Cell Structure & Function

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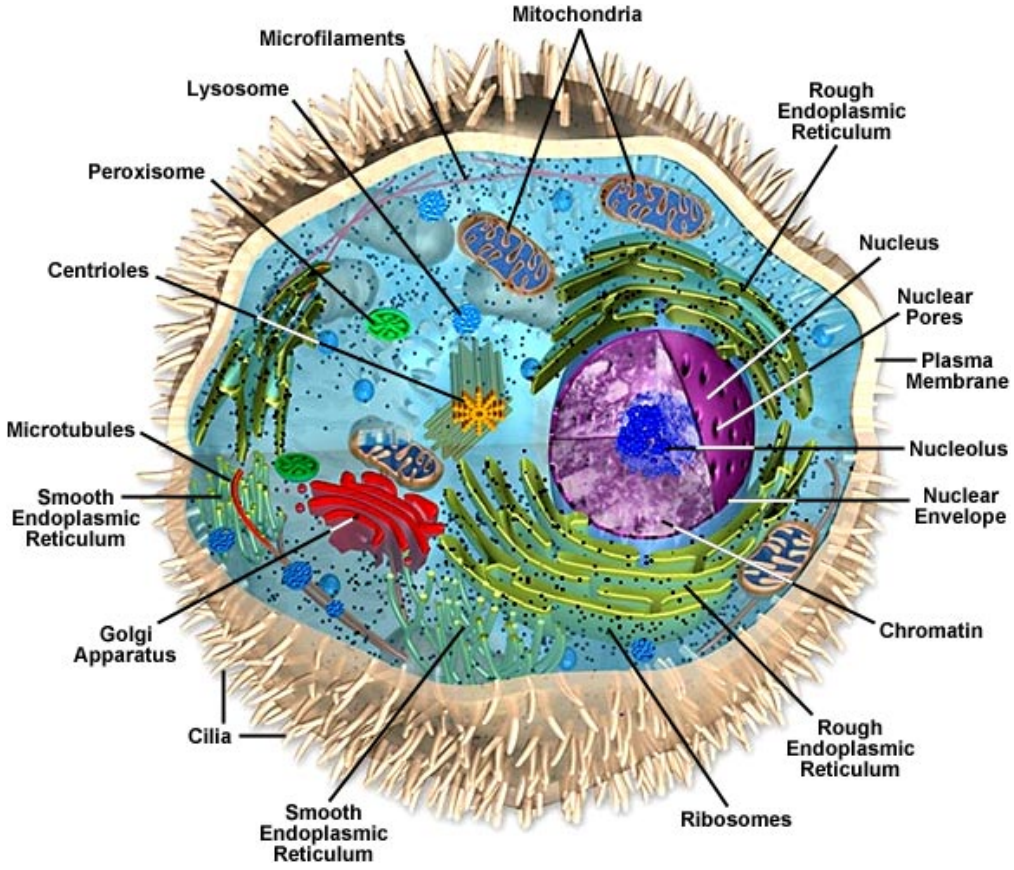

INTRODUCTION:

The cell is one of the most basic units of life. There are millions of different types of cells. There are cells that are organisms onto themselves, such as microscopic amoeba and bacteria cells. And there are cells that only function when part of a larger organism, such as the cells that make up your body. The cell is the smallest unit of life in our bodies. In the body, there are brain cells, skin cells, liver cells, stomach cells, and the list goes on. All of these cells have unique functions and features.

HYPOTHESIS:

I hypothesize that the different parts of one type of cell (Prokaryote) are the cell wall which is what keeps the cell intact and helps it protect itself. The cytoplasm the internal fluid of the cell which is where the basic needs of the cell take place, like cell expansion, growth and replication. The Nucleoid region is the part of the cell that contains the DNA molecule. The cell capsule which is a layer that lies outside the cell wall. The Plasma Membrane separates a cell's interior from its surroundings and controls what moves in and out. The Ribosome which float freely about the cytoplasm, they build proteins from a set of genetic instructions. I do know from an episode of Nova that scientists have mastered changing those genetic instructions in flowers and changed their color, and they soon if not already can do that with humans, with diseases that can be fixed that way. Another part of the cell is the Bacterial Flagellum, this are long hollow tubes that help prepell the cell foward much like a squid uses it's tentacles.

PURPOSE: To better understand the different parts of the cell and how the structure of these parts relates to the function each part performs.

MATERIALS & EQUIPMENT:

- ❑ *Computers with Internet access*
- ❑ *Other reference materials*
- ❑ *Modeling clay*
- ❑ *Plastic Ziploc bags*
- ❑ *Yarn or string*
- ❑ *Buttons*
- ❑ *Paper clips*
- ❑ *Aluminum foil*
- ❑ *Beads*
- ❑ *Pasta*
- ❑ *Miscellaneous craft supplies*

PROCEDURE:

1. *Use the Internet and/or any other reference materials available in the classroom to search out information on the following cellular structures: cell wall, cell membrane, lysosome, ribosome, endoplasmic reticulum, nucleus, centriole, cytoplasm, mitochondrion, vacuole, Golgi apparatus. Find out the following information for each structure: what they look like; roughly how big they are relative to the cell itself; what types of cells they are found in; and what they do. Record your findings in a data table. Try the web sites below for starters:*

   http://www.tvdsb.on.ca/westmin/science/sbi3a1/Cells/cells.htm
   http://www.cellsalive.com/cells/3dcell.htm
   http://www.ibiblio.org/virtualcell/tour/cell/cell.htm

2. *Use the craft materials provided and the information you obtained in step one to construct a model of an animal cell.*

3. *Draw a picture of your model, labeling all of the structures.*

DATA TABLES AND OBSERVATIONS:

Cell Wall: The Cell wall is a fairly rigid layer surrounding the cell, located external to the Cell Membrane. The Cell wall provides the Cell with structural support, protection, and a filtering mechanism. It also prevents over-expansion when water enters the cell. The Cell wall is found in Plants, Bacteria, Archaea, Fungi, and Algae. Animals do not have cell walls. The Cell wall is equal to the size of the Cell, for it is the outermost layer on the cell. (Information adopted from www.Wikipedia.com accessed September 17th 1:30 PM)

Cell Membrane: Also known as the plasma membrane, the cell membrane is the second to outer most layer. It contains a wide variety of molecules and primarily proteins. "The cell membrane surrounds the Cytoplasm of a cell and, in animal cells, physically separates the intracellular components from the extra-cellular environment, thereby serving a function similar to that of skin. In Fungi, Bacteria, and plants an additional Cell Wall forms the outermost boundary, however, the cell wall plays mostly a mechanical support role rather than a role as a selective boundary. It also provides shape to the cell and to help attach to other cells to create tissues." (Quote adopted from www.Wikipedia.com accessed September 17th 1:47PM) The cell Membrane is found in both Animal and Plant Cells. The Cell Membrane is a little smaller than the circumference of the cell.

Lysosome: The lysosome's are used for the digestion of other dying cells or larger extra-cellular material. Other functions include digesting foreign bacteria (or other forms of waste) that invade a cell and helping repair damage to the plasma membrane by serving as a membrane patch, sealing the wound. They are found in both Animal and Plant Cells. They are small spherical objects around 100th of a Cell.

Ribosome: "A ribosome is a small, dense, functional structure found in all known cells that assemble proteins. It catalyses the assembly of protein chains by reading messenger RNAs and binding amino acids that are attached to transfer RNA molecules." (Quote from www.cellsalive.com accessed September 17th 3:45PM) It is seen in all known Cells. Around 1000th of a Cell.

Endoplasmic Reticulum: Assorted Membranes extending thought the cell, studded with Ribosome's; that help transport materials throughout cell, the site of much protein manufacturing. It is found in both Plant and Animal Cells. There're two types of Endoplasmic Reticulum: Smooth and rough. The Smooth Endoplasmic Reticulum is named because it appears smooth by electron microscopy. The Rough Endoplasmic Reticulum appears "Pebbled" by electron microscopy due to the presence of numerous Ribosome's on it's surface. The size is around 1/25th of a Cell.

Nucleus: The nucleus is mostly found in Eukaryotic Cells it contains most of the cell's genetic material, organized as long linear DNA molecules in complex with a large variety of proteins. The main function of the cell nucleus is to control gene expression and mediate the replication of DNA during the Cell Cycle. It is found in both Animal and Plant Cells and is around 1/10th of a cell. (Information adopted from www.Wikipedia.com and www.cellsalive.com accessed September 17th 4:03PM)

Cytoplasm: Jellylike fluid primarily water but also contains enzymes and amino acids. The cytoplasm is the site where most cellular activities are done. All the functions for cell expansion, growth and replication are carried out in the cytoplasm of the cell. The Cytoplasm is found in Animal and Plant Cells. Relative to the cell the Cytoplasm is around 5% for a Plant cell and 65% for an Animal cell.

Mitochondrion: The Mitochondrion is where sugar and fat are digested in the cell, and this produces energy for the Cell. It is found in both Animal and Plant Cells. And is around 1/50th the size of a cell.

Vacuole: A sac that stores and transports ingested materials, waste products and water. That is found in both animal and plant cells. Relative-to the cell it is about 1/30th in an animal cell, 47% in a Plant cell.

Golgi Apparatus: The Golgi Apparatus is a Membrane bound structure with a single membrane. The Golgi apparatus is essential in modifying, sorting, and packaging these substances for cell produced and discharged or for use within the cell. It is found in both Animal and Plant Cells. And takes up around 5% of the cell. (Information adopted from www.Wikipedia.com and www.cellsalive.com accessed September 17th 4:39PM)

Notice: Information that was not sited was altered in phrasing.

Picture of Animal Cell model attached

DATA ANALYSIS AND RESULTS:

In this lab I researched the definition, function and type of cell each of these words: the cell wall, cell membrane, lysosome, ribosome, endoplasmic reticulum, nucleus, centriole, cytoplasm, mitochondrion, vacuole, Golgi apparatus. And then recorded them in a written data table. Doing this helped me understand the basics of the different parts of a cell. That cells are different in Animals than they are in Plants. For instance an Animal cell does not have a Cell wall which provides the Cell with structural support, protection, and a filtering mechanism, but a Plant cells do. Animal cells also don't have a Chloroplast which in a green plant cell contains the Chlorophyll and in which photosynthesis takes place.

Doing this also allowed me to understand how a cell functions and what is in a cell and how they function. Everything in each cell has a basic task that they must do constantly to keep the cell from dying. It also helped me better understand how your body stays alive and how cells convert glucose (which every food you eat is broken down into) into the energy your body uses. One of the things I found interesting in this lab is how complex a cell is and how technology has come to a point where it can figure out all the different parts of the cell and how it functions.

Another thing I found interesting was how even on a molecular level some of the functions of a cell are basic even though their names and look are complex. Something I find very interesting even though I already knew it was how the cell had it's own genetic instructions in it's nucleus (which is mostly found in Eukaryotic cells) and based on those instructions cells can preform expansion, growth and replication. I found this interesting because it takes a very complex organism to actually create something based on DNA instructions, and scientists have still yet to find out how the cells do that and how they can do that. Scientists have only achieved altering the DNA so that the cell creates different proteins thus altering the outcome, but this is very limited due to the fact that they have not mastered it.

One of the ways and outcomes scientists have achieved in altering the DNA instructions of a cell is altering a cell in a flower that made a protein that caused the peddles of the flower to be yellow. They

altered the DNA instructions to make the cell create a flower protein that caused the peddles to be yellow and it worked. I saw this on a show called NOVA which gives basic examples of a topic that can be very broad. I was surprised at the complexity in such a small organism (10-30 micrometers) and that they're so many varying from 75-100 trillion cells in you body.

Some of the materials that I found helpful in my lab was my laptop because I worked on my lab in car rides. And some of the internet resources I found helpful were some of the websites Michele gave to us because it gave a good basic definition, function and image of each part of the cell. I particularly enjoyed the website that used animation to describe the function of each part of the cell. We primarily used Wikipedia for the definition of the part of the cell because we found it to be the easiest source to use. We used the "Human Body" book for a very brief definition of some parts of the cell if we couldn't understand the Wikipedia definition because it was to complex.

Other materials and sources I found helpful was my teacher because my partner and I had a lot of questions regarding the lab that were not answered in our research and she answered them quite clearly. Materials that were helpful in constructing our model were clay which was the base of what we put our parts of the cell on, and especially tooth picks because we used them in creating many sections of our cell like the cell membrane, the rough and smooth ribosome's and we used the toothpicks as flags to label each part of the cell.

QUESTIONS TO CONSIDER:

Approximately how big is the average animal cell (include units)?

The approximate Animal Cell is 10-30 micrometers (0.0000001 meters). Plant Cells are approximately 10-100 micrometers.

Which structure produces ATP?

ATP is created by the Mitochondrion by mixing Glucose and Oxygen to create ATP which is what the Cell uses for energy, other byproducts of this process are Water and Carbon Dioxide.

What is turgor pressure and which structure creates it?

When water enters the cell it is stored in the Vacuole and the result is called turgor pressure. This is important because the pressure of each cell wall against its neighbor results in stiffness that allows the plant to stay upright. Cells not adapted these environments will burst due to the inflow of water if they have no strong membrane or cell wall.

What is an organelle?

An organelle is a part of the cell that floats around in the Cytoplasm and attaches itself to the Ribosome making it rough. The following are the functions of the Organelle: Protection/support, barrier between cell and its environment, building and repairing of cell parts, transport of materials storage, release of energy, disposal of waste materials, and reproduction.

Where are new proteins made?

New proteins are assembled in the Ribosome, the Ribosome assembles the Amino Acids based on the DNA instructions from the Nucleus.

Where does DNA reside?

In the Nucleus.

CONCLUSION:

My hypothesis was partly correct, I got all of the parts of the cell right and their function but I was not clear about the Prokaryote and Eukaryote and what they meant. But I now know the difference and what and where I went wrong. I learned all the parts of a cell in animals and some in plants. I also learned the distinct difference between Prokaryote and a Eukaryote. A few questions that this lab triggered:

- *How can a scientist alter DNA?*
- *How can a scientist alter what type of protein a cell creates?*
- *Can scientists examine a cell that produces incline and identify the type of instructions it gets and insert the same instructions to a persons cells with Diabetes?*
- *When you take any type of medicine is the medicine altering what type of protein cells are creating? If so how?*
- *How can scientists identify how cells split and eventually create a living organism? And if they were to do this how could it help with current known diseases?*

Some of these questions are already answered but I would like to go into them in more detail.