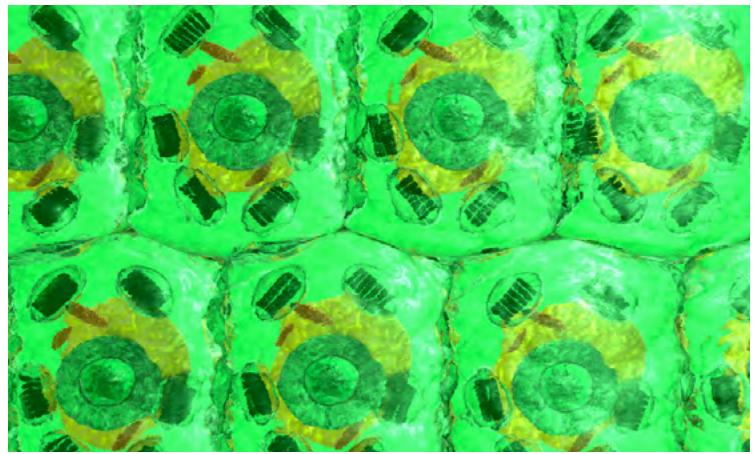


The Cell

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3.1 What Is a Cell?

Cells are the basic units of life, the same way that atoms are the basic units of matter. All living organisms are made up of one or more cells. Organisms made up of just one cell are *unicellular*—bacteria are unicellular. Organisms made up of many cells are *multicellular*.

You, yourself, have about 37 trillion cells in your body, and the diversity of things they do is amazing. Right now, muscle cells are moving your eyeballs as you follow the text on this page, sensory cells in your eyes are taking in the shapes of the letters, cells in your ears are absorbing nearby sounds, red blood cells are carrying oxygen to all the other cells in your body, and digestive cells are making the enzymes that will break down your last snack. And some extremely impressive cells—the neurons in your brain—are producing your thoughts about how amazing cells are.

The Two Types of Cells

Two distinct types of cells are found in different living organisms today: prokaryotic cells and eukaryotic cells. They are distinguished primarily by the presence or absence of a **nucleus**, a structure within the cell that contains the cell's DNA. *Prokaryotic cells* do not have a nucleus (*pro* means “before” and *karyote* refers to “nut” or “nucleus”). *Eukaryotic cells* (“true nucleus”) have a nucleus as well as other structures not present in prokaryotic cells. Organisms with prokaryotic cells are called **prokaryotes**, and organisms with eukaryotic cells are called **eukaryotes**. Figure 3.1 compares typical prokaryotic and eukaryotic cells.

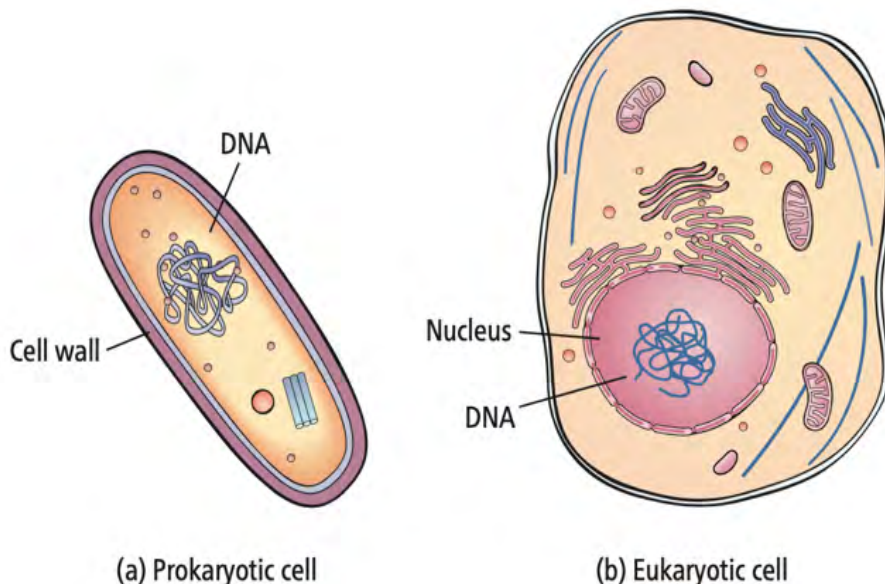


FIGURE 3.1

- (a) Prokaryotic cells have no nucleus.
- (b) Eukaryotic cells have a nucleus.



Prokaryotes have existed on Earth far longer than eukaryotes. Prokaryotes first evolved 3.5 to 4 billion years ago and were the only living things on Earth for several billion years. Prokaryotes now include two major lineages, the bacteria and the archaea.

Prokaryotes are single-celled organisms and are very small, ranging from about 0.1 to 10 micrometers (10^{-6} meter) in diameter. Their structure is simpler than that of eukaryotes. The DNA of prokaryotes is found in a single circular structure and is not contained within a nucleus. Most prokaryotes have an outer *cell wall* that helps protect the cell. The prokaryote *Escherichia coli*, which lives in the human digestive tract and is one of the best-studied organisms in the world, is shown in Figure 3.2.



FIGURE 3.2

Escherichia coli (commonly referred to as *E. coli*) is a prokaryote that lives in the human digestive tract.

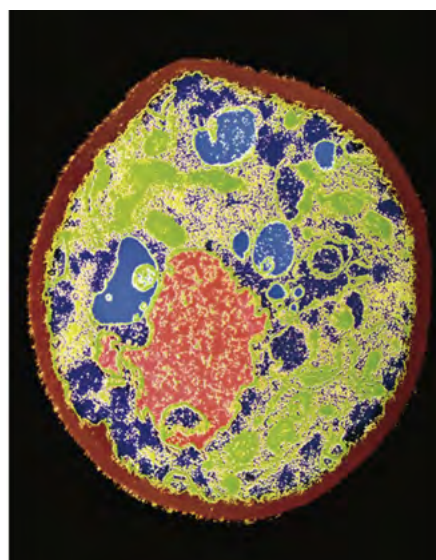


FIGURE 3.3

Saccharomyces cerevisiae, commonly known as baker's yeast or brewer's yeast, is a single-celled eukaryote. The red area at the lower left is the cell's nucleus.

Eukaryotes first appeared on Earth about 2 billion years ago. Eukaryotes can be single-celled, like prokaryotes, or they can be composed of many cells. The fungus known as baker's yeast, commonly used in baking and brewing, is a single-celled eukaryote (Figure 3.3). Humans are multicellular eukaryotes.

Eukaryotes include all animals, plants, fungi, and protists. Eukaryotic cells have their DNA inside a nucleus. In addition, the DNA of eukaryotic cells is found in linear, rather than circular, **chromosomes**. Eukaryotic cells also have numerous **organelles**, structures that perform specific functions for the cell. Finally, eukaryotic cells are larger than prokaryotic cells—whereas prokaryotic cells measure 0.1 to 10 micrometers, eukaryotic cells usually measure 10 to 100 micrometers.



READING CHECK

Which of the following organisms are prokaryotes and which are eukaryotes: the bacterium that causes tuberculosis, a humpback whale, a honey mushroom?

CHECK YOUR ANSWER

The tuberculosis bacterium, like all bacteria, is a prokaryote. A humpback whale, like all animals, is a eukaryote. A honey mushroom, like all fungi, is a eukaryote.

To learn more about prokaryotic and eukaryotic cells, check out this website:

<https://www.livescience.com/65922-prokaryotic-vs-eukaryotic-cells.html>

