

SCIENCE 1004

Cells

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II. CELL DESIGN

As you observed onion cells and cheek cells, you may have wondered what causes these tiny living machines to perform the task for which they were created. Cells have many different parts. We will learn those parts and later learn more about their specific functions. We will look first at animal cells then at the

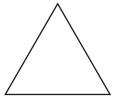
differences between animal cells and plant cells.

Think of a car: each part has its own function. The same is true of the cell. Each part is dependent on the others to perform as God made them.

SECTION OBJECTIVES

Read these objectives. When you have completed this section, you should be able:

3. To identify the parts of the cell.
4. To describe the function of cell parts.
5. To contrast the structure of a plant cell with an animal cell.



VOCABULARY

Study these words to enhance your learning success in this section.

| | | | |
|-------------|-----------------------|--------------|----------------|
| bilayer | chloroplast | glucose | organelle |
| biochemical | chromosome | glycogen | phospholipid |
| cell cement | cleavage furrow | Golgi bodies | photosynthesis |
| cell plate | cytokinesis | lysosome | plastid |
| cellulose | endoplasmic reticulum | mitochondria | polar |
| centriole | enzyme | nonpolar | protein |
| chlorophyll | gene | nucleic acid | spindle |

PLASMA MEMBRANE

The outer covering of an animal cell is called the plasma membrane. It controls what

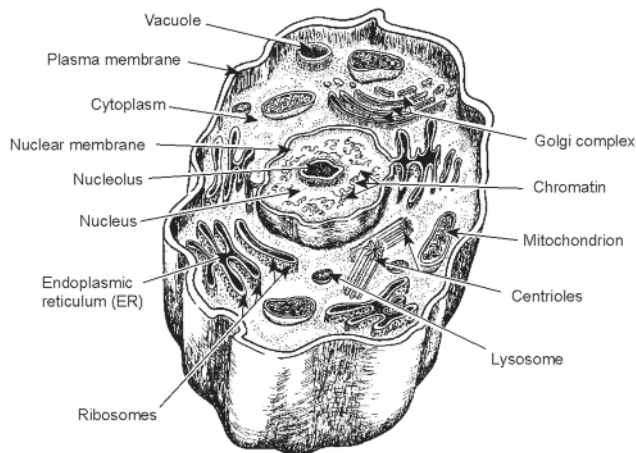


Figure 6: Animal Cell

enters and exits the cell.

Structure. The plasma membrane is made up of two types of **biochemicals**. The

first type is a **phospholipid**. Phospholipids are important in the function of the membrane. One end of a phospholipid molecule has a charge, and is called the **polar** end. The other end of the molecule is branched, has no charge, and is called the **nonpolar** end. You can think of this phospholipid molecule as a “slipper” or old-fashioned clothespin. We can represent this molecule with the following diagram.



The second type of molecule in the plasma membrane is a **protein**, which has the same basic chemical structure as hair or skin. The

plasma membrane has a **bilayer** of phospholipid molecules with the nonpolar ends facing inward. The protein molecules are dispersed throughout the membrane between the phos-

pholipids. One of their functions is to act as “channels” through which substances can enter and exit the cell. Section III mentions more about these “carrier” proteins.

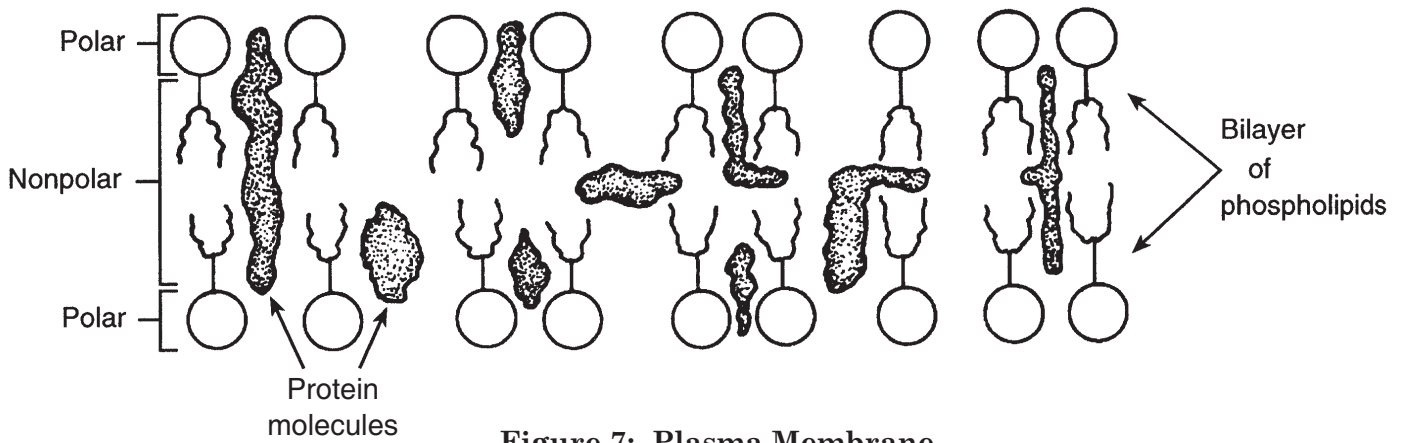


Figure 7: Plasma Membrane



Complete these activities.

2.1 Read Romans 12:4-8 and 1 Corinthians 12:5-12. Make an analogy (comparison) between the body of Christ and the parts of the cell, similar to the car analogy made in the introduction to this section. _____

2.2 Describe the structure of the phospholipid molecule. _____

2.3 Describe the structure of the plasma membrane. _____

ORGANELLES

Inside the plasma membrane lies the cytoplasm, the watery cell fluid that acts as a medium of transport for substances in the cell.

Just as your body has various organs (e.g., heart, lungs, kidneys) which work together to

perform specific functions, so the cell has tiny structures within itself called **organelles**. The organelles and the cell nucleus exist in the watery medium of the cytoplasm.

Each type of organelle performs a unique function, but all work together for the good of

the cell—just as the organs work together for the good of your whole body. Refer often to Figure 6 as you learn the parts of the cell and their functions.

Mitochondria. The organelles which supply the cell with most of its energy are the **mitochondria**. They are the “in-house powerplants” for all the activity that takes place within a cell. Cells that require a lot of energy have a lot of mitochondria in them. Cells in

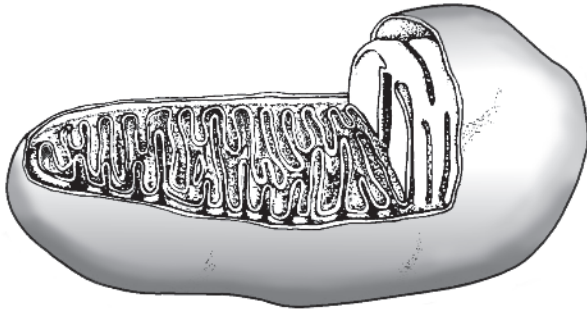


Figure 8: Mitochondrion

the liver, where much body chemistry is done, may contain up to 2500 mitochondria. A *mitochondrion* (singular form) uses oxygen to perform the final step in breaking down **glucose** into CO_2 and water. By breaking the glucose apart, energy is released. We will study the flow of that energy in the next section.

When we look inside a mitochondrion, we see that the inner membrane has many folds in it (see Figure 8). What are these for? The more folds in the membrane, the greater amount of surface area it has. It is on this surface that the chemical reactions take place to provide the cell with energy. More folds mean a higher capacity for energy production.

Vacuoles. Although there are several other types of vacuoles, we are interested only in the *food* vacuole right now. The glucose that the cells use for energy is stored in food vacuoles in the form of **glycogen**. Food vacuoles are the “supply depots” for the mitochondrial powerhouses.

Lysosomes. These organelles are small sacs of digestive **enzymes** that roam the cell. They are sometimes called “suicide cells” because if they release their enzyme in the cytoplasm, it will digest the cell. (This is

thought to be what happens when a developing frog loses its tadpole tail.) The materials that are digested are then free for use by other parts of the body. God has built into the cell the ability to control its organelles for the good of the whole organism.

These enzymes are used specifically, however, in the preparation of glucose for the cell. When glucose is needed, the **lysosomes** pour their enzymes into a vacuole filled with glycogen. The glycogen is “digested” into glucose, ready to be broken down for energy.

Endoplasmic reticulum. Notice the meaning of this big name. *Endoplasmic* refers to “within the cell’s cytoplasm,” while *reticulum* is a word that means “network.” The **endoplasmic reticulum** appears in a cross-section of the cell as highly folded and interconnected sacs of membrane (like a network). It is a complex highway system for molecules produced by the nucleus. Beyond that, different portions of the endoplasmic reticulum appear to have distinctive functions.

Tiny structures called *ribosomes* can be seen on parts of the endoplasmic reticulum. These ribosomes are involved in the production of proteins. The part of the endoplasmic reticulum that contains ribosomes is called the *rough* endoplasmic reticulum, and the part without ribosomes is the *smooth* endoplasmic reticulum.

Special extensions of the endoplasmic reticulum are the bundles of flattened sacs called the **Golgi bodies**. They are the “packaging department” for molecules the cell nucleus has directed to be produced.

Centrioles and cell division. Each cell has a pair of **centrioles** that function during cell division. Just before a cell division, the pair of centrioles split to form a second pair. One pair migrates to each end of the cell, and gradually, a threadlike structure called the **spindle** forms. Then the **chromosomes** split, and each half of a chromosome will move along a spindle toward opposite ends of the cell. At the same time, **cytokinesis**, the splitting of the cytoplasm into two distinct cells, occurs and a **cleavage furrow** forms. This process is known as *mitosis*, and will be discussed in more detail in LightUnit 1007.

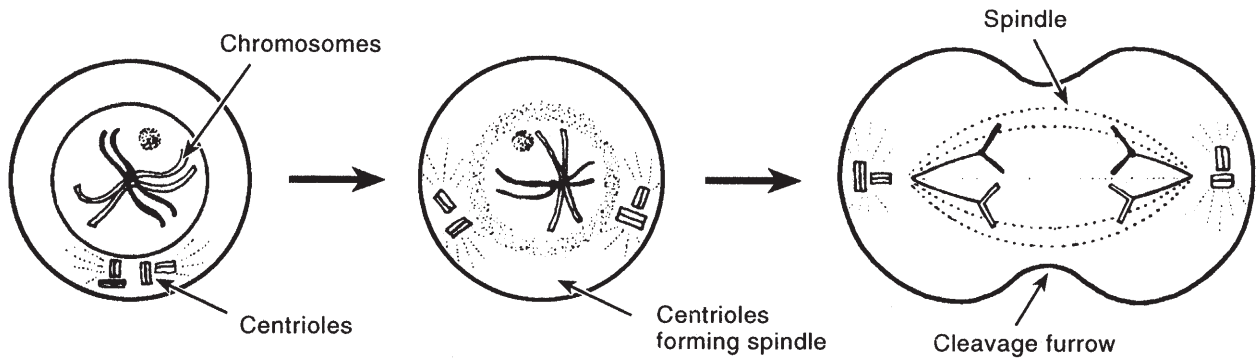


Figure 9: Animal Cell Division



List five organelles described in this section and explain their function.

| | Organelle | Function |
|-----|------------------|-----------------|
| 2.4 | a. _____ | b. _____ |
| 2.5 | a. _____ | b. _____ |
| 2.6 | a. _____ | b. _____ |
| 2.7 | a. _____ | b. _____ |
| 2.8 | a. _____ | b. _____ |



Answer these questions with complete sentences.

- 2.9 What is glucose and why is it important to the cell? _____

- 2.10 In what form is glucose stored in animal cells? _____

- 2.11 In a mitochondrion, how are the number of folds related to its energy production?

- 2.12 What is the function of the ribosomes? _____

- 2.13 What purpose do the Golgi bodies fill? _____

- 2.14 What is the role of the centriole during cell division? _____

