**SBI 3U: VIRUSES**

**IS A VIRUS ALIVE?**

**Common Characteristics**

1. move
2. can’t respond to stimuli
3. can’t develop (grow)
4. contain complex components
5. die (destroyed)

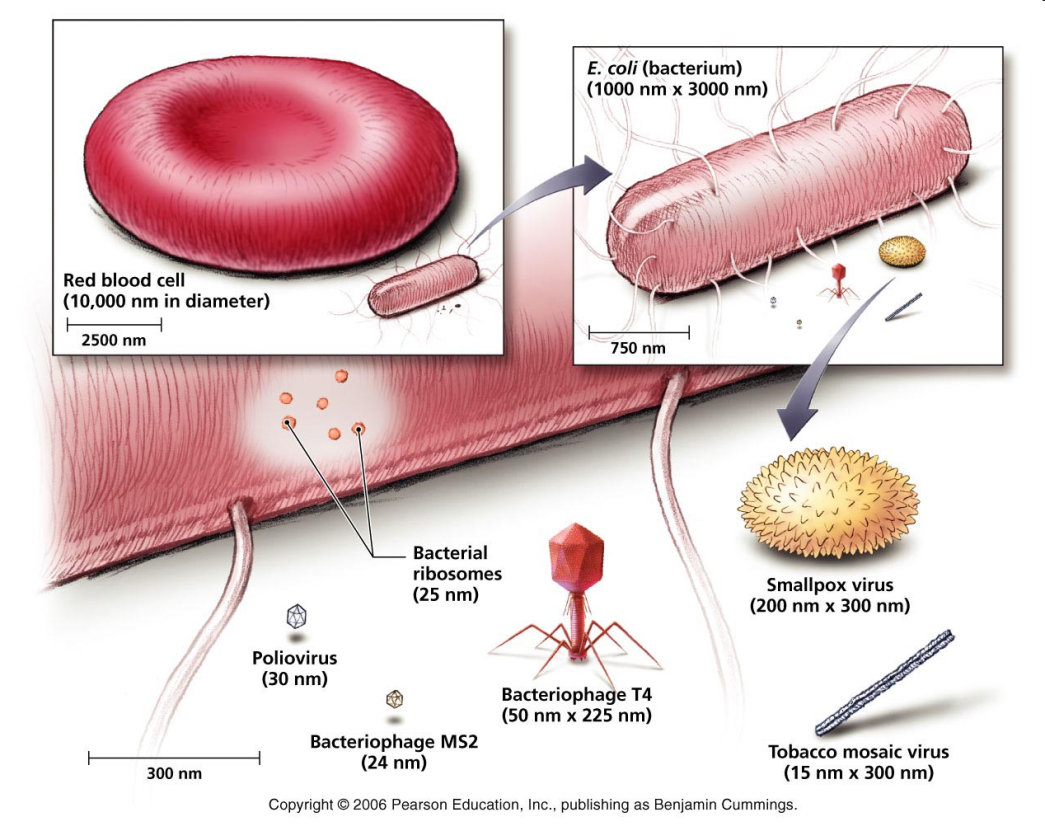
**Fundamental Characteristics**

1. not made of cells
2. no metabolism
3. can’t reproduce (without infecting a living host)
4. can reproduce within a host and kill it
5. no homeostasis

Since viruses don’t have all the fundamental characteristics of life, and they must rely on other living things, they are not quite alive.

**WHAT ARE VIRUSES?**

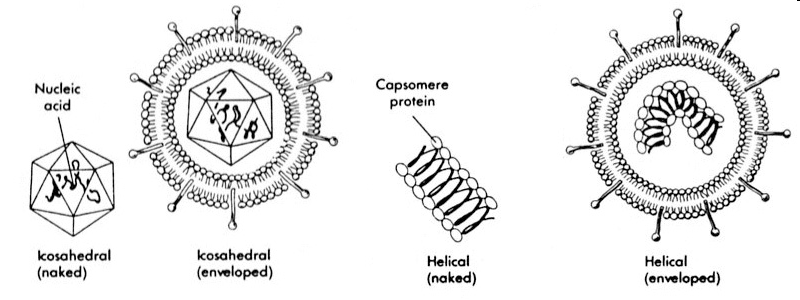
* small, infectious, non-living, non-cellular particles
* contain no cytoplasm
* cannot grow or reproduce on their own (need a host)
* do not produce or use energy
* do not create waste
* do have genetic material which takes control of other cells to create “virus copies”



**SIZE OF VIRUSES**

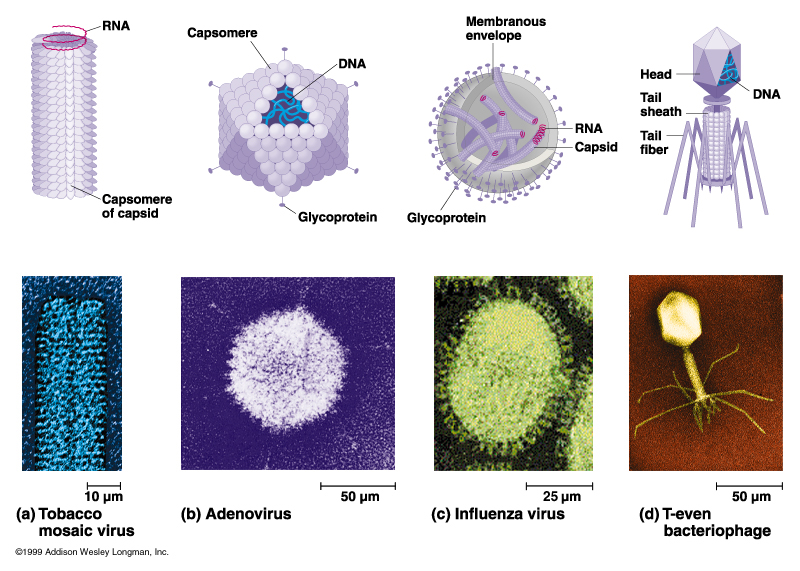
* less than 0.1 µm in diameter
* Hundreds of thousands can fit inside a typical human cell.

**BASIC STRUCTURE OF A VIRION (VIRUS PARTICLE)**

* ***Genetic material***– RNA (ss) or DNA (ds) core
* ***Capsid (or head)*** – protein coat that surrounds and protects the genetic material

*Note: Some viruses are surrounded by an envelope, which is created when a virus leaves a host cell and part of the host cell membrane wraps around the virus.*

**DIAGRAMS OF VIRUSES:**



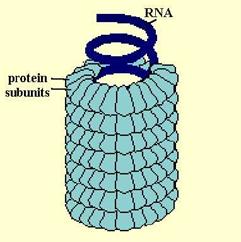
**RNA OR DNA**

Viruses with RNA (called retroviruses, higher mutation rate)

* + Human immunodeficiency virus (HIV)
  + Influenza viruses
  + Rabies
  + Measles, mumps, pneunomia, polio, common cold
  + SARS

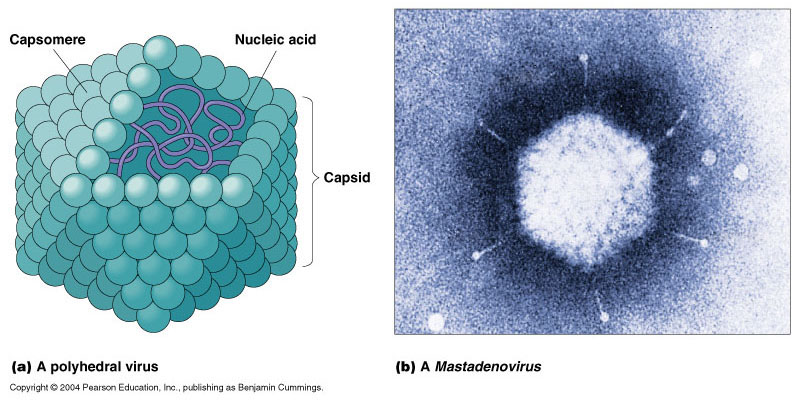
Viruses with DNA (usually stable/constant, vaccines effective )

* + Chickenpox, cold sores, genital herpes
  + Mononucleosis
  + Hepatitis
  + Respiratory infections, tumours



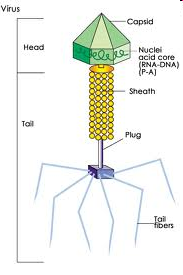
**VIRUS SHAPES**

1) **Helical** – rod-like with capsid proteins winding around the core in a spiral

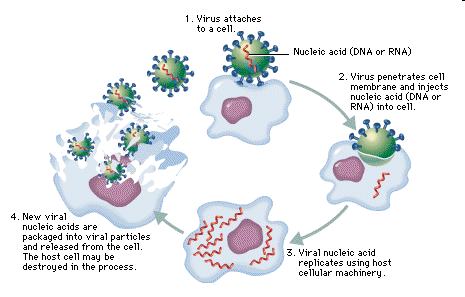
2) **Polyhedral**

- has many sides

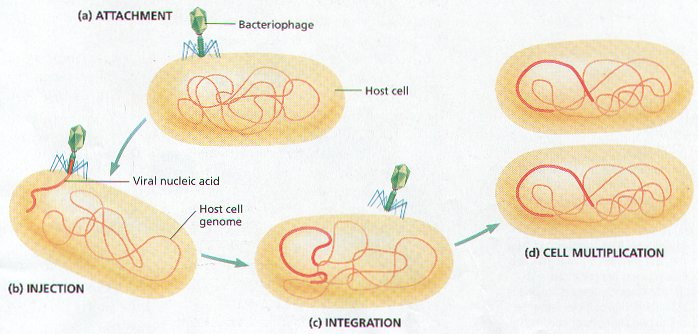
- most polyhedral capsids have 20 sides and 12 corners

3) **Complex** - **Polyhedral capsid *attached* to a helical tail**

The ***tail*** is made of protein, which aids in binding to host cells.

- This is the typical structure of ***Bacteriophages*** (viruses that attack bacteria)

**VIRAL REPRODUCTION**

1) **Lytic Cycle** – the virus enters the cell, replicates itself hundreds of times, and then bursts out of the cell destroying it

*1. Attachment*

*2. Injection/Entry*

*3. Replication*

*4. Assembly*

*5. Release*

*(lysis = breaking open)*

1. **Lysogenic Cycle**

– the virus enters the cell, viral DNA integrates with the host DNA and becomes inactive, the host functions normally

- an environmental change may then cause the virus to enter the Lytic Cycle

*1. Attachment*

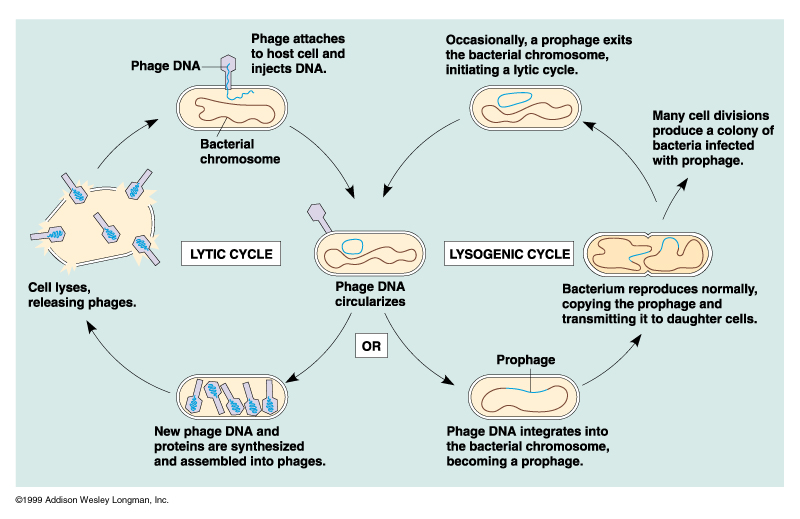
*2. Injection/Entry*

*3. Integration into host cell’s DNA*

*4. Dormancy/Normal cell functions*

*5. Triggering of viral DNA to be*

*released and then Lytic cycle begins*



**DIFFERENCES BETWEEN LYTIC AND LYSOGENIC CYCLE:**

In the Lytic Cycle:

* Viral DNA destroys Cell DNA, takes over cell functions and destroys the cell.
* The virus replicates and produces progeny phages.
* There are symptoms of viral infection.

In the Lysogenic Cycle:

* Viral DNA merges with cell DNA and does not destroy the cell.
* The virus does not produce progeny.
* There are no symptoms of viral infection.

**3 WAYS VIRUSES ENTER LIVING CELLS:**

1. enter bacterial cells by punching a hole in the cell wall and injecting its DNA
2. enter plant cells through *tiny rips in the cell wall*
3. enter animal cells by *endocytosis*

**VIRUSES ARE HOST-CELL SPECIFIC**

* can usually infect one type of host or even an organ, tissue or cell type (called its HOST RANGE)
* a protein on the surface of the virus has a shape that matches a molecule in the plasma membrane of its host, allowing the virus to lock onto the host cell (like a key fits in a lock)

*Examples:*

*- a plant virus can only attack a plant cell and not an animal cell*

*- HIV (human immunodeficiency virus) infects only certain immune system cells*

* some viruses can infect many species

*Examples:*

*- rabies (rhabdovirus) – infects all birds and mammals*

*- swine flu virus can infect swine or humans*

**HOW ARE VIRUSES SPREAD?**

* **VECTORS** - carry the virus from one host to another
* Vectors include:

Insects (yellow fever – mosquitos)

Animals (rabies)

Water (polio)

Air (influenza, common cold, chicken pox)

Humans (influenza, hepatitis, HIV)