

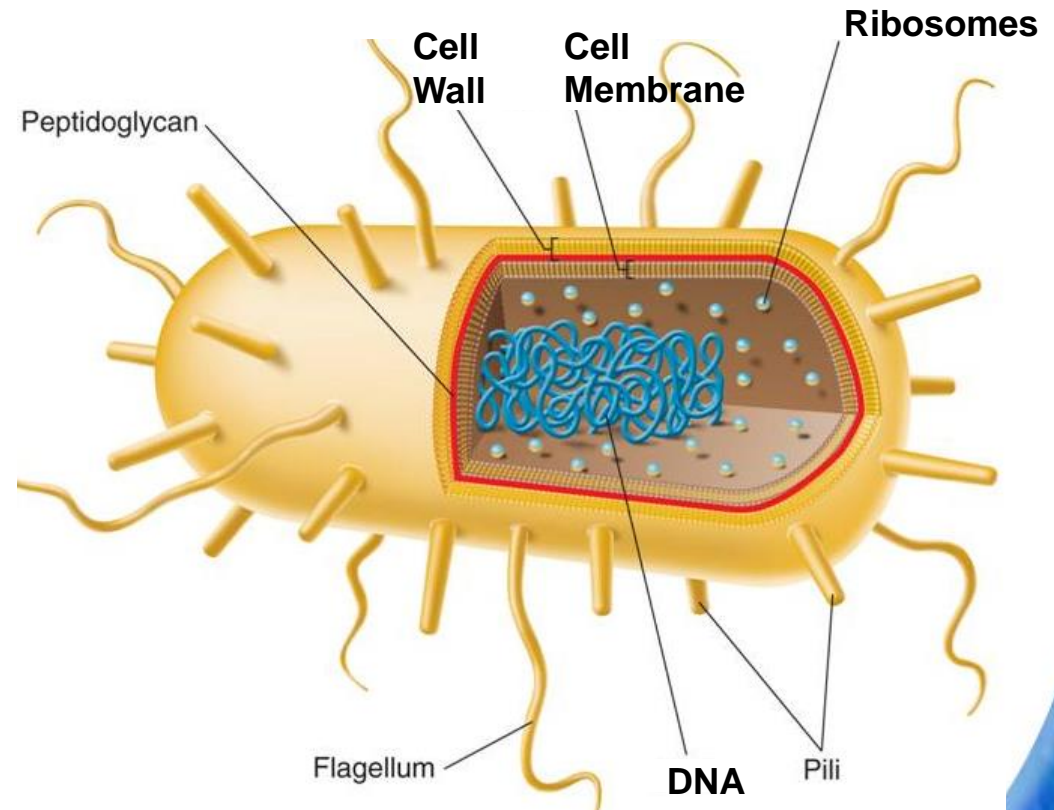
# Unit 3: Bacteria and Viruses

- **What do we know?**

# Bacteria:

## Characteristics of Life

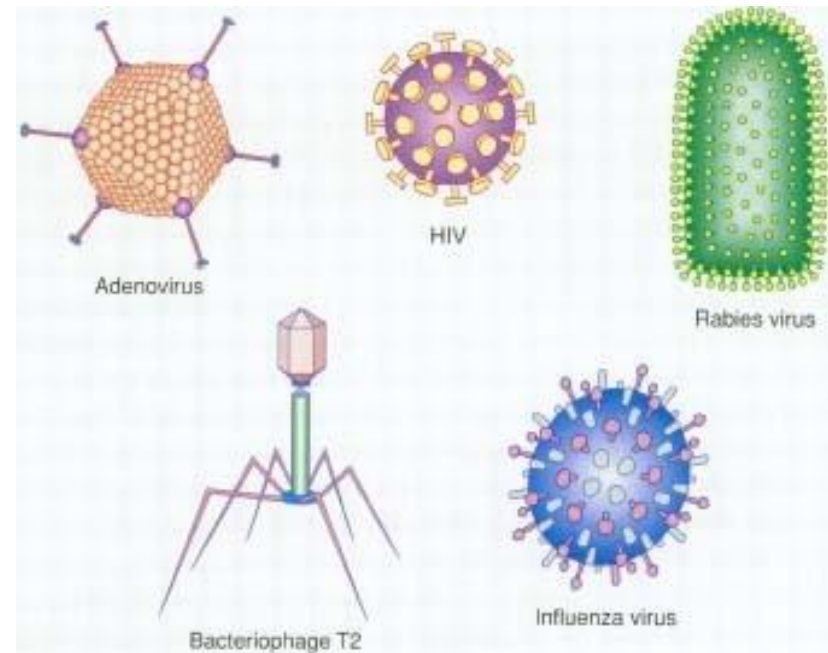
- Made of cells
- Pass on genetic information (DNA)  
Metabolize materials
- Respond to stimulus
- Adapt through evolution
- Maintain homeostasis
- REPRODUCE!!



# Viruses:

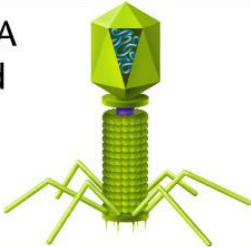
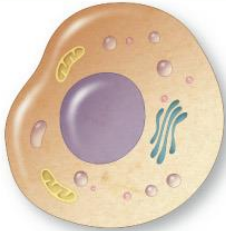
## Characteristics of Life

- Are not made of cells
- **Cannot reproduce**  
independently
  - multiply only by infecting living cells
- Do not metabolize materials
- Do not maintain homeostasis
- However, they do pass on genetic information

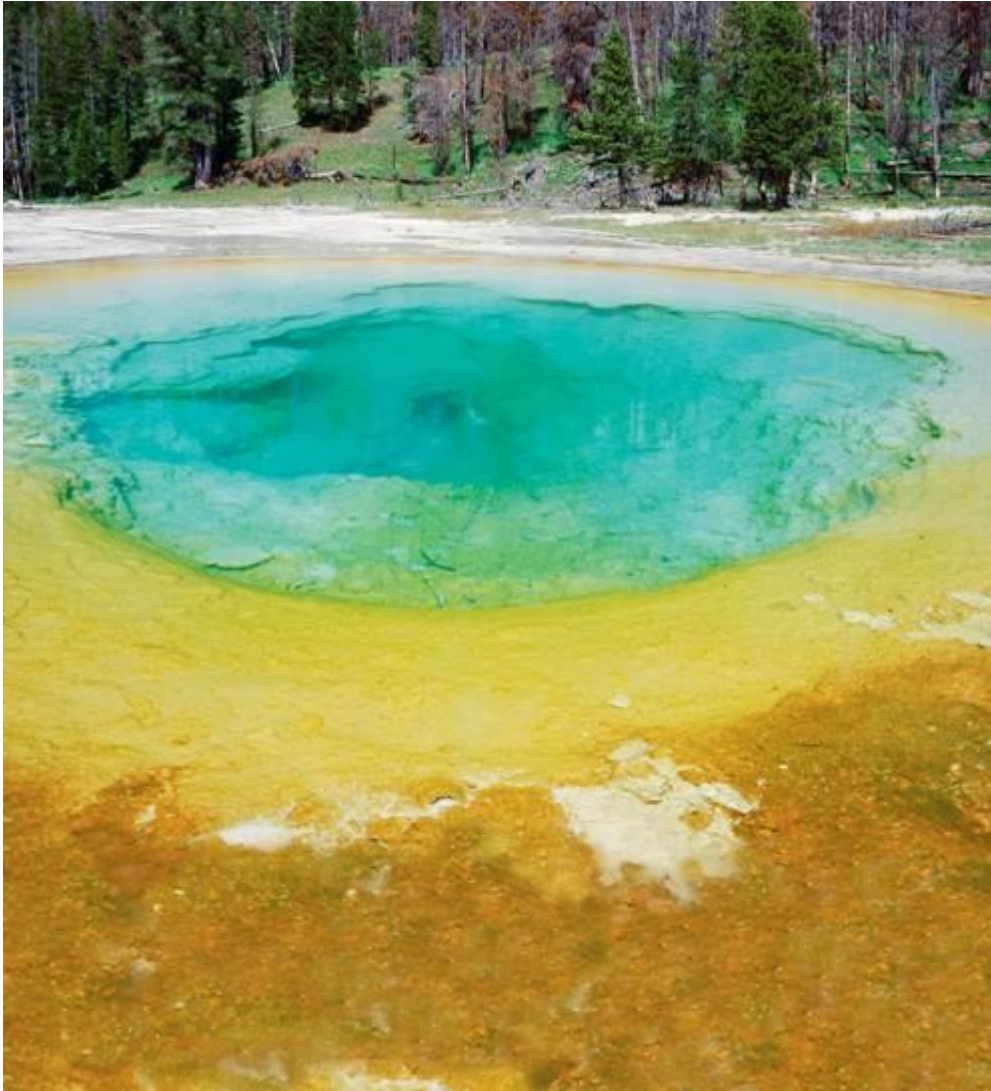


***They are not considered living, but do have some characteristics of life***

## 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

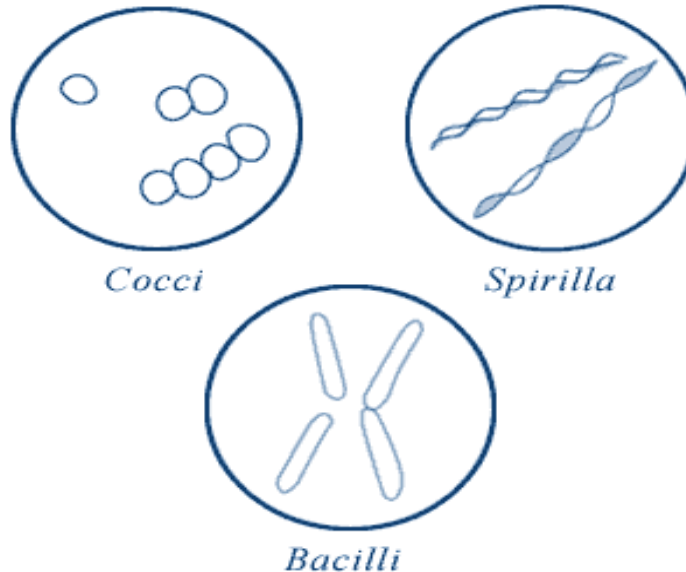
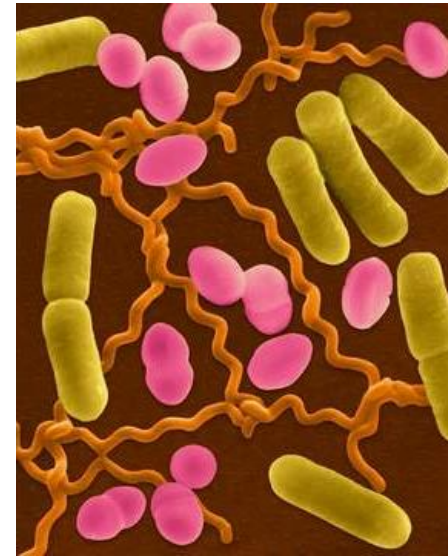
# 19–1 Bacteria



The smallest and most common microorganisms are **prokaryotes**—unicellular organisms that lack a nucleus.

## *Three bacterial shapes:*

- *Rod shaped are called bacilli*
- *Sphere shaped are called cocci*
- *Spiral shaped are called spirilla*



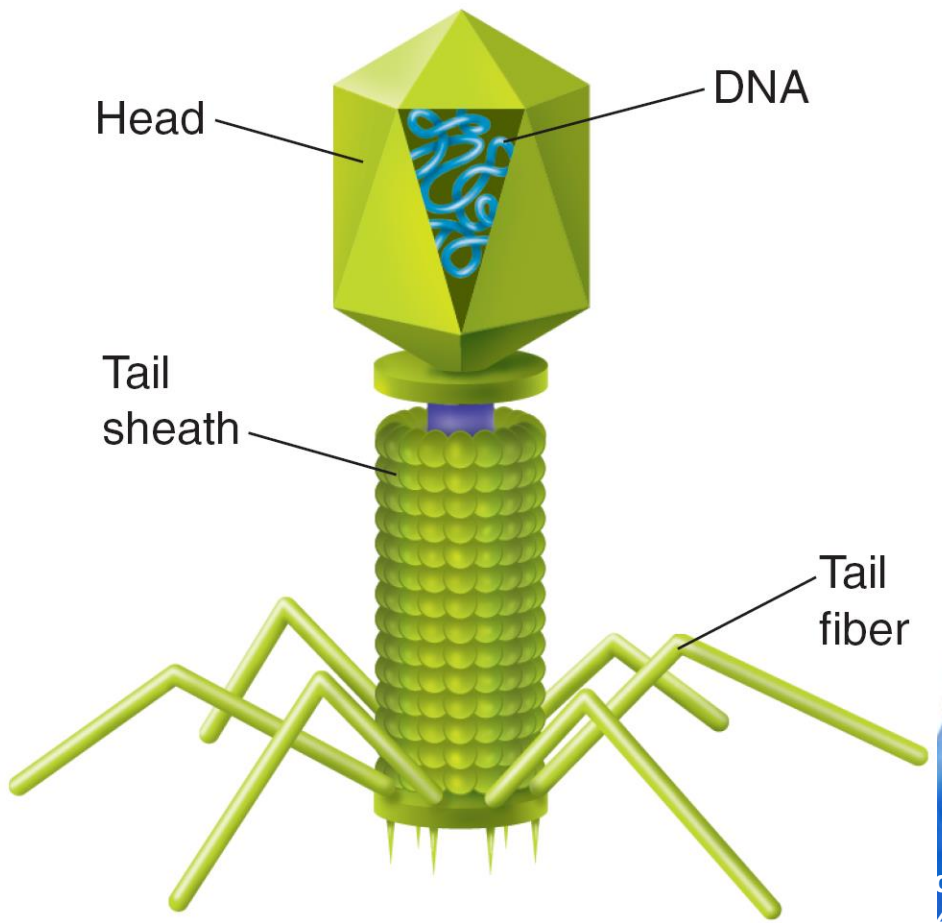
# *Lets draw the Parts of a Bacterial Cell*

19-1 Bacteria

# 19-2 Viruses



### T4 Bacteriophage

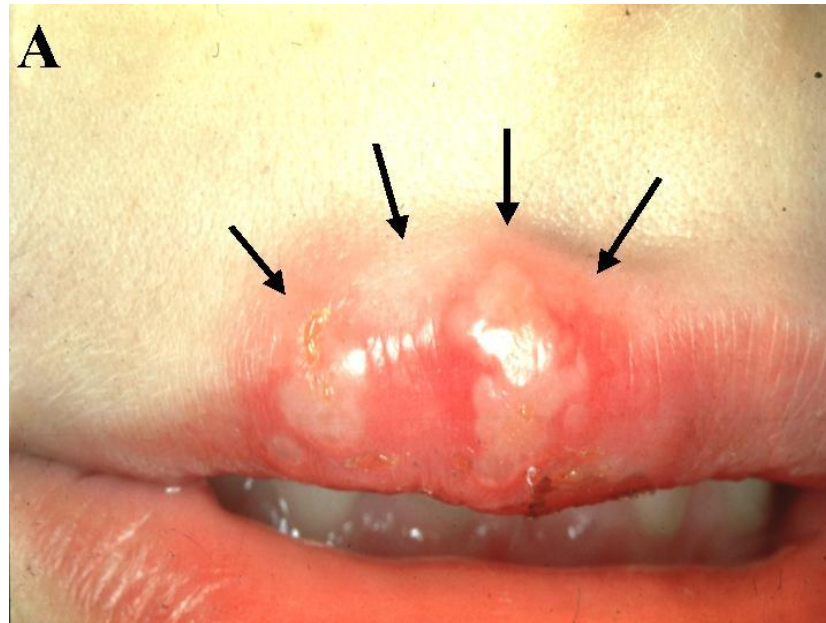




## What Is a Virus?

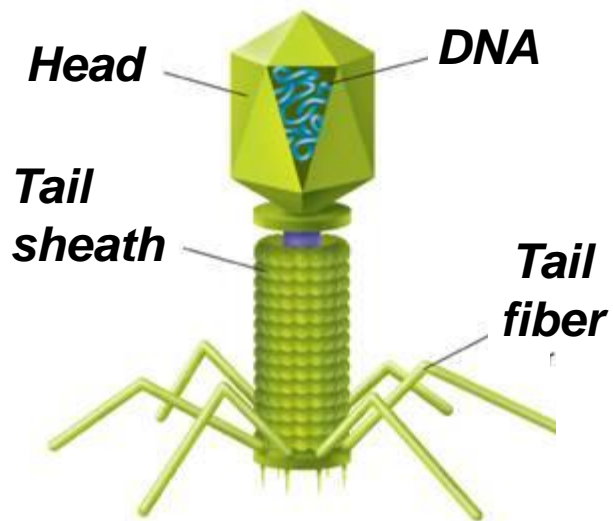
\***Viruses** are particles of nucleic acid, protein, and in some cases, lipids.

**Viruses can reproduce only by infecting living cells.**

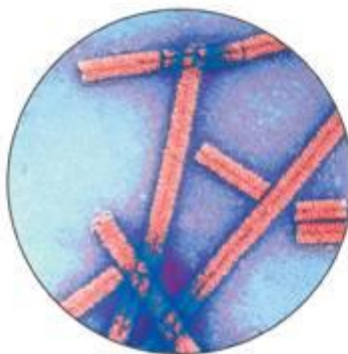
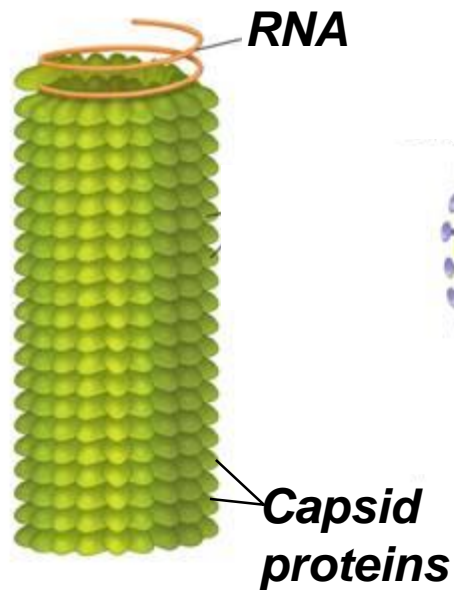


# 19-1 Bacteria → What Is a Virus?

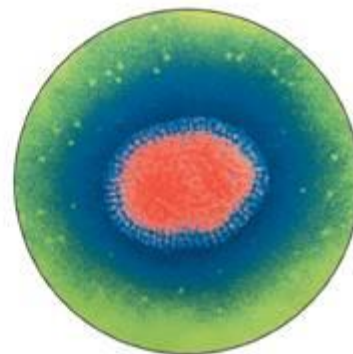
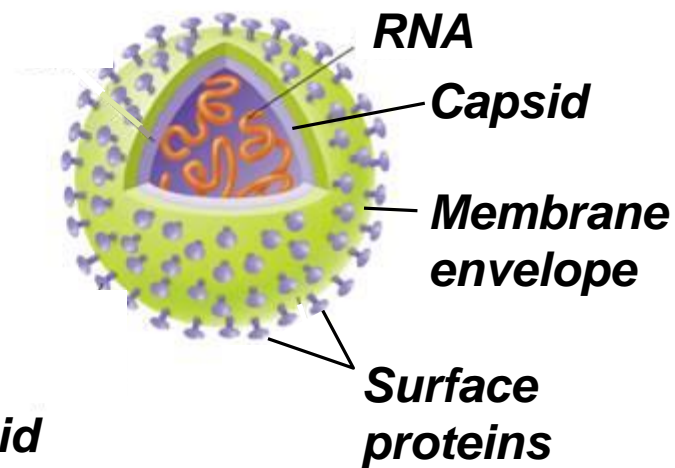
## T4 Bacteriophage



## Tobacco Mosaic Virus

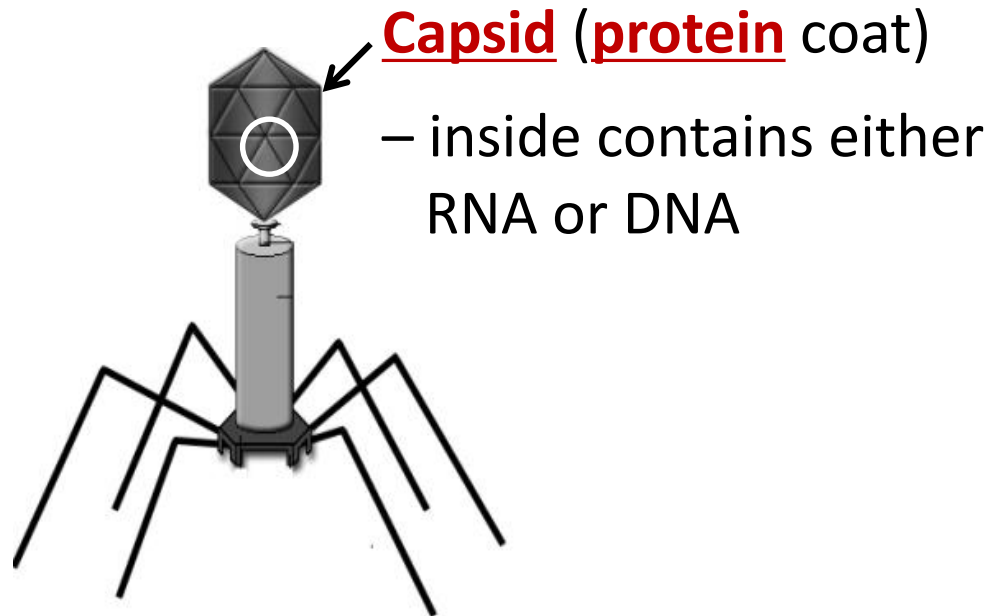


## Influenza Virus

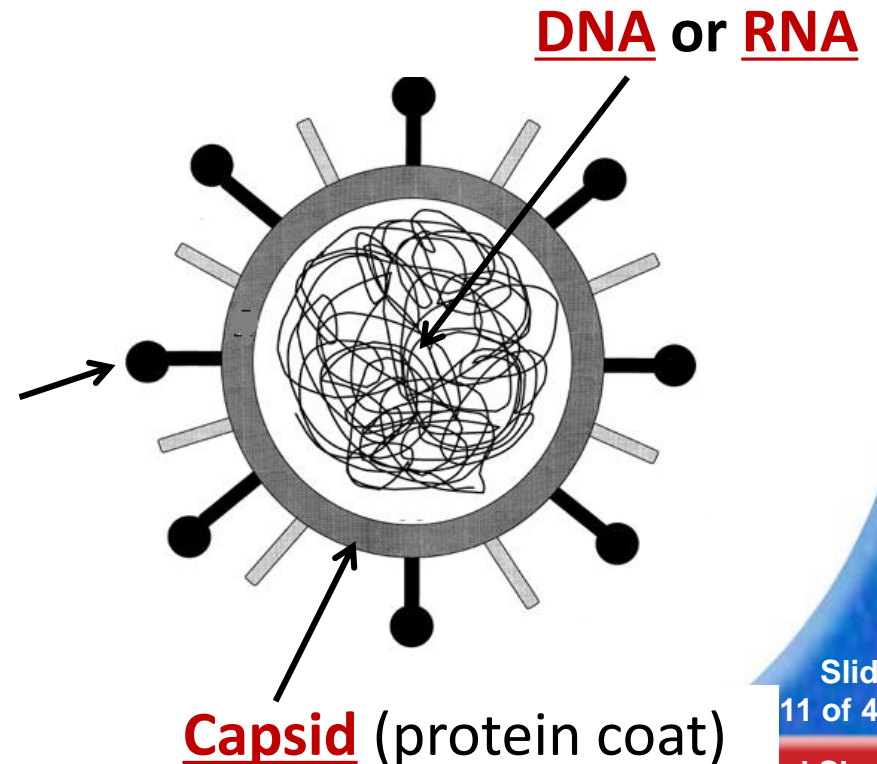


## 19-1 Bacteria →

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

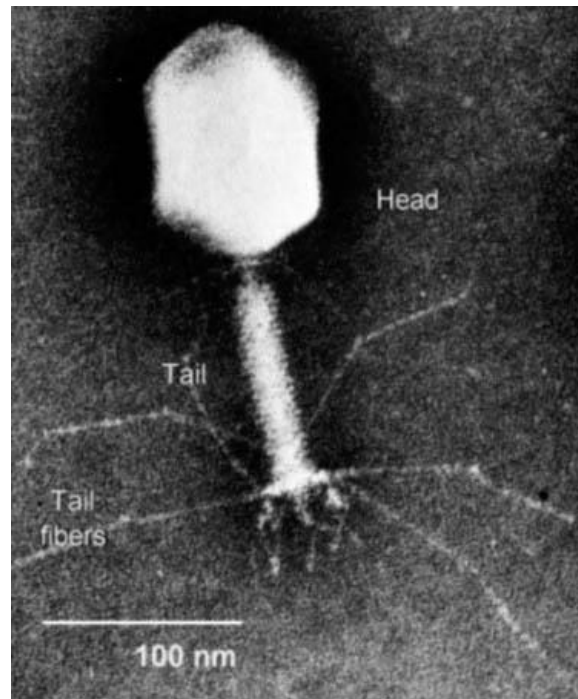


Surface  
Marker



A typical virus is composed of a core of DNA or RNA surrounded by a protein coat.

A **capsid** is the virus's protein coat.

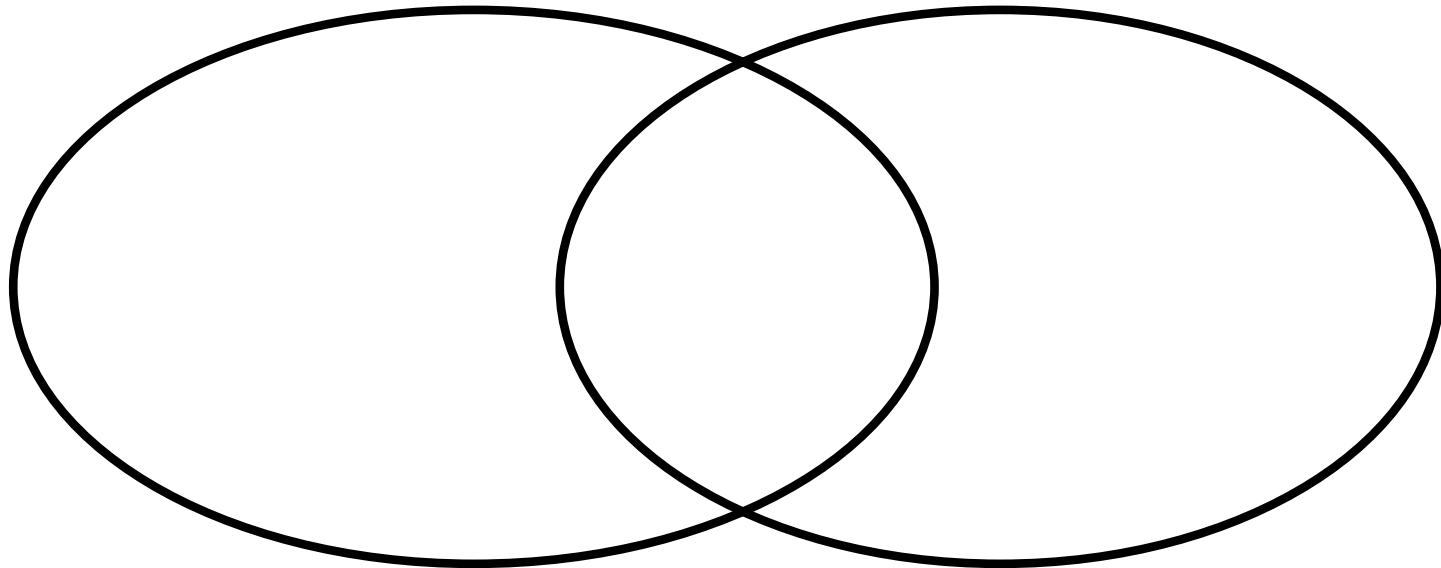


# Questions to think about...

1. Is it **living** or **nonliving**?
2. What can **treat** it?
3. How much of the **body** is affected?
4. Can it reproduce on its own or does it need something else?
5. What is the **size** of **bacteria** compared to **viruses**?
6. How can it **enter** the **body** (at least 4 ways)?
7. Which requires a **host**? Which requires a **host cell**?
8. Would a doctor treat a **viral infection** with an **antibiotic**?  
Explain why.
9. Why do we say viruses **replicate** and bacteria **reproduce**?

# Complete the Venn Diagram for Viruses and Bacteria

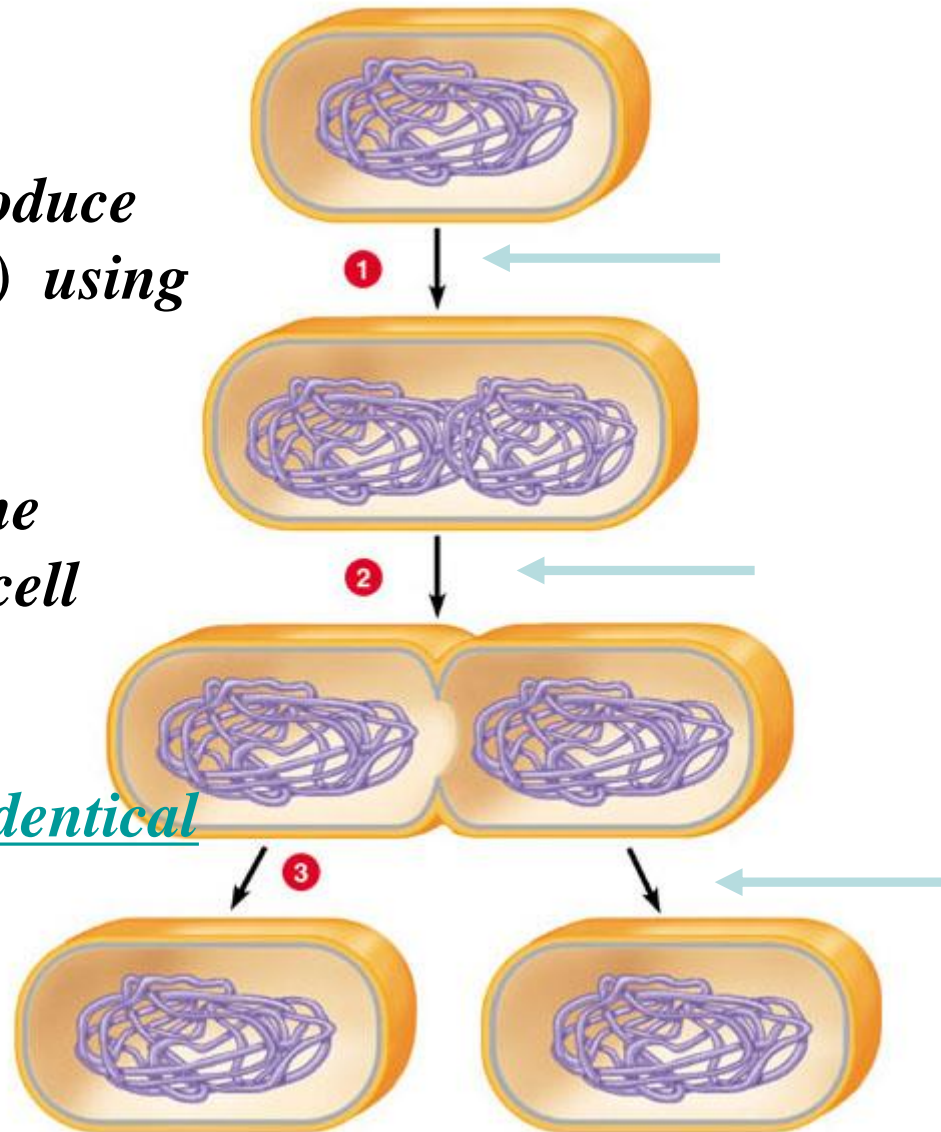
- Include differences and similarities in structure and characteristics of life



- **REPRODUCTION in Bacteria**

# Bacteria – Reproduction: Binary Fission

- Bacteria can reproduce asexually (mitosis) using binary fission.
- Single chromosome replicates & then cell divides
- All new cells are identical (clones)



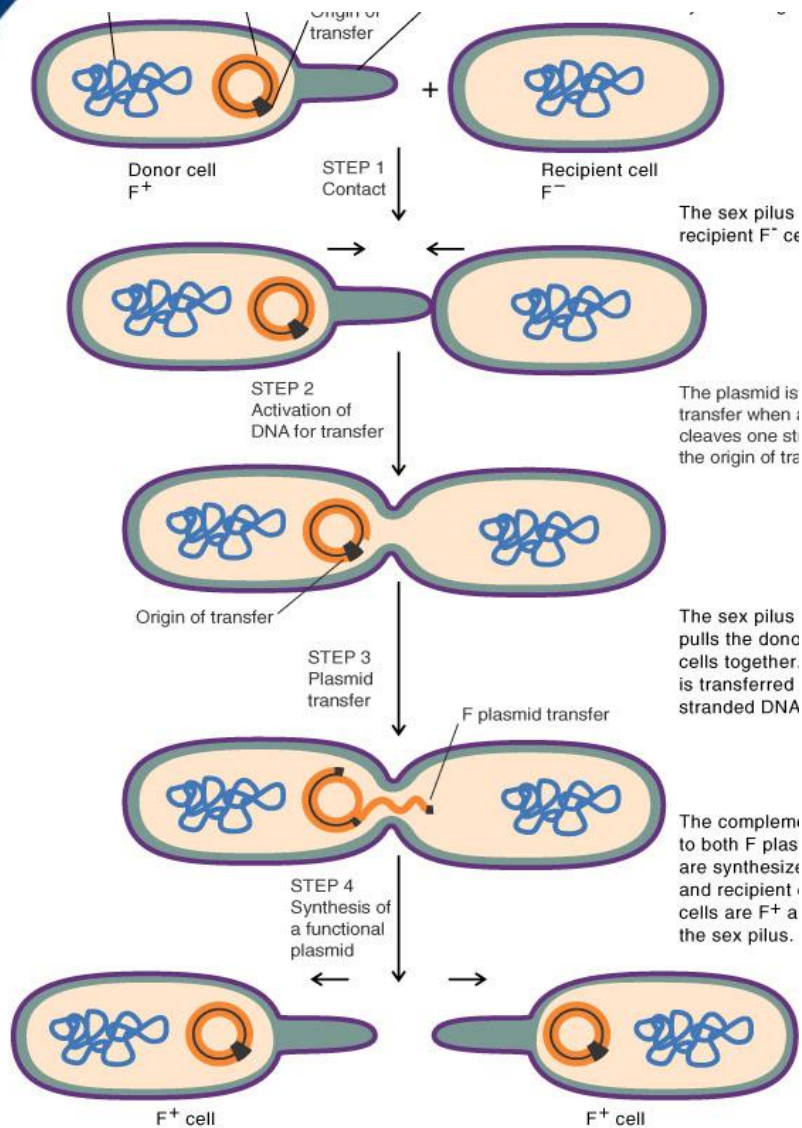


## Conjugation

During **conjugation**, a hollow bridge forms between two bacterial cells, and genes move from one cell to the other.



Conjugation  
(magnification: 7000×)



# Bacterial Genetic Recombination: Conjugation

- Bacteria can exchange genetic information using *conjugation*.
- Bacteria exchange DNA through a tube.
- Resulting cells NOT identical

<https://www.youtube.com/watch?v=7stZk6TesKk>

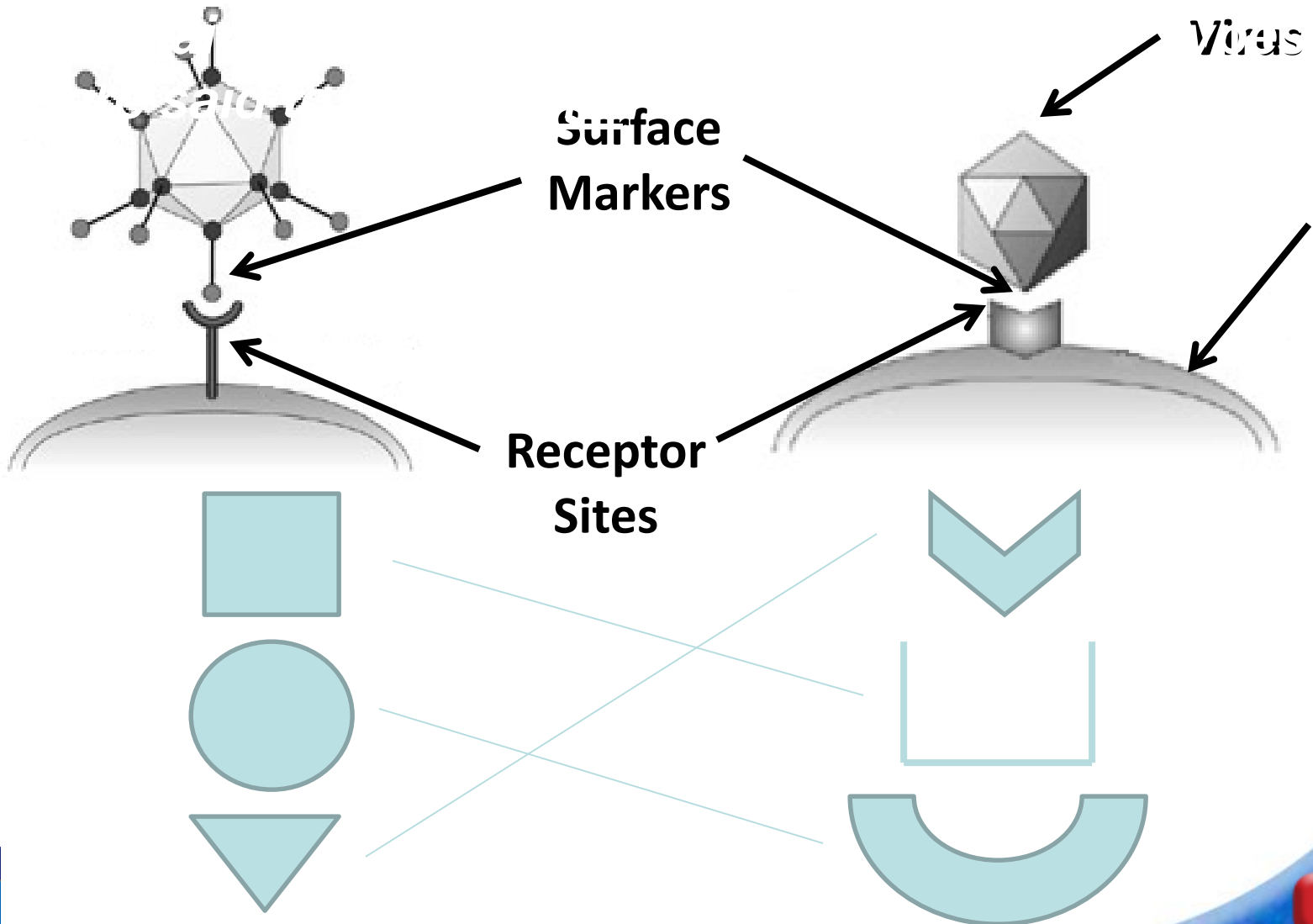
# Viruses replicate Organisms reproduce

- Viruses require a host cell to replicate
  - Invades a host cell
  - Takes over the cell activities
  - Replicates

## 19-1 Bacteria →

### VIRUS IDENTIFIES HOST CELL

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

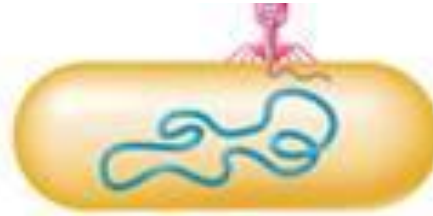


# Viruses **REPLICATE**: Organisms **REPRODUCE**

- Replication is how the virus spreads.
- Two processes of viral replication:
  - **Lytic Cycle**
    - kills host cell immediately
    - Example: common cold, flu, etc
  - **Lysogenic Cycle**
    - can stay in a “dormant” stage for years before killing host cell
    - Example: shingles, AIDs

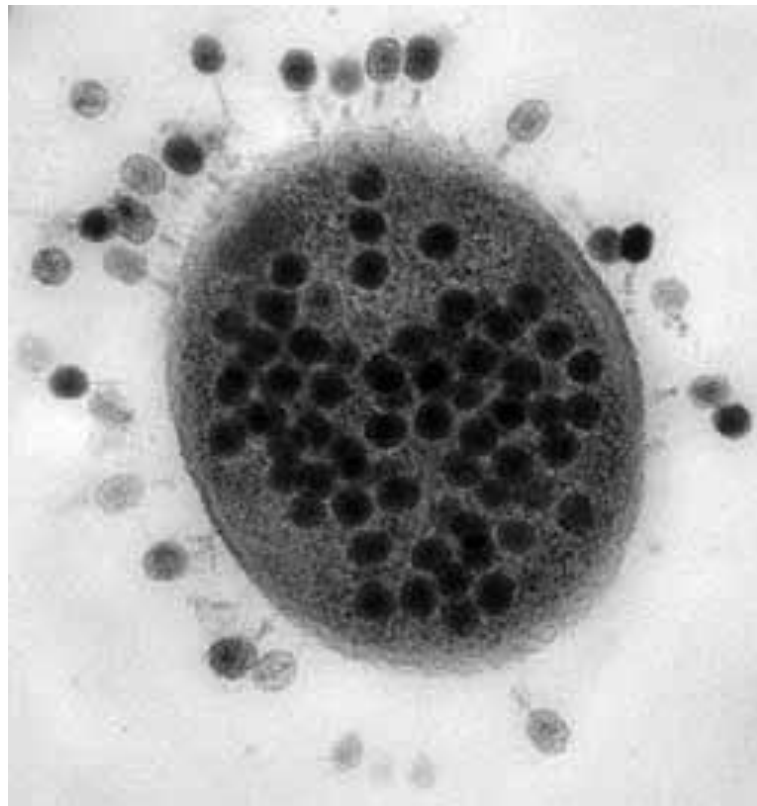
# Viral Infection

***Bacteriophage injects DNA into bacterium***

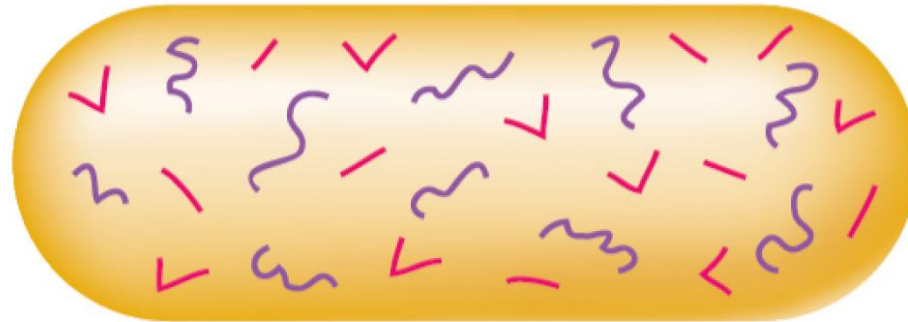


## Lytic Infection

In a lytic infection, a virus enters a cell, makes copies of itself, and causes the cell to burst.



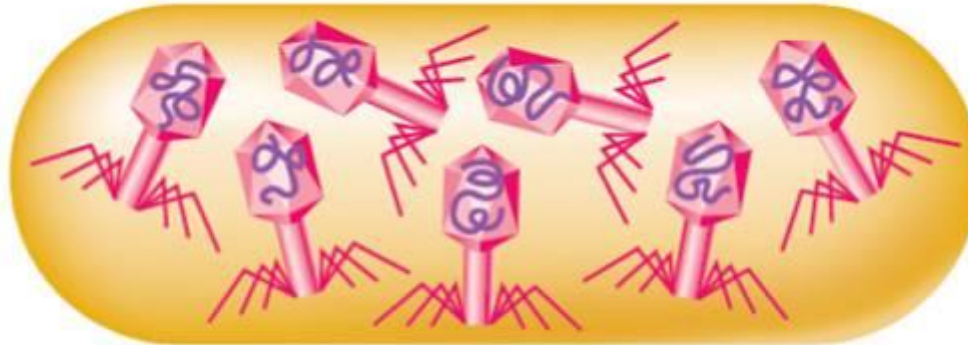
## Lytic Infection



Bacteriophage takes over bacterium's metabolism, causing synthesis of new bacteriophage proteins and nucleic acids.

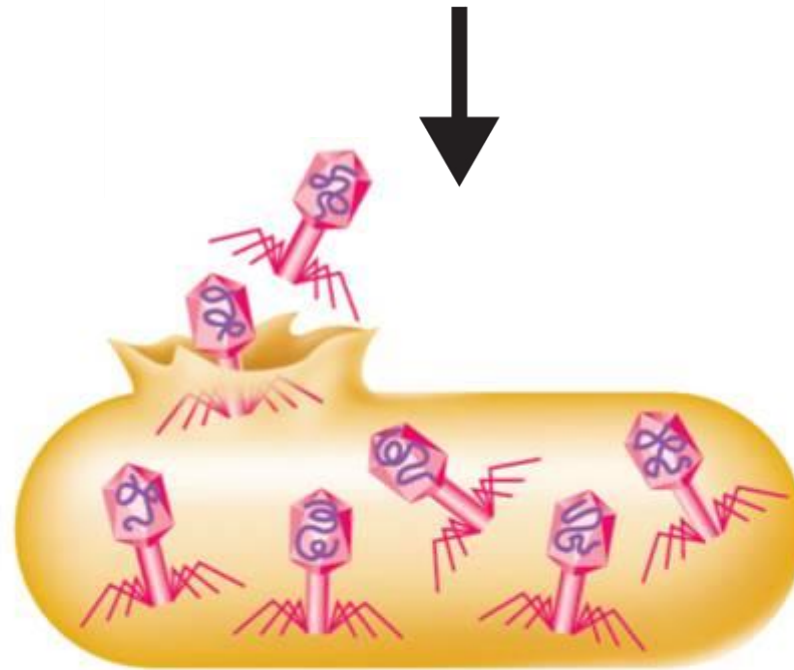


# Lytic Infection



Bacteriophage proteins and nucleic acids assemble into complete bacteriophage particles.

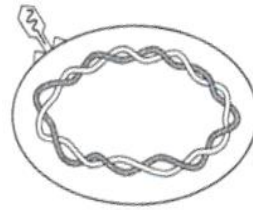
## Lytic Infection



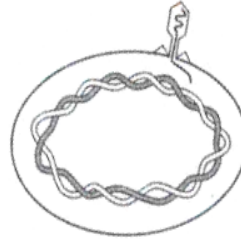
Bacteriophage enzyme lyses the bacterium's cell wall, releasing new bacteriophage particles that can attack other cells.

# Lytic Cycle

*The virus enters a cell, makes copies of itself and causes the cell to burst releasing more viruses.*



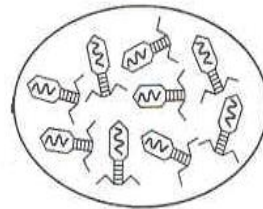
Virus attaches to cell.



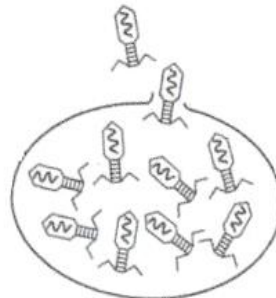
Viral DNA/RNA injected into cell.



Viral and Cell DNA/RNA is copied.



Virus copies itself.



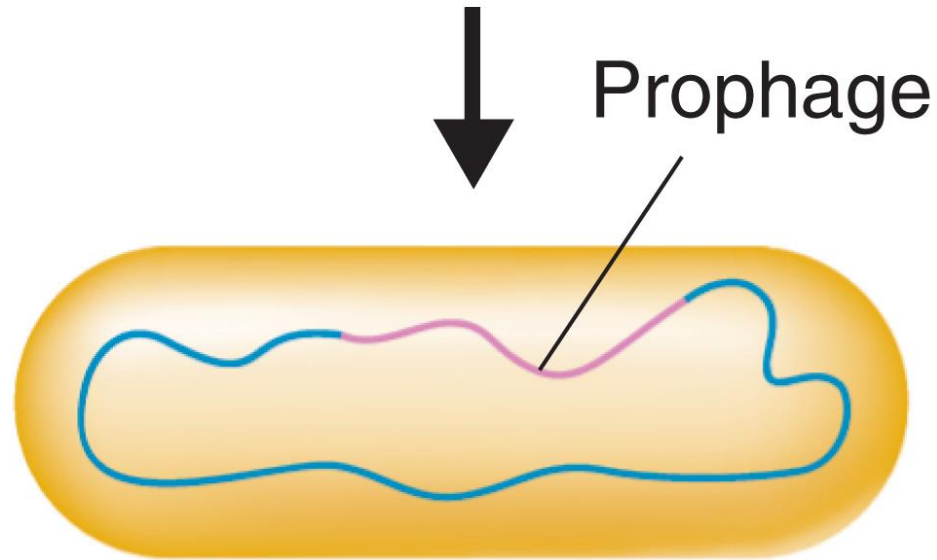
Cell bursts (lyses/dies) and releases new viruses.

## Lysogenic Infection

Other viruses cause **lysogenic infections** in which a host cell makes copies of the virus indefinitely.

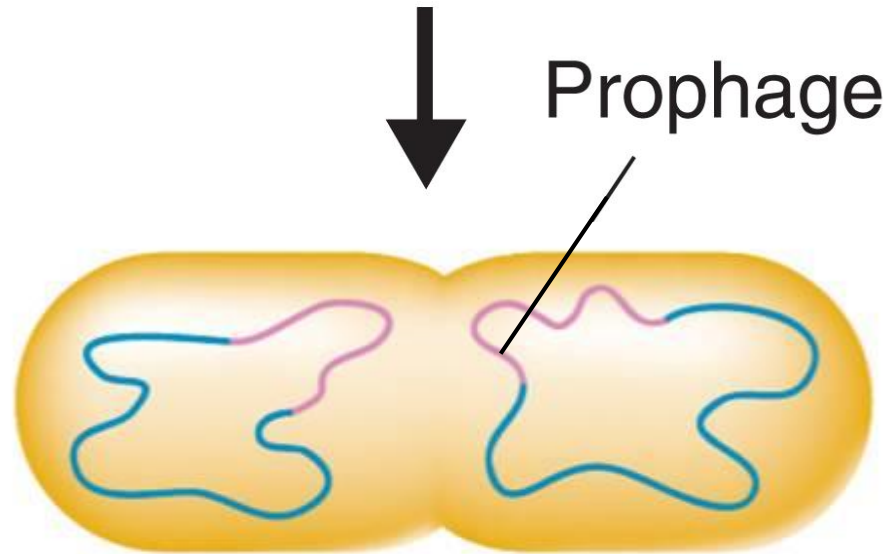
- **Virus merges its DNA into the DNA of the host cell**
- **Viral DNA replicates**
- **Can remain dormant for many generations**

# Lysogenic Infection



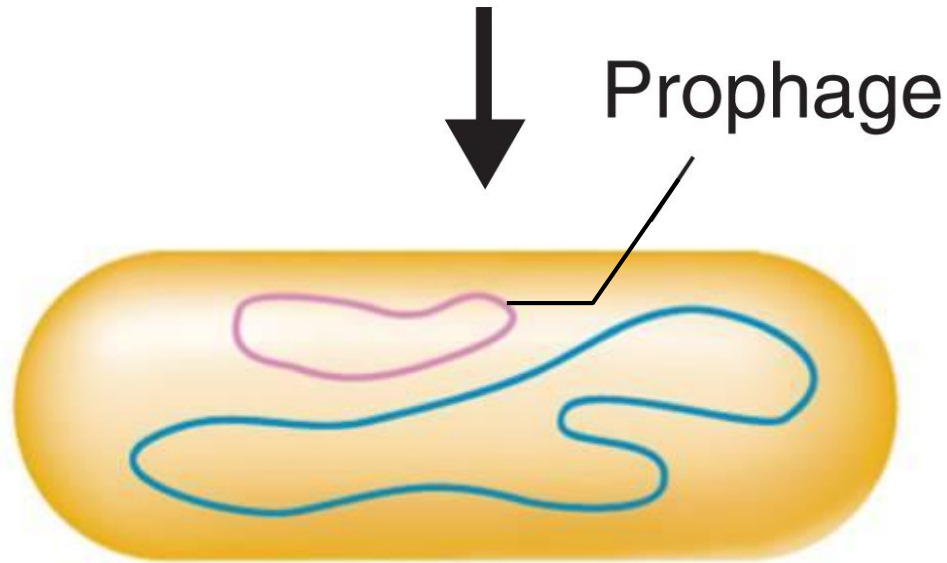
Bacteriophage DNA  
inserts itself into bacterial  
chromosome.

# Lysogenic Infection



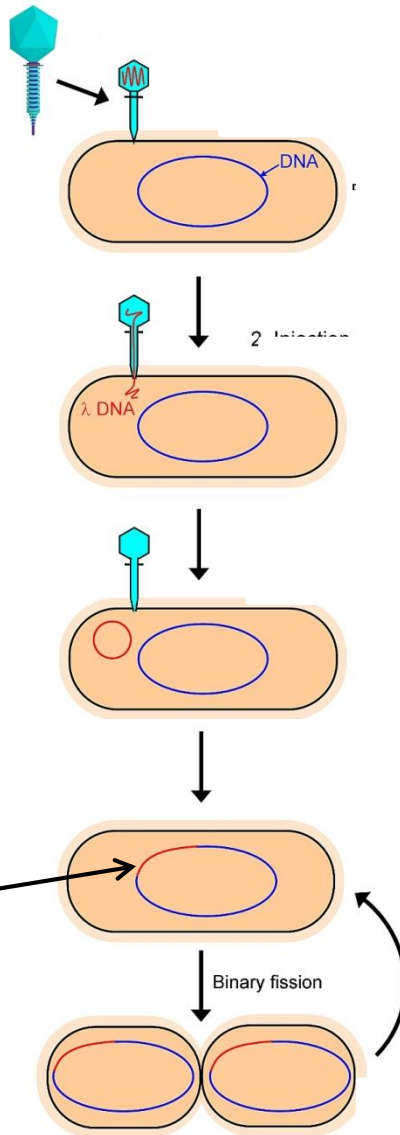
Bacteriophage DNA  
(prophage) may replicate  
with bacterium for many  
generations.

# Lysogenic Infection



Bacteriophage DNA (prophage)  
can exit the bacterial chromosome.  
Bacteriophage enters lytic cycle.

# Lysogenic Cycle



*The virus binds to bacteria (host)*

*Inserts its DNA into the bacteria*

*The viral DNA gets incorporated into the cell's chromosome*

*Viral DNA is replicated along with the host's cell's DNA*

*Stays dormant or can enter the lytic cycle*

*Prophage – when the viral DNA is embedded in the host DNA*



# Do Now:

- A vaccine would be useful if it is given to
  - A. Preschool teacher who works with children prone to viral infections
  - B. A student that is currently sick with the flu.
  - C. A cow infected with mad cow disease
  - D. Cat that has been bitten by a rabid raccoon.



# The Good, the Bad, and the Useful

# The Bad: Pathogens

- **Pathogens**: disease causing agents; include viruses & bacteria that cause disease by disrupting bodies normal activities
- Breaking down body's cells for food
- Release toxins that interfere with normal function



# Prevention

- **Sanitation**
  - **Hand washing**
  - **Covering nose/mouth when coughing or sneezing**
  - **Frequently cleaning surfaces**

# Treatment for Bacterial Infections

- **Antibiotics**

- **Are only effective against bacterial pathogens**
- **Block growth and reproduction of bacteria**
- **Significantly contributed to human life span**



# Controlling Bacteria

## – Disinfectants

- Disinfectants are chemical solutions that kill pathogenic bacteria.
- They are used to clean rooms where bacteria may flourish.

# Controlling Bacteria

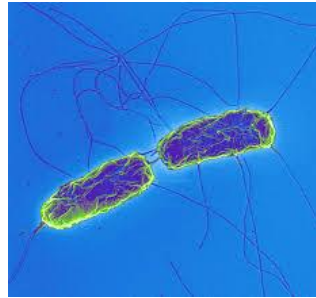
## – Food Storage and Processing

- Bacteria can cause food to spoil.
- Refrigerated food stays fresh longer because the bacteria will take longer to multiply.
- Boiling, frying, or steaming can sterilize certain foods.

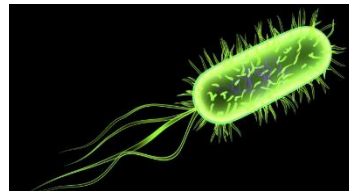
# Examples of Pathogenic Bacteria

## Food Borne Pathogens

– Typhoid



– E coli



Prevention	Treatment
<ul style="list-style-type: none"><li>• Sanitation (Wash hands, food)</li><li>• Cold temperature (refrigeration) will slow down growth of bacteria</li><li>• Hot temperatures (cooking) will kill bacteria</li></ul>	Hydration Antibiotics



# Pathogenic Viruses

- Viruses that disrupt body's normal condition
  - Kill cells
  - Change pattern or growth of cells



# Prevention

## Sanitation

## Vaccines

- A vaccine is a made of weakened or killed pathogens.
- Weakened virus may prompt the body to prepare to fight disease.
- Immunity is the body's ability to destroy new pathogens.

# Viral Disease in Humans

- **Vaccines are often the best protection against most diseases.**
- **Most vaccines work only if used before an infection begins.**



# Treatment

- Viral diseases cannot be treated with antibiotics.
- Overuse of antibiotics contributes to antibiotic resistance
- Symptoms may be treated with over-the-counter medicines.



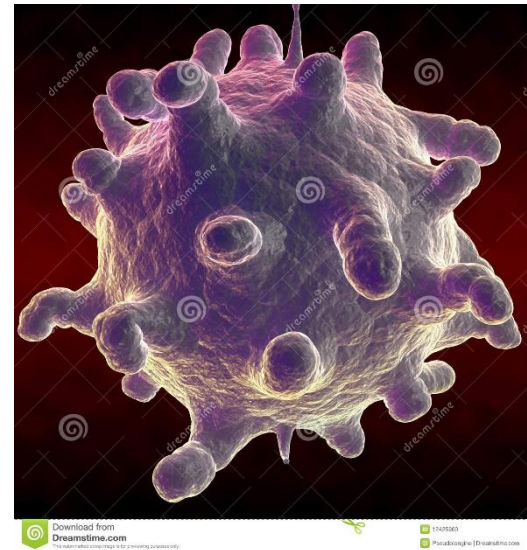
# Examples of Pathogenic Viruses

- Poliovirus

- Kills cells of the nervous system causing paralysis

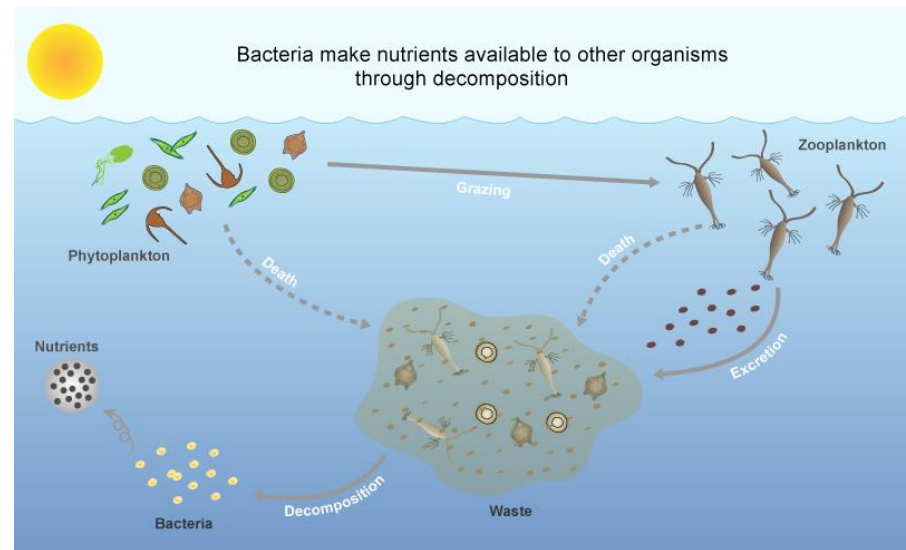
- Common Cold

Prevention	Treatment
<ul style="list-style-type: none"><li>• Sanitation (Wash hands)</li><li>• Vaccines (Polio)</li></ul>	Hydration, rest



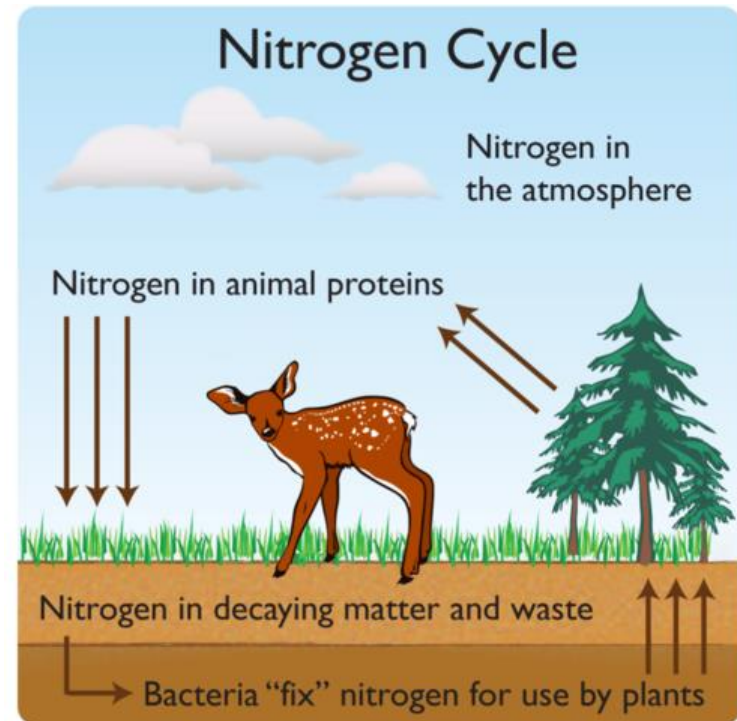
# The Good!

- Bacteria are also beneficial to us
  - Decomposers
    - Recycle nutrients from waste
  - E. coli present in digestive system
    - Digest large molecules providing nutrients to the body



# The Good!

- More good bacteria
  - Nitrogen fixers
    - Fix nitrogen – allowing nitrogen to continuously cycle through the environment



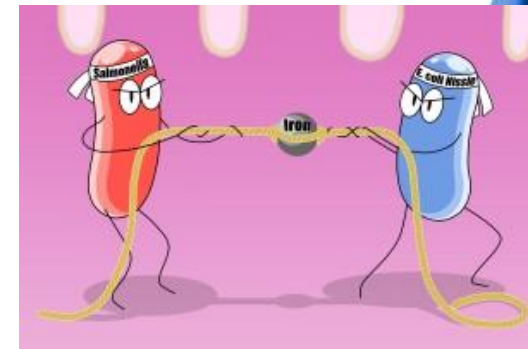
# The Useful

- **Humans use bacteria for a variety of reasons**
  - **Clean up oil leaks by digesting oil**
  - **Bacteria break down oil using enzymes**
  - **Sewage treatment – break down larger waste products**
  - **Used for developing drugs**
  - **Bio-mining**



# Probiotics

- Bacteria that have beneficial effects for the digestive system
  - Replace bacteria killed from antibiotics
  - Balance “bad” bacteria with “good” bacteria
  - Good bacteria may compete with bad bacteria for limited resources
- Examples
  - Lactobacillus – found in yogurt



# Exit Slip



- Large animal farm operations (pig, cow, chicken) often pretreat their livestock with antibiotics, even if the animals are not showing signs of infection.
- How might this practice affect the success of antibiotics in treating bacterial infection?

# 19-1 Section QUIZ

Continue to:

**Section QUIZ**

- or -

Click to Launch:



**2** Rod-shaped prokaryotes are called

- a. bacilli.
- b. cocci.
- c. spirilla.
- d. streptococci.