Text Sections
Section 4.2 All Cells Are Either Prokaryotic or Eukaryotic, p. 56

Introduction
All cells can be placed into one of two categories, prokaryotic or eukaryotic, based on the presence or absence of certain cellular structures. Prokaryotes do not have a nucleus, nor do they contain any membrane-bounded internal structures. Prokaryotic cells are much smaller than eukaryotic cells and according to the fossil record, they predate eukaryotic cells. In this tutorial, we’ll review the basic structures of prokaryotic and eukaryotic cells.

Learning Objectives
- Understand the basic differences between prokaryotic and eukaryotic cells.
- Know the main structures found in many types of cells.
A Comparison of Prokaryotic and Eukaryotic Cells

All forms of life are composed of one of two basic types of cells: prokaryotic cells or eukaryotic cells.

The simplest types of cells are prokaryotic cells. Bacteria, the oldest form of life on Earth, are prokaryotes. The DNA of prokaryotic cells is not contained within a nucleus. Instead, prokaryotic chromosomes are found in a localized area of the cell called the nucleoid region.

Unlike prokaryotic cells, eukaryotic cells have a membrane-bound nucleus that encloses its genetic material. Eukaryotic cells are normally much bigger than prokaryotic cells and contain membrane-bound organelles, organized structures that perform a specific function.

Eukaryotic cells include both animal cells and plant cells. Variations exist even among animal cells, and no one cell looks exactly like the one shown here. But we can consider this to be a representative animal cell.

Plant cells share many of the features of animal cells, such as the cytoplasm, ribosomes, a plasma membrane, a nucleus, an endoplasmic reticulum, the Golgi complex, the cytoskeleton, and mitochondria. Some features are unique to plant cells, however, such as chloroplasts, plastids, central vacuoles, and the cell wall. Variations also exist among plant cells, but we can consider the one shown here to be representative.

All cells have some structures in common, despite the great diversity of cell types. To highlight structures, roll your cursor over the labels. For additional information, click on a label.

Ribosomes

Ribosomes are composed of both RNA and protein and are the sites of protein synthesis. They are the only organelle that is common to both prokaryotic cells and eukaryotic cells.

Plasmid

A plasmid is a circular piece of DNA that is separate from the nucleoid and is sometimes exchanged between prokaryotic cells. The plasmid contains genetic information that is normally nonessential to cell survival.

Plasma membrane

All cells are enclosed by a structure called a plasma membrane. The plasma membrane defines the outer boundary of the cell, isolates the cell's contents from the environment, and serves as a semi-permeable barrier that determines which nutrients are allowed into and out of the cell.
Capsule
Many bacteria are surrounded by a gelatinous capsule, which helps the bacteria attach to cells within tissues they will infect.

Chloroplast
Chloroplasts are specialized plastids that contain the pigment chlorophyll. Chloroplasts are the site of photosynthesis in plant and algae cells.

Nucleus
The nucleus is a membrane-bound compartment that encloses the primary complement of DNA (the chromosomes) in eukaryotic cells. The prominent spherical structure within the nucleus is the nucleolus, an area that specializes in the production of ribosomal RNA, a material that helps make up ribosomes.

Centriole
Centrioles are involved in spindle formation that functions to move chromosomes into daughter cells when the cell divides. Centrioles also provide a center for the formation of flagella and cilia.

Cytoskeleton
The cytoskeleton is a network of protein filaments that function in cell structure, cell movement, and the transport of materials within the cell. The cytoskeleton consists of three types of fibers. Ordered by size, going from smallest to largest in diameter, they are microfilaments, intermediate filaments, and microtubules.

Mitochondria
Mitochondria (singular, mitochondrion) convert the energy contained in food into a useful molecular form of energy for the cell. Most of the heat in our bodies is generated within mitochondria, and almost all the food we eat is ultimately consumed in them.

Cell Wall
The cell wall is a rigid structure that gives the cell shape and protects the plasma membrane. It is composed of a complex mix of protein and carbohydrate called peptidoglycan. The cell walls of bacteria differ in chemical composition from those of plant cells.

You should now be able to...
• Discuss the localization of DNA in prokaryotic and eukaryotic cells.
• Compare and contrast the organelles found in plant and animal cells and their functions.
• Specify one structure found in bacterial and plant cells that is not found in animal cells.
• List three structures that are found in both prokaryotic and eukaryotic cells.