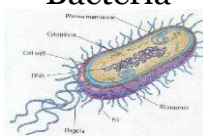


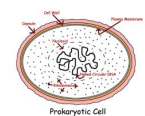
# BACTERIA

## Bacteria



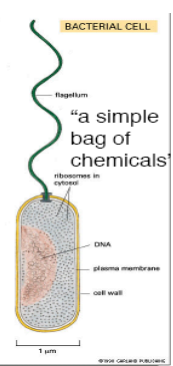
- **Most numerous** organisms on earth
- **Earliest life** forms (fossils: 2.5 billion years old)
- Contain **ribosomes**
- Surrounded by **protective cell wall** containing **peptidoglycan** (protein-carbohydrate)

## Bacteria

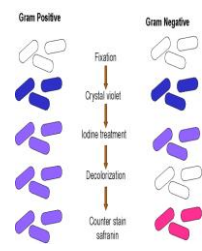
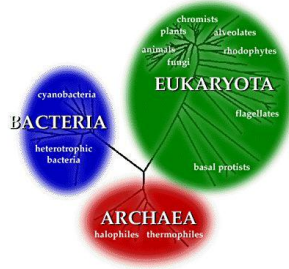


- **one circular chromosome**
- small rings of DNA called **plasmids**
- May have short, hairlike projections called **pili** on cell wall to attach to host or another bacteria when transferring genetic material
- Most are **unicellular**

- Found in **most habitats**
- Most bacteria grow best at a **pH of 6.5 to 7.0**
- Main **decomposers** of dead organisms
- Some beneficial, most harmful
- Move by **flagella, gliding over slime** they secrete



- Classified by:
  - structure
  - motility
  - molecular composition
  - reaction to **Gram stain**
- Once grouped together in the kingdom **Monera**

- Grouped into 2 kingdoms
  - **Eubacteria** (true bacteria)
  - **Archaeobacteria** (ancient bacteria)

## Classification- two main groups

### 1. Archaeobacteria

- "ancient bacteria"
- live in very extreme environments (undersea volcanic vents, acidic hot springs, salty water)
- no peptidoglycan in cell walls
- Subdivided into 3 groups based on their
  1. **methanogens**
  2. **thermophiles**
  3. **extreme halophiles**



## Methanogens

- Live in **anaerobic** environments (no oxygen)
- Obtain energy by changing H<sub>2</sub> and CO<sub>2</sub> gas into methane gas (CH<sub>4</sub>)
- Found in swamps, marshes, sewage, treatment plants, digestive tracts of animals
- Break down cellulose for herbivores (cows)
- Produce marsh gas or intestinal gas (methane)



## Extreme Halophiles

- Live in very salty water
- Found in the Dead Sea, Great Salt Lake, etc.
- Use salt to help generate ATP (energy)



## Thermophiles

- Live in **extremely hot** (1100C) and **acidic** (pH 2) water
- Found in
  - **hot springs** in Yellowstone Park
  - **volcanic vents** on land
  - **cracks on the ocean floor** that leak scalding acidic water

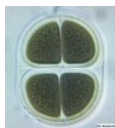


## Classification- two main groups

### 2. Eubacteria

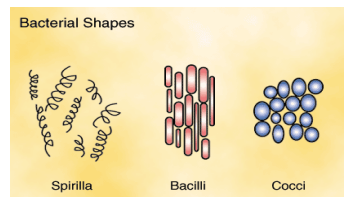
- most bacteria
- some undergo photosynthesis
- most heterotrophs
- larger ribosomes, larger numbers of rRNA nucleotides

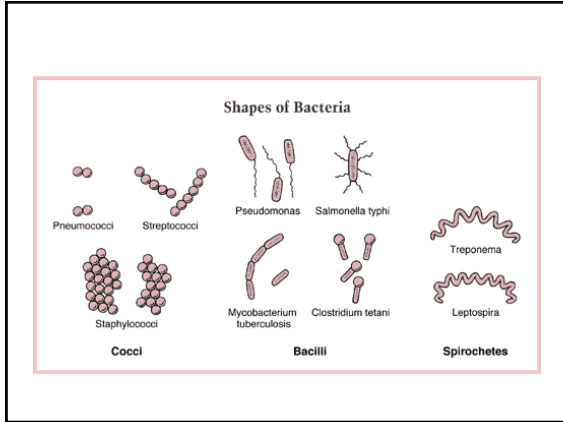
ex: cyanobacteria  
(blue green algae)



## Bacterial Identification

1. Shape (morphology)
  - cocci (spheres)
  - bacilli (rods)
  - spirilla/spirochetes (spirals)





### Bacterial Identification

2. Cell wall

- made of **peptidoglycans** and lipids
- many surrounded by a sticky, protective coating of sugars called the **capsule or glycocalyx**
- **pili**  
short hairlike projections that allow bacteria to attach to host or connect to each other or allow passage of genetic material between cells

### Bacterial Identification

3. Motility (movement)

- **flagella, cilia**

| Structure | Flagella Type | Example                  |
|-----------|---------------|--------------------------|
|           | Monotrichous  | Vibrio cholerae          |
|           | Lophotrichous | Bartonella bacilliformis |
|           | Amphitrichous | Spirillum serpens        |
|           | Peritrichous  | Escherichia coli         |

### Bacterial Identification

4. DNA

- **Plasmid**: single circular strand of DNA

### Bacterial Identification

5. Endospores

- thick coated internal resistant structure
- reproductive structure, contains DNA
- allows DNA to survive after bacteria dies
- resistant to environmental conditions
- gives rise to normal bacterial cell

### Bacterial Identification

6. Reaction to Gram stain

- diagnostic identification techniques
- **gram positive**: purple color
  - high peptidoglycan in cell wall
- **gram negative**: pink/red color
  - high fat content in cell wall

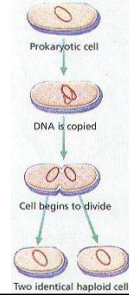
## Bacterial Identification

7. Method of energy acquisition
- **Aerobes:**  
undergo cellular respiration  
must live in an environment with oxygen
  - **Anaerobes:**  
undergo glycolysis  
must live in an environment without O<sub>2</sub>

## Reproduction

### •Asexual:

#### - binary fission



### •Sexual:

#### - conjugation

