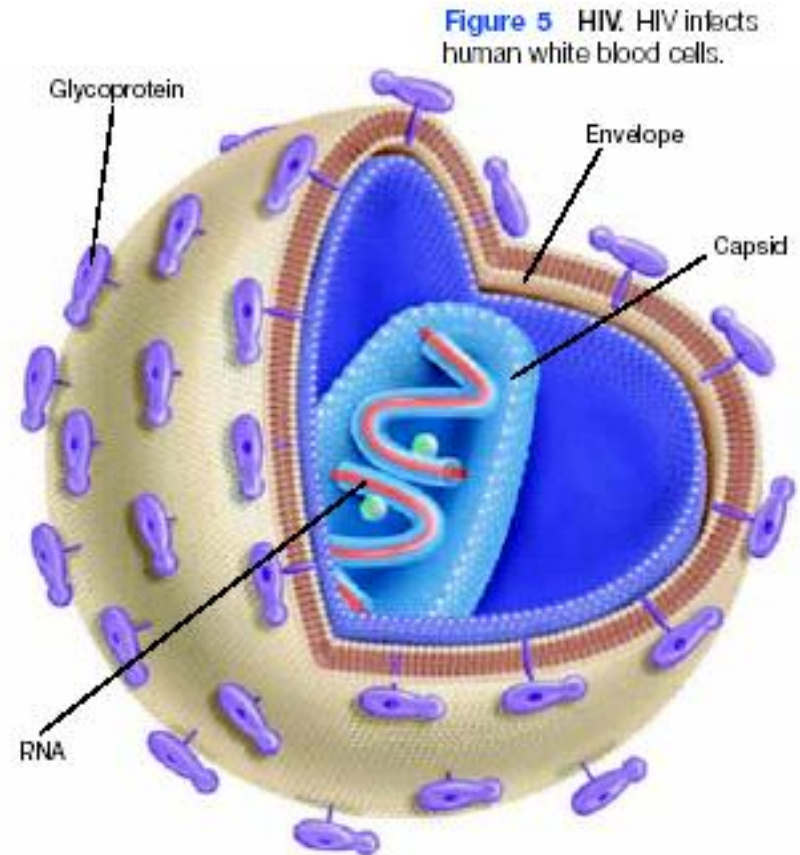


Characteristics of a Virus

- Wendell Stanley concluded that TMV was a chemical rather than an organism/cell
- Smaller than prokaryotic cells (like bacteria)
- Difficult to classify (debate over living vs. nonliving)
- function and reproduce ONLY inside other living cells
- Cause diseases such as colds, flu, AIDS, smallpox, measles, chicken pox, rabies, mumps, and mononucleosis

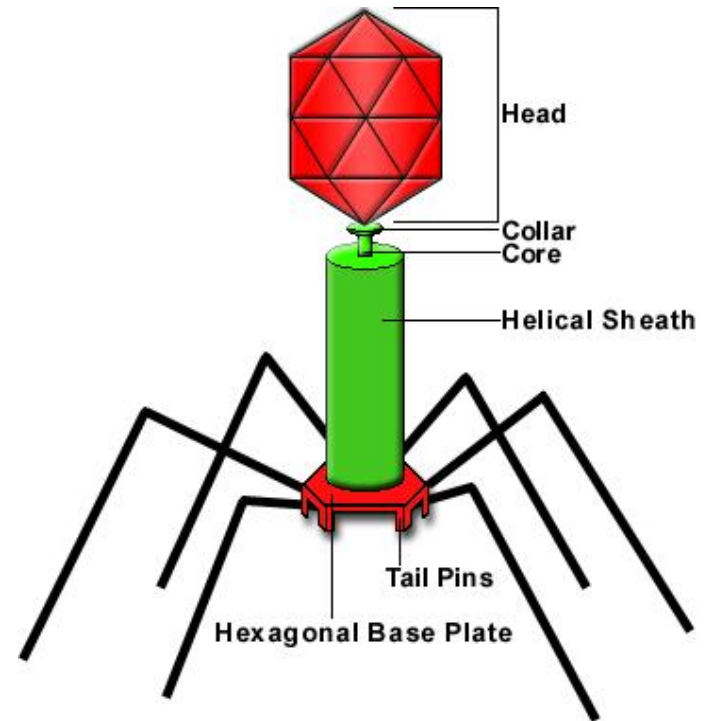
Virus Structure

1. **Core:** segments of nucleic acids (DNA /RNA)
2. Contained in a protein coat (**capsid**)
3. Surrounded by an **envelope** that helps viruses enter cells



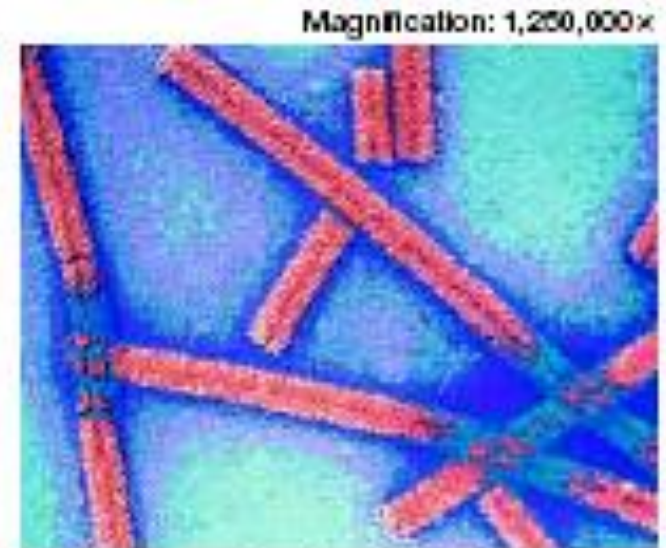
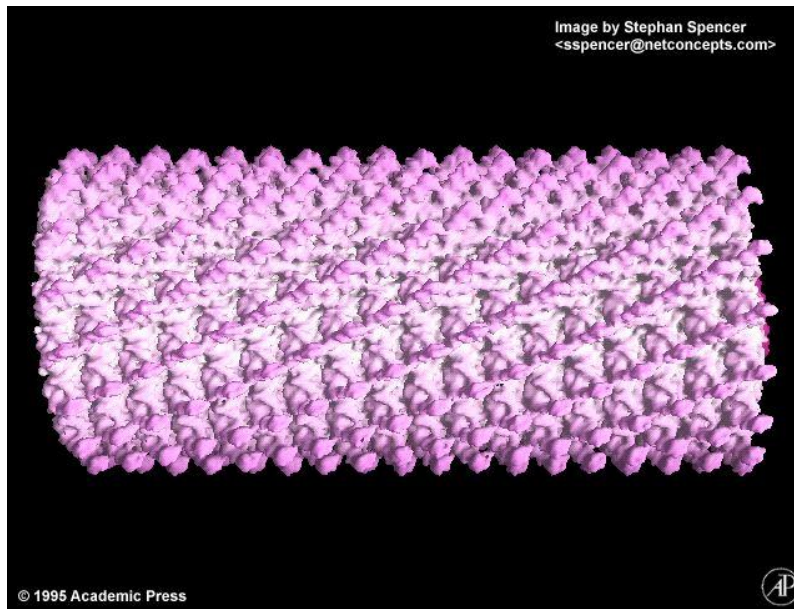
Shapes

- 5 basic shapes of a virus:
 - Helical
 - Spherical
 - Polyhedral
 - Binal
 - Filovirus

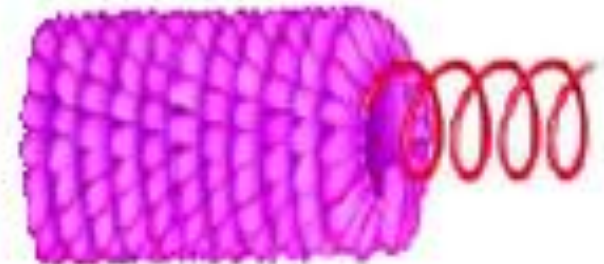


Structures and Shapes

- Helical:
 - RNA or DNA is coiled in a long narrow capsid
- Ex. Tobacco Mosaic Virus



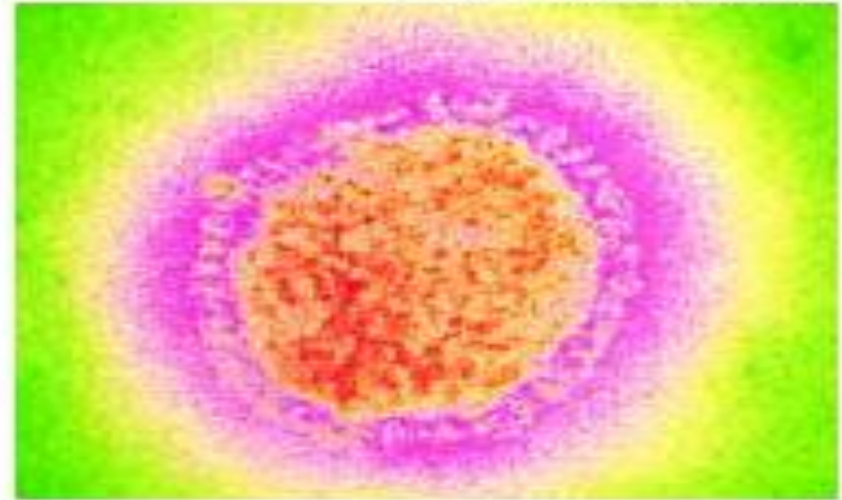
Tobacco mosaic virus (helical)



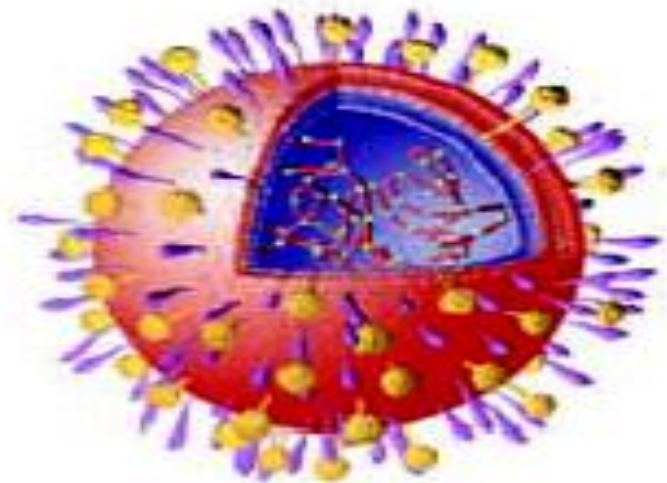
Structures and Shapes

Magnification: 202,500x

- Spherical:
 - Typically studded with receptors, may be enveloped
- Ex. Influenza Virus (Flu)

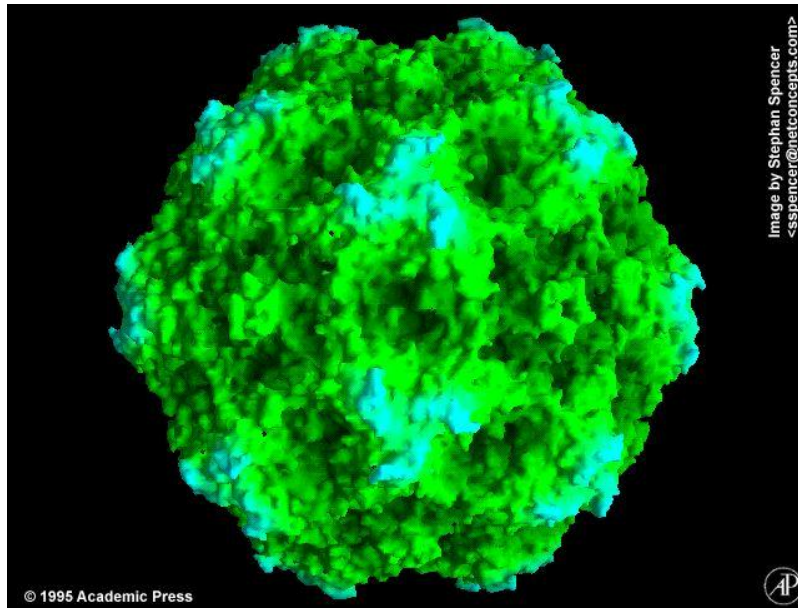


Influenza (enveloped)

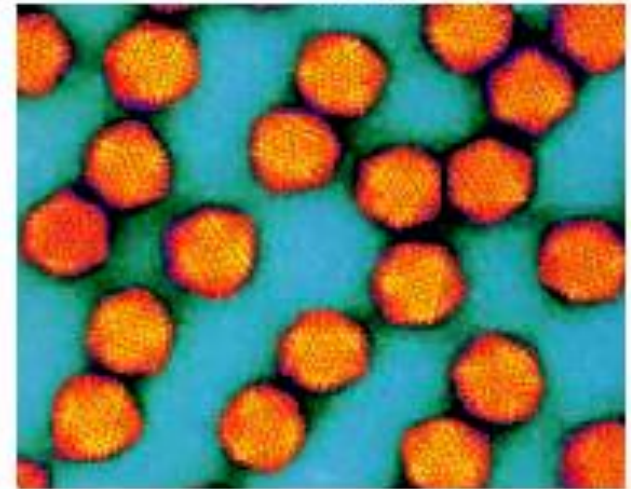


Structures and Shapes

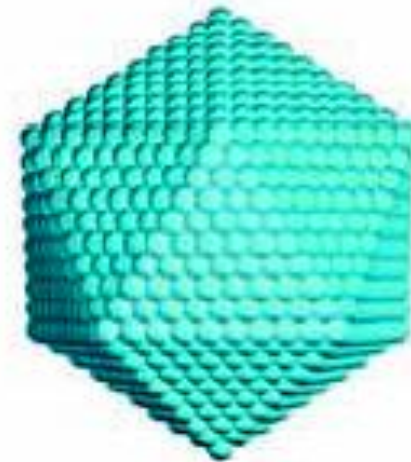
- Polyhedral:
 - Geometric in appearance
 - Ex. Adenovirus (causes the common cold)



Magnification: 135,000x



Adenovirus (polyhedral)

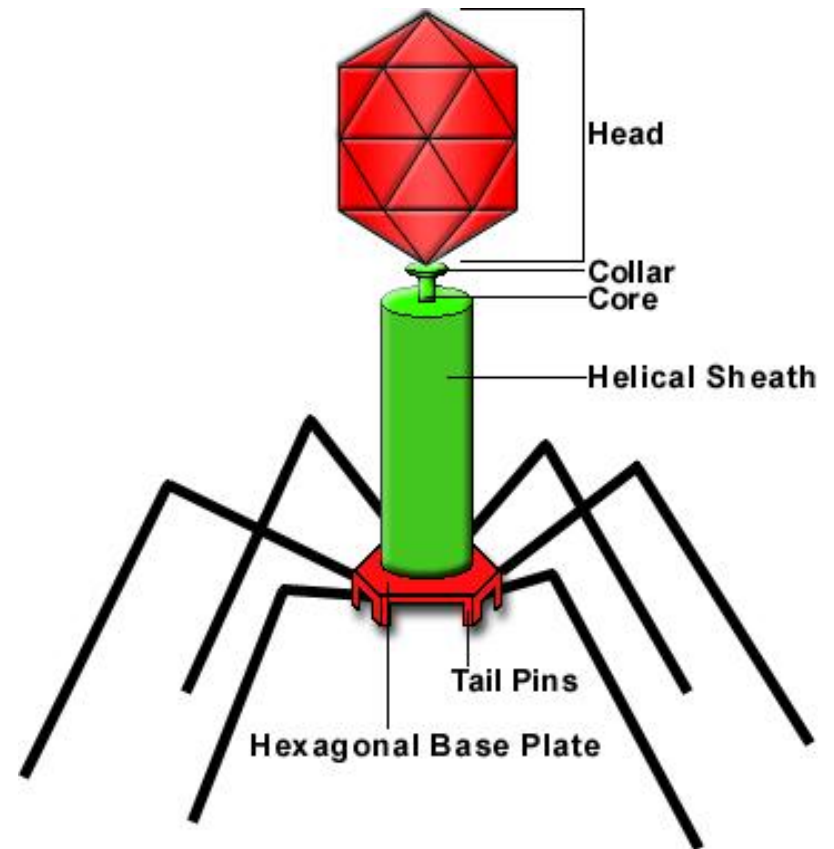


Structures and Shapes

- Binal:
 - Polyhedral capsid
 - Helical tail
- Ex. Bacteriophage



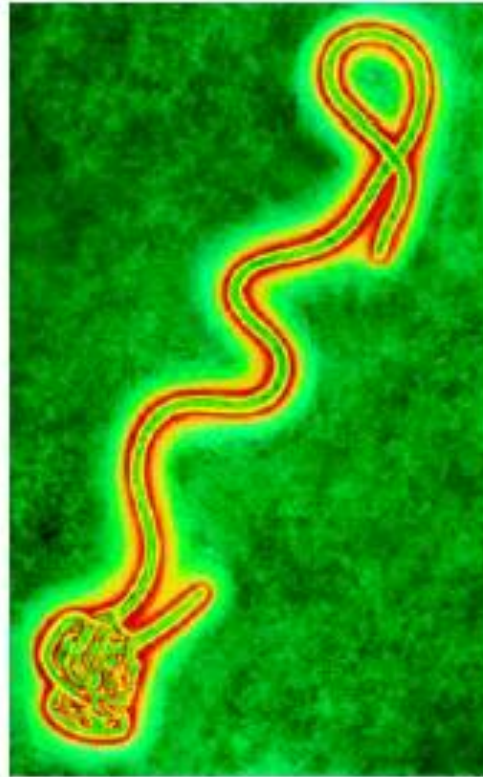
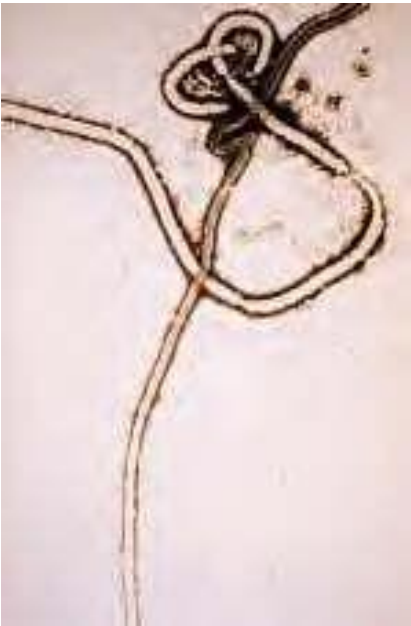
Figure 3 Bacteriophage infecting a bacterium.

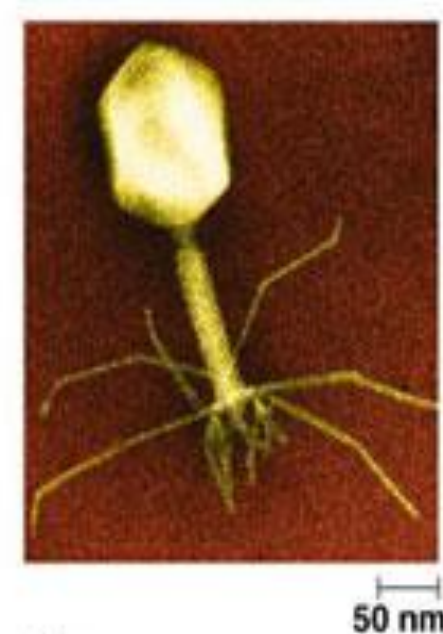
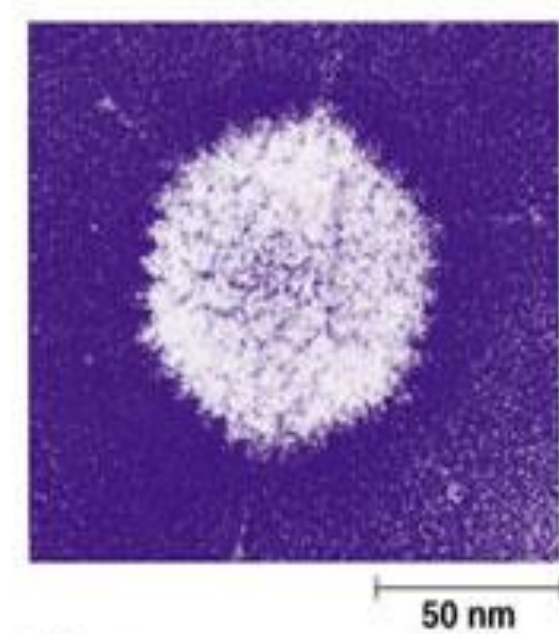
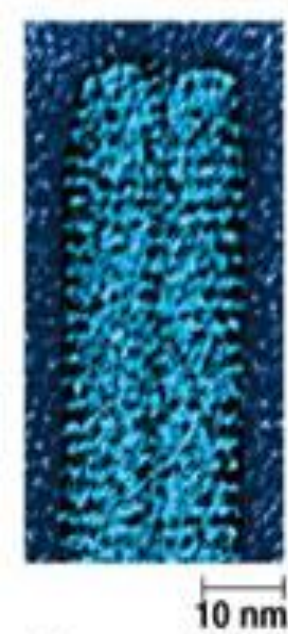
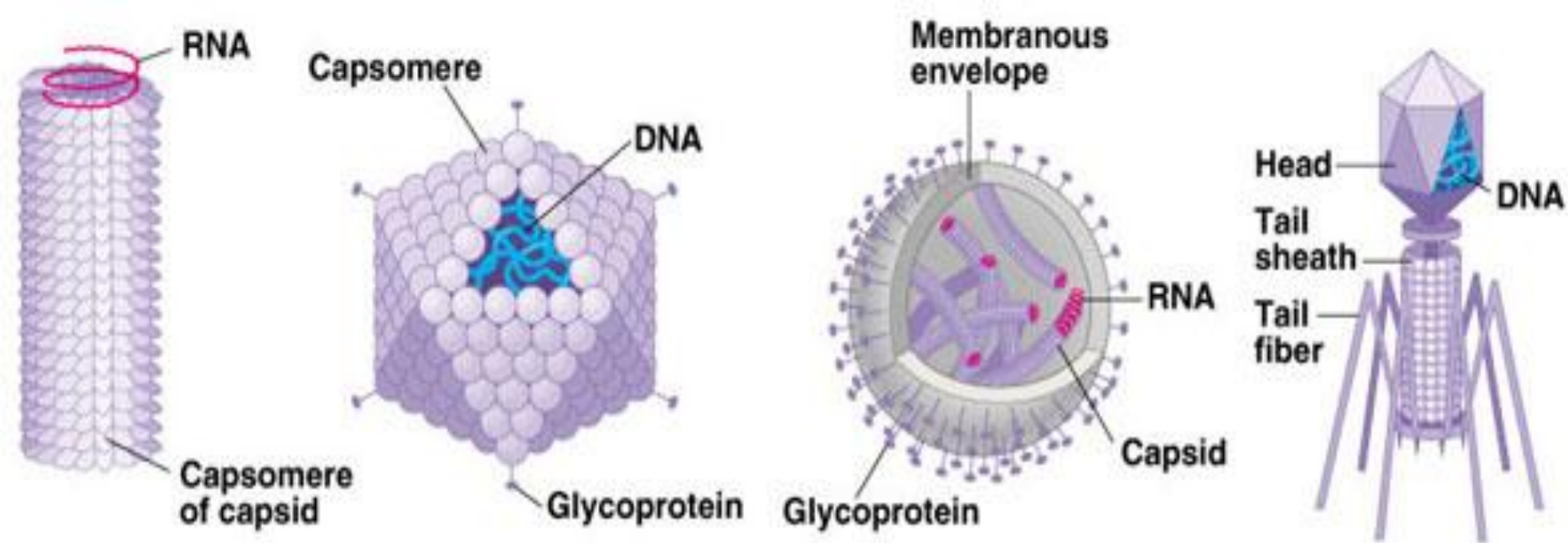


Structures and Shapes

- Filovirus:
 - No distinct uniform shape
 - Threadlike loops

Ex. Ebola virus





(a) Tobacco mosaic virus

(b) Adenoviruses

(c) Influenza viruses

(d) Bacteriophage T4

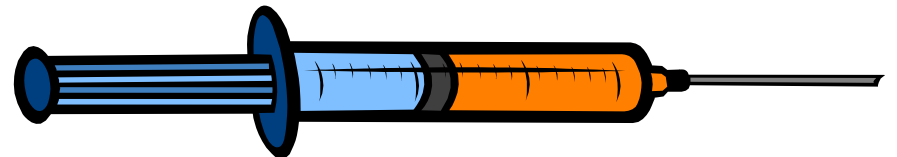
Diseases Caused by Viruses

- Adenovirus (common cold)
- AIDS
- Avian Bird Flu
- Chickenpox
- Ebola
- Hepatitis A & B
- Influenza (Flu)
- Mumps
- Polio
- Rabies
- SARS
- Smallpox
- Warts
- West Nile



How can we fight viruses?

- ***Antibiotics won't cure viral diseases!***
(Only your symptoms are treated.) WHY???
 - Antibiotics interfere with the living processes of bacterial infections. Since viruses do not perform the functions of living things, they cannot be 'killed' .
- Only the body's **immune system** can fight a virus
 - White blood cells engulf and destroy pathogens



Vaccines

- Some viruses can be **prevented** by vaccines which help your own immune system fight the disease.
- Edward Jenner developed the first **vaccine** from cowpox.

Vaccines

- A vaccine is a **weakened** or killed form of a disease
- The vaccine **stimulates** the body's immune system to **recognize** the disease as harmful and **destroy** it
- This causes the immune system to be better **prepared** to fight the infection

Vaccines

Vaccines for smallpox, a deadly virus, helped wipe it out.

Other diseases that can be prevented by vaccines are:

Polio

Measles

Mumps

Influenza