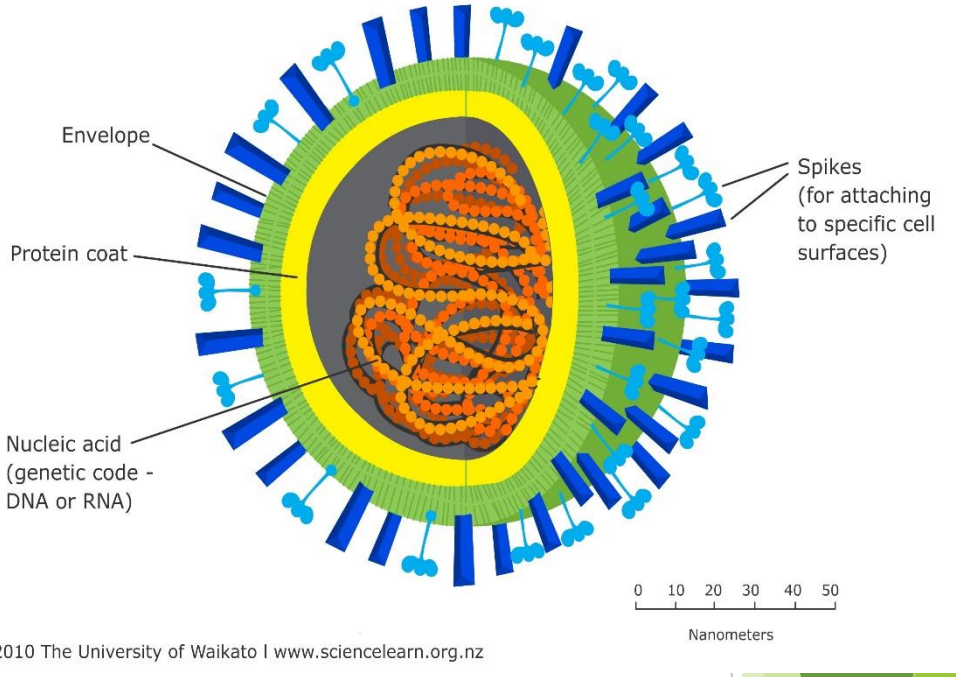
Engage: Current news-deadly virus

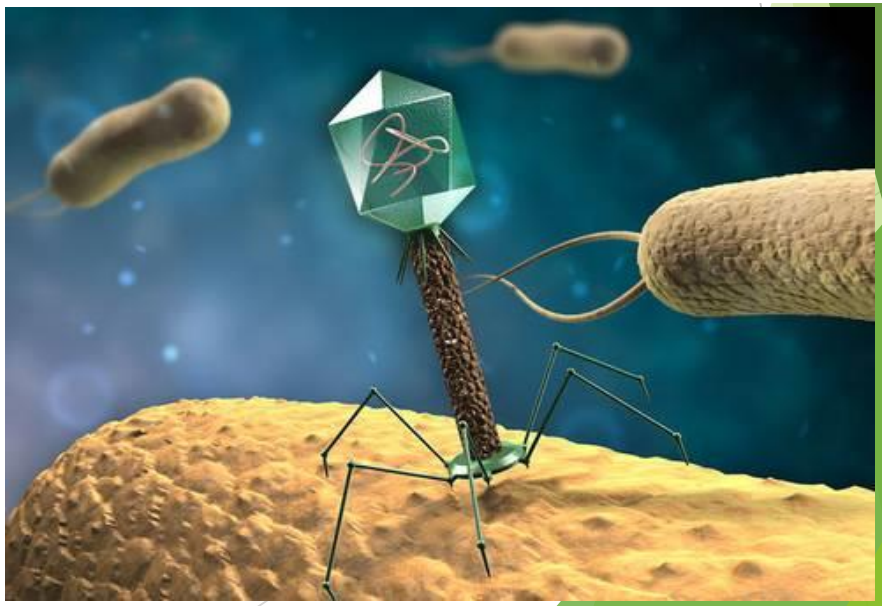
http://abcnews.go.com/WNT/video/potentially-deadly-mystery-virus-25336561

Today *we will compare the structure of viruses to cells*

VIRUSES VS CELLS

And…our Goal: *You will be able to identify viruses from cells.*






Do viruses possess all the characteristics of life?
No
Are viruses living?
NO

Which Characteristics Of Life Do Viruses Possess?

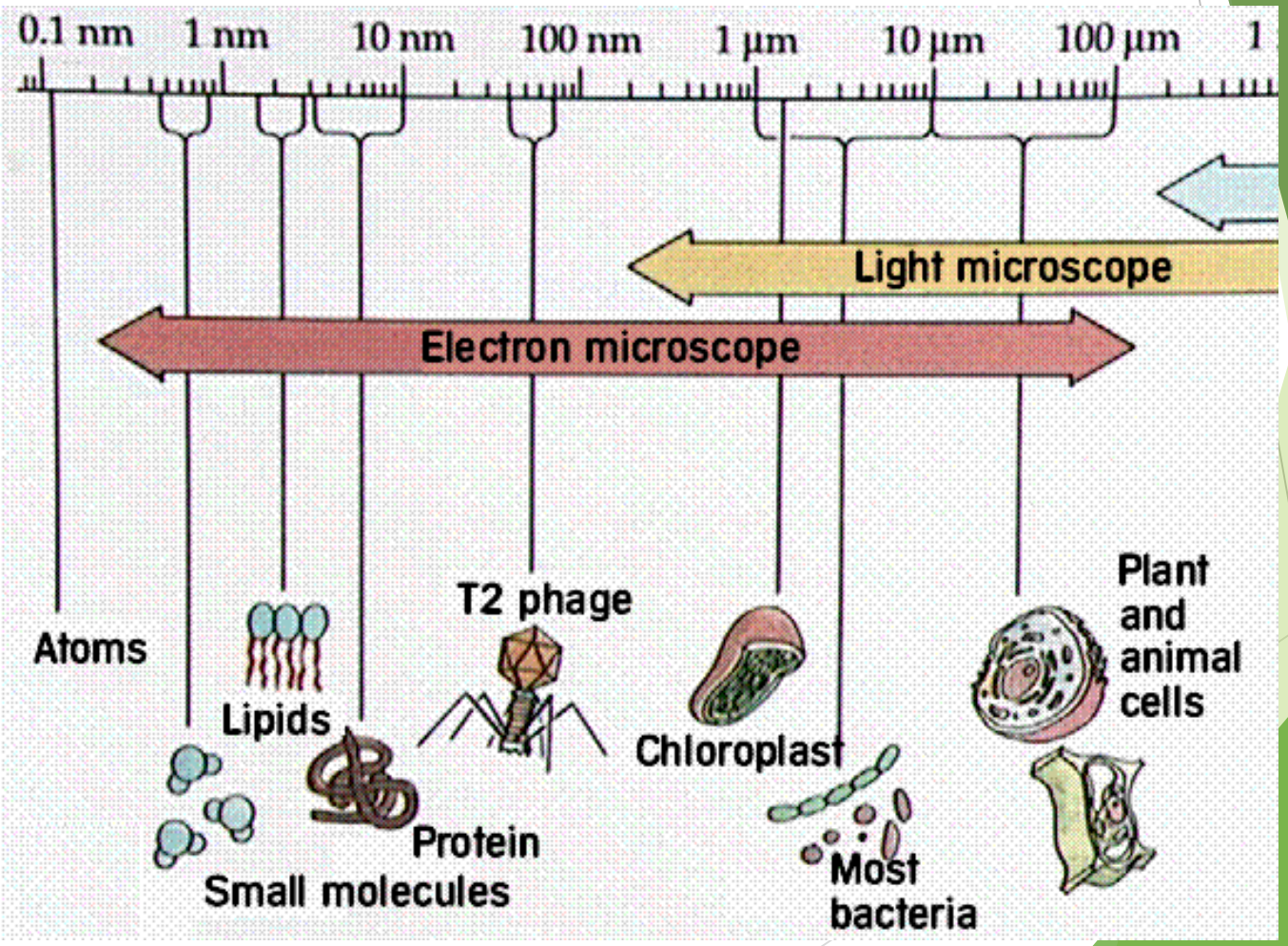
- Obtain and use Energy
- Made up of Cells
- Respond to their environment (adaptation)
- Growth & Development
- Reproduction (on their own)
- Contain Genetic Material (DNA/RNA)
- Movement

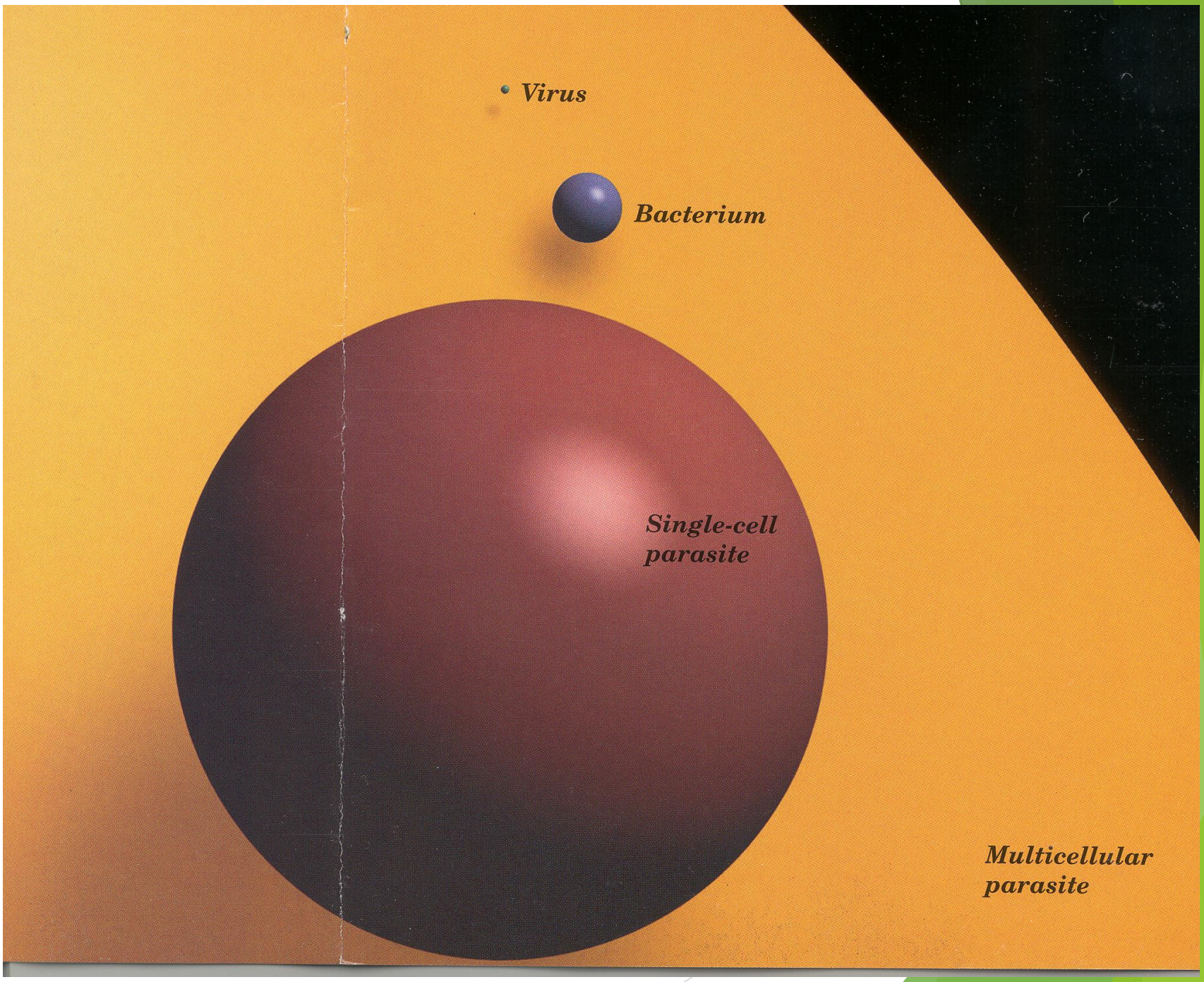




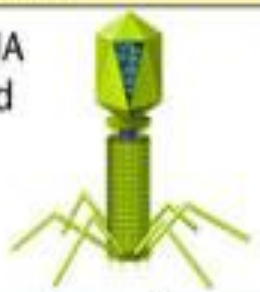


Which one is smaller? Cell or Virus?




Virus
Bacterium
Single-cell parasite
Multicellular parasite

Comparing Viruses to Cells

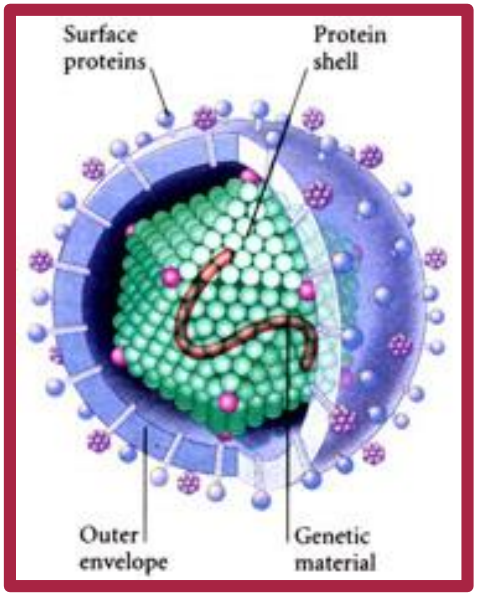
Viruses and Cells		
Characteristic	**Virus**	**Cell**
Structure	DNA or RNA core, capsid 	Cell membrane, cytoplasm; eukaryotes also contain nucleus and organelles 
Reproduction	only within a host cell	independent cell division either asexually or sexually
Genetic Code	DNA or RNA	DNA
Growth and Development	no	yes; in multicellular organisms, cells increase in number and differentiate
Obtain and Use Energy	no	yes
Response to Environment	no	yes
Change Over Time	yes	yes

In Summary:

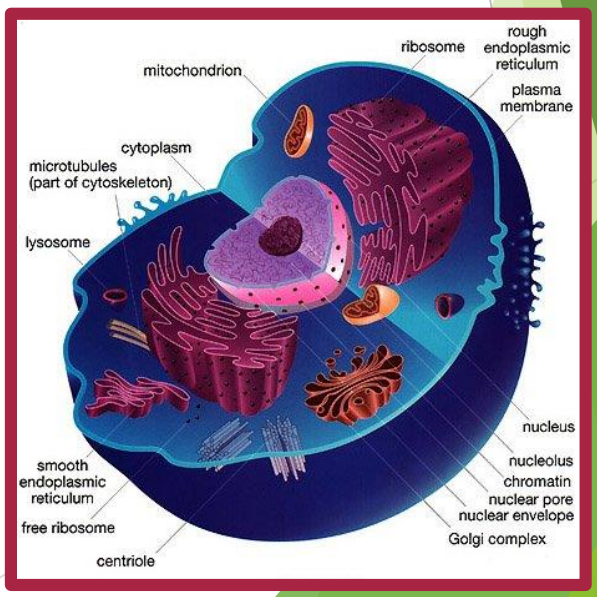
A virus is an infectious agent made up of nucleic acid (DNA or RNA) wrapped in a protein coat called a capsid.

Viruses have no nucleus, no organelles, no cytoplasm or cell membrane—Non-cellular

Viruses do not contain the characteristics used to identify living organisms.



VS



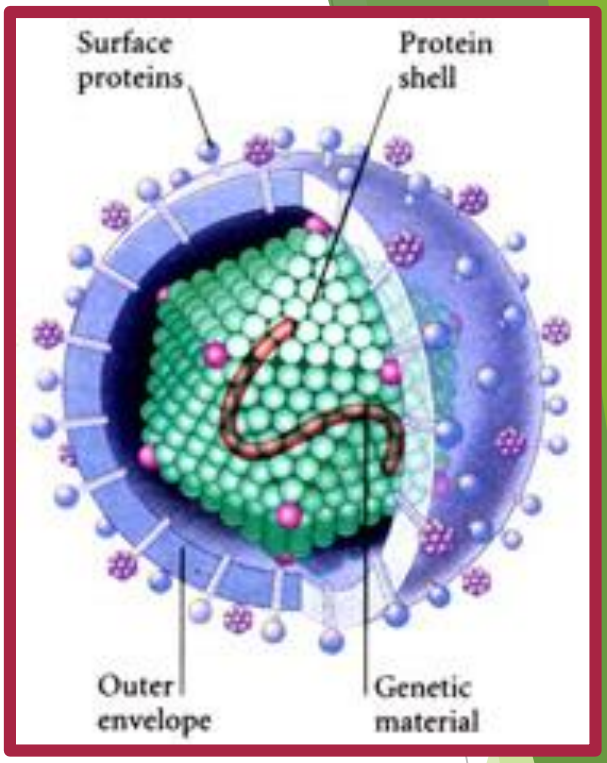
Stop

Virus Structure

Cells Alive Animation

http://www.cellsalive.com/howbig.htm

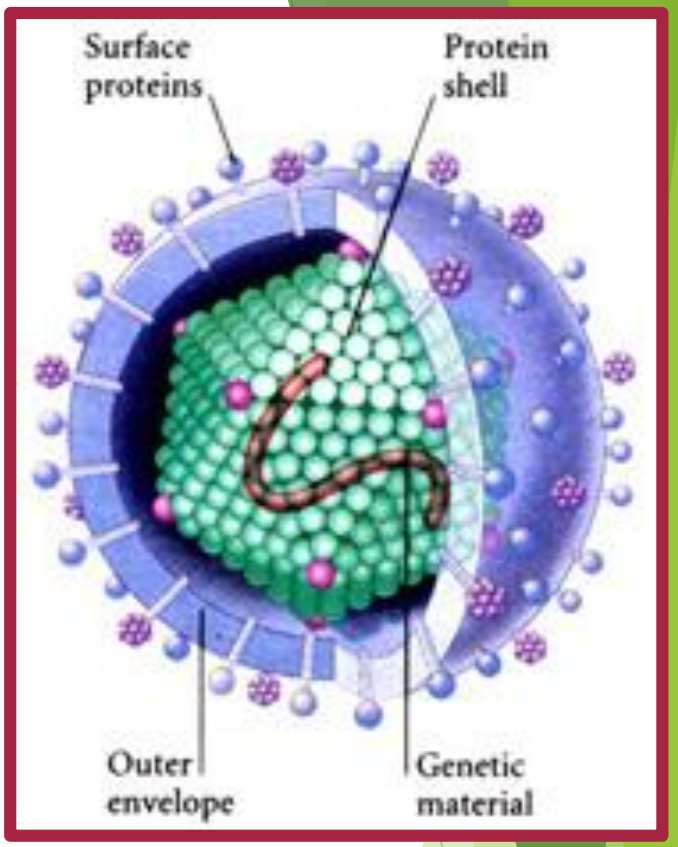
Viruses are made up of :



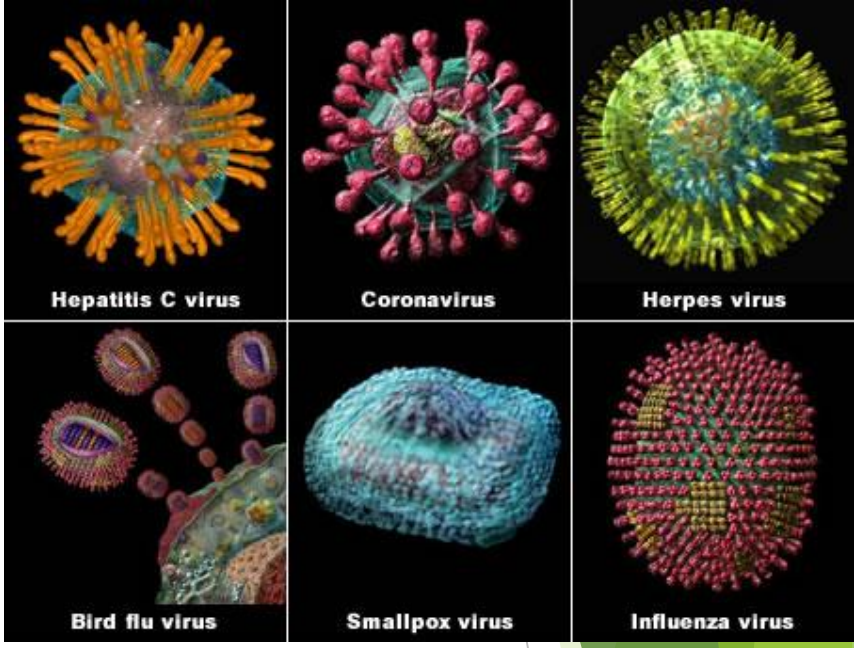
- A strand of **Nucleic Acid** (DNA or RNA) encased in a protective **protein coat.**

Inner core of Nucleic Acids:

- Amount of genetic information is very small – only 10 to 100 genes.

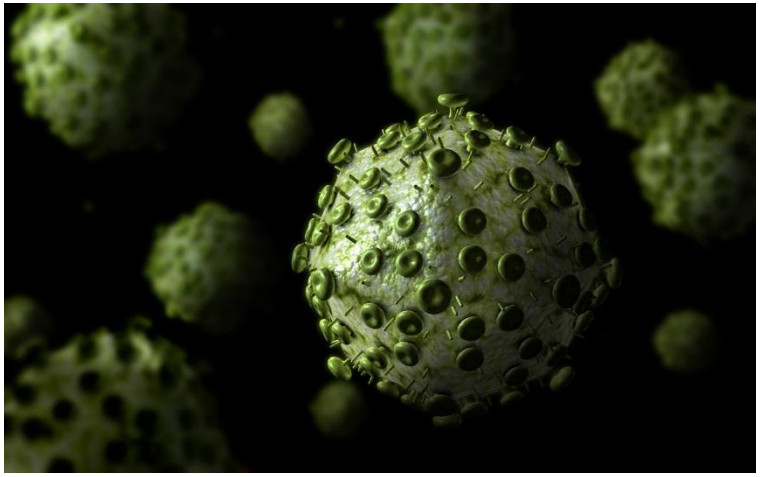


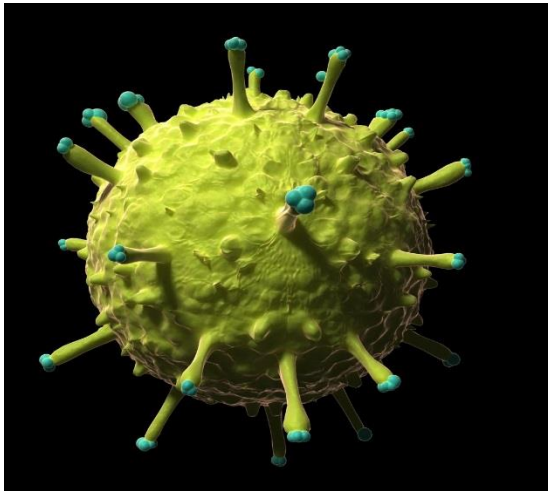
Protein outer coat (capsid):

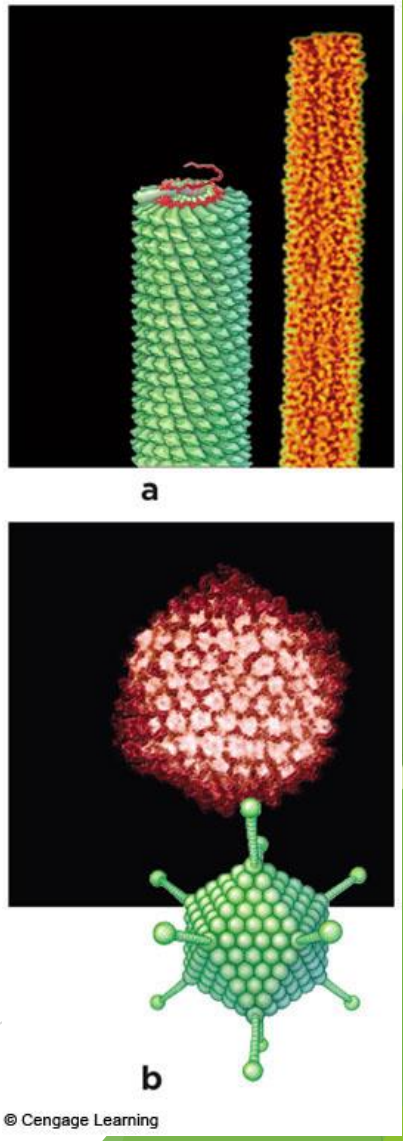


- The capsid makes up 95% of the viral structure.
- The arrangement of the proteins in the outer coat determines the shape of the virus.

Viral Structures

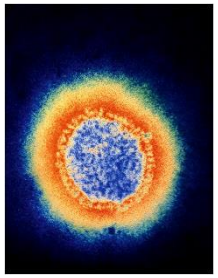




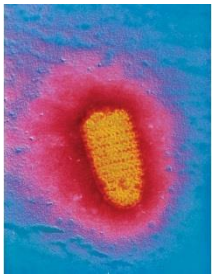


Viruses differ in shape and in ways of entering host cells.

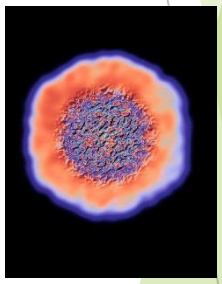
- Viruses have a simple structure.
  - genetic material
  - capsid, a protein shell
  - maybe a lipid envelope, a protective outer coat



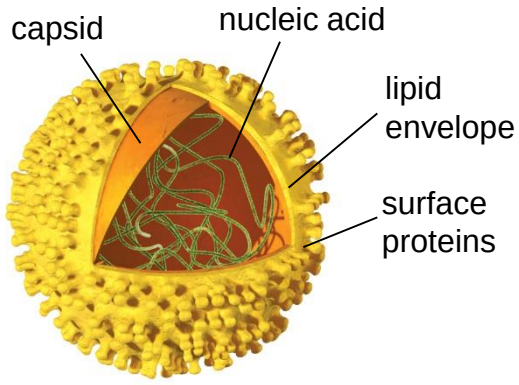
enveloped (influenza)

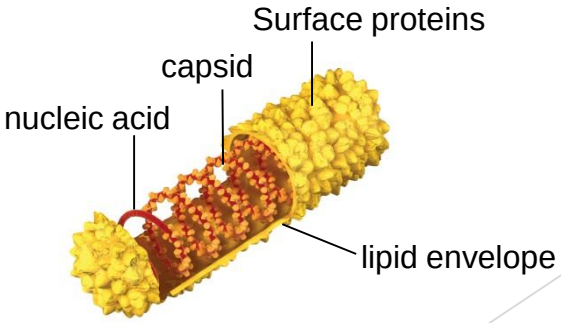


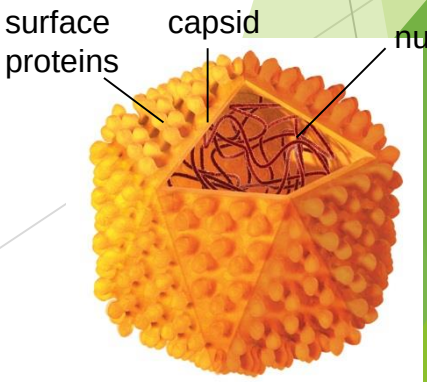
helical (rabies)



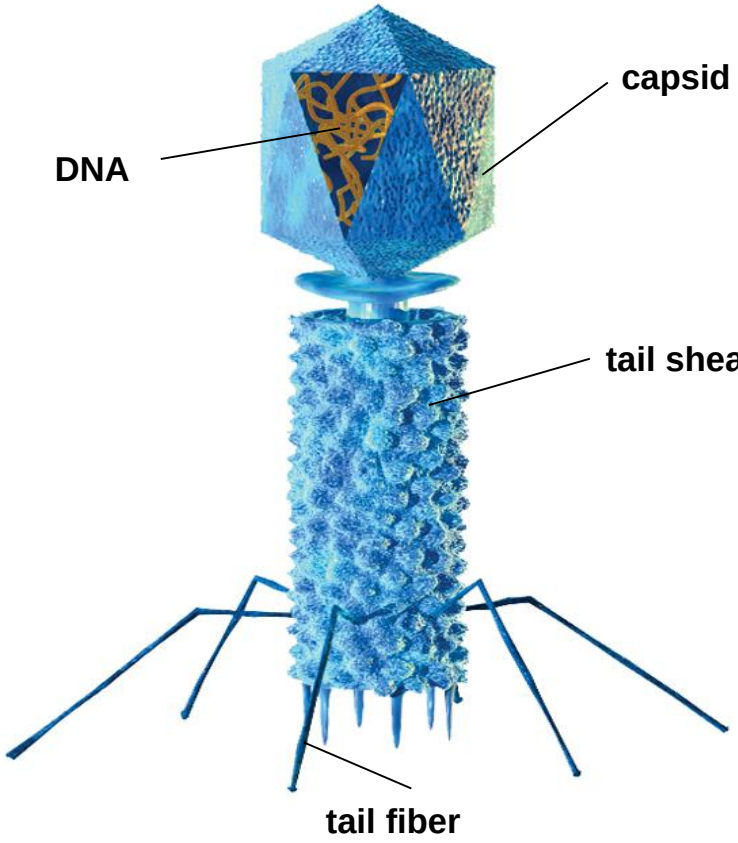
polyhedral (foot-and-mouth disease)





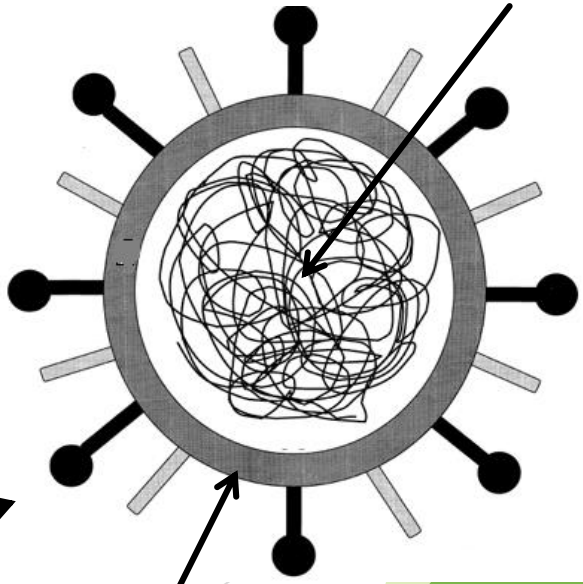


1. **Bacteriophage—<u>viruses</u>** that infect **<u>bacteria</u>**



2. Flu (influenza), HIV

<u>DNA</u> or <u>RNA</u>



<u>Surface Marker</u>

<u>Capsid</u> (protein coat)

Stop

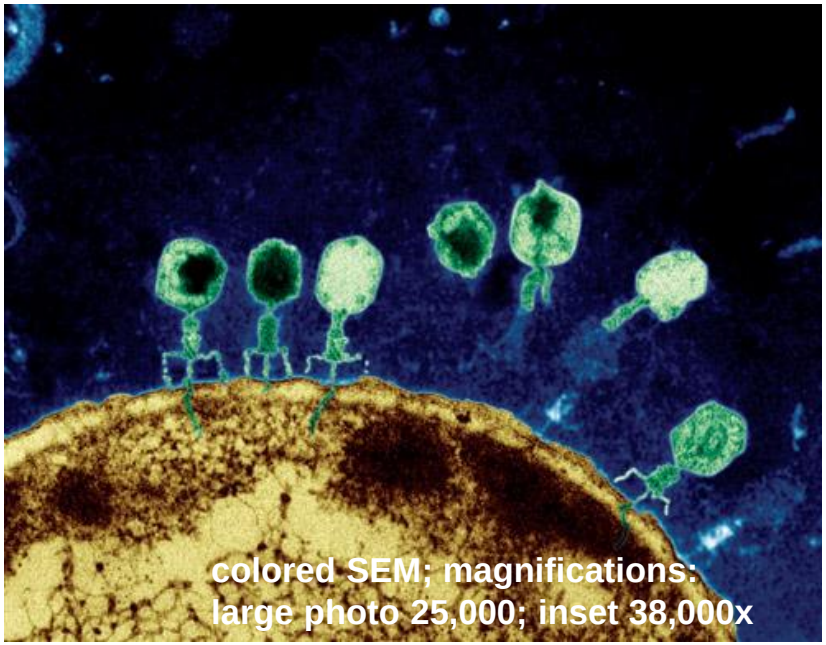
Viral Reproduction

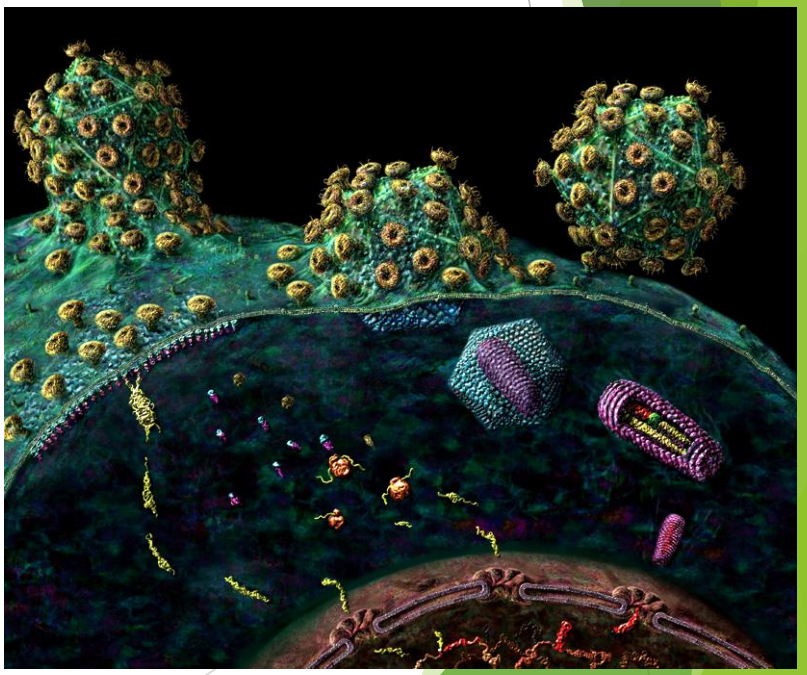
The Virus enters the cell…

- The skin is our 1st defense mechanism in preventing pathogens from entering the body.
- Even though most pathogens enter through the nose & mouth; a defense mechanism is set up to limit the number of invasions (mucous & cilia.)
- Viral infections are difficult to treat because viruses reside within our cells. Anything that destroys the virus is likely to damage our own cells.

Viruses enter cells in various ways.

- bacteriophages pierce host cells
- Viruses of eukaryotes fuse into the membrane



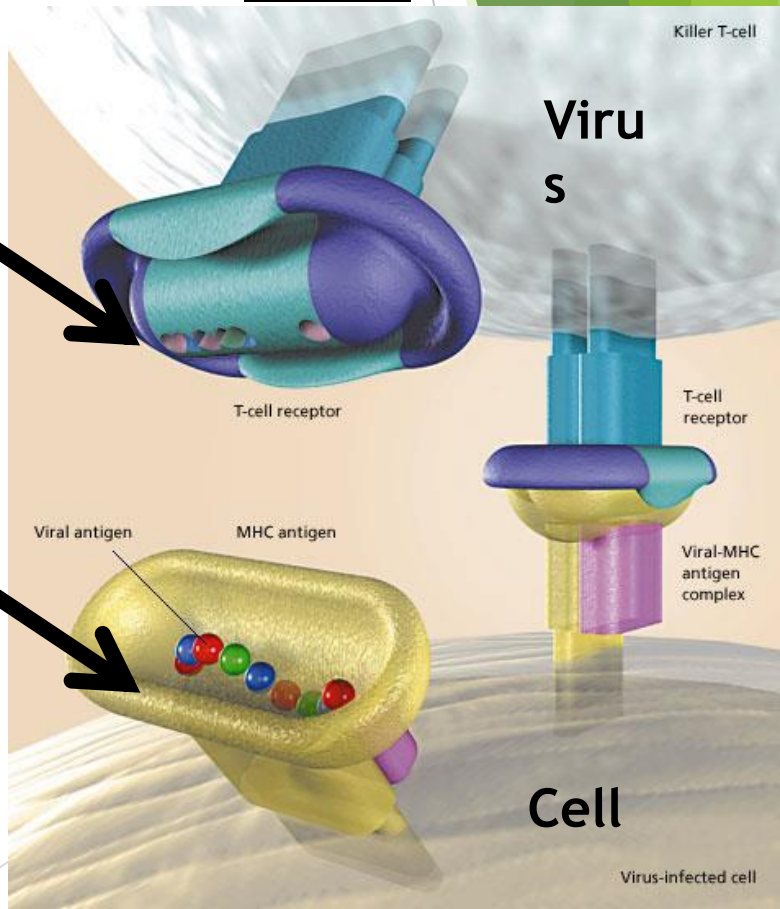


Certain viruses can only attack certain cell types. They are said to be specific.

Example: The rabies virus only attacks brain or nervous cells.

Surface Markers

Receptor Sites



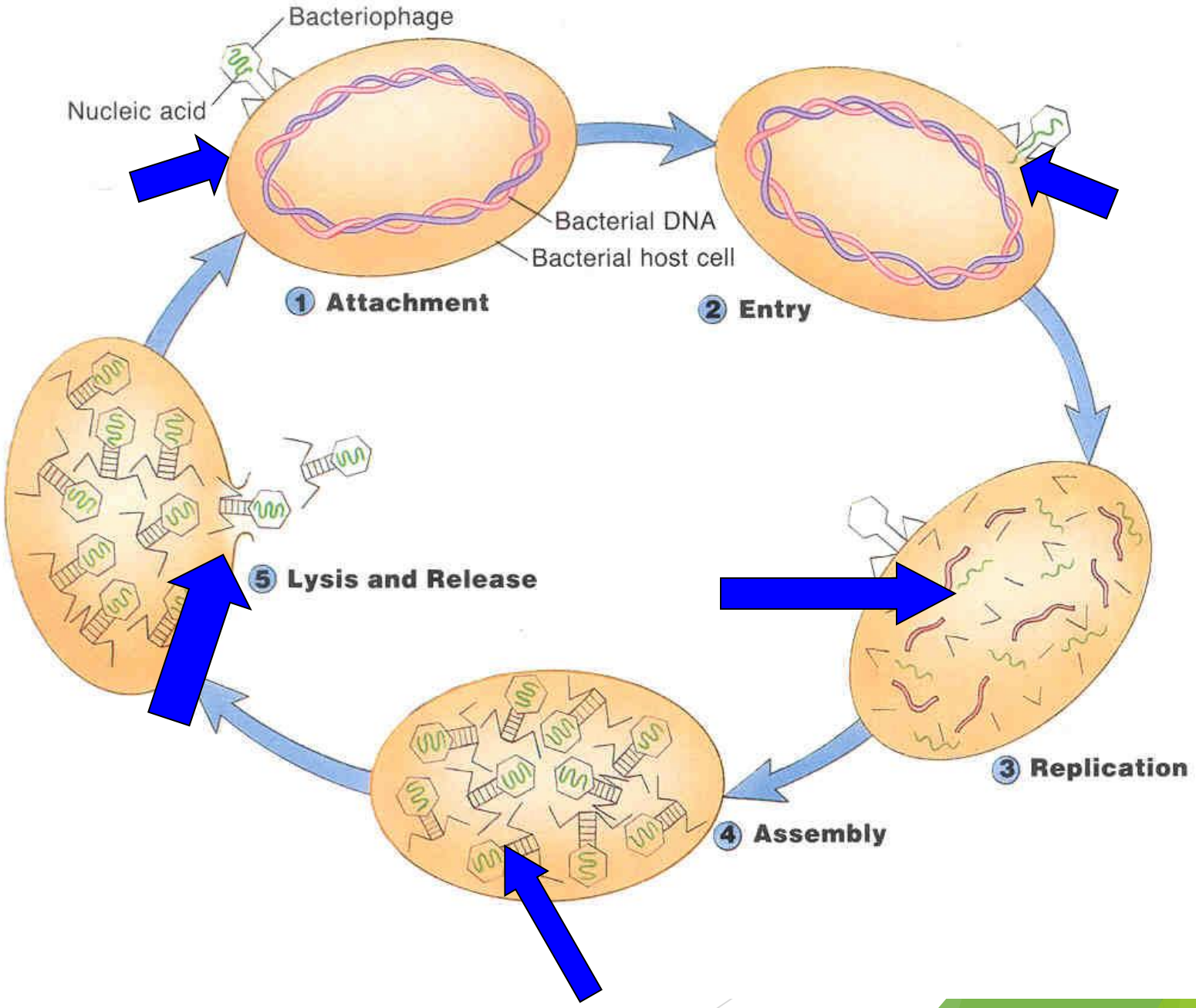
It's like the pieces of a puzzle. The ends have to match up so only certain pieces fit.

1st type of Reproduction:

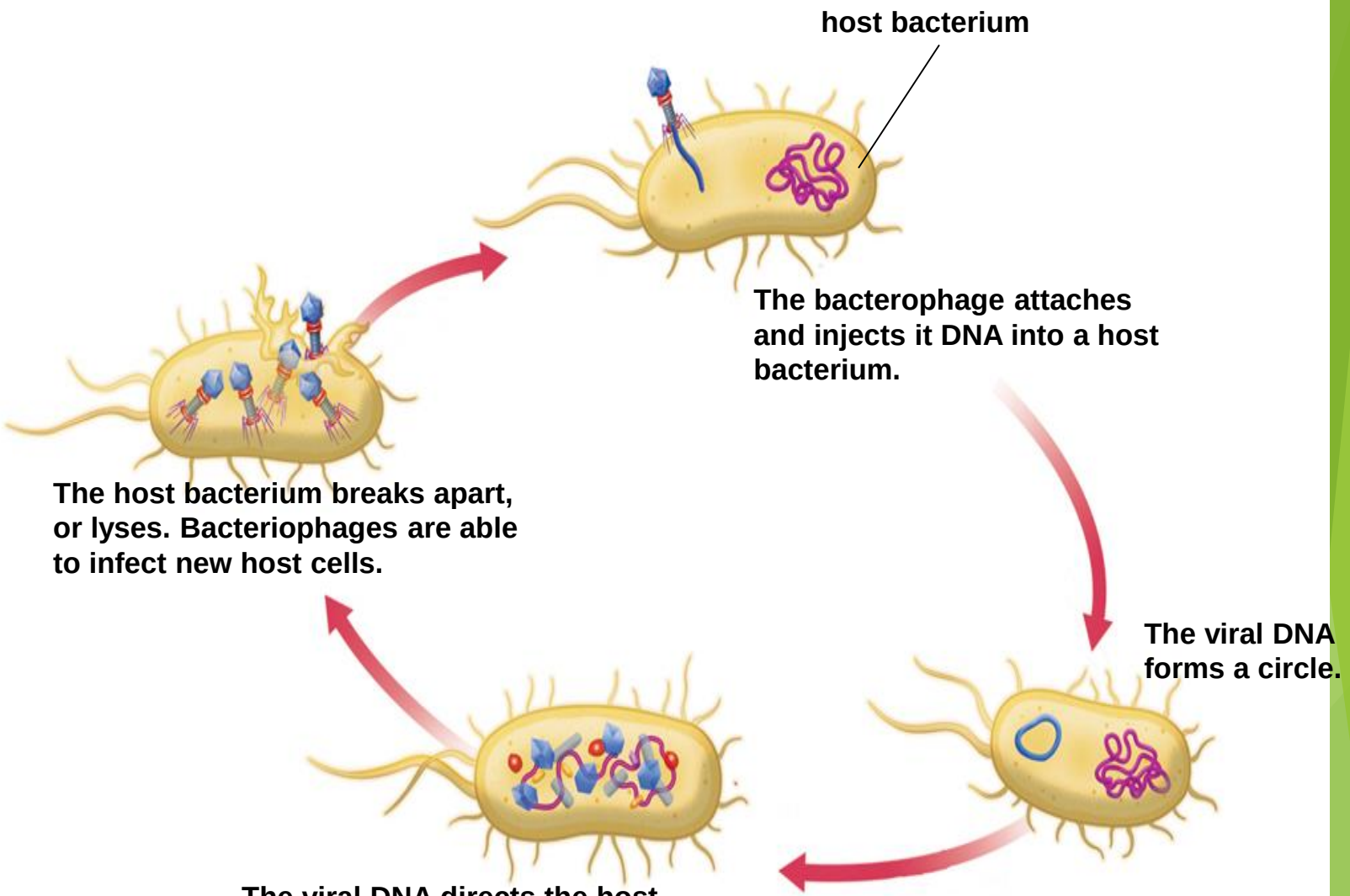
- Lytic cycle –The lytic cycle:
  1- absorption/attachment
  2- injection/entry
  3- replication of viral parts
  4- assembly
  5- release by lysis

- Results in death of host cell

LYTIC CYCLE


Bacteriophage
Nucleic acid
Bacterial DNA
Bacterial host cell
1 Attachment
2 Entry
3 Replication
4 Assembly
5 Lysis and Release

LYTIC CYCLE


host bacterium
The bacterophage attaches and injects it DNA into a host bacterium.
The viral DNA forms a circle.
The virus may enter the lysogenic cycle, in which the host cell is not destroyed.
The viral DNA directs the host cell to produce new viral parts. The parts assemble into new bacteriophages.
The host bacterium breaks apart, or lyses. Bacteriophages are able to infect new host cells.

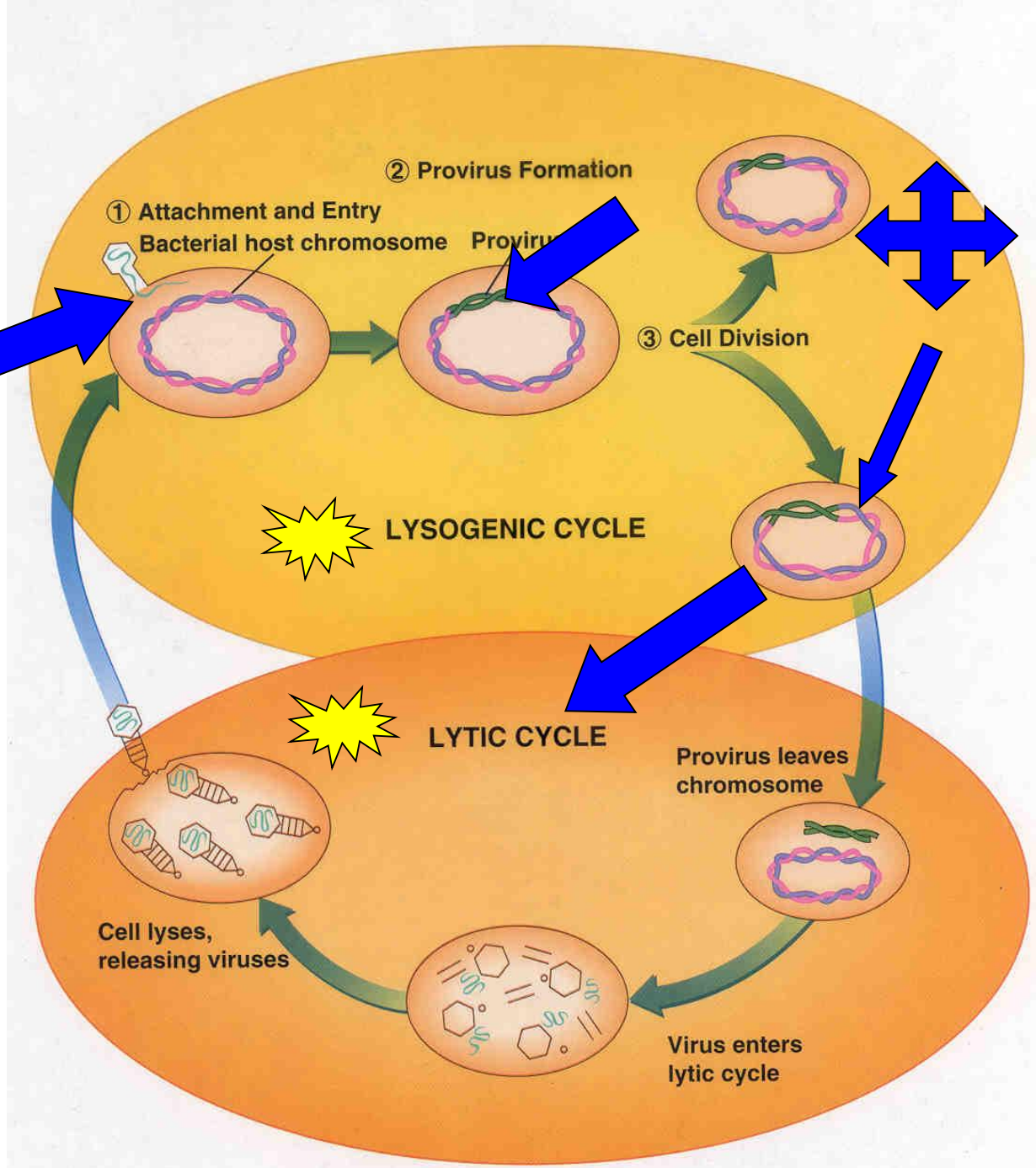
2nd Type of Reproduction:

- LYSOGENIC CYCLE:
  1. absorption/attachment
  2. Entry/Injection
  3. Viral DNA/RNA attaches to host DNA, becoming part of the hosts DNA. Host cells divides by Mitosis coping both host and viral DNA.

- Virus can remain inactive for many generations but then enter back into the Lytic Cycle.

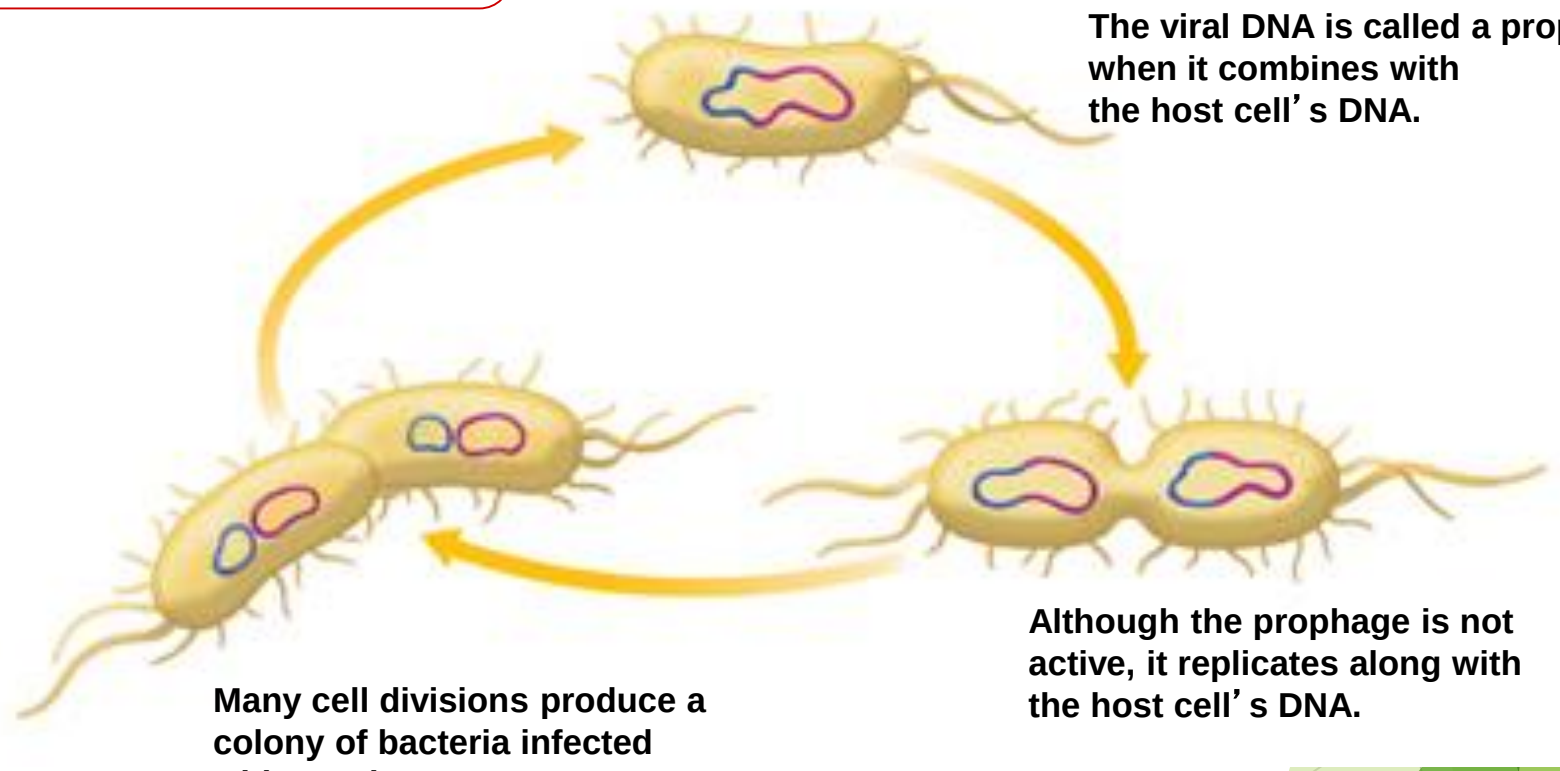
- A lysogenic infection does no immediate harm, harm will come from reactivation of Lytic Cycle

LYSOGENIC CYCLE



LYSOGENIC CYCLE

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.

Animation Sites for Lytic and Lysogenic Cycles

- https://www.youtube.com/watch?v=wLoslN6d3Ec

- http://highered.mheducation.com/sites/0072556781/student_view0/chapter17/animation_quiz_2.html

The body's response to the viruses (Antibodies)

- In the US, viruses are responsible for approx. 80% of all infectious disease.
- Mammals protect themselves by producing **antibodies** to the virus
- An antibody is a protein secreted by cells in the immune system in response to a foreign substance in the body.
- The antibodies attach to the virus and flag it.
- If the virus was not destroyed directly by the antibody or held capitve by it until the virus can be surrounded and destroyed by white blood cells, it may reinfect the organism.
- These specific **antibodies** remain in the body of the organism after the virus has been destroyed.
- If the same virus attempts another invasion, it is quickly killed by the antibodies.

Stop

Types of Viruses

- **RNA Viruses** – have an enzyme that uses the viral RNA to make messenger RNA molecules (**mRNA** have the codes to make proteins.)
- Thus, viral proteins are made (does not take over or become part of the host's DNA.)

Other Types of Viruses

- **Retroviruses** (Lysogenic Retroviruses) – Have an enzyme called **reverse transcriptase**. This makes a copy of DNA from the viral RNA (the reverse of what happens in the cell.) Then, the viral DNA becomes part of the host's DNA (Lysogenic).
- ~In summary:
    1. RNA changes to DNA
    2. DNA is incorporated into a cell's DNA
    3. DNA makes messenger RNA
    4. mRNA redirects the rest of the cell to make viruses.

Other Types of Viruses

- **Viroids-**
  - **Dr.Theodore Diener (1964)** discovered viroids. They have the same devastating effects but lack many of the properties that define viruses.
    - Found only in plants
    - Naked strings of amino acids (no capsid)
    - Free floating single stranded RNA
    - Smaller than viruses

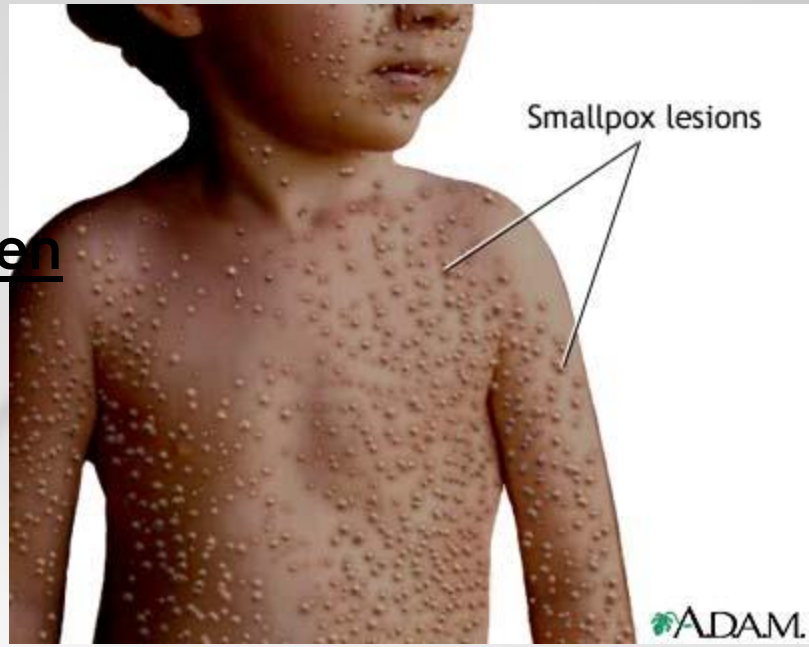
Importance:

*Harmful

Causes disease—pathogenic

Disease producing agent—pathogen

Human Diseases: Warts, common cold, Influenza (flu), Smallpox, Ebola, Herpes, AIDS, Chicken pox, Rabies



Viruses disrupt the body's normal equilibrium/balance

Viruses can be prevented with vaccines, but NOT treated with antibiotics.
(antibiotics treat bacteria)

Beneficial:

Genetic Engineering—harmless virus carries good genes into cells.