

## Bacteria: Common Prokaryotic Cells

Bacteria are everywhere and for the most part they are not bothering anyone or doing any harm. In fact some of them are essential to your health and wellbeing. For example, bacteria in your gut produce vitamin K a necessary cofactor in blood clotting; without these bacteria minor injuries could be life-threatening. Bacteria that colonize your body surfaces prevent pathogens from invading those same surfaces. Bacteria are important in the production of many foods and commercial products. Of course there are bacteria that are quite nasty and kill many people. *Yersinia pestis*, the organism that caused the plague or Black Death, is estimated to have killed between 75 and 200 million people during the Dark Ages. *Vibrio cholera* the causative agent of cholera, has infected over 3 million people this century and killed nearly 70,000 people. While bacterial infections are not major killers in the developed world, they certainly are in less developed countries. The most likely bacterial infections in the United States are related to food handling, hospitalization and sexual behavior.

The major difference between prokaryotic cells and eukaryotic cells is the absence of a nucleus in prokaryotes. The prefix pro- means before and karyo- means colored body or nucleus. So literally, bacteria or prokaryotes are organisms, before the nucleus. Bacterial chromosomal DNA is found in a region called the nucleoid. Bacteria have only a single circular chromosome. They may have multiple copies of that chromosome, but they have only 1 chromosome. Remember prokaryotes do not have internal membrane bound organelles.

Parts of the generic bacterial cell:

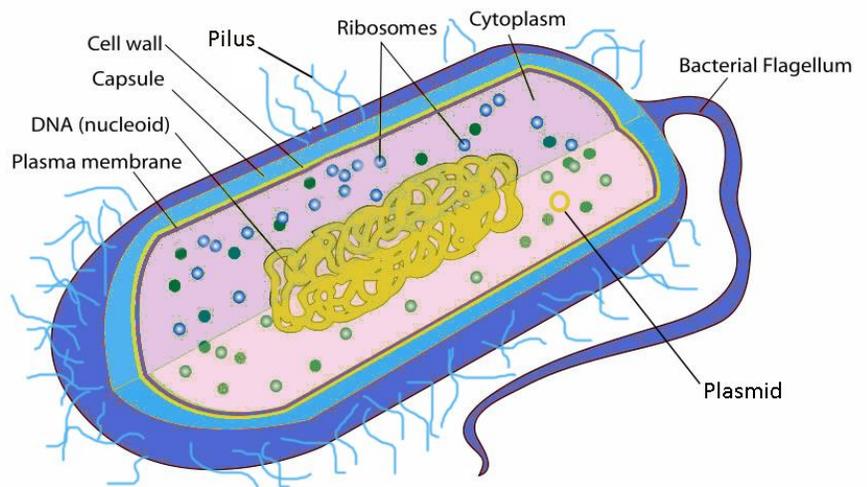
**Plasma membrane:** Composed primarily of lipids and proteins, the plasma membrane of the cell maintains homeostasis.

**Nucleoid:** Region containing the bacterium's single circular chromosome.

**Capsule, slime layer or glycocalyx:** Many bacteria secrete a capsule, slime layer or glycocalyx outside their cell wall. The capsule allows the bacteria to stick to surfaces and can serve as an energy and water reserve.

**Cell wall:** There are 2 major types of bacterial cell walls based on composition. This is important because the cell wall is one site of action for antibiotics. The cell wall protects the bacteria from osmotic lysis and gives the bacteria its distinctive shape. The 3 most common shapes are spherical (a spherical cell is called a coccus, the plural is cocci), rod-shaped, (bacillus, the plural is bacilli) and spiral or corkscrew-shaped (vibrio, spirillum, or spirochete).

**Pilus:** A pilus (pili, pl.) is an extension from the cell wall that helps the bacterium stick to surfaces. Pili also assist with pulling or capturing compounds like DNA and bringing them into the cell.



**Ribosomes:** Ribosomes are the site of protein synthesis. Bacterial ribosomes are different than eukaryotic ribosomes. Bacterial ribosomes are target sites for some antibiotics.

**Cytoplasm:** Gel-like material that suspends the components inside the cell. The site for metabolism.

**Bacterial flagellum:** Not all bacteria swim, but those that do use flagella (pl.). Bacteria can have 1 to hundreds of flagella in any of a number of different arrangements around the cell.

**Plasmid:** A plasmid is a small circular piece of DNA that is outside the chromosome and not necessary for the life of the cell. Bacteria can 'pick up' DNA in a number of ways. The DNA they pick up forms plasmids. Plasmids are important because antibiotic resistance and toxin genes are often transmitted on plasmids.

Keep in mind that bacteria are very, very small. Bacteria range in size from approximately 0.2 microns to the very largest bacteria at 5 microns, with an average size around 1 micron. As a frame of reference, anywhere from 1,500 to 7,500 bacteria could easily fit on the head of a pin. Therefore, when viewing bacterial slides with the light microscope only the shape and size can be observed. Specialized staining can highlight some features of bacterial cells however an electron microscope is needed to view the details of these cells.