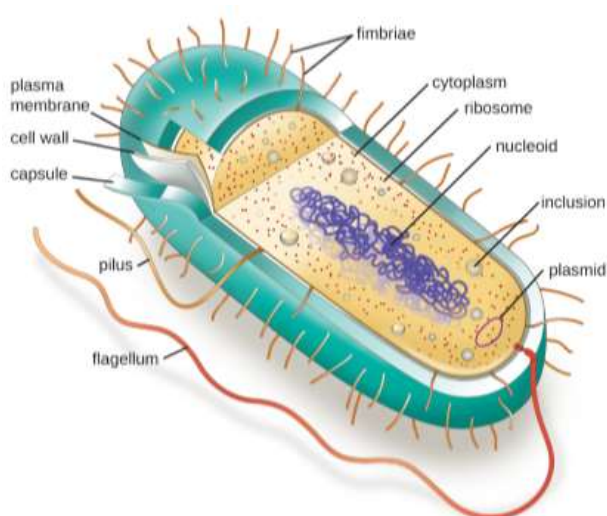


## 05- Characteristics of Prokaryotic Cells (Instructor: Şeref Tağı)

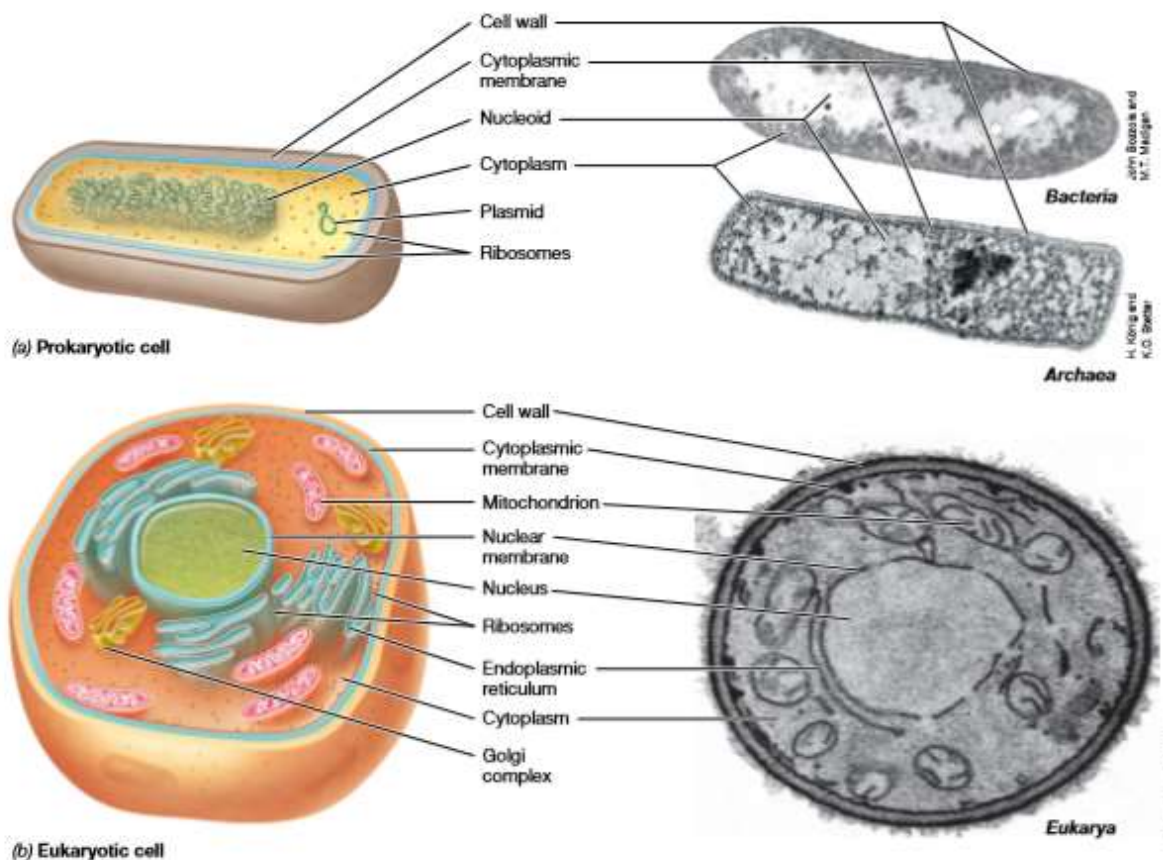
Cell theory states that the cell is the fundamental unit of life. However, cells vary significantly in size, shape, structure, and function. At the simplest level of construction, all cells possess a few fundamental components. These include cytoplasm (a gel-like substance composed of water and dissolved chemicals needed for growth), which is contained within a plasma membrane (also called a cell membrane or cytoplasmic membrane); one or more chromosomes, which contain the genetic blueprints of the cell; and ribosomes, organelles used for the production of proteins. Beyond these basic components, cells can vary greatly between organisms, and even within the same multicellular organism. The two largest categories of cells—prokaryotic cells and eukaryotic cells—are defined by major differences in several cell structures. Prokaryotic cells lack a nucleus surrounded by a complex nuclear membrane and generally have a single, circular chromosome located in a nucleoid. Eukaryotic cells have a nucleus surrounded by a complex nuclear membrane that contains multiple, rod-shaped chromosomes. All plant cells and animal cells are eukaryotic. Some microorganisms are composed of prokaryotic cells, whereas others are composed of eukaryotic cells.

Prokaryotic microorganisms are classified within the domains Archaea and Bacteria, whereas eukaryotic organisms are classified within the domain Eukarya. The structures inside a cell are analogous to the organs inside a human body, with unique structures suited to specific functions.



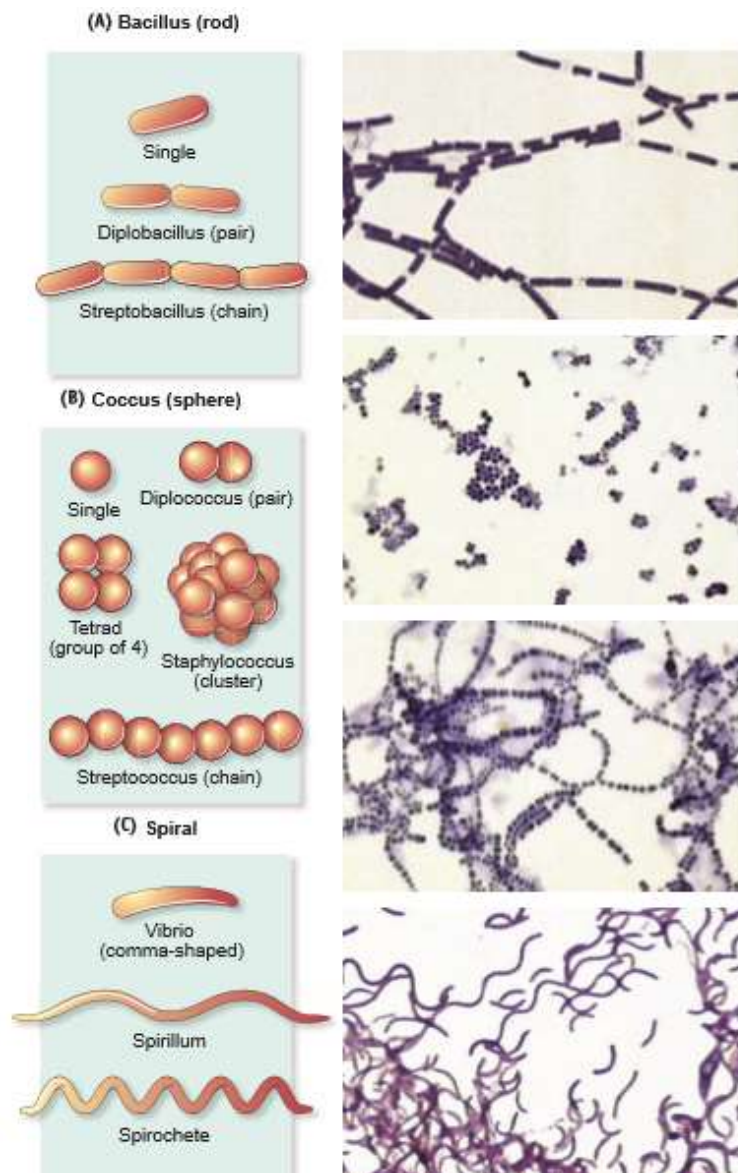
A typical prokaryotic cell contains a cell membrane, chromosomal DNA that is concentrated in a nucleoid, ribosomes, and a cell wall. Some prokaryotic cells may also possess flagella, pili, fimbriae, and capsules.

Some of the structures found in prokaryotic cells are similar to those found in some eukaryotic cells; others are unique to prokaryotes. Although there are some exceptions, eukaryotic cells tend to be larger than prokaryotic cells. The comparatively larger size of eukaryotic cells dictates the need to compartmentalize various chemical processes within different areas of the cell, using complex membrane-bound organelles. In contrast, prokaryotic cells generally lack membrane-bound organelles; however, they often contain inclusions that compartmentalize their cytoplasm. Figure below illustrates structures typically associated with prokaryotic cells.



**Figure 1.3 Microbial cell structure.** (a) (Left) Diagram of a prokaryotic cell. (Right) Electron micrograph of *Helicobacterium modesticaldum* (Bacteria, cell is about 1  $\mu\text{m}$  in diameter) and *Thermoproteus neutrophilus* (Archaea, cell is about 0.5  $\mu\text{m}$  in diameter). (b) (Left) Diagram of a eukaryotic cell. (Right) Electron micrograph of a cell of *Saccharomyces cerevisiae* (Eukarya, cell is about 8  $\mu\text{m}$  in diameter).

## Common Cell Morphologies and Arrangements



(Alcamo's 2011)

Rod-shaped bacteria can divide to form double-celled diplobacilli or longer chains called streptobacilli.

Similarly to the bacilli Cocci (spherical) bacteria that divide along a single plane form small chains of two cells called diplococci or long chains of multiple cells called streptococci.

» Cocci bacteria can also divide along multiple planes to form tetrads (two planes), cubelike sarcinae (three planes), or grapelike clusters called staphylococci (multiple planes).

spiral, which can take one of three forms The vibrio is a curved rod (comma), spirillum

(pl., spirilla) has a helical shape with a thick, rigid cell wall and flagella that assist movement

spiral-shaped form known as spirochete has a thin, flexible cell wall but no flagella (endoflagella that run the length of the cell.)

#### References:

- 1- Alcamo's Fundamentals of Microbiology, 2011, Ninth Edition (9 ed.) by Jeffrey C. Pommerville, Jones & Bartlett Publishers, Canada
- 2- <https://www.bl.uk/collection-items/micrographia-by-robert-hooke-1665>
- 3- "Download for free at <https://openstax.org/details/books/microbiology>."