

Section 18.4: Archae and Bacteria

I. Diversity of Prokaryotes

- Prokaryotes are *unicellular* organisms that do not have a *nucleus* or other *membrane*-bound organelles.
- They are classified in *two* kingdoms: *archaea* and *bacteria*.

II. What is a Bacterium?

- A bacterium is a very *small cell*.
- Most are seen with a *compound light* microscope, but a few can only be seen by an *electron* microscope.
- Although a bacterium is very small, it has all the *structures* necessary to carry out its *life* functions.

A. The structures of bacteria

1. Prokaryotic cells have *ribosomes*, but they are smaller than eukaryotes.
2. They have *genes* that are located for the most part in a single *circular* chromosome.
3. The cell *wall* protects the bacterium by preventing it from *bursting*. Bacteria live mainly in *hypotonic* environments.

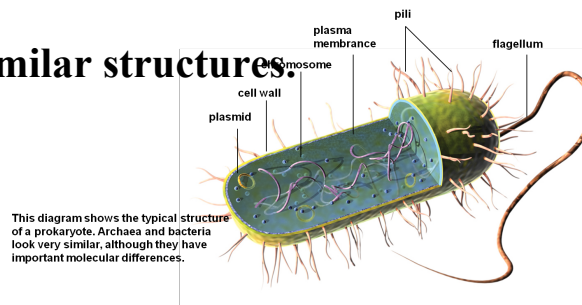
- Some virulent bacteria contain a structure called a ***capsule***, a ***gelatinous outer coating***, which gives the bacteria added protection from eukaryotic cells trying to engulf them, **i.e. white blood cells**.

B. Differences between Bacteria & Archae include:

- Composition of ***cell walls & lipids of plasma membrane***
- Archea genes** more ***similar to*** eukaryotes in structure & function.

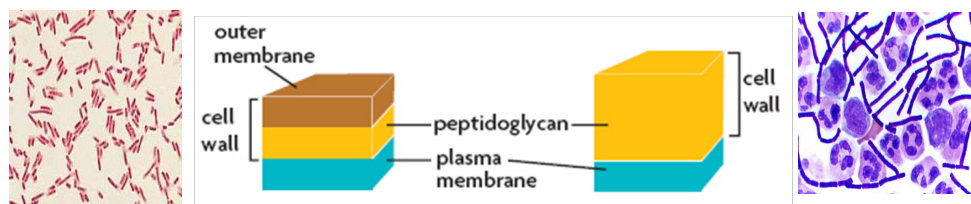
C. Bacteria and Archaea have similar structures.

- plasmid***
- flagellum***
- pili***

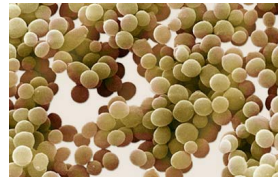


B. Cell Wall Structure

- Bacteria cell ***walls*** contain **peptidoglycan**
- The amount of ***peptidoglycan*** within the cell wall can differ between bacteria
- Gram staining*** is a technique that distinguishes two groups of bacteria because the stain reflects a basic ***difference*** in the ***composition*** of bacterial cell ***walls***.
 - Gram-***negative*** turns ***pink - more*** peptidoglycan
 - Gram-***positive*** turns ***purple - less*** peptidoglycan
 - Gram-positive is affected more by ***antibiotics*** than gram-negative.



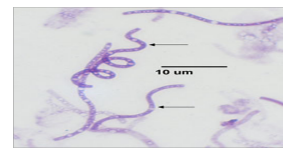
4. Bacteria have **three** common shapes
- sphere shaped called **coccus** (pl. - cocci)



- rod shaped called **bacillus** (pl. - bacilli)



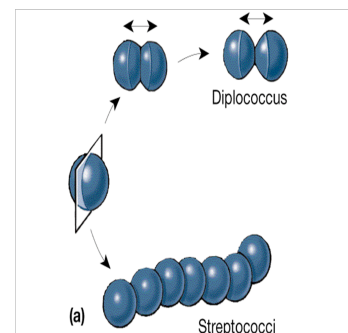
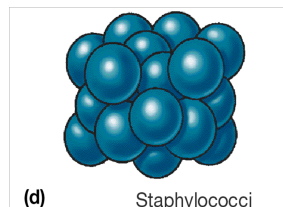
- spiral shaped called **spirillum** (pl. - spirilli)



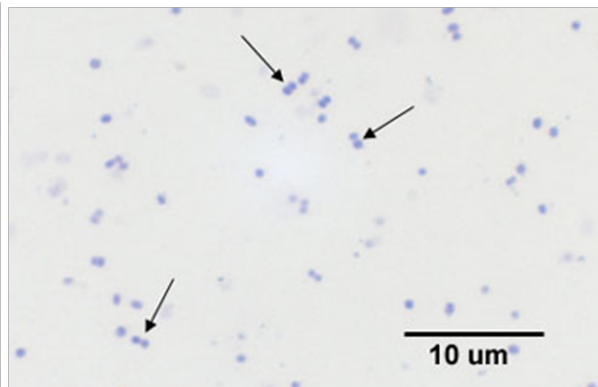
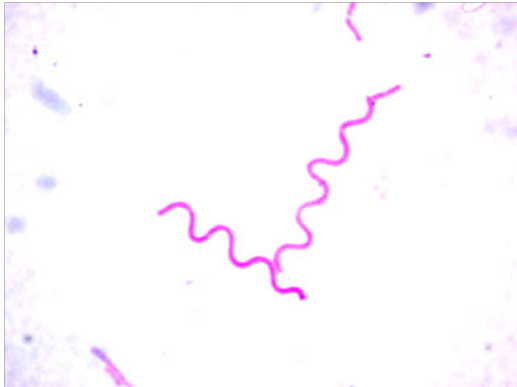
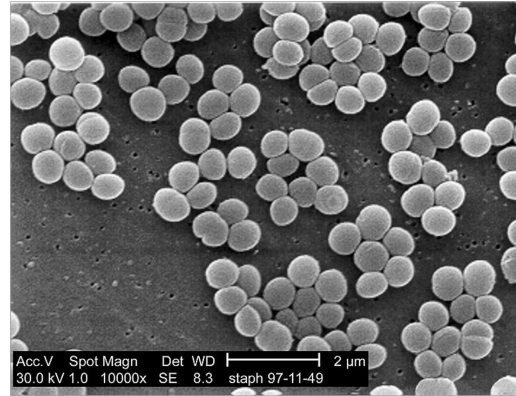
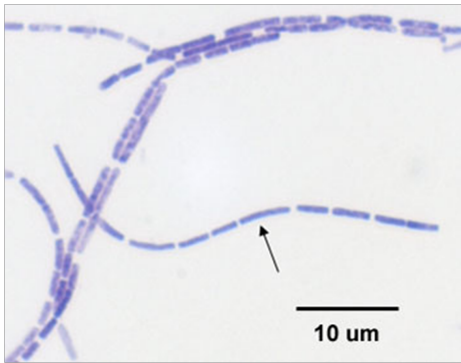
5. They also grow in patterns described in prefixes.

- Diplo - **paired** arrangement of cell growth.
- Staphlo - **clumped**, describes an arrangement of cells that resemble grapes.

- Strepto - **chained** arrangement of cells.



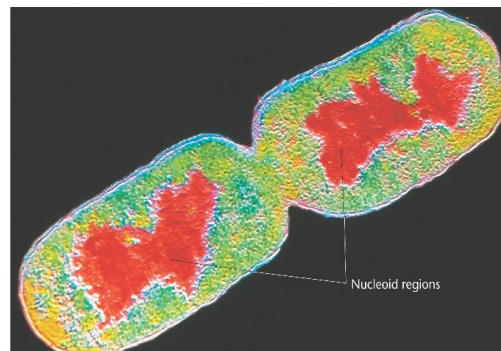
What would you call this?



C. Reproduction in Prokaryotes

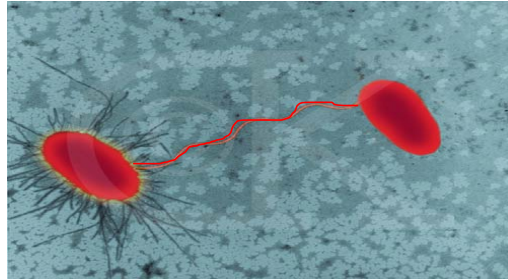
1. Asexual

- Bacteria cannot reproduce by *mitosis* or *meiosis* because they have **no nucleus** and instead of chromosome pairs they have **one** circular chromosome, in a region called the **nucleoid**.
- Bacteria reproduce **asexually** by a process known as **binary fission**.
- After binary fission there are **two** cells that are genetically **identical**.



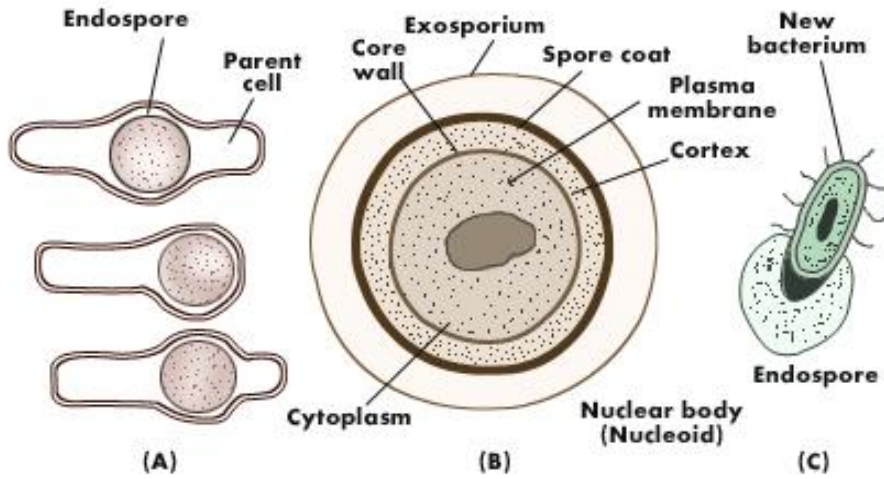
2. Sexual

- a. In addition to **binary fission**, some bacteria have a form of *sexual* reproduction called *conjugation*.
- b. This happens when one bacterium *transfers* all or part of its chromosome to another cell through a *pilus (pl. pili)*.
- c. Conjugation results in a bacterium with a *new genetic composition*.



D. A survival mechanism

1. *Endospore* = a tiny structure that contains a bacterium's **DNA** and a small amount of its **cytoplasm**, encased by a tough **outer** covering.
2. When conditions are right the endospore *germinates* or produces a **cell** that begins to grow.
3. Endospores can cause problems for *humans*.
4. To **kill** endospores items must be *sterilized*.



Endospore formation. A, Endospores according to their position in parent cells.
B, An endospore in cross-section. C, Germination of endospore