Section Summary

All cells share four common characteristics: all cells are enclosed within a plasma membrane, contain cytoplasm, have genetic material, and have ribosomes.

Prokaryotes are predominantly single-celled organisms classified in the domains Bacteria and Archaea. All prokaryotes have plasma membranes, cytoplasm, ribosomes, a cell wall, genetic material, and lack membrane-bound organelles. Prokaryotic cells range in diameter from 0.1-5.0 µm.

Like a prokaryotic cell, a eukaryotic cell has a plasma membrane, cytoplasm, and ribosomes. Eukaryotic cells are typically much larger than prokaryotic cells (10-100µm) and have a true nucleus and other membrane-bound organelles that allow for compartmentalization of functions.

Exercises

1. Which of these do all prokaryotes and eukaryotes share?
    a. nucleus
    b. cell capsule
    c. membrane-bound organelles
    d. plasma membrane

2. A typical prokaryotic cell _____ compared to a eukaryotic cell.
    a. is smaller in size
    b. is similar in size
    c. is larger in size
    d. can be smaller or larger in size

3. Describe the structures that are characteristic of a prokaryote cell.

Answers

1. (d)
2. (a)
3. Prokaryotic cells are surrounded by a plasma membrane and have DNA, cytoplasm, and ribosomes. They have cell walls and may have a cell capsule. Prokaryotes may have flagella for motility, pili for conjugation, and fimbriae for adhesion to surfaces.

Glossary

eukaryotic cell: a cell that has a membrane-bound nucleus and several other membrane-bound compartments or sacs

nucleoid: a central region in a prokaryotic cell where DNA is found

organelle: a membrane-bound compartment or sac within a cell

prokaryotic cell: a unicellular organism that lacks a nucleus or any other membrane-bound organelle

4.3 Eukaryotic Cell Components

Learning objectives

By the end of this section, you will be able to:

- *Describe the components of eukaryotic cells*
- *State the role of the plasma membrane*
- *Know the parts that make up the cytoplasm*
- *Describe the different protein fibers that make up the cytoskeleton*
- *Know the roles that flagella, cilia, and centrosomes*
- *Be able to define and explain all bolded terms*

Eukaryotic cells have a more complex structure than prokaryotic cells. In eukaryotic cells, membrane-bound organelles allow different functions to be compartmentalized in different areas of the cell. Before looking at cell organelles, let's first examine three essential components of the cell: the plasma membrane, cytoplasm, and the cytoskeleton.

The Plasma Membrane

Like prokaryotes, eukaryotic cells have a plasma membrane (Figure 4.12) made up of a phospholipid bilayer with embedded proteins. The plasma membrane separates the internal contents of the cell from its surrounding environment. Because of its chemical makeup, the plasma membrane allows the passage of some substances into and out of the cell while restricting the movement of others. It is important because it helps the cell maintain stable internal conditions. We will look more closely at the plasma membrane in section 5.1.

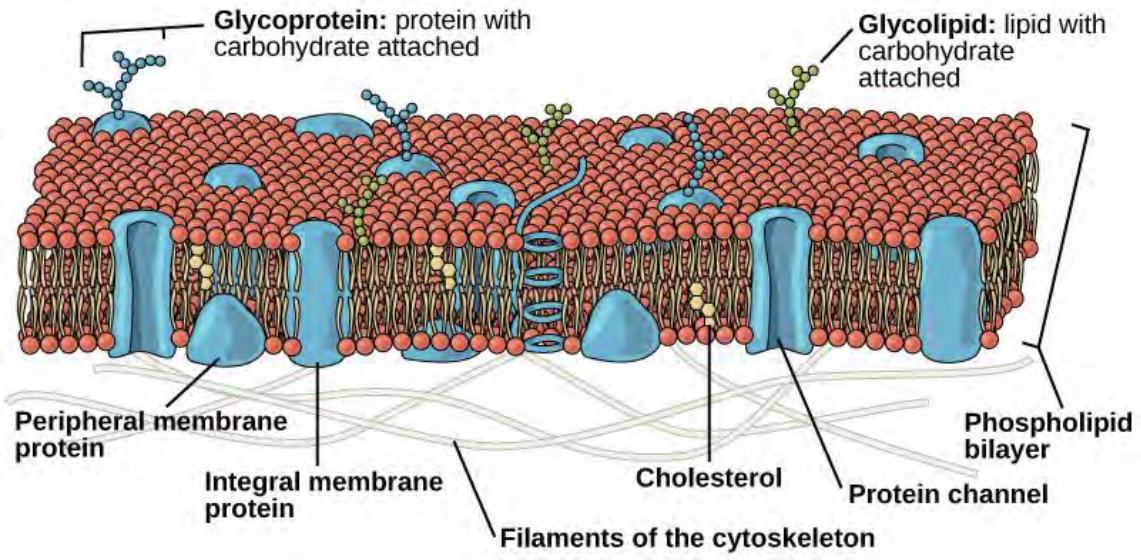

Figure 4.12 The plasma membrane is a phospholipid bilayer with embedded proteins. There are other components, such as cholesterol and carbohydrates, which can be found in the membrane in addition to phospholipids and protein. (credit: Clark et al. / Biology 2E OpenStax)

The Cytoplasm

The **cytoplasm** is made up of two parts: the cytosol and the cytoskeleton. The **cytosol** is a water-based gel-like substance that contains organelles, the cytoskeleton, and various chemicals. Glucose and other simple sugars, polysaccharides, amino acids, nucleic acids, fatty acids, and derivatives of glycerol are all found in the cytosol. Ions of sodium, potassium, calcium, and many other elements are also found here. Many metabolic reactions, including protein synthesis, take place in the cytosol.

The Cytoskeleton

Within the cytoplasm, a network of protein fibers called the **cytoskeleton** helps the cell maintain its shape, secures individual organelles in specific positions, and allows vesicles to move within the cell. Some cells, such as those that line the respiratory tract, also have cytoskeleton proteins that extend outside the cell into the external environment and can be used for motility. The cytoskeleton also enables unicellular organisms, such as the amoeba, to move independently. There are three types of fibers within the cytoskeleton: microfilaments, intermediate filaments, and microtubules (Figure 4.13).

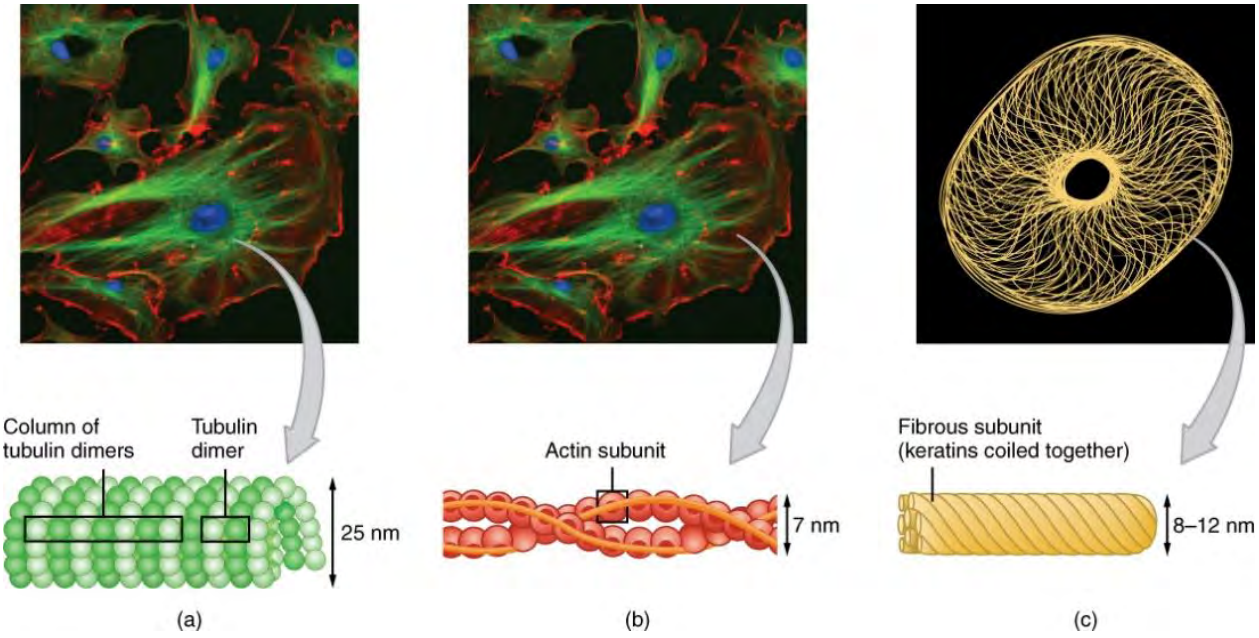

Figure 4.13 The cytoskeleton consists of (a) microtubules, (b) microfilaments, and (c) intermediate filaments. (credit: Betts et al. / Anatomy and Physiology OpenStax)