Bacteria

Bacteria Definition:

- Bacteria are single-celled microorganisms with prokaryotic cells, which are single cells that do not have organelles or a true nucleus and are less complex than eukaryotic cells.
- Bacteria are extremely numerous, and the total biomass of bacteria on Earth is more than all plants and animals combined.

Bacteria Characteristics

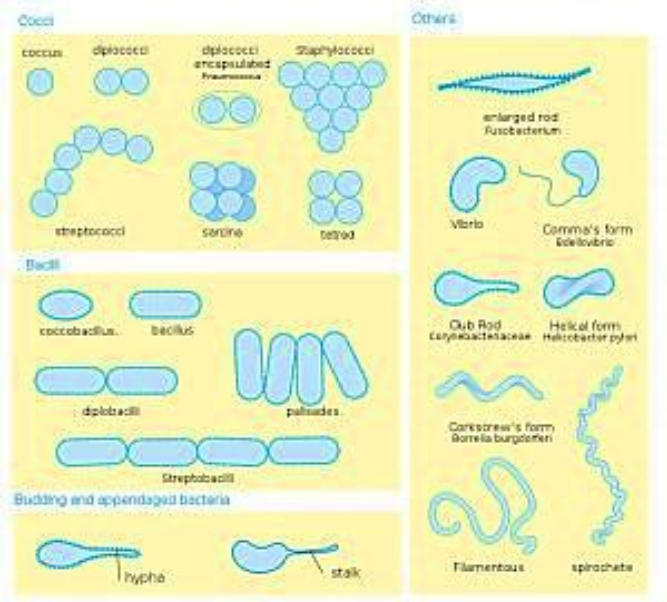
- Bacteria are single-celled organisms, they lack organelles such as chloroplasts and mitochondria, and they do not have the true nucleus found in eukaryotic cells.
- Instead, their DNA, a double strand that is continuous and circular, is located in a nucleoid.
- The nucleoid is an irregularly shaped region that does not have a nuclear membrane.
- Bacteria also have a cell membrane and a cell wall that is often made of peptidoglycan. Together, the cell membrane and cell wall are referred to as the cell envelope.
- Many bacteria need a cell wall in order to survive.
- Reproduction occurs through binary fission, which is the splitting of a bacterial cell after it reaches a certain size.

Bacteria Shapes

Bacteria come in a myriad of shapes. The three main shapes of bacteria are coccus, spiral, and bacillus.

- Cocci are bacteria that are spherical or ovoid in shape. Some cocci remain attached after binary fission, even though separate cells have been formed. For example, diplococci are cocci in pairs, streptococci are chains, and staphylococci are clusters of multiple cocci. Tetrads are square arrangements of four cocci, while sarcinae are cubes of eight cocci.
- Spiral bacteria are, as the name suggests, spiral-shaped. Spirillums are thick, tough spirals. Spirochetes are spirals that are thin and flexible. Vibrio's are comma-shaped rods with a small twist.
- Bacilli are rod-shaped bacteria. Like cocci, bacilli can be solitary or arranged together. Diplobacilli are two bacilli arranged next to each other, and streptobacilli are chains of bacilli.

Bacteria can also be other shapes such as filamentous (long and thin), square, star-shaped, and stalked. This diagram depicts the numerous shapes of bacteria.



Bacterial morphology diagram

Types of Bacteria

The cell wall also makes Gram staining possible. Gram staining is a method of staining bacteria involving crystal violet dye, iodine, and the counterstain safranin. Many bacteria can be classified into one of two types:

1. **gram-positive**, which show the stain and appear violet in color under a microscope.

2. **gram-negative**, which only show the counterstain, and appear red.

- Gram-positive bacteria appear violet because they have **thick cell walls** that trap the crystal violet-iodine complex.
- The **thin cell walls** of gram-negative bacteria cannot hold the violet-iodine complex, but they can hold safranin. This makes gram-negative bacteria appear red under Gram staining.
- Examples of gram-positive bacteria include the genera *Listeria, Streptococcus, and Bacillus*, while gram-negative bacteria include Proteobacteria, green sulfur bacteria, and cyanobacteria.