

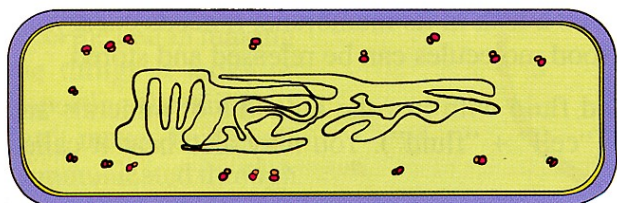
5: Cell Accessories

Life would be pretty boring if everyone did things in exactly the same way. What if every girl carried the same purse and wore the same shoes and the same dress of the same color? Yuk. Life is far more interesting because different people do things differently. The fact that not all cells are alike also helps to make life more interesting. We can only begin to talk about the many differences among cell types, but we will focus on some of the biggies.

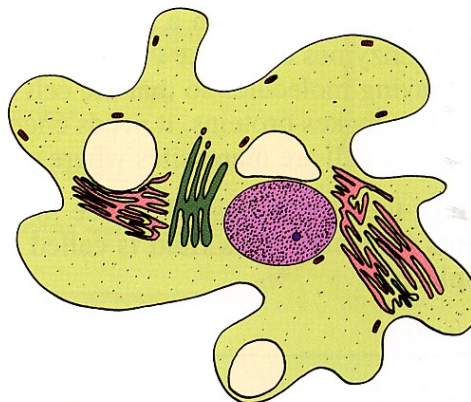
Some cells have a feature, called a **nucleus** (meaning “nut” or “kernel”), that separates the genetic material from the rest of the cell. The nucleus is a structure that keeps the genetic material out of harm’s way. Its contents are separated from the rest of the cytoplasm by a **nuclear membrane**. It also has a fluid inside it, called **nucleoplasm**, that resembles cytoplasm.

The simplest of organisms, called bacteria and archaea, do not have a nucleus. Their genetic material is held among the rest of the cell’s contents. Since these simple organisms lack a nucleus they are called **prokaryotes** [prō-KĀR-ē-ōts] (“before” + “nut”). The genomes of these organisms are made up of a single large DNA molecule in the shape of a circle. The circle is twisted like a rubber band that has been grasped in two places and twirled in opposite directions. The molecule may then be “supertwisted” like that same rubber band if the twisted part then twists on itself.

Other organisms have genomes that are much more complex. Instead of a single circular genome, they may have several paired strands of DNA called **chromosomes**. Like the prokaryotic chromosomes, these chromosomes are twisted, but they are wound around a framework of proteins called **histones**. Organisms with cells having this more complex structure are called **eukaryotes** [ū-KĀR-ē-ōts]. All organisms that are not prokaryotic are eukaryotic, including plants, animals, protozoa and fungi. Since more complex animals have a greater number of functions to carry out, they need this more complex genome.



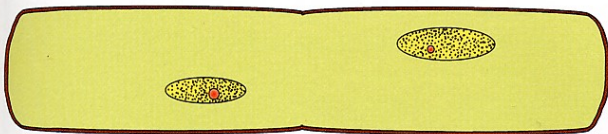
Bacterial cells are prokaryotic (that is, they have no cell nucleus). They are extremely small (about 1 millionth of a meter across) and have a cell wall that may be either rigid or somewhat flexible. Archaea are similar in structure and appearance to bacteria, but the makeup of their molecules is different.



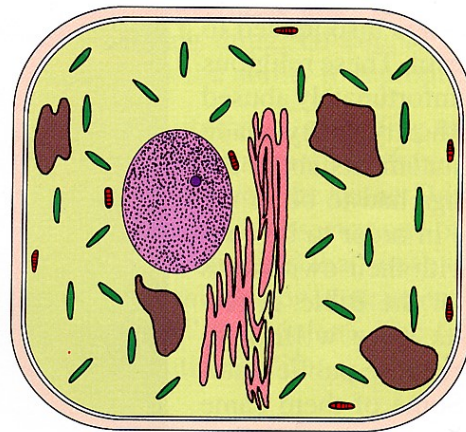
Animal cells are eukaryotic cells perhaps a hundred times larger than bacteria and archaea. They do not have cell walls so they take on a variety of shapes and tend to be flexible. They are not photosynthetic, so there are no green chloroplasts or other pigments within their cells.

Some cells sport stiff outer walls for structure or protection. These cells include the bacteria, the archaea, plants and fungi. Each of these types of organisms has its own **cell wall** characteristics. Cell walls differ somewhat even within these groups. For example, bacteria are classified into two broad categories (“Gram positive” or “Gram negative”) based on the type of cell wall they have. Animal cells do not have cell walls.

Cells of eukaryotes also have a complex inner membrane structure called an **endoplasmic reticulum**. This is a membrane (sheet) folded back and forth on itself to separate the cells into compartments and to provide a high surface area inside the cells on which to perform activities that need some attachment or separation. These more complex cells also require more organization of their energy generation. Energy generation is scattered throughout simpler cells; in these more complex cells, energy is generated in little chemical power plants called **mitochondria**, the “powerhouses of the cell.”



Fungi are eukaryotic (that is, they have a nucleus which contains the cell's DNA) and have outer cell walls made of chitin (found nowhere in the plant kingdom). They are not photosynthetic and often lack a boundary between neighboring cells, causing them to run together into a large semisolid mass.



Plant cells have a rigid cell wall outside their membrane. They are eukaryotic and they have chloroplasts which contain the equipment needed for photosynthesis. When they have an abundance of food, they may store the extra food inside their cells as starch. The starch storage granules may be seen within the cell.

Exercises:

1. What do bacteria and archaea have in common?
2. Do animal cells have a cell wall?
3. In previous lessons we said that all of the work done by cells has to be paid for with energy. Name the structure where all of this energy is generated in eukaryotic cells.