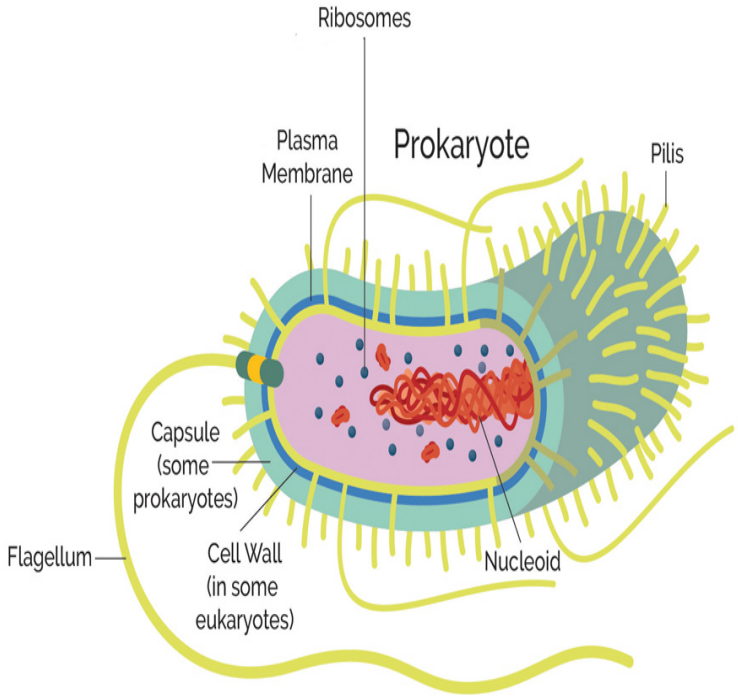
Every living organism falls into one of two groups: eukaryotes or prokaryotes. Cellular structure determines which group an organism belongs to. We will explain in detail what prokaryotes and eukaryotes are and outline the differences between the two.

Prokaryote definition

Prokaryotes are unicellular organisms that lack membrane-bound structures, the most noteworthy of which is the nucleus. Prokaryotic cells tend to be small, simple cells, measuring around 0.1-5 μm in diameter.



The key structures present in a prokaryote cell

While prokaryotic cells do not have membrane-bound structures, they do have distinct cellular regions. In prokaryotic cells, DNA bundles together in a region called the nucleoid.

Prokaryotic cell features

Prokaryotic bacterial cell contain:

- **Nucleoid:** A central region of the cell that contains its DNA.
- **Ribosome:** Ribosomes are responsible for protein synthesis.
- **Cell wall:** The cell wall provides structure and protection from the outside environment. Most bacteria have a rigid cell wall made from carbohydrates and proteins called peptidoglycans.
- **Cell membrane:** Every prokaryote has a cell membrane, also known as the plasma membrane, that separates the cell from the outside environment.
- **Capsule:** Some bacteria have a layer of carbohydrates that surrounds the cell wall called the capsule. The capsule helps the bacterium attach to surfaces.
- **Fimbriae:** Fimbriae are thin, hair-like structures that help with cellular attachment.
- **Pili:** Pili are rod-shaped structures involved in multiple roles, including attachment and DNA transfer.
- **Flagella:** Flagella are thin, tail-like structures that assist in movement.

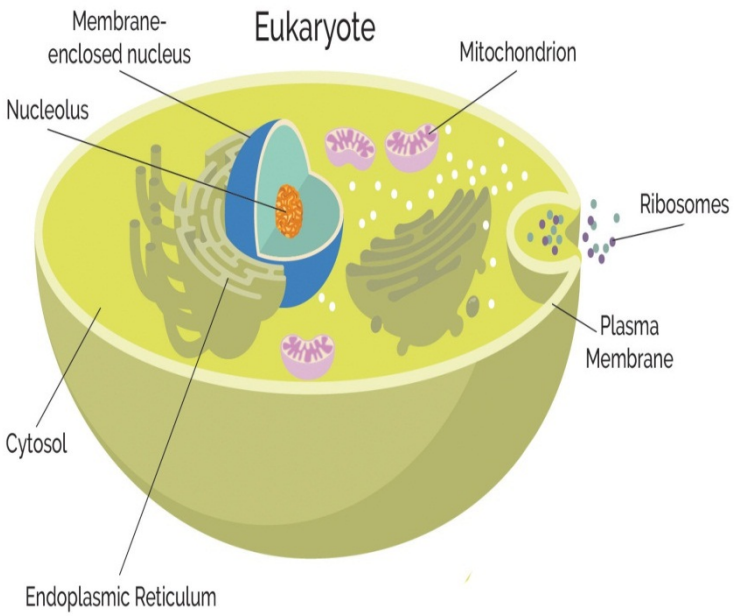
Examples of prokaryotes

Bacteria and archaea are the two types of prokaryotes.

prokaryotes do not have mitochondria. Mitochondria are only found in eukaryotic cells. This is also true of other membrane-bound structures like the nucleus and the Golgi apparatus.

Eukaryote definition

Eukaryotes are organisms whose cells have a nucleus and other organelles enclosed by a plasma membrane. Organelles are internal structures responsible for a variety of functions, such as energy production and protein synthesis.



The key structures present in a eukaryote cell.

Eukaryotic cells are large (around 10-100 μm) and complex. While most eukaryotes are multicellular organisms, there are some single-cell eukaryotes.

Eukaryotic cell features

Within a eukaryotic cell, each membrane-bound structure carries out specific cellular functions. The primary components of eukaryotic cells are:

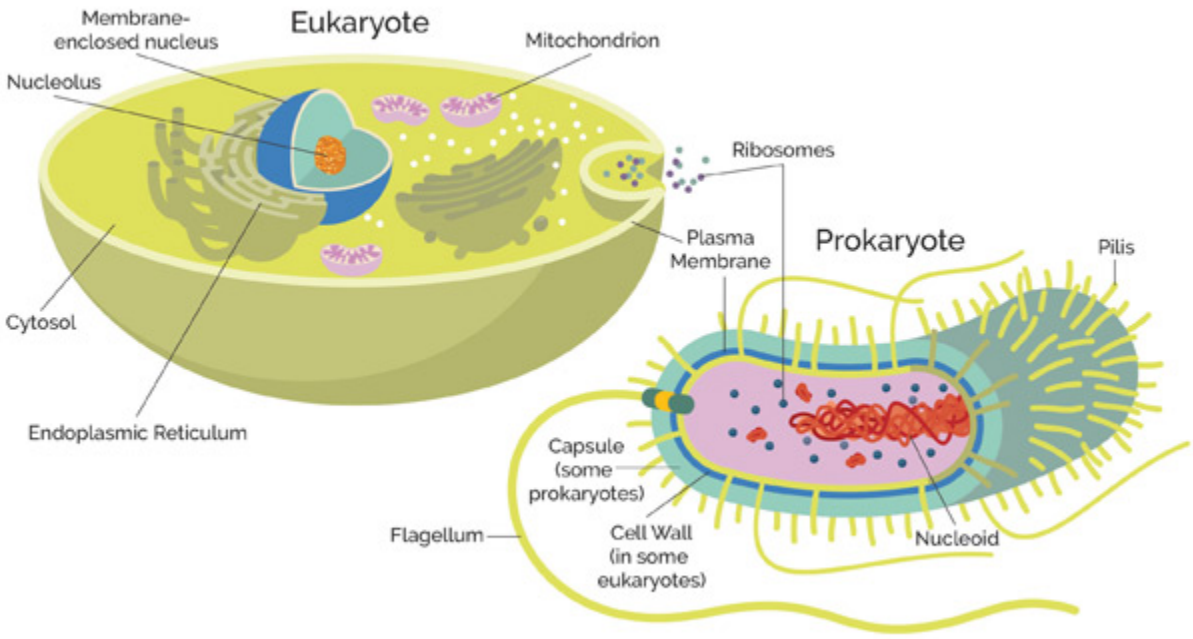
- **Nucleus:** The nucleus stores the genetic information in chromatin form.
- **Nucleolus:** Found inside of the nucleus, the nucleolus is the part of eukaryotic cells where ribosomal RNA is produced.
- **Plasma membrane:** The plasma membrane is a phospholipid bilayer that surrounds the entire cell and encompasses the organelles within.
- **Cytoskeleton or cell wall:** The cytoskeleton or cell wall provides structure, allows for cell movement, and plays a role in cell division.
- **Ribosomes:** Ribosomes are responsible for protein synthesis.
- **Mitochondria:** Mitochondria, also known as the powerhouses of the cell, are responsible for energy production.
- **Cytoplasm:** The cytoplasm is the region of the cell between the nuclear envelope and plasma membrane.
- **Cytosol:** Cytosol is a gel-like substance within the cell that contains the organelles.
- **Endoplasmic reticulum:** The endoplasmic reticulum is an organelle dedicated to protein maturation and transportation.
- **Vesicles and vacuoles:** Vesicles and vacuoles are membrane-bound sacs involved in transportation and storage.

Other common organelles found in many, but not all, eukaryotes include the Golgi apparatus, chloroplasts and lysosomes.

Examples of eukaryotes

Animals, plants, fungi, algae and protozoans are all eukaryotes.

Key similarities between prokaryotes and eukaryotes



A comparison showing the shared and unique features of prokaryotes and eukaryotes

All cells, whether prokaryotic or eukaryotic, share these four features:

1. DNA
2. Plasma membrane
3. Cytoplasm
4. Ribosomes

Comparing prokaryotes and eukaryotes

All life on Earth consists of either eukaryotic cells or prokaryotic cells. Prokaryotes were the first form of life. Scientists believe that eukaryotes evolved from prokaryotes around 2.7 billion years ago.

The primary distinction between these two types of organisms is that eukaryotic cells have a membrane-bound nucleus and prokaryotic cells do not. The nucleus is where eukaryotes store their genetic information. In prokaryotes, DNA is bundled together in the nucleoid region, but it is not stored within a membrane-bound nucleus.

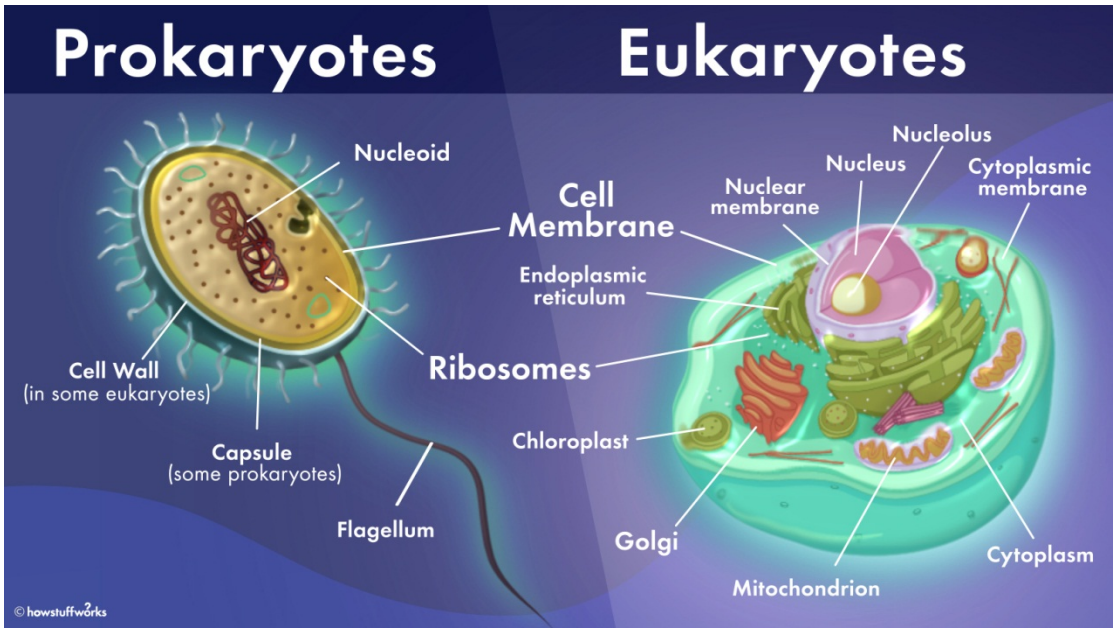
The nucleus is only one of many membrane-bound organelles in eukaryotes. Prokaryotes, on the other hand, have no membrane-bound organelles. Another important difference is the DNA structure. Eukaryote DNA consists of multiple molecules of double-stranded linear DNA, while that of prokaryotes is double-stranded and circular.

Transcription and translation in prokaryotes vs eukaryotes

In prokaryotic cells, transcription and translation are coupled, meaning translation begins during mRNA synthesis.

In eukaryotic cells, transcription and translation are not coupled. Transcription occurs in the nucleus, producing mRNA. The mRNA then exits the nucleus, and translation occurs in the cell’s cytoplasm.

The key differences between prokaryotes and eukaryotes



Prokaryotes and eukaryotes vary in several important ways - these differences include structural variation - whether a nucleus is present or absent, and whether the cell has membrane-bound organelles, and molecular variation, including whether the DNA is in a circular or linear form. The differences are summarized in the

	Prokaryote	**Eukaryote**
Nucleus	Absent	Present
Membrane-bound organelles	Absent	Present
Cell structure	Unicellular	Mostly multicellular; some unicellular
Cell size	Smaller (0.1-5 μm)	Larger (10-100 μm)
Complexity	Simpler	More complex
DNA Form	Circular	Linear
Examples	Bacteria, archaea	Animals, plants, fungi, protists