Plant and Animal Cell Coloring Assignment

The Plant Cell

The tissues of all organisms are composed of cells, and it is within cells that the metabolic functions of living things take place. Most cells are microscopic, but some, such as the frog egg cell, can be seen with the naked eye.

In this plate, we examine the features of a plant cell. Wherever possible, you should compare the plant cell to the animal cell discussed in the first plate of this chapter.

Looking over the plate, notice that we are showing a cross section of a typical plant cell. Just for our study, we have combined the features of most plant cells in this hypothetical one. As you read about the parts of the cell, color them in the plate.

We will begin our study of the plant cell at its surface with the **cell wall (A)**. This structure protects and supports the plant cell and renders it somewhat rigid. The polysaccharide cellulose is the main component of the plant cell wall.

Inside the cell wall is the flexible **cell membrane (B)**, also known as the plasma membrane. The cell membrane regulates the movement of materials into and out of the cell, and allows for communication between cells. Phospholipids and proteins make up this membrane.

The main component of the interior of the cell is the **cytoplasm (C)**, or cytosol. You should use a light color for this liquid mass, which is the site of many metabolic activities. Three types of protein fibers compose a **cytoskeleton (D)** within the cytoplasm, which provides a framework for many cellular activities.

We have examined the outer surface and the main body of the cell, and we will now focus on the cell organelles. Spots of darker colors are recommended for smaller organelles, and light colors for the larger ones. Continue your coloring as you read the paragraphs below.

Located within the cytoplasm are ultramicroscopic bodies called **ribosomes (E)**, which should be indicated with spots of black. These are the "workbenches" of the cell; they are the sites of protein synthesis.

Ribosomes are commonly located along infoldings of the cell membrane called the ER, or **endoplasmic reticulum (F)**, which forms an internal network within the cytoplasm. Membrane components and lipids are synthesized at the ER. When ribosomes are located along the ER, it is referred to as **rough ER (F_1)**, and if there are no associated ribosomes, it is **smooth ER (F_2)**. The arrows that point to the two types should be colored dark colors.

The centers of energy metabolism in the plant cell are the **mitochondria (G)**. Along the inner membranes of these organelles, the energy from carbohydrates is released and used to produce ATP molecules.

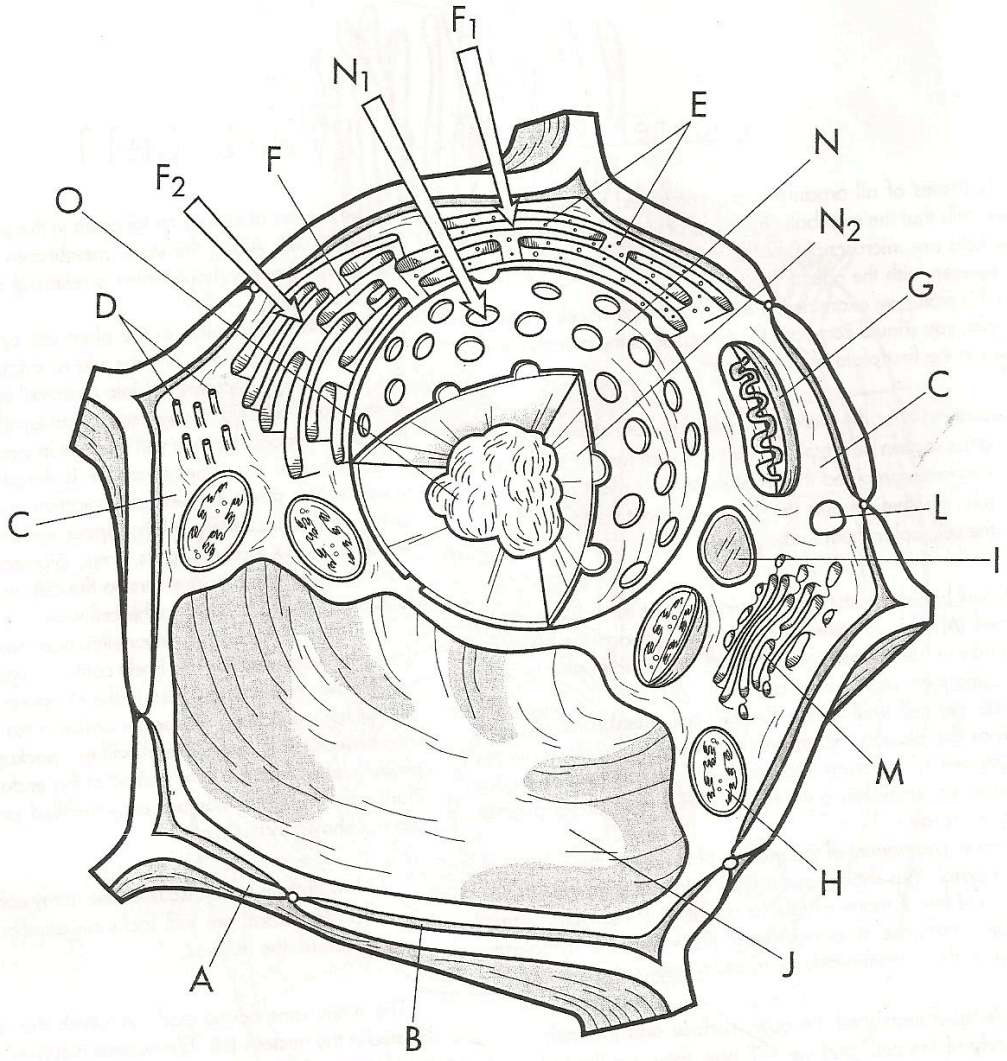
Other key organelles in the plant cell cytoplasm are **chloroplasts (H)**. Chloroplasts are the site of photosynthesis, in which the sun's energy is converted into chemical energy in the form of glucose and other carbohydrates. Photosynthesis is an essential metabolic process that we will explore in depth in future plates.

Still another important organelle is the **plastid (I)**, which is a structure that stores nutrients and pigment molecules. The center of the plant cell contains a large space known as the **vacuole (J)**, which contains water, sugars, ions, pigments, and other substances. It also applies pressure to the cell membrane, causing it to expand and stick close to the cell wall.

Two other cytoplasmic organelles also deserve attention; the first is the **lysosome (L)**. This body contains digestive enzymes that break down compounds. Also in the cytoplasm is the **Golgi body (M)**, which is made up of a series of about ten to twenty flattened membranes. This organelle modifies, packages, and secretes proteins after they are synthesized at the endoplasmic reticulum. Plant cells may also contain enzyme-filled peroxisomes, which are not shown in this plate.

Now that we have discussed the many components of the cytoplasm, we will focus on another prominent structure, the nucleus.

The membrane-bound body in which the chromosomes are located is the **nucleus (N)**. The nucleus is surrounded by a nuclear membrane, which is characterized by shallow depressions called **nuclear pores (N_1)**. RNA passes out of the nucleus through these pores and travels to ribosomes for translation. Proteins and nucleotides also pass into the nucleus through these pores. The fluid substance inside the nucleus is called **nucleoplasm (N_2)**. The final structure we will look at is the **nucleolus (O)**. This is a body of RNA, and is also the area in which RNA is synthesized.



The Plant Cell

- ○ Cell Wall.....A
- ○ Cell Membrane .....B
- ○ Cytoplasm.....C
- ○ Cytoskeleton .....D
- ○ Ribosomes.....E
- ○ Endoplasmic Reticulum.....F
- ○ Rough ER.....F_1
- ○ Smooth ER .....F_2
- ○ Mitochondrion.....G
- ○ Chloroplast.....H
- ○ Plastid.....I
- ○ Vacuole.....J
- ○ Lysosome L
- ○ Golgi Body .....M
- ○ Nucleus.....N
- ○ Nuclear Pore.....N_1
- ○ Nucleoplasm .....N_2
- ○ Nucleolus.....O

Chapter 2-1: The Animal Cell

The basic unit of all living systems is the cell. In this plate, we will describe some of the features of animal cells. We will study the plant cell in the next plate.

This plate consists of a diagram of a section of an animal cell. Under a light microscope, the animal cell seems relatively simple, but the electron microscope reveals a wealth of structures that contribute to its activities. As you read about the structures in the following paragraphs, color them in the plate. Light colors are recommended, because the structures are small.

It is impossible to locate a typical animal cell in nature because none exists; here we present a composite cell.

The cell is enclosed by a **cell (plasma) membrane (A)**, which is composed of phospholipids and proteins. Various biochemical mechanisms permit small nutrients to pass through the membrane to the cell's interior, and will be discussed in a future plate.

Within the cell membrane is the cytosol, which is also known as the **cytoplasm (B)**. This fluid portion of the cell suspends organelles, and enzymes and other proteins are produced within the cytosol.

The cytosol contains an internal protein framework called the **cytoskeleton (C)**. Tracing the fibers with a dark color will help highlight their presence. Microfilaments within the cytoskeleton provide the mechanism for contraction in muscle cells, and other cytoskeleton fibers called microtubules participate in cell reproduction.

Extending out from the cell membrane are projections called **microvilli (D)**. These fingerlike projections are found in cells of the digestive tract, where absorption takes place. Longer hairlike extensions called **cilia (E)** are found on cells of the respiratory tract, where they trap dust particles in mucus in order to prevent them from entering the lungs.

We now move to some of the submicroscopic structures within the cell, and relate them to cell functions. Continue your coloring as above. Light colors are recommended to keep you from obscuring the details in the plate.

The first internal cell structure we will study is the **centrosome (F)**. The centrosome contains two bodies called **centrioles (F_1)**. As the plate indicates, centrioles are situated at right angles to one another and are composed of microtubules; they are involved in mitosis.

Ribosomes (G) are seen at numerous locations within the cell. These ultramicroscopic bodies are the "workbenches" of the cells; they are the sites of protein synthesis from amino acid subunits. Ribosomes are especially numerous in cells that synthesize proteins, such as pancreatic cells, muscle cells, and epidermal cells.

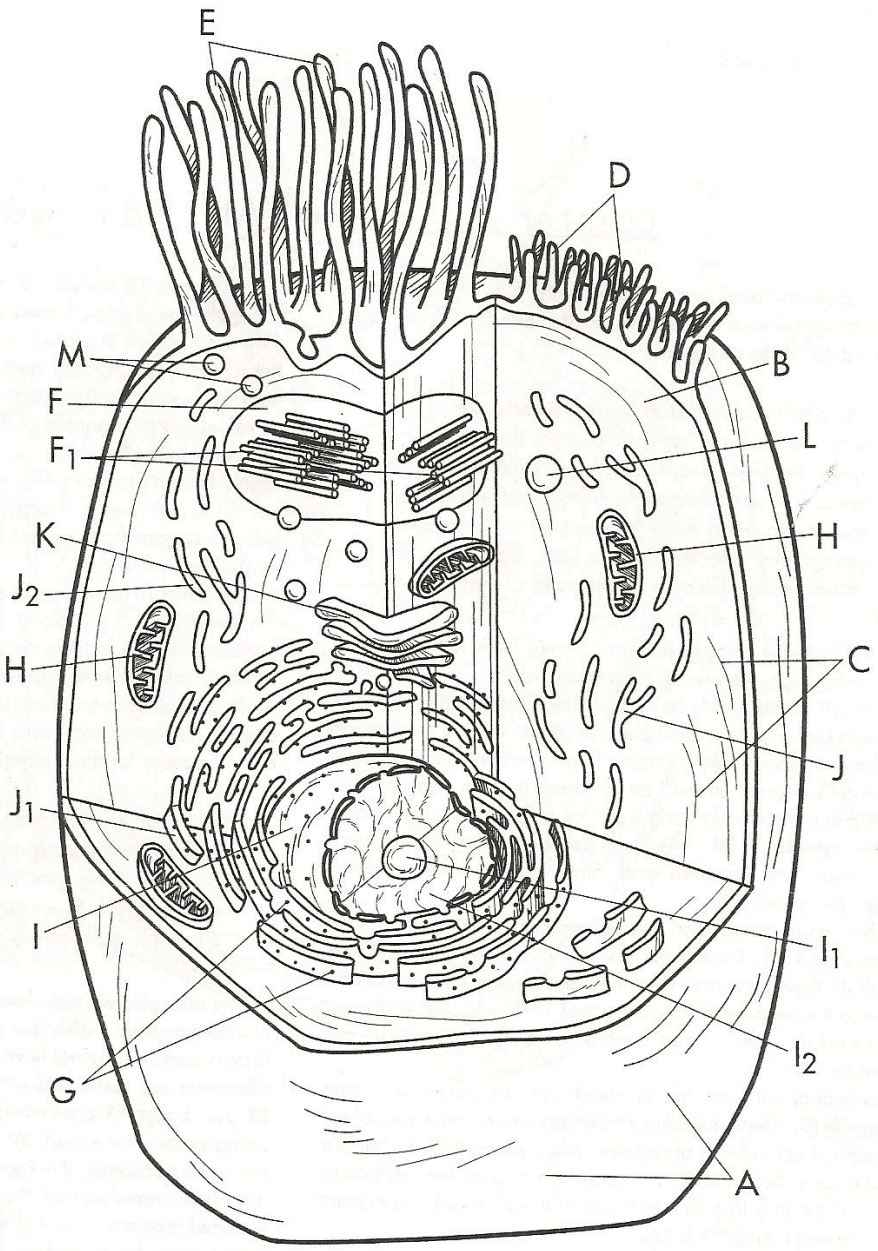
An important organelle of the cytoplasm is the **mitochondrion (H)**. The mitochondrion is a double-membrane enclosed organelle that produces ATP, which is the energy currency of the cell. Cells that require a large amount of energy such as muscle cells and sperm cells contain many mitochondria, while fewer exist in less active cells.

The center of genetic activity in the cell is the **nucleus (I)**. With the exception of red blood cells and gametes (sex cells), all human cells have forty-six chromosomes in their nucleus. A body of RNA called the **nucleolus (I_1)** is suspended in the fluid-like **nucleoplasm (I_2)** in the nucleus. The genes within the nucleus are specific nucleotide sequences of DNA that contain the biochemical instructions for the synthesis of particular proteins.

We complete the plate by examining the last few cellular structures important to the activity of the cells. Some of these structures are involved in protein synthesis. Continue using light colors, since these structures are relatively small.

The **endoplasmic reticulum (J)**, also called the ER, is a system of interconnected membrane channels in the cytosol. These membranes may or may not have ribosomes associated with them. If ribosomes are associated with the ER, it is referred to as **rough ER (J_1)**. Rough ER predominates in cells that are actively synthesizing protein for export. Where the endoplasmic reticulum has few or no ribosomes, it is known as **smooth ER (J_2)**. After proteins have been manufactured, they are generally stored in a series of flattened membranes called the **Golgi body (K)**. The Golgi body sorts and packages proteins for secretion from the cell.

The cell stores digestive enzymes in organelles known as **lysosomes (L)**. Enzymes in lysosomes help break down organic molecules into components that are useful to the cell in protein synthesis and energy metabolism. Enzymes are also stored in **peroxisomes (M)**. This is the site in which toxic compounds are neutralized. For this reason, peroxisomes are abundant in liver cells where they participate in the breakdown of alcohol, among other toxins.



The Animal Cell

○ Cell Membrane.....A	○ Centrioles.....F_1	○ Endoplasmic Reticulum..J
○ Cytosol (Cytoplasm)....B	○ Ribosomes.....G	○ Rough ER.....J_1
○ Cytoskeleton C	○ Mitochondrion.....H	○ Smooth ER .....J_2
○ Microvilli .....D	○ Nucleus.....I	○ Golgi Body .....K
○ Cilia.....E	○ Nucleolus .....I_1	○ Lysosome L
○ Centrosome .....F	○ Nucleoplasm .....I_2	○ Peroxisome .....M