INTRODUCTION TO CELLS

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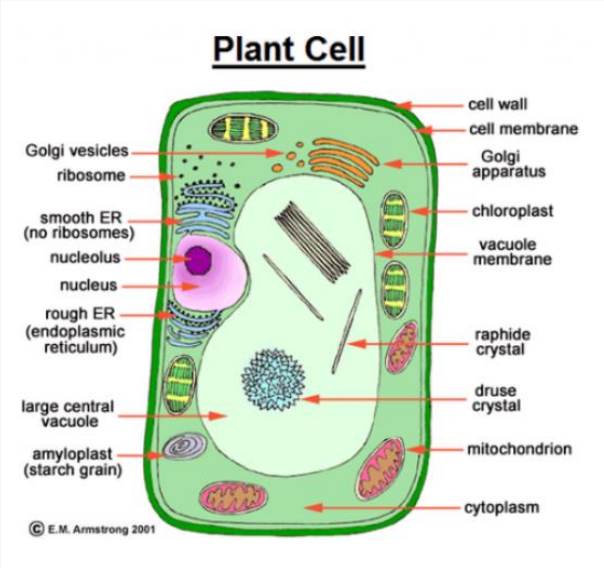
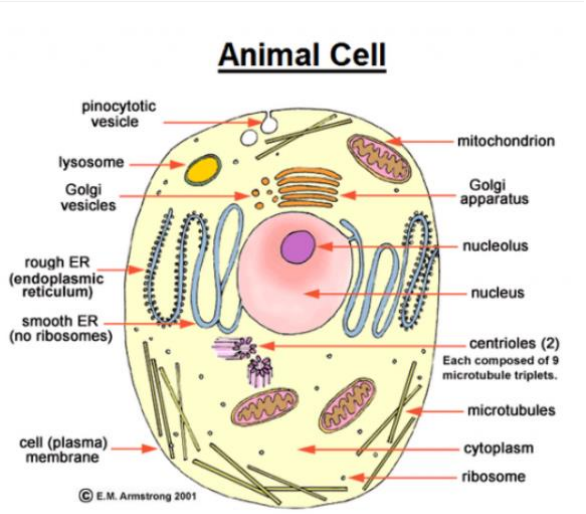




The Human Cheek Cell

Write a short description of each of the following:

--cell membrane

--cytoplasm

--nucleus

--organelle

Procedure:

1.Gently scrape the inside of your cheek with the flat side of a toothpick.

2. Rub the toothpick on a clean slide.

3. Add a small drop of water and cover with a cover slip.

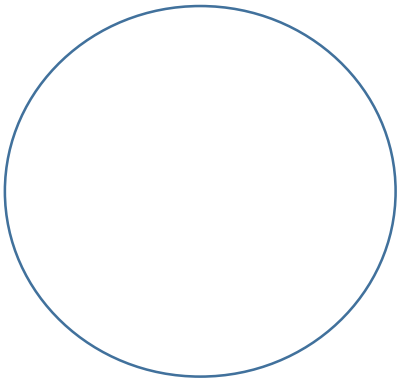
4. Observe the cells on low, medium, and then high power.

5. Once you think you have located a cell, switch to high power and refocus.

(Remember; do NOT use the coarse adjustment knob at this point)

---**Sketch** the cell at low, medium, and high power. Label the nucleus, cytoplasm, and cell membrane. Draw your cells to scale.

Low Power



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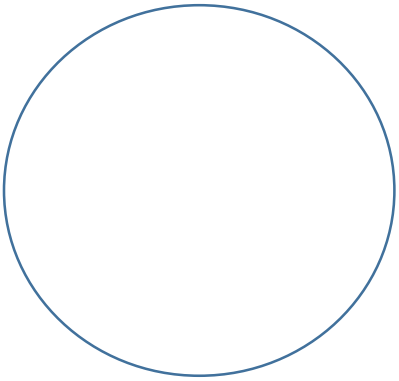
Middle Power



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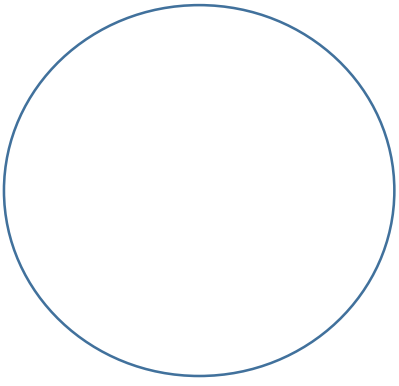
High Power



_____

_____

6. Gently scrape the inside of your cheek with the flat side of a toothpick.

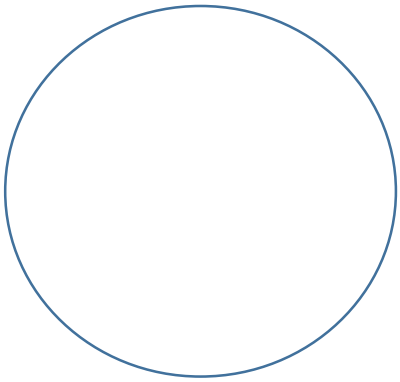
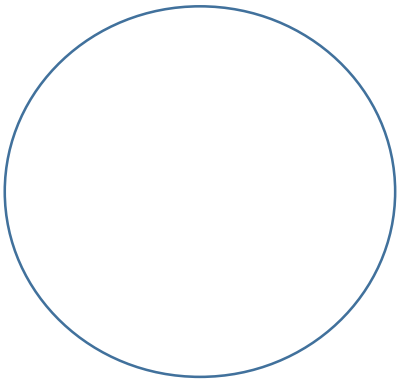
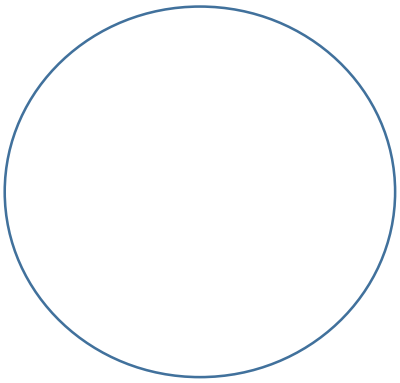
7. Rub the toothpick on a clean slide.

8. Add a small drop of iodine and cover with a cover slip.

9. Observe the cells on low, medium, and then high power.

10. Once you think you have located a cell, switch to high power and refocus. (Remember; do NOT use the coarse adjustment knob at this point)

---**Sketch** the cell at low, medium, and high power. Label the nucleus, cytoplasm, and cell membrane. Draw your cells to scale.

Low	Medium	High
		
_____	_____	_____
_____	_____	_____

11.Why is iodine necessary?

12.The light microscope used in the lab is not powerful enough to view other organelles in the cheek cell. What parts of the cell were visible?

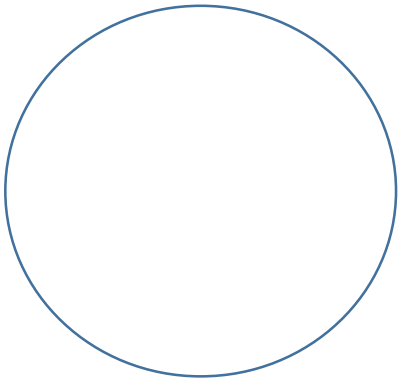
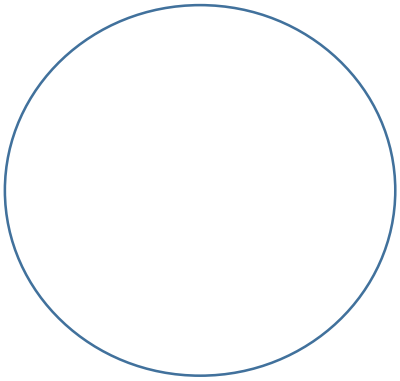
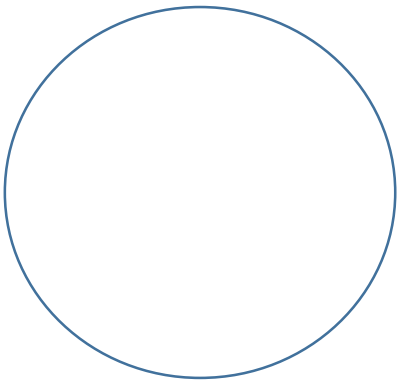
13. List 2 organelles that were NOT visible but should have been in the cheek cell.

Skin Cell Lab

Procedure:

1. Wash the underside of a wrist that will be sampled for epidermal cells with soap and water.
2. Stick a clean piece of clear tape on the underside of the washed wrist.
3. Gently remove the piece of tape from the wrist being careful to avoid getting fingerprints on the tape. A forceps might help to remove the tape and avoid fingerprinting the tape.
4. Place the tape, sticky-side up, on a clean microscope slide.
5. Stain the top, sticky side of the tape with 2 or 3 drops of iodine solution.
6. Use a dissecting needle to gently place a cover slip over the sticky tape. Lower the cover slip down onto the tape and then remove the dissecting needle. This should help prevent staining your fingers. Caution: Use iodine carefully. It will stain most items including skin, clothing, and tabletops.
7. Examine the slide under a microscope. Look for cells with low power first, and then switch to medium and high power for details.
8. Once you think you have located a cell, switch to high power and refocus. (Remember; do NOT use the coarse adjustment knob at this point)

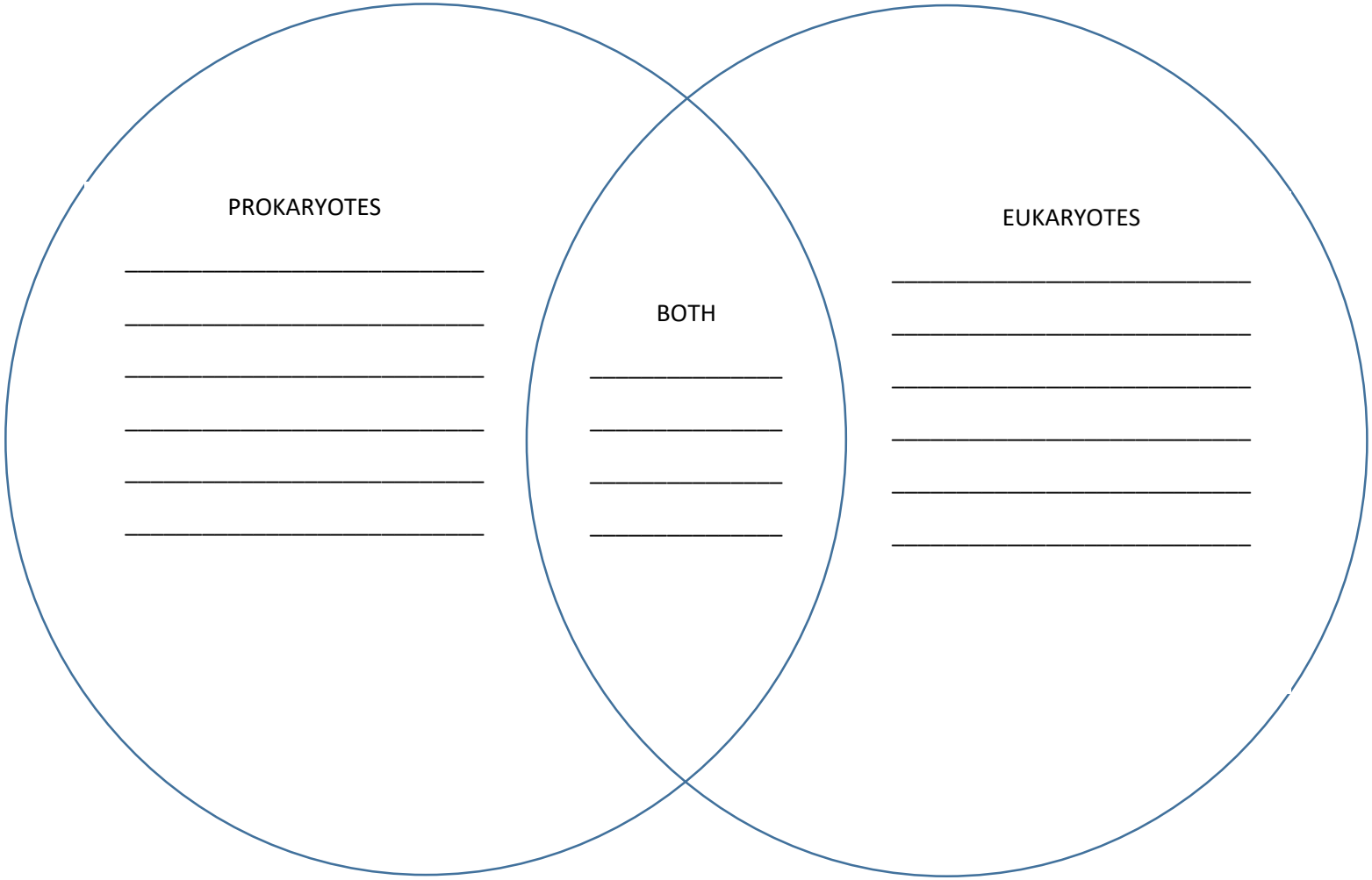
---**Sketch** the cell at low, medium, and high power. Label the nucleus, cytoplasm, and cell membrane. Draw your cells to scale.

Low	Medium	High
		
_____	_____	_____
_____	_____	_____

PROKARYOTES vs EUKRYOTES

https://www.youtube.com/watch?v=RQ-SMCmWB1s

1. All living things have _____ _____
2. Prokaryotic cells are the _____ and most _____ kinds of cells.
3. Prokaryotic cells gave rise to _____ cells _____ billion years ago.
4. Prokaryotic cells are a lot _____ than eukaryotic cells.
5. Prokaryotes can _____ very quickly because they are so _____.
6. Prokaryotic cells lack a _____.
7. The word prokaryotic means _____ _____.
8. Prokaryotes have no membrane bound _____
9. DNA is found in the _____ region.
10. They have a _____ _____ that surrounds the _____ _____.
11. They often have a _____ for movement.
12. Eukaryotic cells contain a _____ _____ _____ and other _____ _____ _____.
13. The word eukaryote means _____ _____.
14. Eukaryotes are _____ and more _____ than prokaryotes.


PROKARYOTES
BOTH
EUKARYOTES

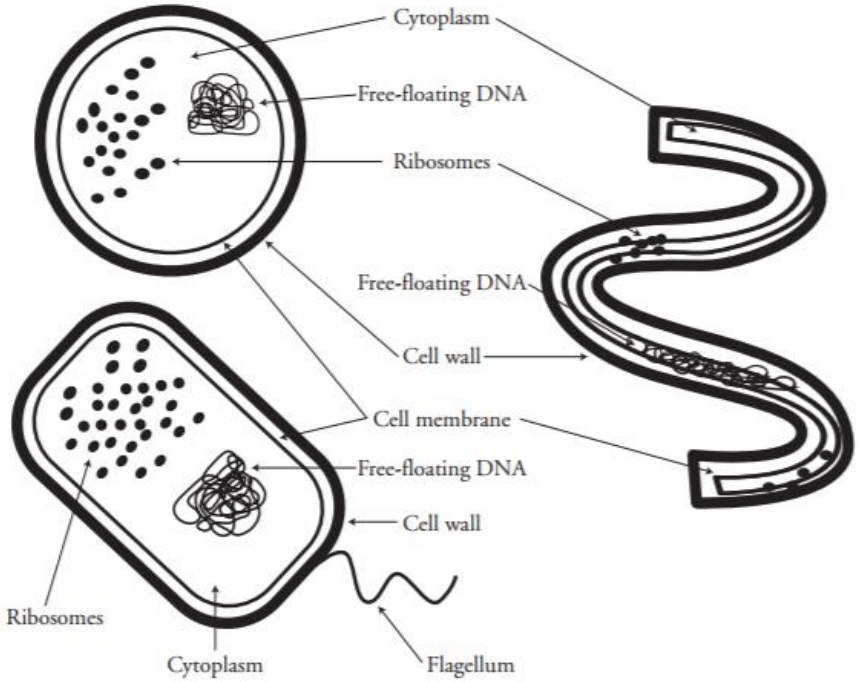
Prokaryotic and Eukaryotic Cells

Do all cells have the same structure?

Why?

An efficiency apartment is a one-room apartment. This one room is where you sleep, eat, shower, and entertain your guests. It all happens in one room. It is a simple way of living in a small space. A mansion is a large, complex living space with many separate rooms. There are rooms for cooking, eating, sleeping, bathing, reading, watching TV, entertaining guests, exercising, and storage. The rooms in a mansion are constructed for the specific things you would like to be able to do. You can live in simple efficiency or complexity. In this activity we will be looking at cells that are as simple as a one-room efficiency apartment or as complex as a mansion.

Model 1 – Three Types of Bacterial Cells



1. The three bacterial shapes in Model 1 are referred to as *coccus* (sphere), *spirillum,* and *bacillus* (rod). Label the diagrams in Model 1 with the correct descriptions.
2. What is represented by the small dots found in each of the bacteria cells?
3. What is the name of the outermost layer that forms a boundary around the outside of each cell?
4. How is the DNA described and what does this mean?

5. All the internal structures are suspended (floating) in what substance?

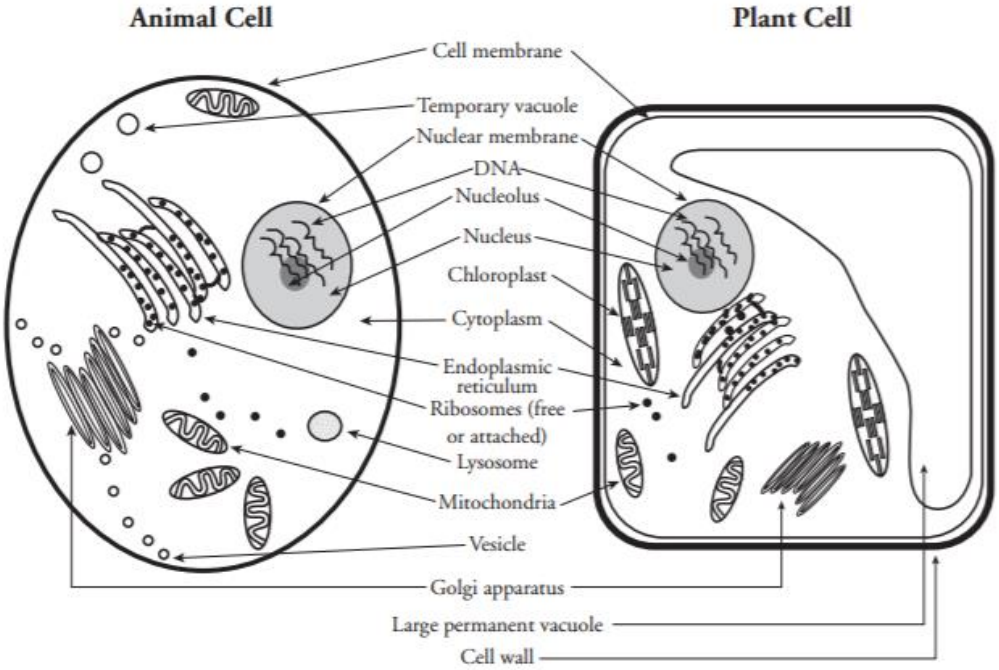
6. One of the bacteria in Model 1 has a tail-like structure.

   a. What is this structure called?

   b. What might be the purpose of this structure?

   c. Based on your answer to the previous question, what might you infer about the absence of this structure in the other two bacteria cells?

Model 2 – Animal and Plant Cells



7. Looking at Model 2, list at least three structural differences (other than shape) between an animal and a plant cell.

8. Where do you find the DNA in each cell in Model 2?

9. Do both cells in Model 2 have a nucleus?

10. List the structure(s) that form the boundary between the inside and the outside of each cell in Model 2.

11. What is different about the outermost boundary in a plant cell compared to an animal cell?

12. Decide as a group whether the cells in Model 1 or 2 are more complex and list at least three supporting reasons for your choice.

Model 3 – Structural Comparisons

Word Part	Meaning
pro	before
karyon	nucleus or kernel
eu	true

13. Use the chart in Model 3 to determine the meaning of the word prokaryote.

14. What does the word eukaryote mean?

15. Based on the above word definitions, label the cells in Model 1 and Model 2 as prokaryotic or eukaryotic.

16. By comparing Model 1 and Model 2, what structures are the same in both prokaryotic and eukaryotic cells?

17. What differences are there between a prokaryotic and eukaryotic cell?

18. Refer to Models 1 and 2 to complete the chart below. Write yes or no in the box for each cell.

	Bacterial Cell	**Animal Cell**	**Plant Cell**	**All Cells**
Cell Membrane				
Ribosome				
Cytoplasm				
Mitochondria				
Nucleolus				
Nucleus				
DNA				
Cell Wall				
Prokaryotic				
Eukaryotic				

19. As a group, write a definition for a prokaryotic cell.

20. As a group, write a definition for a eukaryotic cell.

21. Complete the phrase below. Each member must contribute one complete sentence. The words prokaryotic and eukaryotic must be used:

    All cells are not the same because…

22. As a group, discuss the opening analogy of an efficiency apartment and a mansion as it relates to cells. Record your final consensus of how this analogy applies to cell structure.

ORGANELLES

https://www.youtube.com/watch?v=URUJD5NEXC8

OVERVIEW OF CELLS

1. _____ are the smallest living unit of an organism.

2. All cells have a _____ _____, _____ and _____.

3. Eukaryotic cells have _____ that include a _____.

4. Eukaryotic cells are more _____ cells found in _____ and _____.

5. Prokaryotic cells don't have a _____ or _____ _____.

6. Prokaryotic cells do have _____ _____ but not in the _____.

WHAT ARE ORGANELLES

1. Organelle means_____ _____.

2. They are _____ parts of the cell that have _____ jobs.

ORGANELLE	FUNCTION
Nucleus	
Nucleolus	
Ribosomes	
Cytoplasm	
Endoplasmic Reticulum	
Golgi Apparatus (Golgi Body)	

Vacuoles (plants)	
Lysosomes (animals)	
Mitochondria	
Cytoskeleton	
Chloroplasts (plants)	
Cell wall (plants)	
Cilia	
Flagella	

Summary:

Eukaryotic Cells:

Prokaryotic Cells:

All cells have a:

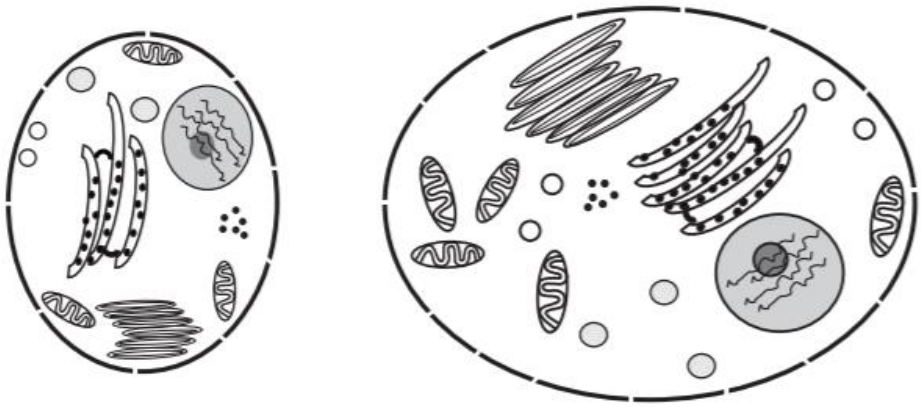
Cell Size

What determines the size of a cell?

Why?

Sometimes bigger is better—tall basketball players, more closet space, and savings accounts may come to mind. What about cells? Does having big cells make an organism bigger or better? Would having larger cells be an advantage to an organism? If so, why do cells divide rather than continue growing? Maybe there is an advantage to being small.

Model 1 – Investigating Cell Size



Cell A **Cell B**

1. Are the cells shown in Model 1 plant or animal cells? Explain your answer.

2. Label Cell B in Model 1 with the following structures.

cell membrane	cytoplasm	nucleus
ribosomes	vacuole	mitochondria

3. Compare the smaller cell in Model 1 to the larger cell in Model 1.

   a. Which cell has a larger surface area (more cell membrane surface)?

   b. Which cell has more channels in its cell membrane that can transport molecules (nutrients, oxygen, and waste products) in and out of the cell?

4. Compare the smaller cell to the larger cell in Model 1.

   a. Which cell has more mitochondria?

   b. Propose an explanation for why the cell in part *a* would need more mitochondria for proper functioning of the cell.

5. What would be the consequences for a cell if the cell membrane was not large enough to have adequate channels for bringing in nutrients and removing waste?

6. Compare the smaller cell to the larger cell in Model 1.

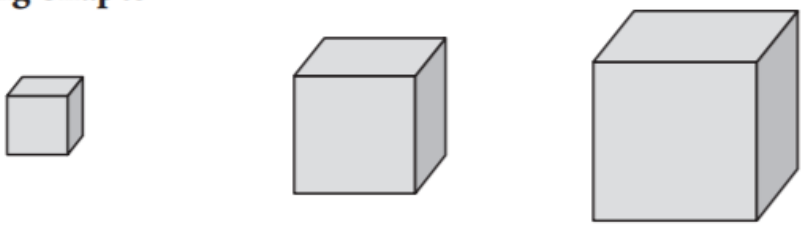
   a. Which cell has a larger volume?

   b. Imagine a glucose molecule entering the cell membrane. Would that molecule be able to reach the mitochondria faster if the cell had a smaller volume or a larger volume? Explain.

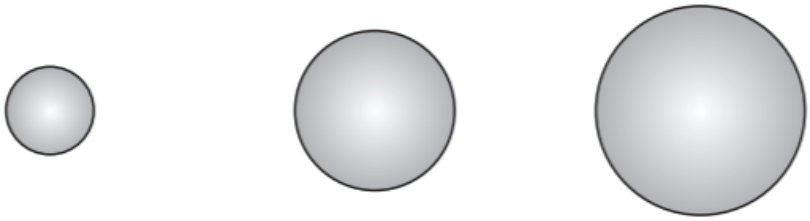
   c. As the mitochondria metabolize the glucose, they produce carbon dioxide waste. Would the CO_2 molecules be able to leave the cell faster if the cell had a smaller volume or larger volume? Explain.

7. Consider your answers to the previous questions. Is bigger always better for a cell? Explain.

Model 2 – Comparing Shapes



Side	1 cm	2 cm	4 cm
Surface area	6 cm^2	24 cm^2	96 cm^2
Volume	1 cm^3	8 cm^3	64 cm^3
Surface Area-to-Volume Ratio			96:64 = 1.5:1



Diameter	1 cm	2 cm	4 cm
Surface area	3 cm^2	13 cm^2	50 cm^2
Volume	0.5 cm^3	4.2 cm^3	34 cm^3
Surface Area-to-Volume Ratio			

Diameter × Height	1 cm × 1 cm	1 cm × 2 cm	1 cm × 4 cm
Surface area	4.7 cm^2	7.9 cm^2	14 cm^2
Volume	0.8 cm^3	0.6 cm^3	3.1 cm^3
Surface Area-to-Volume Ratio			

8. Label the sets of shapes in Model 2 with each of the following: cubes, spheres, cylinders.
9. Calculate the surface area and volume values that are missing in Model 2. Divide the work among the members of your group and check each other's work.

10. Consider the data in Model 2.
    a. Describe the change in the surface area of the cube when the length of the side doubles.

    b. Describe the change in the volume of the cube when the length of the side doubles.

    c. When a shape gets larger, which increases at a faster rate, surface area or volume?

12. Calculate the surface area-to-volume ratio for each shape in Model 2. One example is given in Model 1 for this calculation.
13. For all three of the shape sets, describe the change in the surface area-to-volume ratio as the size of the shape increases.

14. Considering your answer to Question 7, is it more desirable for a cell to have a small surface area-to-volume ratio or a large surface area-to-volume ratio? Explain your answer in terms of the functions of a cell.

15. Circle two figures in Model 2 that have a similar surface area (within 1 cm^2 of each other).
    a. Do the two figures have the same volume?

    b. Which shape has a more desirable surface area-to-volume ratio?

16. In multicellular organisms some cells need to be large because of the functions they perform (*i.e.* nerve cells, muscle cells). What shape would be most desirable for these larger cells?

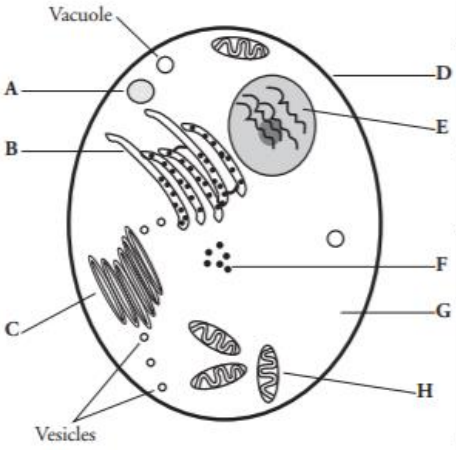
Organelles in Eukaryotic Cells

What are the functions of different organelles in a cell?

Why?

The cell is the basic unit and building block of all living things. Organisms rely on their cells to perform all necessary functions of life. Certain functions are carried out within different structures of the cell. These structures are called **organelles**.

Model 1 – How Is a Cell Like a Factory?



Part of factory	Cell organelle	Function
Control room (E)	Nucleus	Contains and protects genetic material (DNA)
Factory manager	DNA/chromo-somes	Information for making proteins
Assembly workers (F)	Ribosomes	Make proteins
Production line (B)	Endoplasmic reticulum (ER)	Transports and finishes proteins and other biologi-cal molecules
Custodians (A)	Lysosomes	
Power generators (H)	Mitochondria	
Shipping department (C)	Golgi apparatus	
Factory interior (G)	Cytoplasm	Space for work to be done
Items to be shipped	Vesicles	Cellular pack-age containing products such as protein
Warehouse for storage of products	Vacuole	
Loading dock	Pores/gated channels	Points of entry and exit for materials
Security fence (D)	Cell membrane	

1. Using the letters from the table in Model 1, label the cell diagram with the organelle names.
2. According to the table,
   a. what substance is analogous to a factory manager?

   b. in what organelle would this substance be found?

3. Using the information in Question 2, which cell organelle controls the activities of the entire cell?

4. Which organelle generates energy to power cellular activities?

5. Which organelle is responsible for assembling proteins?

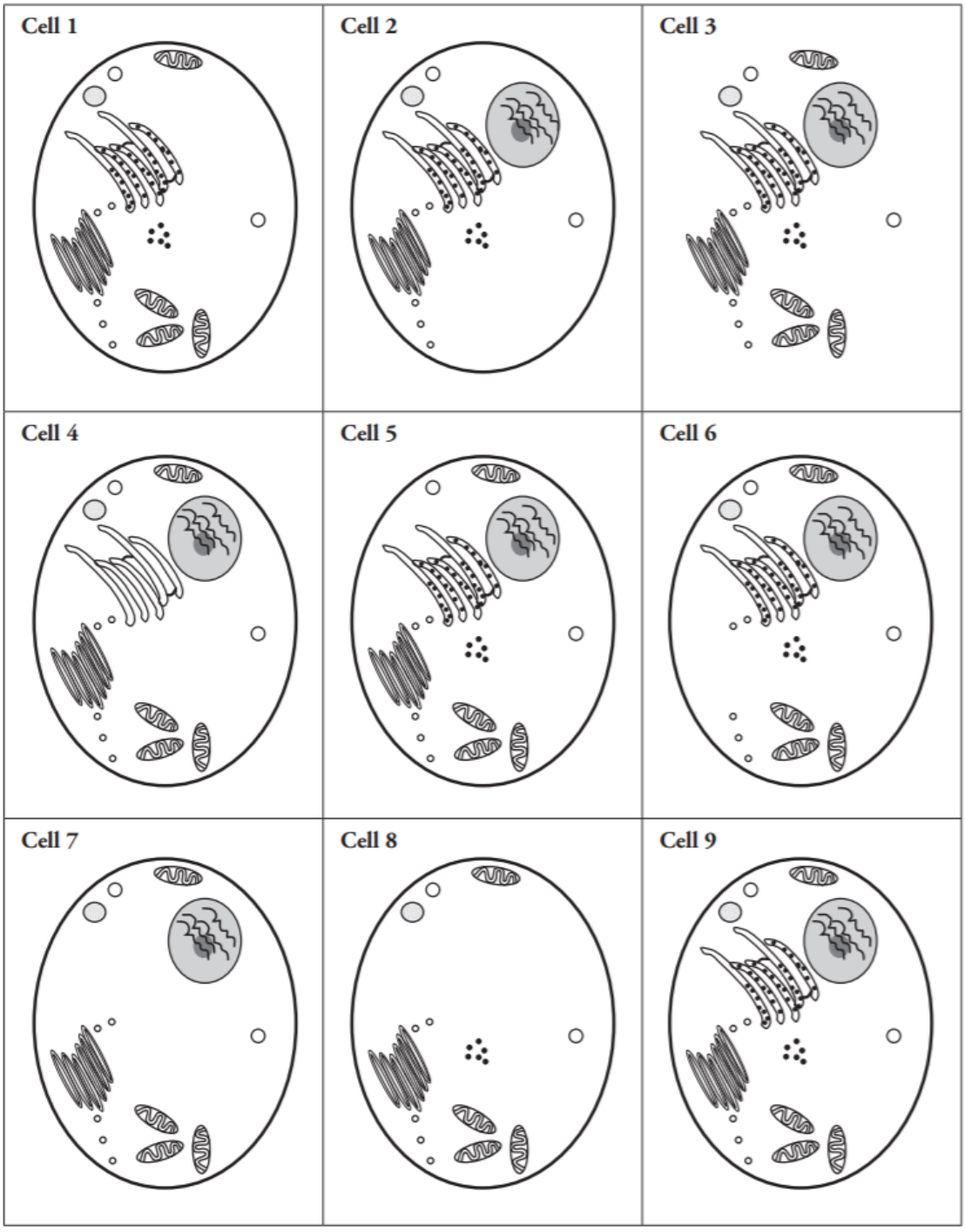
6. Once proteins have been assembled, to which organelle would they go next?

7. Into what organelle might the cellular products be placed?

8. Fill in the missing functions of cellular organelles in the table in Model 1.

9. Starting with instructions from the factory manager (DNA/chromosomes), create a flow chart to show how a protein is produced and shipped from a cell.

Model 2 – Animal Cells with Organelle(s) Removed



10. Study the cells in Model 2. Which cell is not missing any organelles compared to Model 1?

11. Look carefully at Cell 2 in Model 2. Compared to Model 1, what kind of organelle is missing?

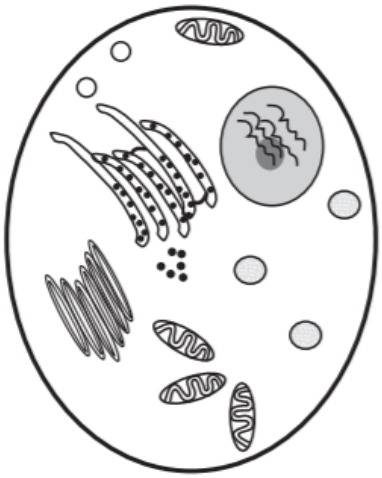
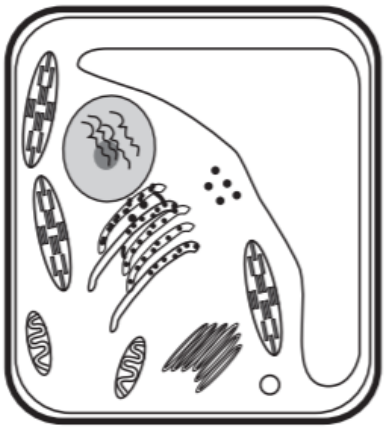
12. Using grammatically correct sentences, describe why Cell 2 would not function normally.

13. Which two cells in Model 2 will have difficulty containing and getting rid of wastes within the cell? Why?

14. Cell 1 is missing one organelle. List as many reasons as possible why Cell 1 will not survive.

15. Cell 4 and Cell 7 will not be able to synthesize a major biological molecule. What molecule is this?

Model 3 – Animal Cell vs. Plant Cell

Animal Cell	Plant Cell
	

16. Do both cells in Model 3 have a nucleus?

17. Do both cells in Model 3 have mitochondria?

18. Describe at least three differences between the animal and plant cells shown in Model 3.

Read This!

Plant cells have three organelles not found in animal cells. They include the cell wall, large central vacuole, and plastids (including chloroplasts).

19. Complete the table below using the three plant organelles mentioned in the *Read This!* box.

Organelle	Function
	Fluid-filled organelle stores water, enzymes, and waste products. Size of this organelle can change.
	Supports and protects the cell.
	Some store food or pigments; some convert light energy to chemical energy in the form of organic compounds.

20. Label each of these three organelles on the plant cell diagram in Model 3.

21. Individually, in one grammatically correct sentence, describe why it is necessary for plants to have chloroplasts.

22. As a group, reach a consensus on the answer to Question 21. Record the answer below.

23. The central vacuole stores water. What would happen to the size of the central vacuole if a plant does not have enough water?

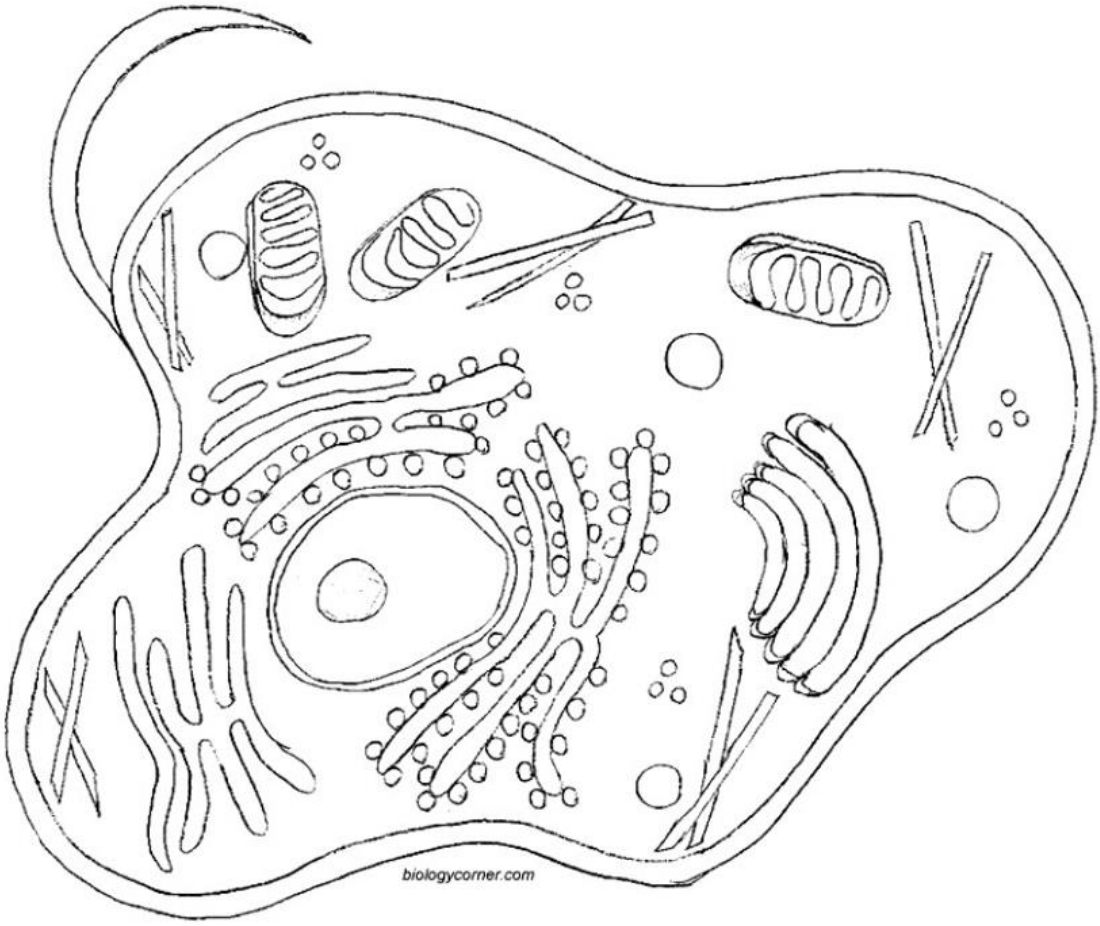
24. Describe the appearance of the vacuole in a well-watered plant. What effect would this have on the cell wall of the plant?

25. Using your response to Question 24, construct an explanation for why a plant has both a rigid cell wall and a cellular membrane.

Animal Cell Coloring

I. Directions: Color each part of the cell its designated color.

- ☐ Cell Membrane (light brown)
- ☐ Cytoplasm (light yellow)
- ☐ Nucleoplasm (pink)
- ☐ Nuclear Membrane (dk brown)
- ☐ Microtubules (dark green)
- ☐ Nucleolus (black)
- ☐ Golgi Apparatus (pink)
- ☐ Flagella (red/blue striped)
- ☐ Rough Endoplasmic Reticulum (dark blue)
- ☐ Smooth Endoplasmic Reticulum (light blue)
- ☐ Mitochondria (orange)
- ☐ Lysosome (purple)
- ☐ Ribosome (red)



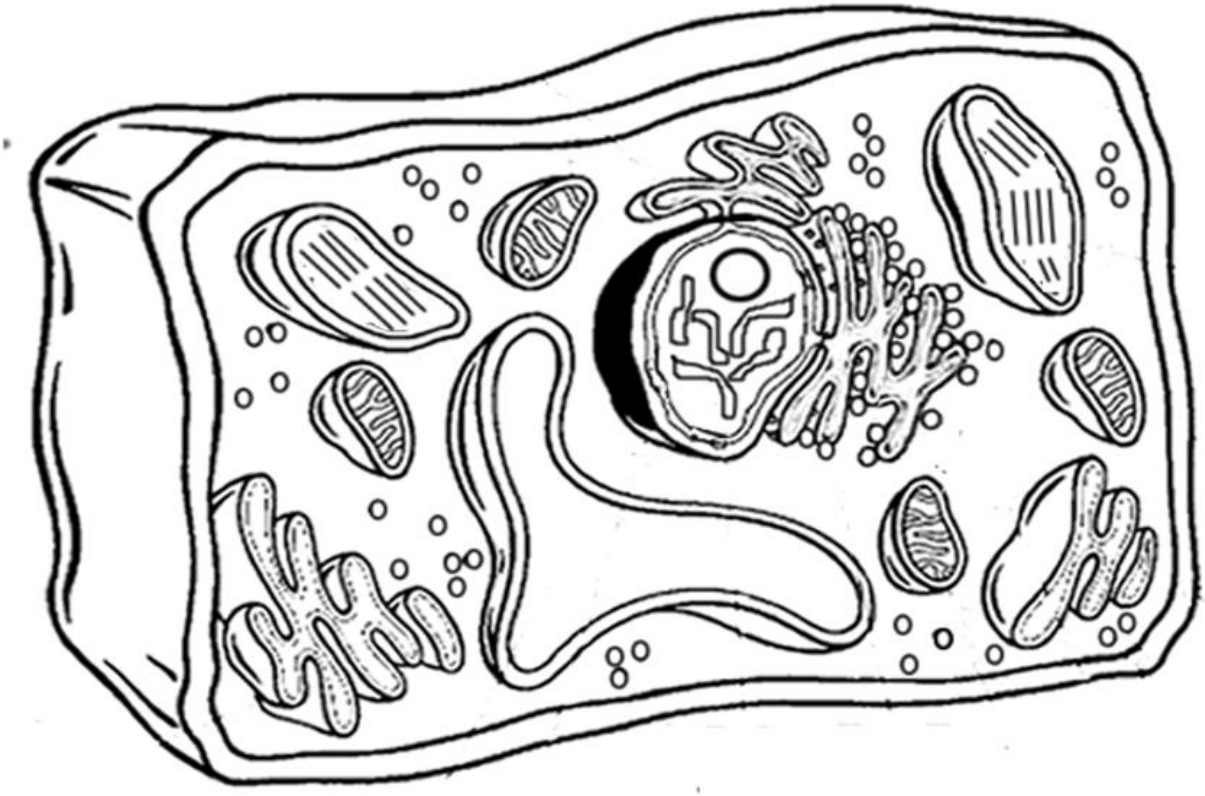
II. Briefly describe the function of the cell parts.

1. Cell membrane	5. Lysosome
2. Endoplasmic Reticulum	6. Microtubule
3. Ribosome	7. Mitochondria
4. Golgi Apparatus	8. Nucleus

Plant Cell Coloring

I. Directions: Color each part of the cell its designated color.

- ☐ Cell Membrane (orange)
- ☐ Nucleoplasm (yellow)
- ☐ Mitochondria (red)
- ☐ Vacuole (light Blue)
- ☐ Chromatin (gray)
- ☐ Cell Wall (dark green)
- ☐ Nucleolus (brown)
- ☐ Chloroplasts (light green)
- ☐ Smooth Endoplasmic Reticulum (pink)
- ☐ Rough Endoplasmic Reticulum (pink)
- ☐ Ribosome (purple)
- ☐ Cytoplasm (white)
- ☐ Golgi Apparatus (dark blue)



Analysis

1. Name two things found in a plant cell that are not found in an animal cell:

2. What is the function of the chloroplasts?

3. What is the function of the vacuole?