MP3 Tutor Topic: Cell Organelles

Time: 9:00

Vocabulary: plasma membrane, nucleus, nuclear membrane, endomembrane system, endoplasmic reticulum, ribosome, Golgi apparatus, lysosome, mitochondrion, cytoskeleton, cell wall, central vacuole, chloroplast

Hey there. This is Eric Simon and welcome to another MP3 Tutor session for tough terms. In today's tutorial, I'll walk you through many of the parts that make up animal and plant cells. If you have a pen and paper handy, you may want to make a table to keep track of everything. Draw a table with two columns. The first column will be the name of each cell part and the second column will be the cell part's function. But don't worry if you don't have any paper handy; you'll still be able to follow along. Ready to get started?

Cells are the fundamental units of life, the smallest biological units that display all of life's characteristics. Despite their small size, animal and plant cells have a diverse array of organelles (or mini-organs) specialized for the tasks necessary to help cells survive and function. First, let's focus on organelles that are common between animal and plant cells, and then we'll cover a few additional organelles found only in plant cells.

Let's start at the outside of a cell. All cells separate themselves from the external environment by a plasma membrane. A **plasma membrane** is a thin, double-layered wall that regulates the traffic of molecules into and out of the cell. You can think of a plasma membrane as similar to the walls of your house. The walls have windows and doors that can be opened to allow things in and out of the house. These windows and doors can be regulated—in other words, you can decide which windows and doors to open, and when to open them. Similarly, a plasma membrane has channels, comprised of proteins, which regulate the passage of specific molecules into and out of the cell. This creates a semi-permeable membrane between the inside, the cytoplasm, and the outside, the environment. The term "semi-permeable" refers to the fact that some substances can pass through the membrane while others cannot.

Inside animal and plant cells, one of the most prominent organelles is the nucleus. The **nucleus**

contains the DNA, the genetic information that controls the activity of the cell. You can think of the nucleus as the "brain" of the cell. The nucleus is surrounded by a membrane called the **nuclear envelope**. Like the plasma membrane, it functions to regulate the traffic of molecules. In this case, the nuclear envelope controls the flow of molecules between the nucleus and the rest of the cell.

Many materials leaving the nucleus are sent through the endomembrane system. The **endomembrane system** is a network of organelles that make and distribute cellular products. These organelles include the endoplasmic reticulum, the Golgi apparatus, and lysosomes. Let's look at the specific function of each of these organelles.

The **endoplasmic reticulum**, also called the "ER" for short, is the main manufacturing center of the cell. There are two kinds of ER in a cell: rough ER and smooth ER. Rough ER contains ribosomes on its outer surface, which give it a "rough" appearance under the microscope. **Ribosomes** are the organelles responsible for making proteins. If the endoplasmic reticulum is the "factory" of the cell, then ribosomes are the individual machines that manufacture items. Smooth ER is so named because it lacks ribosomes. Its main function is the construction of lipids.

Items manufactured in the ER often go next to the Golgi apparatus. The **Golgi apparatus** is a refining and packaging center. In this organelle, proteins are modified, tagged, and sent to the appropriate areas of the cell. In many ways, the Golgi apparatus is like the "post office" of the cell, addressing proteins and then directing them to the correct location.

The last organelle that we'll discuss from the endomembrane system is the lysosome. A **lysosome** is a membrane-enclosed sac of digestive enzymes. Its main function is to break down substances such as waste products or old organelles. The resulting molecules are often recycled and then used to make new compounds elsewhere in the cell. You can think of lysosomes as the "garbage disposals" of the cell.

OK, let's move on and address two more organelles that are found in both animal and plant cells.

Mitochondria are the main energy-producing organelles in cells. They are the primary site for cellular respiration, where energy from sugars and other food molecules is converted into ATP. ATP is a small molecule which cells can use to fuel most forms of work. Cells that use a lot of energy, such as those in our brain and muscles, have many mitochondria, which produce a lot of ATP.

The last organelle we'll discuss that is common to both animal and plant cells is the cytoskeleton. The **cytoskeleton** is the support structure of a cell. As the name implies, you can think of the cytoskeleton as the skeleton or framework of the cell. It provides shape and a place to attach all of the other organelles so that they don't just float freely around the cell. The cytoskeleton is also used as a "highway system," with special proteins designed to ferry molecules along the cytoskeleton, like trucks on a road.

Let's pause here and recap what we've discussed so far. If you're making a table, follow along and be sure that you have properly identified the function of each organelle. All cells separate themselves from the external environment with a semi-permeable plasma membrane, which regulates the flow of molecules in and out of the cell. Inside the cell, the nucleus contains the genetic information that directs the cell's activity. Extending from the nuclear envelope around the nucleus is the endoplasmic reticulum, also called the ER, which is the main manufacturing site for the cell. Rough ER contains ribosomes, which make proteins. The Golgi apparatus modifies and packages items. And lysosomes are membrane-bound sacs that digest and recycle waste products. Mitochondria produce ATP. Last, the cytoskeleton provides a framework for the cell.

All of the organelles we've discussed so far are found in both plants and animals. Now let's discuss three other organelles found only in plant cells: the cell wall, the central vacuole, and chloroplasts.

A **cell wall** is a rigid protective layer outside the plasma membrane. In plants, the cell wall is composed of a substance called cellulose. Have you ever peeled a string off a stalk of celery? That string is made up largely of cellulose from cell walls.

Inside plant cells, the central vacuole is often the largest organelle. The **central vacuole** is a membrane-bound sac that functions as a storage center and helps to regulate the amount of water inside the cell.

The third organelle unique to plants is the **chloroplast**, which is an energy-producing organelle found only in plant cells. What energy-producing organelle have we already discussed? Right, the mitochondria. Mitochondria are specialized for creating ATP from sugars. Chloroplasts, on the other hand, are specialized for using the energy in sunlight to make sugars. Do you see a connection here? Chloroplasts use light energy to make sugar and mitochondria use sugars to make ATP. Plant cells have both chloroplasts and mitochondria: chloroplasts to make sugars from sunlight and mitochondria that make ATP from these sugars. However, animal cells only have mitochondria, which means that they cannot make their own sugars. Thus, animals must eat plants or other animals to get sugars, which they can then use in mitochondria to make ATP.

How's that table look now? Let's review what we've learned about plant cells. Plant cells have a cell wall that provides rigid support, a central vacuole for storage and water regulation, and chloroplasts to create chemical energy from light energy.

I hope this tutor session helped you learn the organelles in both animal and plant cells. If you need more help, you can try listening to this tutorial again, or consult your textbook or lecture notes. Good luck with your studying, and keep that organelle table handy!