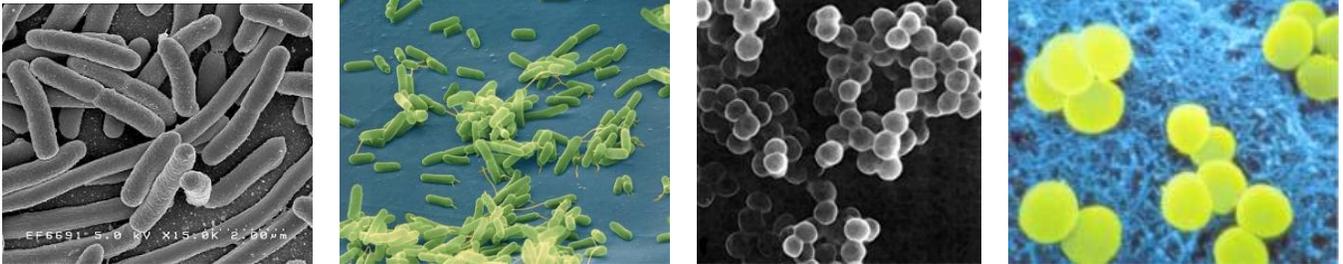
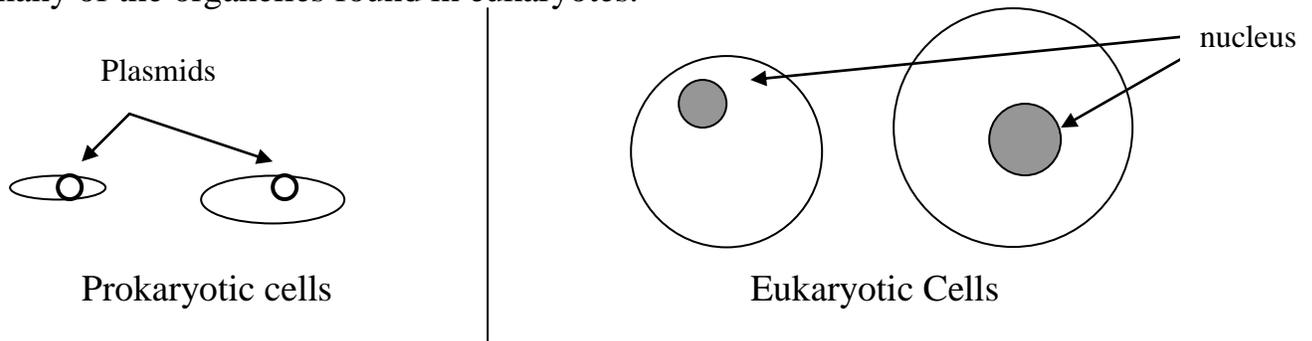


19-1 Notes “Bacteria”

- Bacteria are found virtually everywhere!
- Named after the Greek word “Little stick” because many bacteria have a stick-like shape when viewed under a microscope



- We know that bacteria are classified as prokaryotes, due to lack of a nucleus. All bacteria also have cell walls, unlike animal cells.
- Length of bacteria are usually from 1 to 10 micrometers (about .01 to .001 mm...very small) this is about 1/10 to 1/100 the size of Eukaryotic cells. This is due to the lack of many of the organelles found in eukaryotes.



- Most of the bacterial DNA is found in 1 or more circular chromosome(s), called a plasmid, found in the cytoplasm of the bacteria.

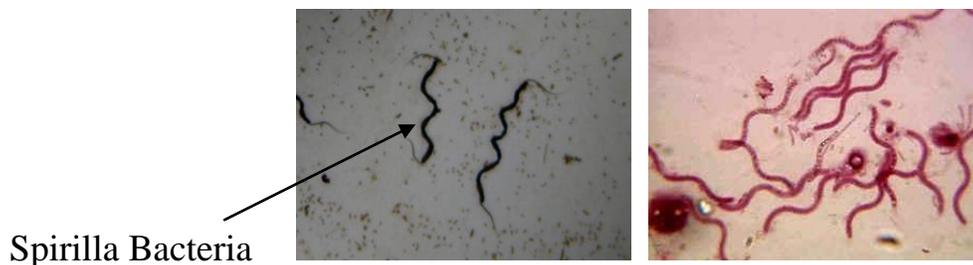
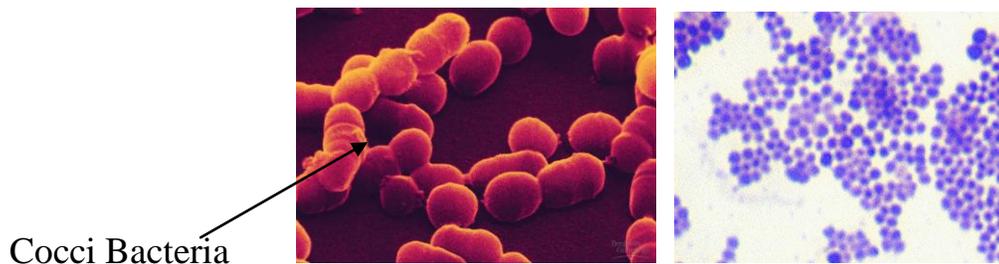
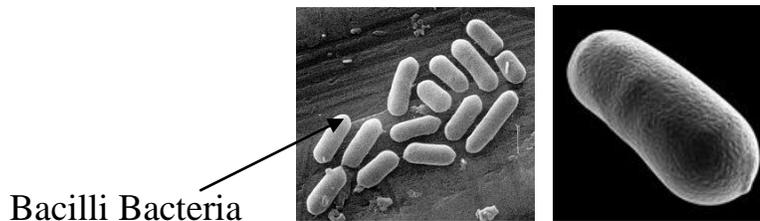


- The cell wall located on the outside of bacteria varies in composition. Some bacteria have a carbohydrate compound called peptidoglycan in their cell walls, some do not.
- Those that have high amounts of peptidoglycan are called gram-positive, because they absorb a stain called crystal violet stain.

- Those that are **gram-negative** do not absorb the crystal violet stain, and can be “bleached” with ethanol in the gram staining technique. Lacking peptidoglycan causes this. These bacteria are usually much more dangerous and linked to infections.

Bacterial Shape:

- Bacteria cells come in 3 forms: Bacilli (Rod like), Cocci (spherical), or spirilla (spirals).



- Some bacteria have flagella, or whip-like extensions for movement.
- Large amounts of bacteria tend to accumulate onto nutritious surfaces in **colonies**.

2 Kingdoms:

- As we discuss, bacteria are divided into 2 kingdoms based on similarities/differences (was previously known as 1 kingdom called monera).
 - **Kingdom Archaeobacteria** – “ancient bacteria” can live in extreme environments due to differences in cell membrane construction. Believed to be the original types of life forms on Earth.
- Contains the following 4 phyla: **Crenarchaeota, Euryarchaeota, Korarchaeota, and Nanoarchaeota**

- **Kingdom Eubacteria** – “true bacteria” largest group of bacteria, found everywhere. Some are photosynthetic, and some are chemosynthetic (energy from chemicals).
- Contains the following 23 phyla: **Aquificae** (5 genera) **Thermotogae** (5 genera) **Thermodesulfobacteria** (1 genus) **Deinococcus-Thermus** (3 genera). **Chrysiogenetes** (1 genus) **Chloroflexi** (5 genera) **Thermomicrobia** (1 genus) **Nitrospira** (4 genera) **Deferribacteres** (5 genera) **Cyanobacteria** (57 genera) **Chlorobi** (5 genera) **Proteobacteria** (441 genera) **Firmicutes** (184 genera) **Actinobacteria** (139 genera) **Planctomycetes** (4 genera). **Chlamydiae** (5 genera). **Spirochaetes** (13 genera) **Fibrobacteres** (1 genus) **Acidobacteria** (3 genera) **Bacteroidetes** (53 genera) **Fusobacteria** (7 genera) **Verrucomicrobia** (3 genera) **Dictyoglomus** (only 1 genus)

Bacterial Energy Acquisition

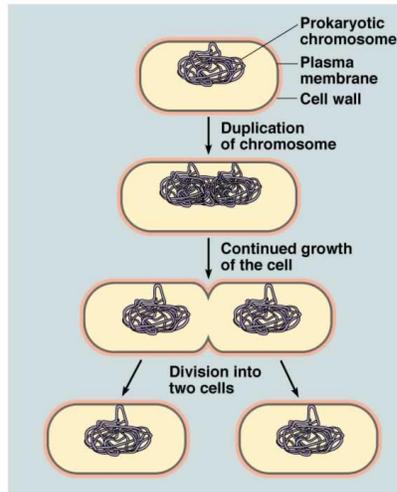
- Just like organisms in other kingdoms, bacteria can be either autotrophic (phototrophic Autotrophs or chemotrophic autotrophs), or heterotrophic (autotrophic heterotrophs or chemotrophic heterotrophs).
 - Autotrophic = makes their own food
 - Heterotrophic = obtains food from surroundings
 - Phototrophic = uses sunlight for energy
 - Chemotrophic = uses inorganic molecules for energy

Bacterial Respiration

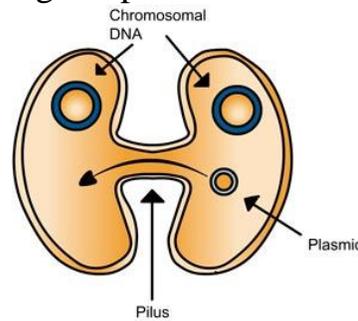
- Just like all organisms, bacteria must maintain a constant supply of energy for cellular functions. This is done by the process of respiration – breaking down food to release energy.
 - Bacteria that require a constant supply of O₂ to respire = **obligate aerobes**.
 - Bacteria that do NOT need O₂ to respire = **obligate anaerobes** (live w/o O₂)
 - Bacteria that do NOT need O₂, but can respire in its presence = **facultative anaerobes**.

Growth/Reproduction in Bacteria:

- Bacteria grow very fast. Some can reproduce in 20 minutes!
 - Everyday a bacteria could divide 72 times...which = 4 billion cells!
- Most reproduce by binary fission (mitosis – splitting in half) a type of asexual reproduction.



- Some use conjugation = exchange of plasmid DNA into other cells via “pilus”



- Some use spore formation to help them survive. They form a capsule inside their cytoplasm that protects some cytoplasm and DNA, which can last for years.



Bacterial Symbiosis

- Many bacteria have developed along side of other organisms for millions of years, and often have developed mutualistic relationships with organisms called symbiosis. This is where the bacteria may live within the organism obtaining nutrients from the organism’s diet, while in turn, helping the organism to digest the food.

Ex) Humans and E. coli bacteria in intestine – helps us to absorb water, break down food, and create essential vitamins.

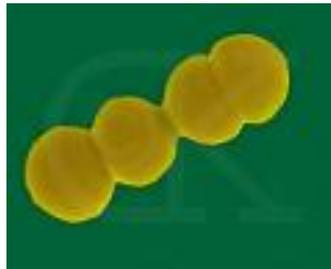
Ex) Komodo dragons have deadly bacteria in their saliva to help break down food.

Bacteria and the Environment

- Many bacteria play essential roles in balancing the gasses in the atmosphere and compounds in the ground.
 - Nutrient flow – bacteria decompose matter and recycle nutrients back into the ground to be re-used.
 - Sewage decomposition – some bacteria can be utilized to help break down organic waste water and clean the environment.
 - Nitrogen fixation – occurs when bacteria trap nitrogen from the atmosphere and use it to make nitrogen containing compounds for chemosynthesis. Other organisms can also benefit from this process Ex) plant roots

Bacteria and Disease:

- Bacteria can cause all kinds of diseases in humans and other animals because of their small size, quick reproduction rates and high immunity/resistance to chemicals.
- One examples is *Streptococcus pyrogenes* – causes step throat
 - Species = *pyrogenes* Genus = *Streptococcus* Shape = cocci



- Some people are given vaccines to protect them against bacterial infections
 - Shots containing denatured or dead bacteria to build body immunity.
- Scientists try to design antibiotics that fight off bacterial infections. But not all work, since many bacteria become resistant to the drugs after overexposure.