

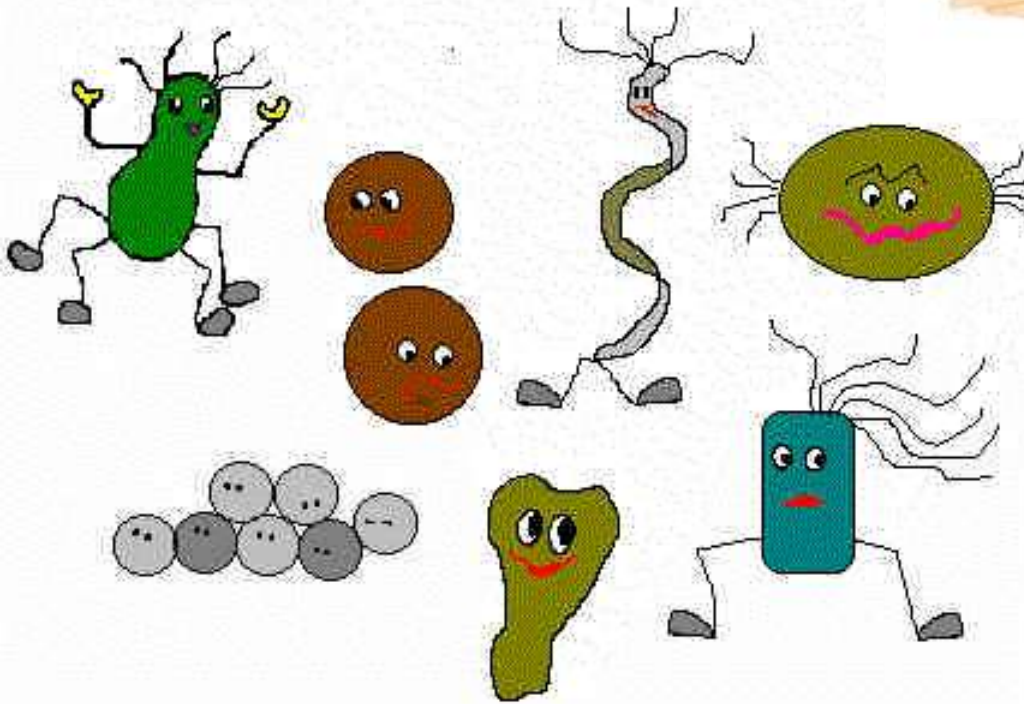
Structure of Bacteria

Botany Department
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Bacteria



Illustration: Don Smith



Two kingdoms of bacteria:

- **Eubacteria** – “true” bacteria
- **Archaeobacteria** – oldest organisms on earth, live in extreme conditions

Bacteria are:

- Unicellular
- Prokaryotic...which means?

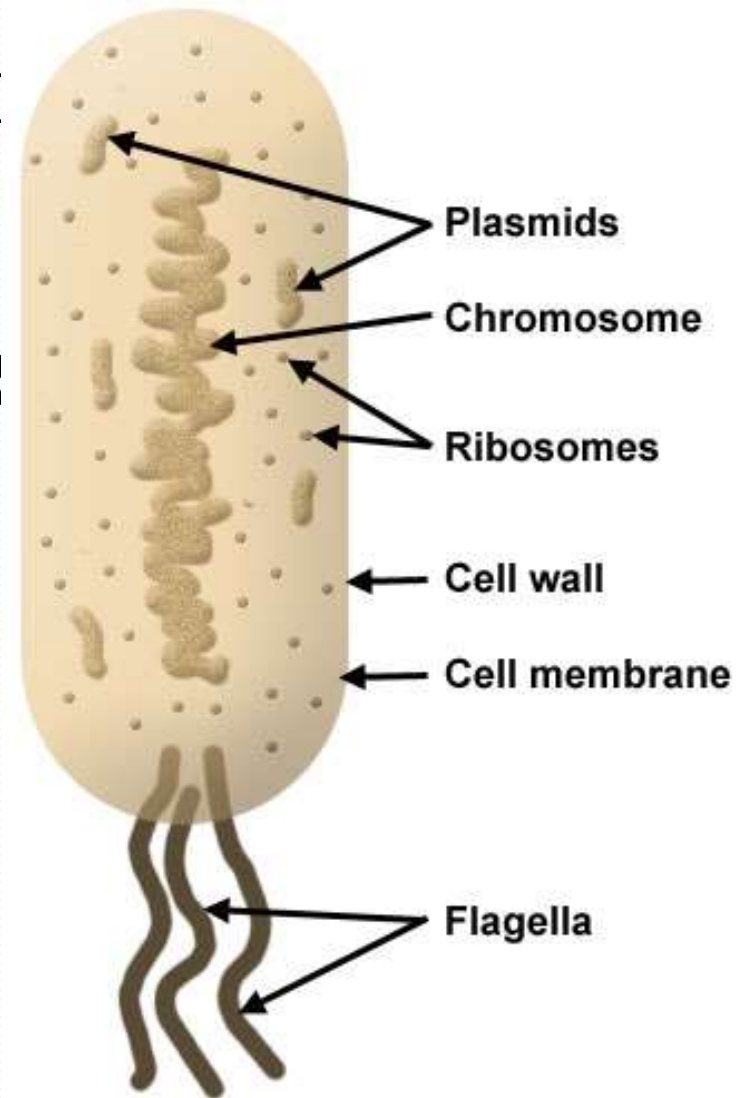
Each square centimeter of your skin averages about 100,000 bacteria. A single teaspoon of topsoil contains more than a billion (1,000,000,000) bacteria.

Bacteria Characteristics

- Some bacteria are aerobic, meaning that they require oxygen in order to survive. Other bacteria are anaerobes, meaning that they do not require oxygen to survive.
- Most bacteria are harmless and offer beneficial functions to living things and humanity.

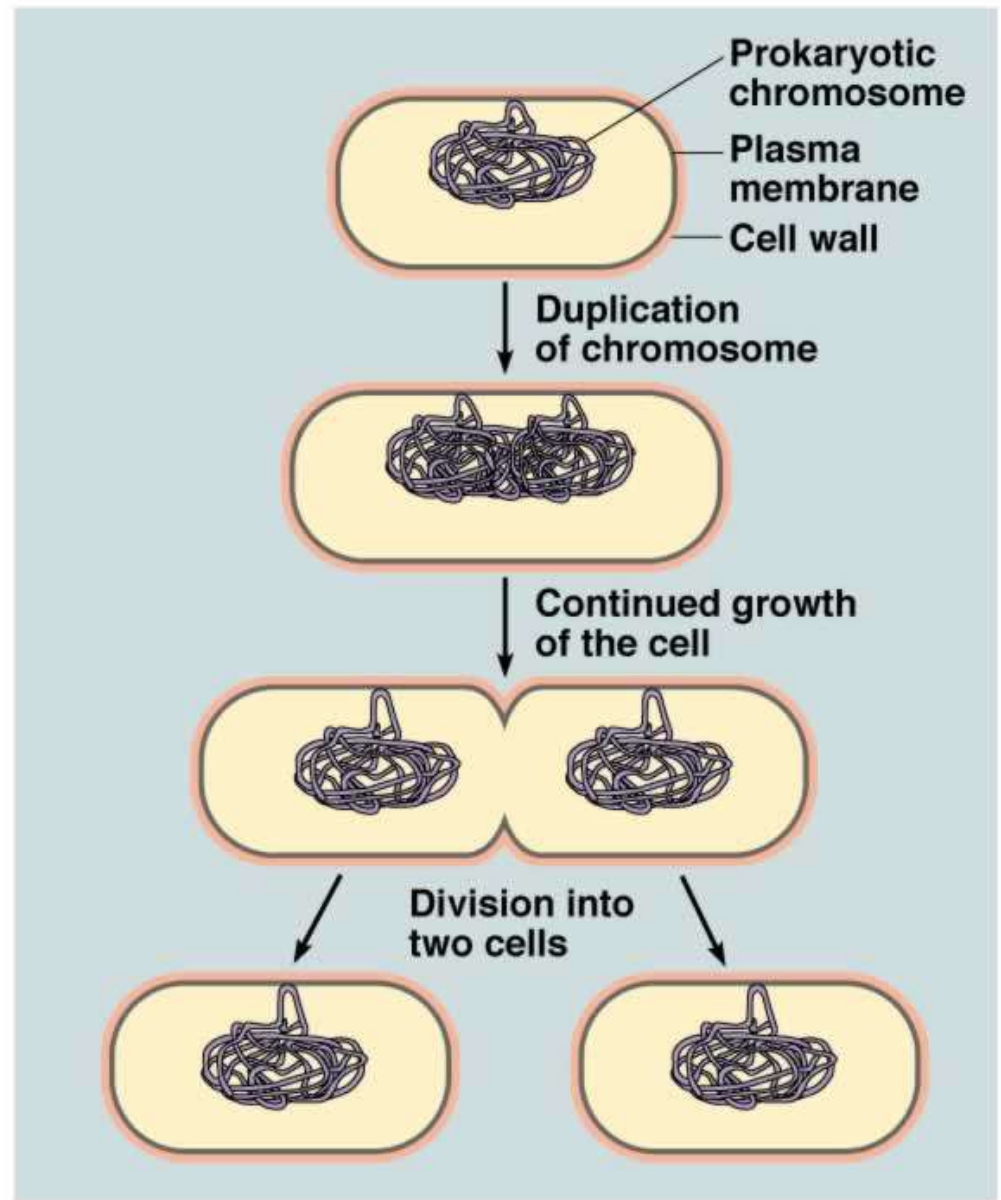
Bacteria contain:

- a singular, circular piece of DNA
- tiny circular pieces of DNA called **plasmids**
- **ribosomes**



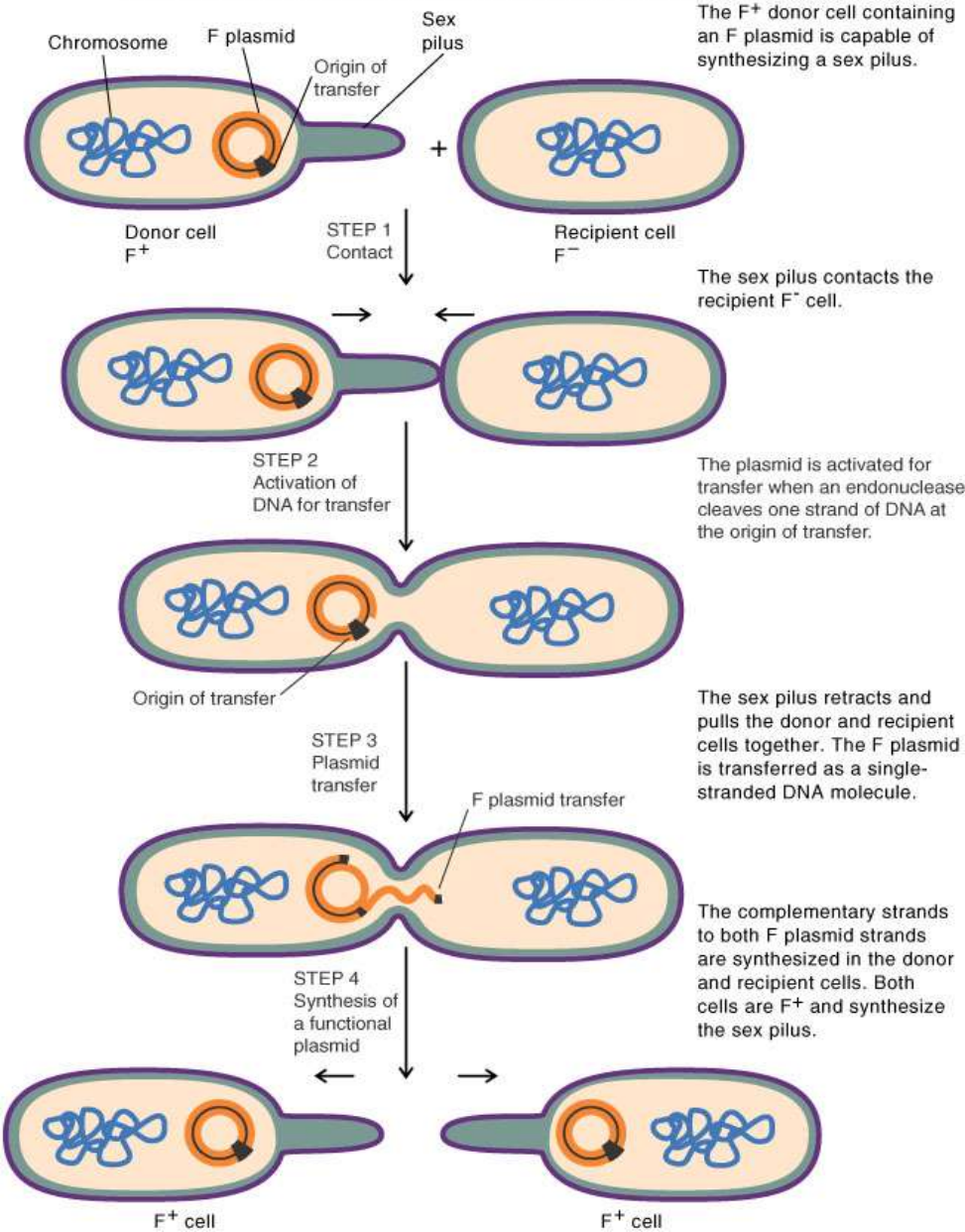
Bacteria reproduce:

Asexually
(mitosis) using **binary fission**.



Bacteria reproduce:

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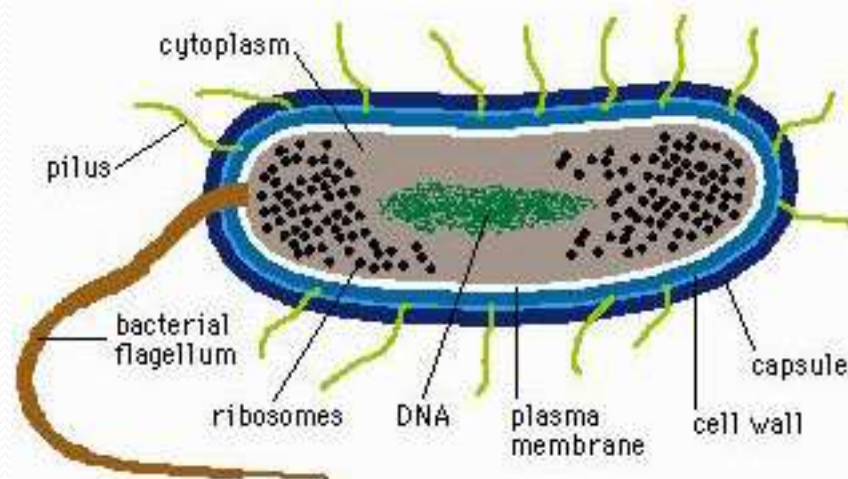
sexually using
conjugation.

Bacteria exchange
plasmid DNA.

This is how bacteria
become antibiotic
resistant.

Bacteria have cell walls made of:

- **peptidoglycan** (polysaccharide linked with chains of amino acids).
- this may be covered with an outer membrane of **lipopolysaccharide** (chain of sugar with a lipid attached).

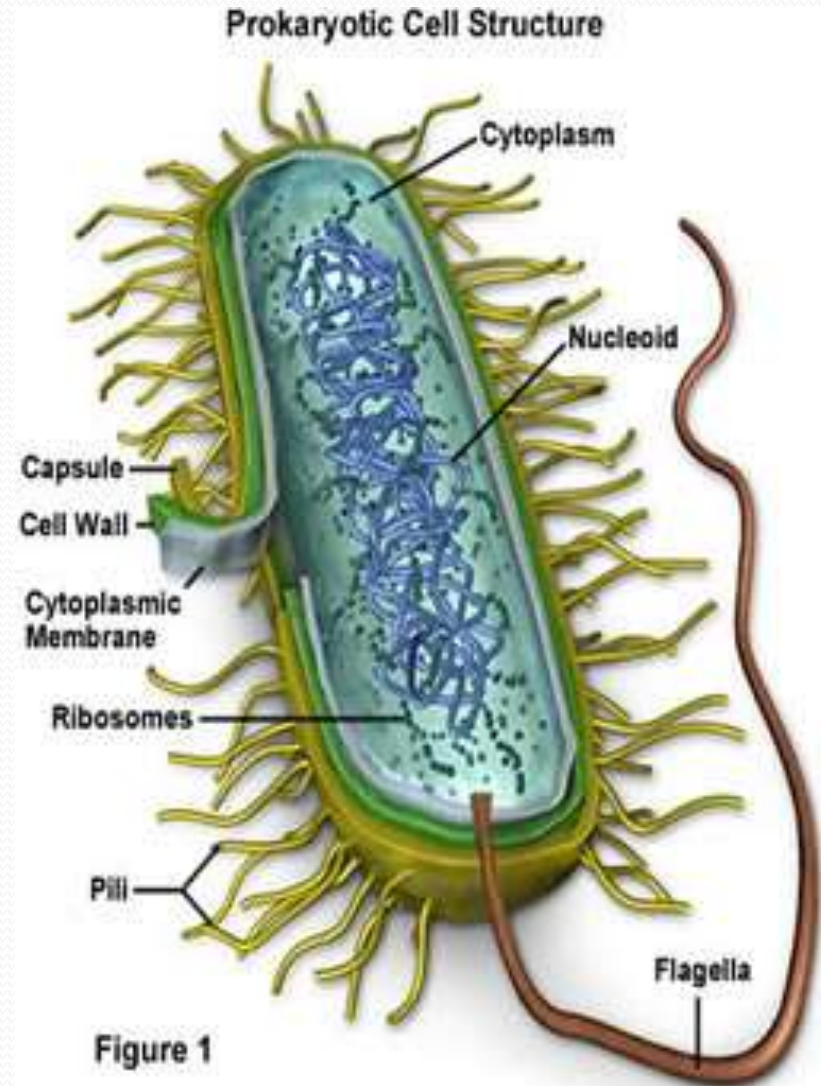



Some bacteria:

- have a gelatinous layer called a **capsule** surrounding the cell wall.
- form thick-walled **endospores** around chromosomes when they are exposed to harsh conditions (drought, high temperatures) - these types cause botulism

Some bacteria have:

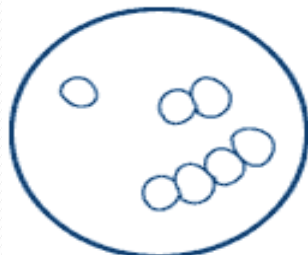
- **flagella** for locomotion.
- **pili** (short, thicker outgrowths that help cell to attach to surfaces)



- 
- Bacteria can be moved by air and water currents, and on any surface such as clothing, hands, or any object.

Three bacterial shapes:

1. Rod shaped are called bacillus(i)
2. Sphere shaped are called coccus(i)



Cocci

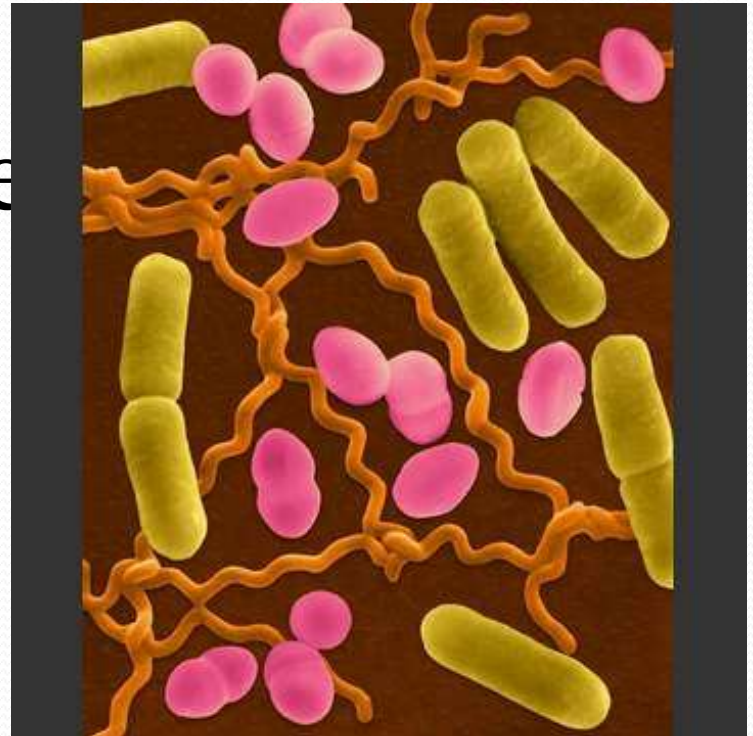


Spirilla



Bacilli

are



Gram stains:

- Important in medicine because provides information for treatment of bacterial disease.
- Bacteria stain either gram positive (purple) or gram negative (pink).
- Gram positive tend to respond to penicillin and like antibiotics.
- Gram negative respond to types of antibiotics unrelated to penicillin.

Gram Stain

Process:

Crystal violet dye → **Iodine** →

Purple

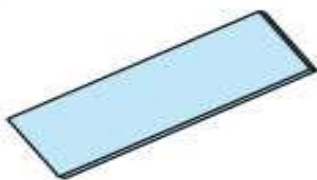
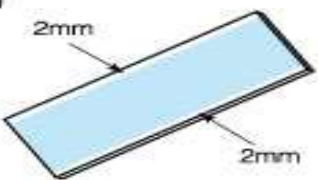

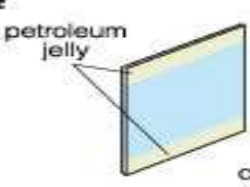
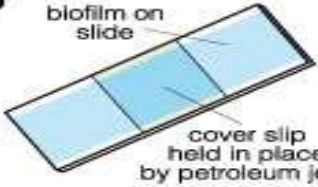
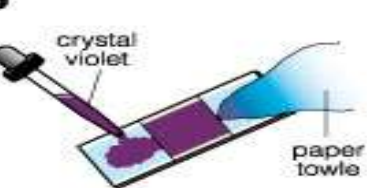
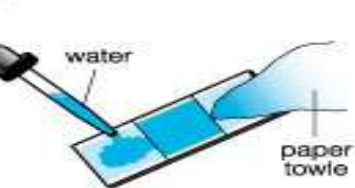
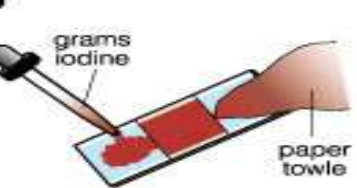
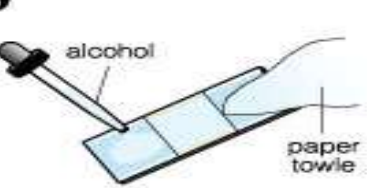
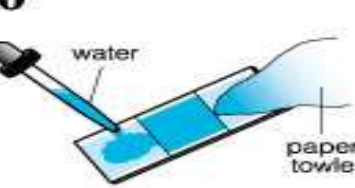
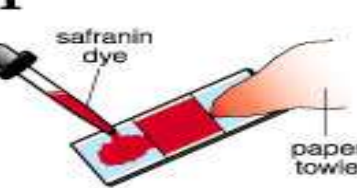
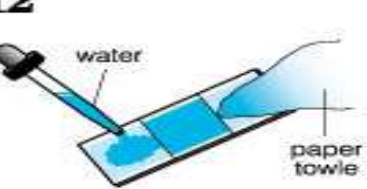
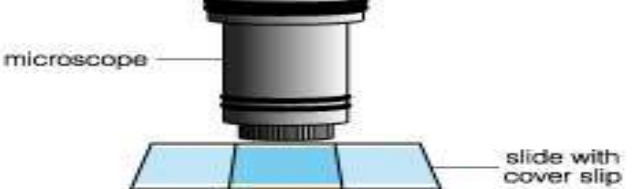
Decolorizes

Alcohol → **Safranin**

Pink

Counterstain

GRAM STAINING

	<p>1</p> 	<p>2</p> 
<p>Flow Through Procedure</p>	<p>Wipe bottom of biofilm slide clean</p>	<p>Clean top edges of slide about 2mm</p>
<p>3</p> 	<p>4</p> 	<p>5</p> 
<p>Build up a ridge of petroleum jelly on the top and bottom of a cover slip</p>	<p>Cover slip with petroleum jelly</p>	<p>Biofilm on slide with cover slip</p>
<p>6</p> 	<p>7</p> 	<p>8</p> 
<p>Add crystal violet-wait 30 sec.</p>	<p>Wash with water</p>	<p>Add Grams Iodine-wait 1.5 min.</p>
<p>9</p> 	<p>10</p> 	<p>11</p> 
<p>Decolorize with alcohol</p>	<p>Wash with water</p>	<p>Stain with Safranin dye-wait 30 sec.</p>
<p>12</p> 	<p>13</p> 	
<p>Wash with water</p>	<p>Examine under oil immersion through the cover slip</p>	

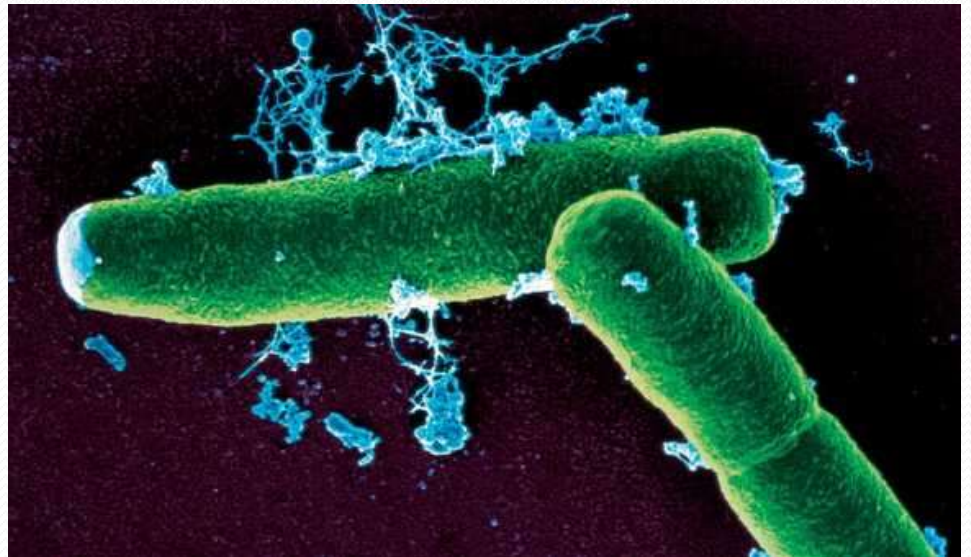
A Gram Stain is usually performed on a smear preparation that has been heat fixed. One function of fixation is to secure (fix) the cells to the slide.

Antibiotics:

- work by preventing cell wall formation, breaking up cell membranes, or disrupting chemical processes.
- Antibiotics cannot treat viral infections.

There are three types of bacteria based on how they obtain energy: heterotrophs, photosynthetic, and chemoautotrophs.

This is the anthrax bacterium.



1. Most are heterotrophs:

a. **Decomposers** – feed on and recycle organic material

b. **Pathogens** – parasitic, disease-causing bacteria

- Either attack cells or secrete toxins

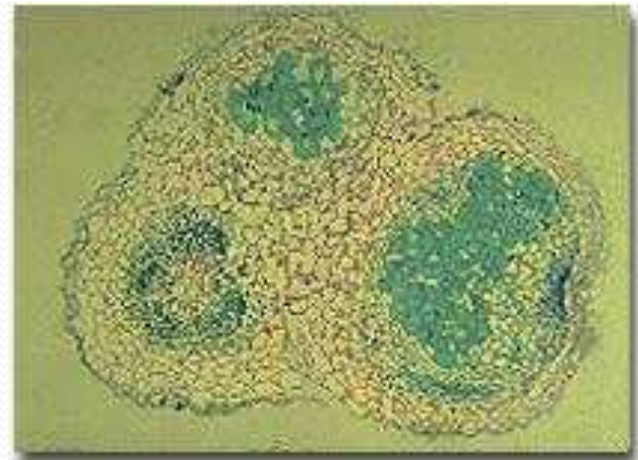
c. **Nitrogen-fixing bacteria** (*Rhizobium*)

- Found in nodules of soybeans, peanuts, alfalfa, and clover
- Convert atmospheric nitrogen (N_2) into ammonia, called nitrogen fixation.
- Used in crop rotation

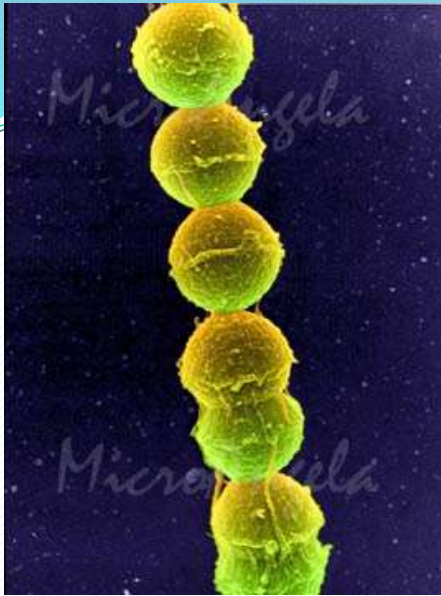
Decomposers

- Bacteria are decomposers, they break down the chemical elements inside other living or dead organisms. Some bacteria live in the intestines of humans and animals

Rhizobia bacteria convert nitrogen gas into other substances that help plants grow.



Pathogens



Streptococcus



Staphylococcus



Strep throat

Staph AND Streptococcus species



Impetigo: face, light skin



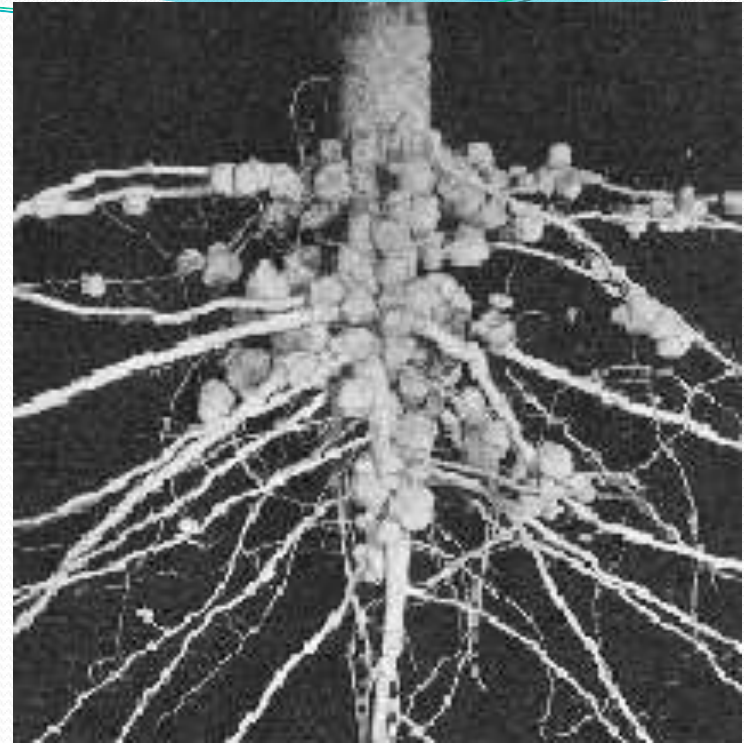
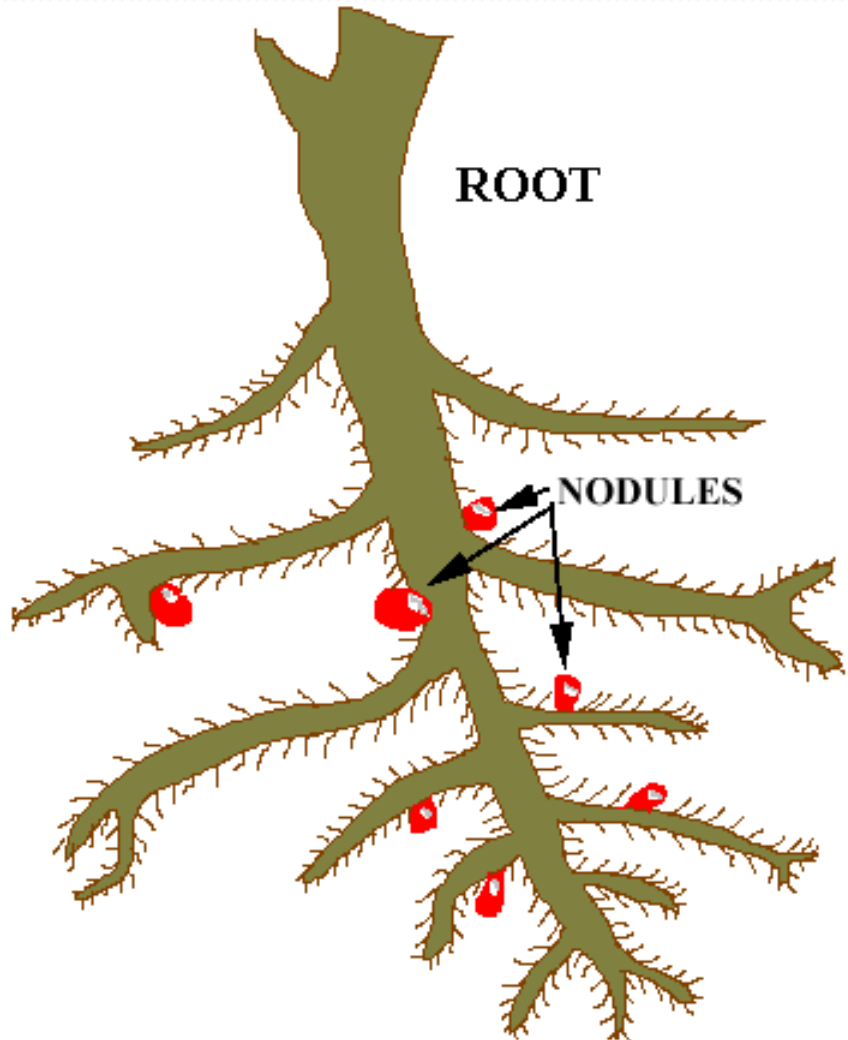
Fasciitis:
face, light skin



Necrotizing Fasciitis: light skin, left;
(especially important *Strep.* problem)

Cellulitis: lower legs, dark skin, right

Nitrogen-fixing bacteria (*Rhizobium*)



Nitrogen fixing bacteria
in the nodules of roots

2. Some, like *Cyanobacteria*, are **photosynthetic**.

- These are autotrophs that use the sun's energy to make food.

This bacteria has chlorophyll and uses the process of photosynthesis to produce food very much like a plant.

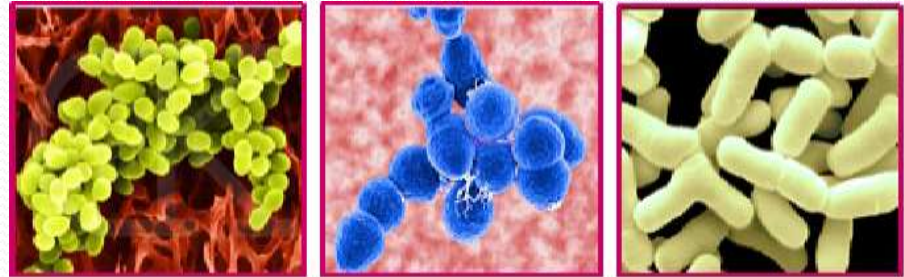


3. Chemoautotrophs

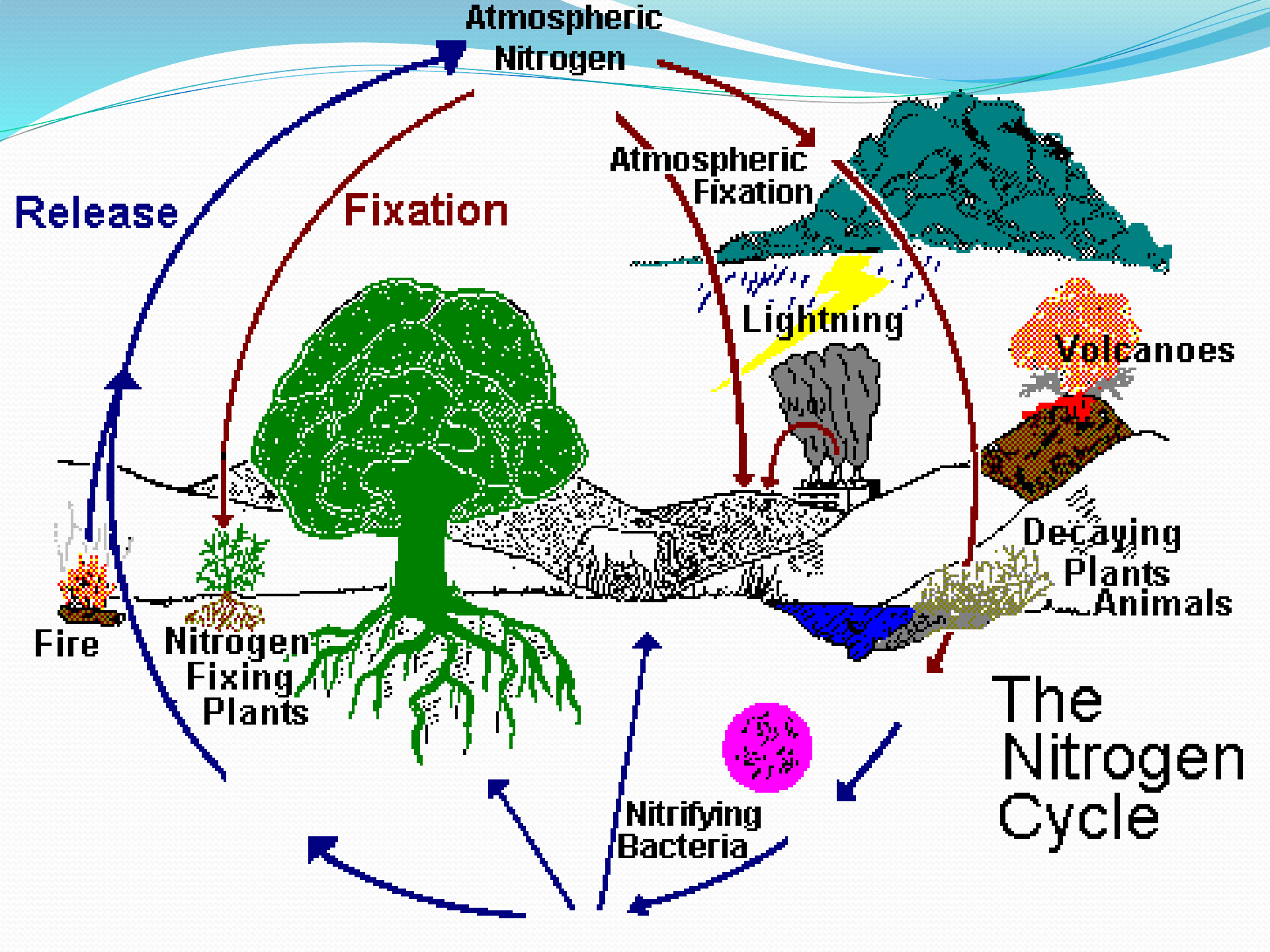
- Obtain energy by removing electrons from inorganic molecules such as ammonia and methane to make food.
- Examples: *Nitrobacter* and *Nitrosomonas*
 - live in soil
 - have a crucial role in nitrification (turn ammonia into nitrates, the form of nitrogen commonly used by plants).

Some Good Bacteria

- **Lactic acid bacteria** have been used to ferment or culture foods for at least 4000 years.
- Examples: products like **yogurt and cheese**



- **Wastewater bacteria** feed on everything from solid human waste matter to last night's leftovers. As the bacteria eat, they convert organic matter to carbon dioxide, releasing electrons, the basic element of electrical current.





Thank you