**Cells Worksheet**

1. Examine the 5 pictures of a prokaryote, a eukaryote fungi cell, a eukaryote plant cell, a eukaryote animal cell, and a eukaryote protist below. Then answer the following questions.



 Prokaryote cell Eukaryote Fungi cell Eukaryote Plant cell





 Eukaryote Animal cell Eukaryote Protist cell

1. What structure differentiates a prokaryote and eukaryotic cell?
2. What 3 structures are common to all cells?
3. Is a fungi cell capable of engaging in photosynthesis? Explain.
4. What 4 structures do bacteria and fungi share with plant cells?
5. What structure do bacteria and fungi possess that is absent in animal cells?
6. Examine the picture below and answer the following questions.



* 1. Which number depict the development of the first eukaryotic plant cell? Explain.
	2. According to the diagram, did plant cells precede the appearance of animal cells? Explain.
	3. How would the original prokaryote cell that ingested the chloroplast benefit from its presence? Explain.
	4. How would the original prokaryote cell that ingested the mitochondria benefit from its presence? Explain.
1. Read the following paragraphs, and answer the following questions.

Tay-Sachs disease is a rare inherited disorder that progressively destroys nerve cells (neurons) in the brain and spinal cord. The most common form of Tay-Sachs disease becomes apparent in infancy. Infants with this disorder typically appear normal until the age of 3 to 6 months, when their development slows and muscles used for movement weaken. Affected infants lose motor skills such as turning over, sitting, and crawling. They also develop an exaggerated startle reaction to loud noises. As the disease progresses, children with Tay-Sachs disease experience seizures, vision and hearing loss, intellectual disability, and paralysis. An eye abnormality called a cherry-red spot, which can be identified with an eye examination, is characteristic of this disorder. Children with this severe infantile form of Tay-Sachs disease usually live only into early childhood.

Tay-Sachs disease is very rare in the general population. The genetic mutations that cause this disease are more common in people of Ashkenazi (eastern and central European) Jewish heritage than in those with other backgrounds. The mutations responsible for this disease are also more common in certain French-Canadian communities of Quebec, the Old Order Amish community in Pennsylvania, and the Cajun population of Louisiana. Mutations in the HEXA gene cause Tay-Sachs disease. The HEXA gene provides instructions for making part of an enzyme called beta-hexosaminidase A, which plays a critical role in the brain and spinal cord. This enzyme is located in lysosomes, which are structures in cells that break down toxic substances and act as recycling centers. Within lysosomes, beta-hexosaminidase A helps break down a fatty substance called GM2 ganglioside. Progressive damage caused by the buildup of GM2 ganglioside leads to the destruction of these neurons, which causes the signs and symptoms of Tay-Sachs disease.

* 1. According to the article, what is the relationship between beta-hexosaminidase A and GM2 ganglioside?
	2. What is the relationship between lysosomes and Tay Sachs?
1. Examine the picture below and answer the accompanying questions.



* 1. What process is being illustrated above? Explain.
	2. Write down, in order, the parts of the cell involved in this process. What 2 other organelles, in order, have not been depicted?
	3. Based on this picture, is this a prokaryotic or eukaryotic cell? Explain.
	4. Where in the cell can you locate the examples of nucleic acids? Explain.
	5. According to the picture, where does the process of dehydration synthesis of amino acids occur? Explain.
	6. Prokaryotes lack a nucleus, yet are capable of producing proteins. Explain why.
1. Plant cells have cells that contain chloroplasts. Why must their cells contain mitochondria as well?
2. In some ways, a cell is analogous to a school. Create an analogy describing the job of the following organelles within a cellular “school.”

Fill in the spaces below for each cell part in order to create a one-sentence analogy that shows the similarity between the cell part and a school. Be sure to explain the reasoning behind your analogies (see the underlined section of the example).

**Exemplar:** “The **nucleus** is like a **brain** because it controls and coordinates the activities of the whole cell in the same way the **brain** controls and coordinates the activities of the body.”

**Remember:** Your analogies need to be accurate, complete, and ***original***.

**ORGANELLES FOUND IN ALL EUKARYOTIC CELLS**

* 1. The **plasma (cell) membrane** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it ­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	2. The **nucleus** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
	3. The **cytoskeleton** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	4. The **mitochondrion** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	5. **Cytoplasm** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	6. The **Golgi apparatus** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	7. The **lysosome** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	8. The **ribosome** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	9. The **endoplasmic reticulum** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	10. The **nucleolus** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**ORGANELLES FOUND IN PLANT CELLS *BUT NOT ANIMAL CELLS***

* 1. The **central** **vacuole** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	2. The **cell wall** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
	3. The **chloroplast** is like \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ because it \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the same way \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.
1. Fill in the name of the cell structure in the appropriate lines below.

I’m a real “powerhouse.”

That’s plain to see

I break down food

To release energy. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

I’m strong and stiff

Getting through me is tough.

I’m found only in plants

But I guess that’s enough\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

I’m the watery goo

that holds the shape of the cell

I’m an important component

Surrounding organelles as well \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

I’m the brain of the cell

Or so they say.

I regulate the activities

From day to day.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Found only in plant cells,

I’m green as can be.

I make food for the plant

Using the sun’s energy.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

I’m a superhighway

Found throughout the cell.

I transport proteins

And other things as well.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

I’m the doorway to the cell

Flexible and thin

I control what gets out

As well as what comes in. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Proteins are made here

Even though I’m quite small.

You can find me in the cytoplasm

Or attached to E.R.’s wall.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

I’ve been called a “storage tank”

By those with little taste.

I’m a sac filled with water,

Food enzymes, or waste.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Since I contain many enzymes,

I can digest an injured cell;

And can break down a large molecule

Into a smaller one as well.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Read the paragraph below and answer the following questions.

 All organisms are composed of cells. Unicellular organisms are composed of a single cell. Multicellular organisms are composed of many specialized cells. Specialized cells differ in structure (size, shape...) and function (the role they perform in the organism). The structural modifications that occur in a specialized cell equip it to do its job in the organism. An adult human is composed of approximately 100 trillion cells and has over 200 different types of specialized cells.

The life cycle of a cell consists of a growth phase (interphase) followed by a division phase (either mitosis or meiosis). Some cells cycle between interphase and division continuously through the life of an organism. This allows the body to produce new cells allowing for growth and maintenance of tissues. Other cells exit the cell cycle and enter a non-dividing phase called GO. Depending on environmental signals, they may reenter the cell cycle or remain in GO permanently. A cell specializes while in interphase or GO. The process in which a cell becomes specialized is called differentiation and occurs when the cell selectively activates or inactivates specific genes.

The specialized cells of an organism contain the exact same complement of genes. In humans, this means that each cell type contains approximately 30,000 genes. This is because each cell is the descendent of a single cell (the fertilized egg) that underwent mitotic cell division to form a multicellular organism during embryonic development. Cell differences are the result of differences in gene expression. A gene is expressed (activated) when it is transcribed and translated into a protein.

Some genes (such as those responsible for glucose metabolism or protein synthesis) are expressed in all cells. Other genes are expressed in a single or select few specialized cells. The expression of a gene within a particular specialized cell changes over an individual’s life. For example, all human cells contain a gene that codes for caesin, the major protein found in milk. However, the gene is only expressed in milk producing cells of lactating females.

*Red blood cells*

Red blood cells (RBC’s) form from undifferentiated cells in the bone marrow throughout your life. Bone marrow is the soft, interior portion of certain bones found in the chest, upper arms, upper legs and hips. The cells located here are undifferentiated, but limited in the type of cell they can become. They can only differentiate into a type of blood cell. They are capable of dividing continuously to allow lost blood cells to be replenished. As RBC's differentiate, changes in gene expression result in the destruction of their nucleus, the production of hemoglobin proteins, and modifications to the cytoskeleton allowing them to take their donut shape. Once differentiation is complete, they are released into the blood stream. Your body replaces 2 million red blood cells every second.

1. Explain how cells become specialized.
2. Can cell specialization change? Explain using evidence from the article.
3. If a scientist compared a cell from your nose, another from your ear, and another from your foot, would the DNA in each cell be different? Support your answer using information from the article.
4. According to the article, how has gene expression altered the structure of RBC’s so that they are better adapted to transporting oxygen throughout the body?
5. Use the Build-A- cell game and select “Plant cell”
	1. Drag and drop each cell structure as well as read the accompanying details for each. Answer the following questions.
		1. What macromolecule gives the plant cell its rigidly defined shape?
		2. What macromolecules comprise the cell membrane?
		3. What 3 structures provide the cell with its shape as well as act as ‘rails’ for the transportation of cellular components?
		4. What is the relationship between chromatin and chromosomes?
		5. Where are ribosomes synthesized?
		6. How is the function of the smooth ER different from the rough ER?
		7. Which organelle serves as the site of cellular respiration?
		8. Where in the chloroplast is chlorophyll contained?
	2. Select “animal cell” and drag and drop each cell structure as well as read the accompanying details for each. Answer the following questions.
		1. How is the composition of the cell membrane in plants similar to those in animals?
		2. What cellular structures do animal cells share with plant cells?
		3. What cellular structures do animal cells possess that are lacking in plant cells?
	3. Select “fungal cell” and drag and drop each cell structure as well as read the accompanying details for each. Answer the following questions.
		1. What cellular structures do fungal cells share with plant cells?
		2. What cellular structures do fungal cells share with animal cells?
		3. How does the composition of the cell wall in fungi differ from plant cells?
		4. Are fungi capable of producing their own food? Cite 1 reason.
		5. Are fungi capable of engaging in cellular respiration? Cite 1 reason.
	4. Select “bacterial cell” and drag and drop each cell structure as well as read the accompanying details for each. Answer the following questions.
		1. What is the function of a capsule?
		2. What cellular structures do bacterial cells share with fungi and plant cells?
		3. How is a nucleus different from the nucleoid?
		4. Which other type of cell contains a flagella?
		5. Are bacteria capable of producing their own food? Cite 1 reason.
		6. Are bacteria capable of engaging in cellular respiration? Cite 1 reason.
	5. Select “case studies” then “starch storage” and then read the accompanying details for each. Answer the following questions.
		1. The cell is unable to store starch. Which organelle is malfunctioning?
		2. What macromolecule is starch an example of?
			1. Is it produced from hydrolysis or dehydration synthesis?
	6. Select “case studies” then “turgor pressure” and then read the accompanying details for each. Answer the following questions.
		1. What organelle is affected by the lack of water? Why?
	7. Select “case studies” then “plant bacterial invasion” and then read the accompanying details for each. Answer the following questions.
		1. Which part of the cell will cellulose affect? How?
	8. Select “case studies” then “cyanide poisoning” and then read the accompanying details for each. Answer the following questions.
		1. Which organelle is affected by cyanide poisoning? How?
	9. Select “case studies” then “A bacterium’s defenses” and then read the accompanying details for each. Answer the following questions.
		1. What cell component protects the bacterium from phagocytes? How?
	10. Select “case studies” then “oxidative damage” and then read the accompanying details for each. Answer the following questions.
		1. Which organelle protects the cell from oxidative damage? How?