

Looking Around Your Cell

There are two basic kinds of organisms:

✓ **Prokaryotes:** Organisms whose cells lack a nucleus and therefore have DNA floating loosely in the liquid center of the cell

✓ **Eukaryotes:** Organisms that have a well-defined nucleus to house and protect the DNA

A *nucleus* is a compartment filled with DNA surrounded by a membrane. The basic biologies of prokaryotes and eukaryotes are similar but not identical. Because all living things fall into these two groups, understanding the differences and similarities between cell types is important. In this section, I will show you how to distinguish the two kinds of cells from each other, and you get a quick tour of the insides of cells — both with and without nuclei.

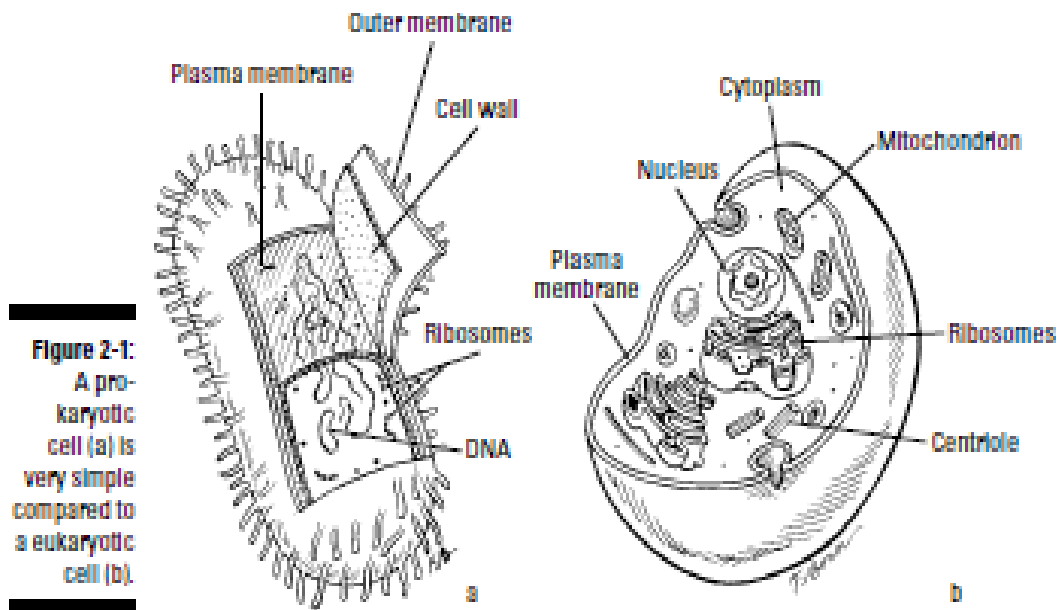


Figure 2-1:
A prokaryotic cell (a) is very simple compared to a eukaryotic cell (b).

Cells without a nucleus

Scientists classify organisms composed of cells without nuclei as *prokaryotes*, which means “before nucleus.” Prokaryotes are the most common forms of life on earth. You are, at this very moment, covered in and inhabited by millions of prokaryotic cells: bacteria. Much of your life and your body’s processes depend on these arrangements ; for example, the digestion going on in your intestines is partially powered by bacteria

that break down the food you eat. Most of the bacteria in your body are completely harmless, but some species of bacteria can be vicious and deadly, causing rapidly transmitted diseases such as cholera. All bacteria, regardless of temperament, are simple, one-celled, prokaryotic organisms. None has cell nuclei, and all are small cells with relatively small amounts of DNA

The exterior of a prokaryotic cell is encapsulated by a *cell wall* that serves as the bacteria's only protection from the outside world. A *plasma membrane* (membranes are thin sheets or layers) regulates the exchange of nutrients, water, and gases that nourish the bacterial cell. DNA, usually in the form of a single, hoop-shaped piece, floats around inside the cell; segments of DNA

like this one are called chromosomes (see the section "Examining the basics of chromosomes" later in the chapter). The liquid interior of the cell is called the cytoplasm. The cytoplasm provides a cushiony, watery home for the DNA and other cell machinery that carry out the business of living. Prokaryotes divide, and thus reproduce, by simple mitosis,

Cells with a nucleus

Scientists classify organisms that have cells with nuclei as eukaryotes, which means "true nucleus." Eukaryotes range in complexity from simple, one-celled animals and plants to complex, multicellular organisms like you. Eukaryotic cells are fairly complicated and have numerous parts to keep track of (refer to Figure 2-1). Like prokaryotes, eukaryotic cells are held together by a plasma membrane, and sometimes a cell wall surrounds the membrane (plants, for example, have cell walls).

Unlike prokaryotes, eukaryotes have all sorts of cell parts, called organelles, that help carry out the business of living. The organelles float around in the watery cytoplasm outside the nucleus. Two of the most important organelles are

✓ **Mitochondria:** The powerhouses of the eukaryotic cell, mitochondria pump out energy by converting glucose to ATP (adenosine triphosphate). ATP acts like a battery of sorts, storing energy until it's needed for day-to-day living. Both animals and plants have mitochondria.

✓ **Chloroplasts:** These organelles are unique to plants. They process the energy of sunlight into sugars that the plant mitochondria use to generate the energy that nourishes the living cells.

In most multicellular eukaryotes, cells come in two basic varieties: body cells (called somatic cells) or sex cells. The two cell types have different functions and are produced in different ways.

Somatic cells

Somatic cells are produced by simple cell division called mitosis (see the section “Mitosis: Splitting Up” for details). Somatic cells of multicellular organisms like humans are differentiated into special cell types. Skin cells and muscle cells are both somatic cells, for instance, but if you were to examine your skin cells under a microscope and compare them with your muscle cells, you’d see that their structures are very different. The various cells that make up your body all have the same basic components (membrane, organelles, and so on), but the arrangements of the elements change from one cell type to the next so that they can carry out various jobs such as digestion (intestinal cells), energy storage (fat cells), or oxygen transport to your tissues (blood cells).

Sex cells

Sex cells are specialized cells used for reproduction. Only eukaryotic organisms engage in sexual reproduction, which I cover in detail at the end of this chapter in the section “Mommy, where did I come from?” Sexual reproduction combines genetic material from two organisms and requires special preparation in the form of a reduction in the amount of genetic material allocated to sex cells — a process called meiosis (see “Meiosis: Making Cells for Reproduction” later in the chapter for an explanation). In humans, the two types of sex cells are eggs and sperm.