

CHAPTER

2

Prokaryotic and Eukaryotic Cells

- Distinguish between eukaryotic and prokaryotic cells.



Are bacteria cells like our cells?

Yes and no. Bacteria cells are similar to our cells in some ways. Like our cells, bacteria cells have DNA and a plasma membrane. But bacteria are unique in other ways. They are called prokaryotic cells because of these differences.

Prokaryotic and Eukaryotic

There are two basic types of cells, **prokaryotic cells** and **eukaryotic cells**. The main difference between eukaryotic and prokaryotic cells is that eukaryotic cells have a **nucleus**. The nucleus is where cells store their **DNA**, which is the genetic material. The nucleus is surrounded by a membrane. Prokaryotic cells do not have a nucleus. Instead, their DNA floats around inside the cell. Organisms with prokaryotic cells are called **prokaryotes**. All prokaryotes are single-celled organisms. Bacteria and Archaea are the only prokaryotes. Organisms with eukaryotic cells are called **eukaryotes**. Animals, plants, fungi, and protists are eukaryotes. All multi-cellular organisms are eukaryotes. Eukaryotes may also be single-celled.

Both prokaryotic and eukaryotic cells have structures in common. All cells have a plasma membrane, ribosomes, cytoplasm, and DNA. The **plasma membrane**, or cell membrane, is the phospholipid layer that surrounds the cell and protects it from the outside environment. **Ribosomes** are the non-membrane bound organelles where proteins are made, a process called **protein synthesis**. The **cytoplasm** is all the contents of the cell inside the cell membrane, not including the nucleus.

Eukaryotic Cells

Eukaryotic cells usually have multiple **chromosomes**, composed of DNA and protein. Some eukaryotic species have just a few chromosomes, others have close to 100 or more. These chromosomes are protected within the nucleus. In

in addition to a nucleus, eukaryotic cells include other membrane-bound structures called **organelles**. Organelles allow eukaryotic cells to be more specialized than prokaryotic cells. Pictured below are the organelles of eukaryotic cells (**Figure 2.1**), including the **mitochondria**, **endoplasmic reticulum**, and **Golgi apparatus**. These will be discussed in additional concepts.

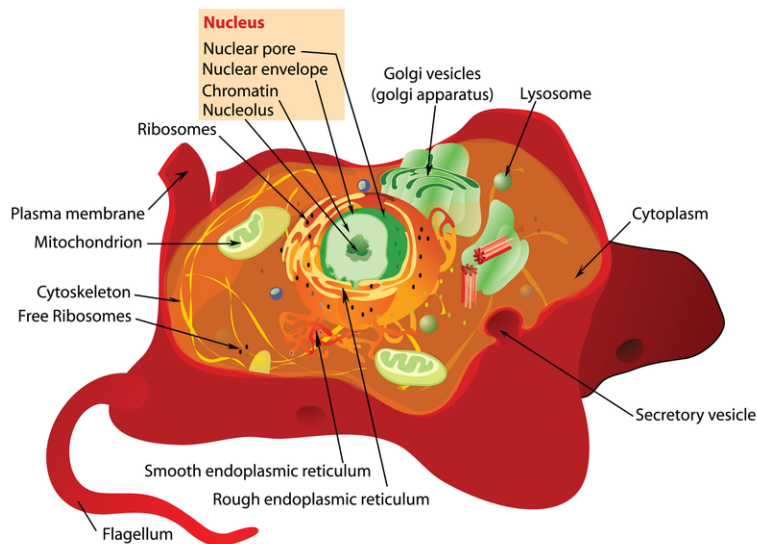


FIGURE 2.1

Eukaryotic cells contain a nucleus and various other special compartments surrounded by membranes, called organelles. The nucleus is where the DNA (chromatin) is stored.

Prokaryotic Cells

Prokaryotic cells (**Figure 2.2**) are usually smaller and simpler than eukaryotic cells. They do not have a nucleus or other membrane-bound organelles. In prokaryotic cells, the DNA, or genetic material, forms a single large circle that coils up on itself. The DNA is located in the main part of the cell.

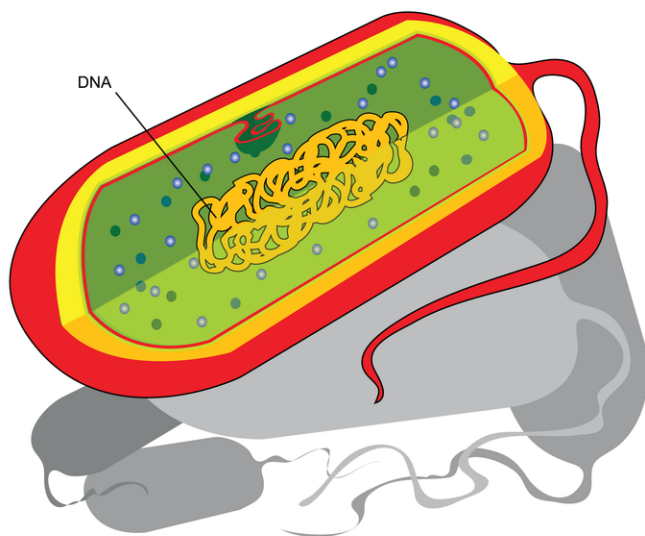


FIGURE 2.2

Prokaryotes do not have a nucleus. Instead, their genetic material is located in the main part of the cell.

TABLE 2.1: Comparison of Prokaryotic and Eukaryotic Cells

Feature	Prokaryotic cells	Eukaryotic cells
Nucleus	No	Yes
DNA	Single circular piece of DNA	Multiple chromosomes
Membrane-enclosed organelles	No	Yes
Examples	Bacteria	Plants, animals, fungi

Vocabulary

- **cytoplasm:** Entire contents of the cell inside the plasma membrane, excluding the nucleus.
- **deoxyribonucleic acid (DNA):** Nucleic acid that is the genetic material of all organisms.
- **endoplasmic reticulum:** Organelle that is the site of lipid synthesis and protein modification.
- **eukaryote:** Organism with cells containing a nucleus and membrane-bound organelles.
- **eukaryotic cell:** Cell that contains a nucleus and membrane-bound organelles.
- **Golgi apparatus:** Organelle that processes and packages proteins.
- **mitochondrion (plural mitochondria):** Organelle of the cell in which energy is generated.
- **nucleus:** Cell structure that contains the genetic material, DNA.
- **organelle:** Structure within the cell that has a specific role.
- **plasma membrane:** The lipid barrier that surrounds the cell; known as the cell membrane.
- **prokaryote:** Organism that lacks a nucleus; i.e. bacteria.
- **prokaryotic cell:** Cell without a nucleus or membrane-bound organelles.
- **ribosome:** Organelle in which proteins are made (protein synthesis).

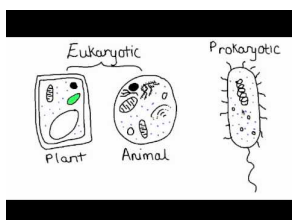
Summary

- All cells have a plasma membrane, ribosomes, cytoplasm, and DNA.
- Prokaryotic cells lack a nucleus and membrane-bound structures.
- Eukaryotic cells have a nucleus and membrane-bound structures called organelles.

Practice

Use the resource below to answer the questions that follow.

- **Compare Prokaryotic and Eukaryotic Cells** at <http://www.youtube.com/watch?v=QON4z9vo7Ag> (1:55)



MEDIA

Click image to the left for more content.

1. What does "naked" DNA mean? What kinds of organisms have "naked" DNA?
2. Where do you find membrane bound organelles? Are plasmids membrane bound organelles?
3. What is the size of mitochondria in prokaryotes?

- **Quizzes on Prokaryotic or Eukaryotic** by neoK12 at <http://www.neok12.com/quiz/CELSTR03> and <http://www.neok12.com/quiz/CELSTR04>

Review

1. What do all cells have in common?
2. What are organelles?
3. Compare the location of the genetic material of eukaryotic cells and prokaryotic cells.
4. What are some examples of eukaryotes?

References

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2. Mariana Ruiz Villarreal (LadyofHats), modified by CK-12 Foundation. . Public Domain