**The Cell: the basic unit of life**

All living things are made of tiny little units called cells. These cells are the smallest things which can carry out processes to sustain life. There are many different kinds of cells and they differ greatly from each other. Some cells can survive on their own and some need to be with other cells to all survive.

**Animal Cells**

While all cells are different and have different parts, most animal cells have similar features. They all have a cell membrane, membrane-bound organelles, ribosomes, a nucleus and a few more pieces. We will look at each of these pieces of a complete cell and discuss their function independently.

All cells have a cell membrane which goes covers the entire cell. This protects the cell from losing all of the pieces inside it. It also prevents all of the unwanted things outside the cell from coming inside. The membrane however does let some things pass through to the inside, and it has a special ability to select which things it wants to let in and which things it does not. This is called selective permeability, where permeability just means that it lets things pass through it and selective means that it can choose what passes through the membrane. Inside the cell membrane is a fluid called the cytoplasm. This cytoplasm is a jelly like material which fills the cell and everything else floats around in. These pieces that float around inside the cell are called organelles. They all have their own little membranes similar to the cell membrane, so they are called membrane-bound organelles.

One of the biggest and most recognizable pieces floating around in the cytoplasm is the nucleus. The nucleus is where all of the genetic material is housed in the cell. It is made up of a few different parts: the nuclear envelope, nuclear pores, and the nucleolus. The nuclear envelope is similar to the cell membrane in that it is a barrier which protects the genetic material, DNA, inside of it. The nuclear envelope has little holes in it called pores. These pores are let other pieces of the cell in and out of the nucleus. The heart of the nucleus is called the nucleolus. This is where all of the DNA is found in the cell. It is in a super tightly wound structure called a chromosome. The chromosomes are all coiled up and packed closely together in the nucleolus.

All around the nucleus is a structure called the endoplasmic reticulum, ER, which is covered in ribosomes. The ER takes little pieces of genetic material which come out of the nucleus and make proteins from it. This genetic material that comes out of the nucleus is kind of like a CD with a program on it. The ER gets this CD and sends it to the ribosome. This ribosome is a small little protein which reads this CD and makes a new protein. These proteins are then sent down the endoplasmic reticulum to the Golgi bodies.

These Golgi bodies are like a packing plant. They take the proteins, which are made in the ribosomes, and package them in little pieces of membrane called vesicles. These vesicles will float through the cytoplasm all through the cell to where they are supposed to go. They could be going to the cell membrane, to the nucleus, or to outside of the cell as a secretion.

So you may be wondering where the cell gets the energy to do all of these things. The energy that supports life is made in an organelle called the mitochondria. The mitochondria are organelles with two membranes, an inner membrane and an outer membrane. The inner membrane has many folds in it to increase surface area. This is because most of the production of energy occurs on the inner membrane rather than inside of it. The metabolic functions of mitochondria will be discussed in a later chapter.

A much smaller but still important organelle is the lysosome. Lysosomes are small organelles, similar to a vesicle, filled with enzymes that degrade organic material. They degrade a variety of things like viruses, debris from the cell, and proteins as well as other molecules. Lysosomes can be thought of as the cleanup crew inside the cell. Whenever a cell is done with a molecule or a protein the lysosome will fuse with the molecule and degrade it. The leftover waste will be excreted from the cell.

Some organelles are only used at special times like cell replication (mitosis). One such organelle is the centrosome. The centrosome is made up of two structures called centrioles. The centrosome is mostly dormant when the cell is not replicating. However, when the cell is replicating, the centrosome beaks down into its two centrioles which help guide the chromosomes to the new cells. Cellular replication will be covered more in a later chapter.

**Plant Cells**

Plant cells are very similar to animal cells, and just like animal cells their organelles are also membrane-bound. They have many of the same organelles as the animal cells. They have all the pieces mentioned about an animal cell, but they also have a few organelles not found in animal cells. Some of these plant specific organelles are the cell wall, the central vacuole, and the chloroplast.

One of the first and most notable differences you will see in a plant cell is the cell wall surrounding the outside of the cell membrane. The cell wall is made up of small units called polysaccharides. Polysaccharides are molecules made up of many sugars linked together. Most plants have cell walls made of cellulose. The cell wall is much more rigid than a cell membrane. It functions to give the plant more strength and structural integrity. Plants with stems will have much thicker cell walls to support the top heavy flowers or leaves on them.

Another major difference between plant cells and animal cells is the central vacuole. While some animal cells may have a few very small vacuoles to contain food or other substances, most plant cells have a central vacuole which is made from many little vacuoles fusing together to make one big, central, vacuole. Usually the central vacuole is used to store excess food produced by the plant cell by photosynthesis.

Photosynthesis occurs in a structure not found predominantly in plant cells called the chloroplast. While a few bacteria have been found to contain photosynthetic systems, chloroplasts are nearly exclusive to plant cells. These chloroplasts are filled with a liquid called stroma. Floating around in the stroma are little structures called thylakoids which are stacked together to form grana. The thylakoids have two have their own membranes which make them similar to the inner membrane of mitochondria. Instead of breaking down food molecules like the mitochondria, chloroplasts make food using the energy from the sun. Often times, excess food is stored in the central vacuole.

While plant cells do have these special organelles, they share many organelles with animal cells. Both types of cells have the following: a nucleus, mitochondria, lysosomes, centrosomes, Golgi bodies, ribosomes, and endoplasmic reticulum. There are not always the same number of each organelle in all of the different cell types. A liver cell may have more ribosomes, larger Golgi bodies, and more endoplasmic reticulum as it responsible for producing and secreting enzymes. A plant cell will have fewer mitochondria than a muscle cell because the muscle cell needs to produce more energy. A cactus may have a thicker cell wall than a dandelion as it has to stand up to higher temperatures and it needs to conserve water.

**Prokaryotes**

Plants and animals are both organisms with many cells. The world is a very diverse place however. Plants and animals belong to a group called eukaryotes. Eu means many and karyotes means cells, so they are made of many cells. Another group of organisms, prokaryotes, are unicellular, meaning each organism is made up of only one cell. To accommodate the challenges of each cell being its own organism, prokaryotes have slightly different characteristics than eukaryotic cells.

One of the first things to note about prokaryotes is that they do not have membrane-bound organelles. This means that everything is floating around in the cytoplasm of the cell. This also means that there are no mitochondria, no chloroplasts, no endoplasmic reticulum, no Golgi bodies and no nucleus. Prokaryotes perform many functions very differently.

Since they do not have any mitochondria, they break down food molecules in the cytoplasm rather than the mitochondria. While this process produces less energy, it is a simpler process which is easier for prokaryotes to perform. Also because they do not have to gave DNA to encode for producing the mitochondria, they can replicate and grow faster.

Another very different thing to note about prokaryotes is that they do not have a nucleus. This means that the DNA is stored in what is sometimes called the nucleoid region. The DNA is not coiled into chromosomes in prokaryotes. This means that the DNA is often in a circular shape. This makes it easier to access the DNA to make proteins.

Prokaryotes have developed mechanisms to live in many different environments. They can live floating in the ocean or around underwater volcanoes. They can live in the dirt around us or even on our skin and in our mouth. These bacteria, however, have become very specialized and often can only live in the environment they have specialized for.

**Summary**

There are two different kinds of cells: prokaryotes and eukaryotes. Prokaryotes do not have membrane-bound organelles like a nucleus, mitochondria, or chloroplasts. Eukaryotes have membrane-bound organelles like a nucleus and mitochondria. Eukaryotes can be divided into plant cells and animal cells. Animal cells have a nucleus, which is where the DNA is stored in chromosomes, mitochondria, to produce energy, and ribosomes to synthesize proteins. Plant cells have all of these and a few other things like a cell wall, to help the cell be stronger and better maintain its shape, a central vacuole, for food storage, and chloroplasts, to synthesize food using energy from the sun.

Reference:

Wikipedia.org