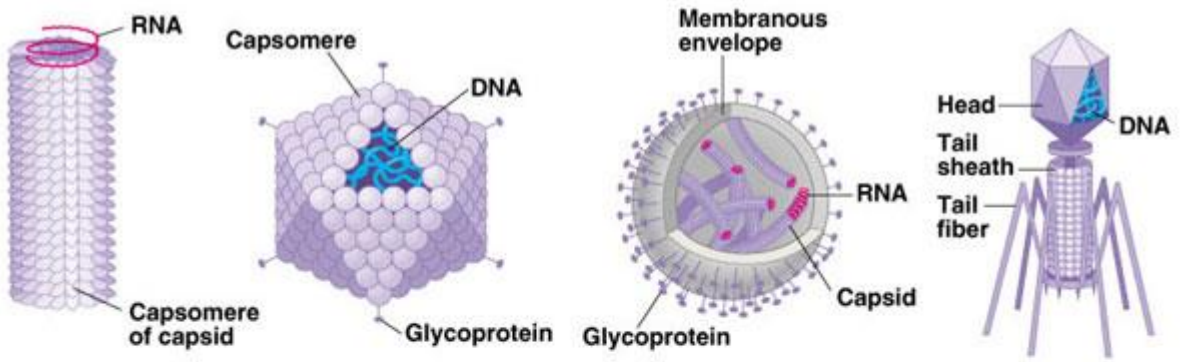
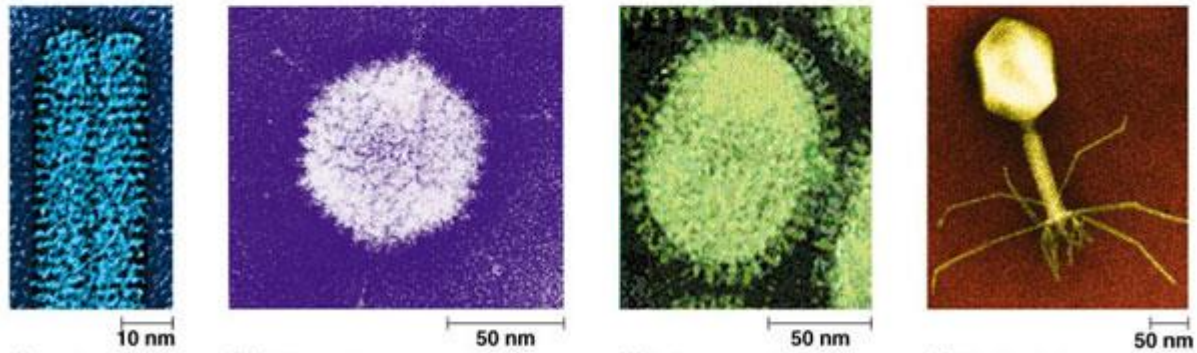
# VIRUSES

- are not classified into a kingdom because they do not possess all of the traits of living things:
  - does not grow, respire, or respond to stimuli but it **does** reproduce
  = **non-living particles** which infect every form of life, in every kingdom
  - the word Virus comes from Latin meaning **poison**
  - are classified by the type of **nuclear material** they contain
  - are named after the **disease** they cause (ex: Rabies virus) or for the **organ or tissue** they infect
- **Structure And Shape**
  - are very small
  - all viruses are made of at least 2 parts:
    1. an inner core of **nuclear material** (DNA or RNA)
    2. enclosed in **protein** shell called a **capsid** (about 95% of the virus)
    3. some also contain a fatty **lipoprotein envelope**
  - viruses **do not** contain the organelles of a cell
  - the capsid of a virus gives it its **shape**



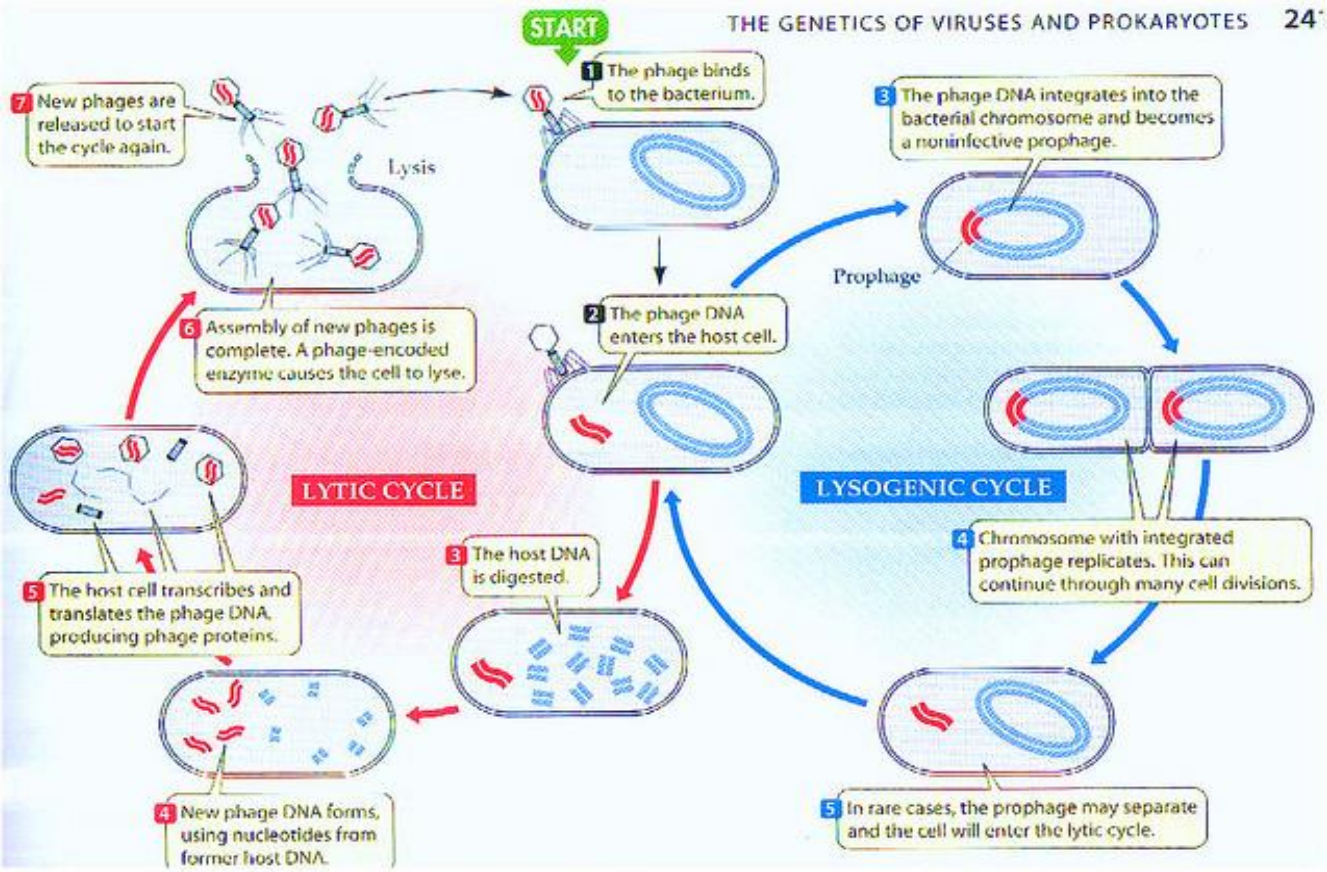

(a) Tobacco mosaic virus (b) Adenoviruses (c) Influenza viruses (d) Bacteriophage T4

- **Function And Reproduction**
  - viruses are strict parasites and function only when inside a **host cell**
  - when outside a host cell, viruses can **crystalize** and remain **inert** for long periods of time
  - crystals become **infectious** when the viral particles they contain come in contact with and invade host cells
  - viruses are specific to the **species** and **cell-type** they infect
    example: polio infects only human intestinal and nerve cells
  - once it enters a host cell, the virus takes over the **cell's processes** to produce more viral material killing the original cell and infecting other cells

- two types of viruses:

a) **Virulent Virus**: reproduction starts **immediately** after entering the host cell
= **Lytic Cycle**
: example - cold, flu

b) **Latent Virus**: after entering the host cell, the virus may go through a **'resting stage'** before something triggers reproduction to begin
= **Lysogenic Cycle**
: example – AIDS, Shingles




- **Significance Of Viruses**
  - cause sickness and **disease**
  - cause some forms of **cancers**
  - can be used to better our lives
    - a) further our understanding of **genes** and **DNA replication**
    - b) transmit **a specific gene** to engineer cells for a specific purpose
    - c) destroy **resistant bacteria** & control **insect pests**
    - d) control pandemics through the creation **vaccines** and **antiviral drugs**
    - e) treat **cancer**

- **Phylogeny of Viruses**
  - there is no fossil evidence as to the origin of viruses but many theories:
    - a) ancestors of viruses were **parasitic** cells that lost their cellular components
    - **b) viruses came from detached fragments of **genetic material** belonging to other cells

- **Treatment of Viruses**
  - As viruses are **nonliving** they cannot be killed using antibiotics so alternate methods must be used:

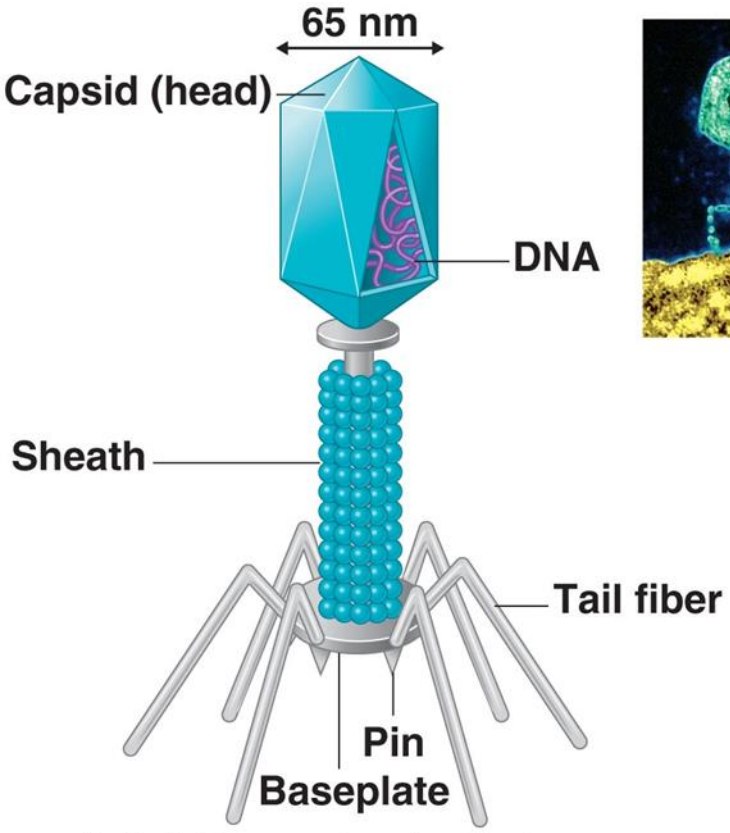
**a)** Prevent primary infection **(vaccination)**
b) Treat **symptoms**
c) Localize the infection **(antivirals)**
d) Immunoglobulin therapy- **synthetic antibodies** used to identify and neutralize viruses

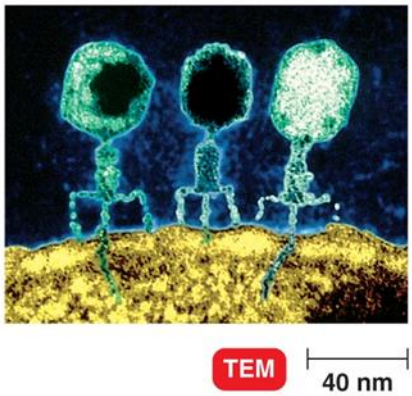
- **Other Noncellular Agents of Disease**
  - even viruses are not the smallest infectious particles around:

**a) Viroids**
- **RNA molecules** with no protein capsid or fatty envelope
- disease causing
- only infect plants
- ie. Potato spindle tuber

**b) Prions**
- naked pieces of **proteins molecules**; no nucleic acids involved
- normally exist in cells and are shaped like a coil
- when mutated prions are shaped like a piece of paper folded many times = cause disease
- ie. Mad Cow disease, Chronic Wasting Disease

| *Agent* | *Constituents* | *Example* | *Disease* |
|---|---|---|---|
| Viruses | DNA plus protein | Parvovirus | Hepatitis A |
| | | Herpes simplex I, II | Herpes |
| | | Epstein-Barr | Mononucleosis, Burkitt's lymphoma |
| | | Smallpox virus | Smallpox |
| | RNA plus protein | Paramyxovirus | Measles |
| | | Togavirus | Rubella (German measles) |
| | | Rhinoviruses | Common cold |
| | | Myxovirus | Influenza |
| | | Poliovirus | Poliomyelitis |
| | | Paramyxovirus | Mumps |
| | | Rhabdovirus | Rabies |
| | | Togavirus, flavivirus | Yellow fever |
| | | Retroviruses | Cancer (some forms) AIDS |
| Viroids | RNA only | PST viroid | Potato spindle tuber disease |
| | | Exocortis viroid | Citrus exocortis disease |
| Prions | Protein only | Various prions | Kuru (a brain disease in Borneo and elsewhere); Creutzfeldt-Jakob disease (a brain disease); scrapie (a disease of sheep) |




**(a)** A T-even bacteriophage